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ICT Integration in Elementary School for Mathematics Subject

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Abstract. The Philippines' Department of Education Computerization Program aims to equip public schools with technological advances that will make the instruction and learning process more effective and allow them to address the issues of the 21st century better. The study assessed the significant relationships between Mathematics Teachers based on their profile characteristics. The researcher employed a descriptive-correlational design. Descriptive statistics like mean and weighted mean were used to evaluate the ICT-based activities used in teaching and the factors influencing their implementation. Inferential statistics using Pearson correlation was used to examine the relationship between respondents' profiles and their assessments of ICT implementation. The results, showed that 1) teacher–respondents from private schools have higher scores on assessing the ICT implementation, 2) teacher-respondents who are younger have higher scores on assessing the effectiveness of ICT on student's learning and helps more in developing the skills and competence in ICT as compared to those who are older 3) highest educational attainment of the respondents was found to be negatively correlated to the availability of the ICT in school. This means that teacher-respondents with lower educational backgrounds are given more freedom to design their teaching with ICT help than teachers with higher educational experience. It is recommended that the necessary ICT resources be provided to schools, teachers, and students to ensure the consistent use of ICT in learning and teaching.

Keywords: COVID-19; Instruction; Mathematics; Online Class; Technology

1. Introduction

1.1 Theoretical Framework

The impact of information and communication technology (ICT) on the educational system in the digital age cannot be overstated. There are many challenges to consider, including the existing school infrastructure and various

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variables such as class size, availability of instructors, and teachers' qualifications. Critics have questioned the efficacy of ICT programs in improving technology in the classroom and addressing technological issues in schools (Alba & Trani, 2018). As a result, there is some scepticism about whether Philippine schools, particularly public schools, are prepared to use such costly technology effectively.

1.2 Literature Review

ICT-based understanding, teachers' roles shift from transmitting information to promoting education and from being a primary source of knowledge to a learning manager. The effect of ICT preparation and experience on in-service teachers' basic ICT literacy. Most teachers had moderate essential ICT awareness and skills and viewed ICT positively. The report also found that formal ICT preparation and familiarity with ICT can positively impact teachers' understanding, skills, and attitudes (Alba & Trani, 2018). As a result, it is essential to provide teachers, especially those older and with more teaching experience, with special training programs in the form of ICT workshops and courses.

1.3 ICT implementation status in the Philippines

The government of the Philippines has been working to integrate technology into the classroom to improve teachers' and students' competencies and skills. The Departments of Trade and Industry (DTI) and the Department of Education (DepEd) have provided computers and other technological resources to several public schools. Teachers at these schools have also received training on how to use these resources in their teaching. The goal was to create a more interactive and engaging learning environment that is accessible to all students.

The use of ICT in the Philippine educational system can be traced back to 1996, when a decade-long program of educational modernization was launched. This program, which ran from 1996 to 2005 (DepEd, 1996), aimed to improve the teaching and learning process, educational administration, and educational operations through technology. One key component of this initiative was the computerization project supported by various government agencies and private sector organizations, including the Department of Commerce and Industry's PCs for Public Schools program and the Commission on Information and Communications Technology's School Project. Providing access to quality education has long been a priority for the government. Department of Education in the Philippines promoted the use of ICT to improve the accessibility and quality of primary education services. This effort aligns with national initiatives like the Medium-Term Development Plan of the Philippines and Education for All, which recognize the potential of ICT to enhance education in the country. (DepEd Computerization Program Orientation Handbook, 2018).

To further this initiative, a Centre for Education and Technology (CET) was established to facilitate and expedite Department of Education, Culture and Sports (DECS) projects and activities that can include digital learning. Following DepEd Order No. 59 s. 1996, the department's new plan was to achieve quality education in preparation for "Philippines 2000" (DepEd, 1996). Its primary structure consists of a miniature School of the Future to demonstrate the modern concepts of a multimedia-enhanced educational system and a showroom where

multimedia equipment, facilities, and materials will be previewed, displayed, and kept. During that time, the Centre served the following purposes: (1) ease the establishment of Schools of the Future Task Forces and Multimedia Task Forces in the field, with the latter supervising the operational implementation of the former; (2) facilitate the development and production of locally tailored multimedia teaching materials; (3) instruct officials from DECS, school administrators, curriculum/subject specialists, and instructors in the proper use of multimedia technology; (4) develop ties with organizations that are interested with the multimedia industry to engage in cooperative and collaborative endeavours on subjects relating to the transfer of technology, equipment, and instructional multi-media resources.; and (5) carry out other responsibilities that may be given to it in the future.

In August 2001, the name DECS was transformed into The Department of Education (DepEd) with redefined roles, especially those related to educational improvement. DepEd's Computerization Program (DCP) was launched in 2018 to provide public schools with the technology and resources needed to improve the teaching and learning process and meet the challenges of the 21st century. The program focused on two main components: the computerization project and schools' participation in the project (DepEd Computerization Program Orientation Handbook, 2018). The objectives of the DCP included providing public schools with ICT packages that meet the needs of the K-12 curriculum, integrating ICT into the teaching and learning process, increasing the ICT literacy of learners, pupils, students, teachers, and headteachers, improving the computer-to-student ratio in public schools and expanding the availability of ICT packages. The DCP provided public schools with hardware and software and basic troubleshooting instructions to achieve these goals.

DepEd's Information and Communication Technology Strategic Plan (2008) helped strengthen the computerization program by providing a framework for incorporating ICT into the educational system. The plan, which was developed in collaboration with educational stakeholders from the Philippines, recognized the many benefits of ICT for learning and cooperation in schools. It included an overview of the skills, knowledge, and values related to ICT that Filipino learners should possess.

1.4 Hypothesis:

Considering the challenges in implementing ICT in schools and the initiatives taken by the Philippine government, it is essential to understand how teachers perceive the integration of ICT into teaching and learning and the potential consequences of this integration. The focus will be on Mathematics as it forms the foundation of understanding numbers. This information can be used to devise an initial ICT implementation plan for Mathematics in elementary public schools. By considering the perspectives and experiences of Mathematics teachers, we can ensure that implementing ICT in the classroom is effective and beneficial for both teachers and students.

2. Research Objectives and Methodology

2.1 Research Objective

The research objective is to assess the significant relationships in the respondents' answers (Mathematics teachers) that were grouped based on their profile.

2.2 Research Methodology

A) Design

The researcher employed descriptive-correlational design to determine if there are significant relationships in the answers of the respondents. 1) assessing the ICT implementation by teacher – respondents from public/private schools, 2) effectiveness of ICT on student's learning based on teacher's age, and 3) availability of the elements of ICT in school about the educational attainment of the teachers.

B) Participants

The study was conducted in Cabanatuan City. The Division of Cabanatuan City enumerated 86 schools offering Grades 1 - 6EBEIS (Electronic Basic Education Information System 2020). The respondents were 102 Mathematics teachers from public and private elementary schools. The chosen respondents were in the study's specified locale and have already handled Mathematics subjects.

Table 1 Presents the Socio-demographic Profile of the Teacher Respondents in terms of age, sex, years in teaching, academic rank/position, highest educational attainment, and monthly income.

Table 1. Socio-Demographic Profile of the Respondents

Profile	Frequency	Percentage
Age		
20 to 30 yrs old	22	21.60%
31 to 40 yrs old	27	26.50%
41 to 50 yrs old	37	36.30%
Above 50 yrs old	16	15.70%
Sex		
Male	32	31.40%
Female	70	68.60%
Highest Educational Attainment		
BS / BA graduate	22	21.60%
with MS / MA units	56	54.90%
MS / MA graduate	22	21.60%
with Ph.D. units	2	2.00%
Academic Rank/ Position		
Teacher I	27	26.50%
Teacher II	11	10.80%
Teacher III	53	52.00%
Master Teacher I	7	6.90%
Master Teacher II	4	3.90%
Type of School		
Public	91	89.22%
Private	11	10.78%

Monthly Income		
Below P10,000	2	2.00%
P10,000 to P20,000	9	8.8%
P20,001 to P30,000	72	70.60%
P30,001 to P40,000	9	8.80%
P40,001 to P50,000	9	8.80%
P50,001 and above	1	1.00%
Number of Years in Teaching		
Below five years	19	18.60%
5 to 10 years	33	32.40%
11 to 15 years	23	22.50%
16 years and above	27	26.50%
Average Number of Students		
25 students and below	12	11.80%
26 to 35 students	53	52.00%
36 to 45 students	27	26.50%
46 students and above	10	9.80%

C) Sampling Technique

The researcher used purposive sampling in determining the respondents as it was found acceptable in the study. The criteria in selecting the participants for the survey were the following: first, the participants must be in the specified locale of the study; second, the participants must be elementary teachers; third, the participants must handle/already handle Mathematics subjects; and last, the participants must be currently employed in public or private schools.

D) Instruments

The researcher used a questionnaire to be administered online in gathering the data. Due to limited face-to-face transactions during this pandemic, the researcher conducted an online survey via Google Forms. Since the pandemic brings about risk factors, the researcher conducted a self-assessment. He did not travel before or during the quarantine period for potential COVID-19 risk factors. During the COVID-19 crisis, the researcher collected data via an online survey.

The questionnaire consisted of three parts. Part I focused on the respondent's profile, such as age, sex, highest educational attainment, years in teaching, academic rank/position, type of school, handling what grade level, students per grade level, monthly income, ICT at home, and ICT at school. Part II focused on the ICT-based activities used for teaching. Part III focused on the assessment of teachers on the implementation of ICT in terms of effectiveness on integration in education, effectiveness on student's learning, availability of the elements of ICT in school, attitude towards computers, skills and competencies, and professional development of teachers. Three parts comprised the questionnaire that was used to collect data. Part I consisted of researcher-made profiling questions. Part II consisted of Likert-scale questions adapted from the work of Ghavifekr & Rosdy (2015). Part III consisted of Likert-scale questions, with Parts A, B, and C drawn from the work of Infante-Moro & Gallardo-Pérez (2019), Parts D and E removed from the work of Ghavifekr & Rosdy (2015), and Part F removed from the work

of Leask & Younie (2013). The computed weighted means were interpreted based on the following scoring guide:

Table 1.1 Response Mode for ICT-Based Activities Used for Teaching

Scale	Verbal Interpretation	Interpretation
3.25 - 4.00	Always	Almost all the time done (75-95 % of the time)
2.50 - 3.24	Often	Frequently done (50 – 75 % of the time)
1.75 -2.49	Sometimes	Occasionally done (25 – 50% of the time)
1.00 -1.74	Not at All	Almost never done (10 – 25 % of the time)

Table 1.2. Response Mode for Effectiveness on Integration in Teaching

Scale	Interpretation	Descriptor
3.25 - 4.00	Highly Effective	There are no weaknesses in implementing ICT in teaching and learning activities, and it meets all criteria for effectiveness.
2.50 - 3.24	Effective	Implementing ICT in teaching and learning activities meets all criteria for effectiveness, although there are a few acceptable tolerable weaknesses that will not significantly impact its function.
1.75 - 2.49	Improvement needed	Implementing ICT in teaching and learning activities meets only some criteria for effectiveness and has minor weaknesses that may slightly affect its function.
1.00 - 1.74	Poor	Implementing ICT in teaching and learning activities meets very few criteria for effectiveness and has major weaknesses that will significantly impact its function.

Table 1.3. Response Mode for Availability of the elements of ICT in school

Scale	Interpretation	Descriptors
3.25 - 4.00	Always Available	ICT is very much integrated into teaching-learning activities (76% - 95% of the time)
2.50 - 3.24	Available	ICT is integrated into teaching-learning activities (51% - 75% of the time)
1.75 - 2.49	Somewhat Available	ICT is slightly integrated into teaching-learning activities (26% - 50% of the time)
1.00 - 1.74	Not Available	ICT has not been integrated into teaching-learning activities (0% - 25% of the time)

Table 1.4. Response Mode for Students' Attitude Towards Computers

Scale	Interpretation	Descriptors
3.25 - 4.00	Highly effective	The learner shows ***very good*** performance when it is integrated into teaching-learning activities (76% - 95% of the time)
2.50 - 3.24	Effective	The learner shows ***good*** performance when it is integrated into teaching-learning activities (76% - 95% of the time)
1.75 - 2.49	Needs Improvement	The learner shows ***fair*** performance when it is slightly integrated into teaching-learning activities (26% - 50% of the time)
1.00 - 1.74	Poor	The learner shows ***poor*** performance in class (0% - 25% of the time)

Table 1.5. Response Mode for Skills and Competence

Scale	Interpretation	Descriptors
3.25 - 4.00	Highly Effective	Students' performance exceeds expectations going above and beyond the desired skills and competency level for each task.
2.50 - 3.24	Effective	Students' performance meets expectations demonstrating the desired skills and competency level for each task.
1.75 - 2.49	Needs Improvement	Students' performance slightly meets expectations, fairly demonstrating the desired skills and competency level for each task.
1.00 - 1.74	Poor	Students' performance does not meet expectations, demonstrating skills and competency levels that are below for each task.

Table 1.6. Response Mode for Professional Development

Scale	Interpretation	Descriptor
3.25 - 4.00	Highly Effective	The teacher is *highly knowledgeable* in ICT by attending relevant training/seminar/workshop/lectures.
2.50 - 3.24	Effective	The teacher is *moderately knowledgeable* in ICT by attending relevant training/seminar/lectures.
1.75 - 2.49	Needs Improvement	The teacher is *slightly knowledgeable* in ICT by attending relevant training/seminar/workshop/lectures.
1.00 - 1.74	Poor	The teacher is *not knowledgeable* in ICT and never attended relevant training/seminar/workshop/ lectures.

The researcher-made questionnaire and the adopted part underwent face and content validation by experts in ICT and Mathematics to determine if the questionnaire measured the study's objectives. Then, the questionnaire was pre-tested on Mathematics teachers who were not included as respondents of this study. The reliability of the questionnaire was tested using Cronbach's Alpha Test. Based on the reliability statistics, the questionnaire sent to 102 participants with 67 items had a Cronbach's Alpha of 0.968. Cronbach's Alpha has values ranging from 0 to 1, with higher values exhibiting the reliability of the questionnaire. Hence, the questionnaire had excellent reliability.

The researcher gathered the data from the Mathematics teachers of both public and private elementary schools through their respective supervisors or focal person. After the questionnaire had passed the reliability test and been verified by the statistician, the data collection method began. The researcher sent a letter of request to the School Division asking permission for a study to be conducted. Thus, if no response is received from the school within ten days, the researcher proceeded cautiously with the distribution of the request letter.

All information collected was kept strictly confidential and used only for academic and research purposes. The respondents' and schools' identities were not disclosed. To protect the respondents, the outcome and conclusion were represented by other independent variables such as age, sex, and type of school. This allowed students to participate in the instrument's validation and be part of the survey.

E) Data Analysis:
To analyse the respondents' profiles, including characteristics such as age, sex, highest educational attainment, years of teaching experience, academic rank or position, type of school, grade level taught for Mathematics, number of students per grade level, and availability of ICT gadgets at home and in school, the researchers used descriptive statistics such as frequency counts and percentage distributions. They also used descriptive statistics like mean and weighted mean to evaluate the ICT-based activities used in teaching and the factors that influence ICT implementation, such as integration in teaching and student learning, availability of ICT resources in school, attitudes toward computers, skills and competence, and professional development. Inferential statistics using Pearson correlation was used to examine the relationship between the respondents' profiles and their assessments of ICT implementation. The results were used to develop an Information and Communications Technology Management Plan in Mathematics for elementary teachers.

The researcher considered various ethical issues in this study. Before the survey began, the researcher ensured that the authority had authorized the analysis. Additionally, the researcher required participants to agree with an informed consent form online to participate in the study. If participants chose to withdraw from the survey, the researcher emphasized that there would be no compulsion on their part and that there would be no repercussions of any kind. Apart from that, the researcher ensured that the study incurred no costs to the school or participants. Under the Data Privacy Act and the questionnaire, a prior consent form was included to obtain respondents' consent to participate in the study. This includes their voluntary participation in activities where they may withdraw at any time. Additionally, they will have the right to ask questions about the survey. Likewise, the consent form assures that the respondents' responses will remain confidential.

3. Results and Discussion

3.1 Socio-Demographic Profile of the Teacher Respondents

Table 2 Presents the information and communication technology (ICT) at home and school.

Table 2. Usage of ICT at home

Profile	Frequency	Percentage
ICT at home		
Android mobile phone	96	94.12%
Desktop	36	35.29%
Notebook / Netbook	37	36.27%
Tablet / iPad	14	13.73%
Digital camera	11	10.78%
Radio	18	17.65%
Television	14	13.73%
Printer	82	80.39%
Scanner/Copier	37	36.27%
CD	12	11.76%
Flash drive	62	60.78%

DSL	21	20.59%
Broadband	25	24.51%
ICT in the school		
The desktop computer without internet access	21	20.59%
Desktop computer with internet access	32	31.37%
Non-internet-connected laptop, tablet PC, netbook	20	19.61%
Internet-connected laptop, tablet PC, netbook, or mini notebook	75	73.53%
Digital reader (portable device to read books, news, etc., on-screen)	6	5.88%
Mobile phone provided by the school	5	4.90%
Interactive whiteboard	10	9.80%
Digital camera	9	8.82%
LCD projector	39	38.24%
Printer	81	79.41%
Photocopier	40	39.22%
Scanners	37	36.27%
DVDs and CDs	16	15.69%
Flash discs	19	18.63%
Radio	6	5.88%
Television	65	63.73%

Results show that there were 102 elementary teacher-respondents. Most respondents ranged from 41 – 50 years old (36.30%). There were 32 males (31.40%) and 70 females (68.60%). Regarding the highest educational attainment, most teachers have already earned MS/MA units (56 or 52.90%). Most of them have the academic position as Teacher III (53 or 52%) and were employed in public schools. Most earned P30,001 – P40,000 monthly (72 or 70.60%). Most have been in the teaching profession for around 5 to 10 years (33 or 32.40%) and handle an average of 26 to 35 students per class (53 or 52%).

The availability of information and communication technology equipment was categorized into two: at home and in school. At home, the top ICT equipment that teacher respondents were using our android mobile phones (96 or 94.12%), printers (82 or 80.39%), flash drives (62 or 60.78%), netbook (36.27%), scanners/copiers (37 or 36.27%), and desktop (36 or 35.29%). However, in the school, the top ICT equipment that teacher respondents were using were printers (81 or 79.41%), Internet-connected laptops, tablet PC, netbooks or mini notebooks (75 or 73.53%), television (65 or 63.73%), a photocopier (40 or 39.22%), LCD projector (39 or 38.24%), and scanner (37 or 36.27%).

3.2 Information and Communication Technology (ICT) Based Activities in Teaching

Table 3 presents the Information and Communication Technology (ICT) based activities in teaching.

Table 3. ICT-based Activities Used for Teaching

Indicators	Weighted Mean	Verbal Interpretation
1. Browse/search the internet to collect information to prepare lessons	3.59	Always
2. Browse/search the internet to collect resources to be used during lessons	3.48	Always
3. Use applications to prepare presentations for lessons	3.46	Always
4. Create your digital learning materials for students	3.06	Often
5. Prepare exercises and tasks for students	3.60	Always
6. Post homework for students on the school website	2.72	Often
7. Use ICT to provide feedback and assess students' learning	3.24	Often
8. Evaluate digital learning resources in the subject(s) you teach	3.14	Often
9. Communicate online with parents	3.65	Always
10. Download/upload/browse material from the school's website	3.15	Often
11. Download/browse material from a learning platform	3.33	Always
12. Look for online professional development Opportunities	3.29	Always
Average Weighted Mean	**3.31**	**Always**

Table 4 shows the results of the ANOVA test at alpha = 0.05, which was used to test the null hypothesis that the means of all ICT indicators are equal.

Table 4. ANOVA Test Results

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	82.09	11.00	7.46	15.41	1.89E-28	1.80
Within Groups	586.79	1212.00	0.48			
Total	668.88	1223.00				

Based on the results in Table 4, we can see that the F value is greater than the F crit value, so we can reject the null hypothesis and say that at least one of the ICT indicator groups is significantly different.

Friedman-Nemenyi Test was used to identify which ICT Indicator group had significant differences, and results are mentioned in Table 5 below.

Table 5. ICT Indicators with Significant Difference

group 1	group 2	R sum	q-stat	p-value	Significant Difference
6. Post homework for students on the school website	9. Communicate online with parents	411.50	11.30	0.00	Yes

5. Prepare exercises and tasks for students	6. Post homework for students on the school website	389.00	10.68	0.00	Yes
1. Browse/search the internet to collect information to prepare lessons	6. Post homework for students on the school website	377.00	10.35	0.00	Yes
2. Browse/search the internet to collect resources to be used during lessons	6. Post homework for students on the school website	334.50	9.19	0.00	Yes
3. Use applications to prepare presentations for lessons	6. Post homework for students on the school website	315.50	8.66	0.00	Yes
4. Create your digital learning materials for students	9. Communicate online with parents	301.50	8.28	0.00	Yes
4. Create your digital learning materials for students	5. Prepare exercises and tasks for students	279.00	7.66	0.00	Yes
1. Browse/search the internet to collect information to prepare lessons	4. Create your digital learning materials for students	267.00	7.33	0.00	Yes
8. Evaluate digital learning resources in the subject(s) you teach	9. Communicate online with parents	253.50	6.96	0.00	Yes
6. Post homework for students on the school website	11. Download/upload/browse material from a learning platform	248.00	6.81	0.00	Yes
6. Post homework for students on the school website	12. Look for online professional development Opportunities	232.50	6.38	0.00	Yes
5. Prepare exercises and tasks for students	8. Evaluate digital learning resources in the subject(s) you teach	231.00	6.34	0.00	Yes
9. Communicate online with parents	10. Download/upload/browse material from the school's website	228.50	6.28	0.00	Yes
2. Browse/search the internet to collect resources to be used during lessons	4. Create your digital learning materials for students	224.50	6.17	0.00	Yes
1. Browse/search the internet to collect information to prepare lessons	8. Evaluate digital learning resources in the subject(s) you teach	219.00	6.01	0.00	Yes

6. Post homework for students on the school website	7. Use ICT to provide feedback and/or assess students' learning	211.00	5.79	0.00	Yes
5. Prepare exercises and tasks for students	10. Download/upload/browse material from the school's website	206.00	5.66	0.00	Yes
3. Use applications to prepare presentations for lessons	4. Create your digital learning materials for students	205.50	5.64	0.00	Yes
7. Use ICT to provide feedback and/or assess students' learning	9. Communicate online with parents	200.50	5.51	0.01	Yes
1. Browse/search the internet to collect information to prepare lessons	10. Download/upload/browse material from the school's website	194.00	5.33	0.01	Yes
6. Post homework for students on the school website	10. Download/upload/browse material from the school's website	183.00	5.03	0.02	Yes
9. Communicate online with parents	12. Look for online professional development Opportunities	179.00	4.92	0.03	Yes
5. Prepare exercises and tasks for students	7. Use ICT to provide feedback and/or assess students' learning	178.00	4.89	0.03	Yes
2. Browse/search the internet to collect resources to be used during lessons	8. Evaluate digital learning resources in the subject(s) you teach	176.50	4.85	0.03	Yes

The questionnaire result shows that teacher-respondents had an average mean of 3.31 in using ICT-based activities in their teaching, which has a verbal interpretation of "Always."

To highlight the statements with the highest means are as follows: Item 9, "Communicate online with parents" (mean = 3.65, "Always"); Item 5, "Prepare exercises and tasks for students" (mean = 3.60, "Always"); and Item 1 "Browse/search the internet to collect information to prepare lessons" (mean = 3.59, "Always").

On the other hand, the statements with the lowest means are as follows: Item 6, "Post homework for students on the school website" (mean = 2.72, "Often"), Item 8, "Evaluate digital learning resources in the subject(s) you teach" (mean = 3.14, "Often"), and Item 10 "Download/browse material from the school's website" (mean = 3.15, "Often").

According to the findings, teachers could contact parents of students to provide feedback on their children's performance using ICT as a communication medium. Similarly, ICT aids teachers in preparing, organizing, delivering, and monitoring academic tasks. It differs significantly from the traditional method of designing educational materials.

ICT-based activities to assess student learning have also become more common. Teachers often use ICT tools like posting homework assignments, evaluating digital learning materials, and accessing learning resources online. However, research has shown that teachers may initially need more concern about the quality of online content, copyright, or e-safety when planning ICT-assisted instruction. Still, their awareness of these issues increases after participating in such activities. This is also evidenced by the Friedman-Nemenyi Test, in which the following two groups were significantly different:

group 1	group 2	Sum of R sum	Sum of q-stat	Sum of p-value
1. Browse/search the internet to collect information to prepare lessons	4. Create your digital learning materials for students	267.00	7.33	1.52
	8. Evaluate digital learning resources in the subject(s) you teach	219.00	6.01	0.00

Assessing these items based on the means, item 1 was given more preference than items 4 and 8. This suggests that structured and consistent training in developing skills and competencies for using ICT resources is essential. Unfortunately, such activity is often lacking, and computer hardware maintenance, software upgrades, and license renewals for application packages are only sometimes completed promptly and efficiently.

3.3 Respondents' Assessment of ICT implementation in their school

3.3.1 Effectiveness of ICT Integration in Teaching

Table 6 exhibits the results of the ANOVA test at alpha = 0.05, which was used to test the null hypothesis that factors of all ICT effectiveness are equal.

Table 6. ANOVA Test Results

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	216.06	14	15.43	33.00	1.21E-77	1.70
Within Groups	708.39	1515	0.47			
Total	924.45	1529				

Based on the results in Table 6, we can see that the F value is greater than the F crit value, so we can reject the null hypothesis and say that at least one of the ICT effectiveness groups is significantly different.

Friedman-Nemenyi Test was used to identify which ICT effectiveness group had significant differences, and results are mentioned in Table 7 below.

Table 7. ICT Effectiveness Indicators with Significant Differences

group 1	group 2	Sum of R sum	Sum of q-stat	Sum of p-value
1. Learning new computer skills and engaging in ICT-based activities gives me confidence in my ability to teach the subject	11. Because of its complexity and high cost, using ICT in the classroom is a waste of time	361.00	7.99	1.85E-06
	12. Students may learn best in the classroom without using ICT.]	277.50	6.14	1.38E-03
	13. When ICT is used in the classroom, classroom management may be out of control due to the students' divided attention	307.50	6.81	1.57E-04
	14. When ICT is used in the classroom, students pay less attention to the lesson because they are more focused on its features	306.50	6.79	1.70E-04
	15. When ICT is used in the classroom, students make no effort to learn	367.50	8.14	1.03E-06
10. Without the use of ICT, teachers can still deliver a practical lesson	11. Because of its complexity and high cost, using ICT in the classroom is a waste of time	296.00	6.55	3.72E-04
	13. When ICT is used in the classroom, classroom management may be out of control due to the students' divided attention	242.50	5.37	1.26E-02
	14. When ICT is used in the classroom, students pay less attention to the lesson because they are more focused on its features	241.50	5.35	1.34E-02
	15. When ICT is used in the classroom, students make no effort to learn	302.50	6.70	2.30E-04

2. The ICT includes procedures that are easy to follow	11. Because of its complexity and high cost, using ICT in the classroom is a waste of time	338.50	7.49	1.31E-05
	12. Students may learn best in the classroom without using ICT.]	255.00	5.65	5.97E-03
	13. When ICT is used in the classroom, classroom management may be out of control due to the students' divided attention	285.00	6.31	8.21E-04
	14. When ICT is used in the classroom, students pay less attention to the lesson because they are more focused on its features	284.00	6.29	8.80E-04
	15. When ICT is used in the classroom, students make no effort to learn	345.00	7.64	7.53E-06
3. ICT opens up a world of possibilities for effective teaching.	11. Because of its complexity and high cost, using ICT in the classroom is a waste of time	391.00	8.66	1.14E-07
	12. Students may learn best in the classroom without using ICT.]	307.50	6.81	1.57E-04
	13. When ICT is used in the classroom, classroom management may be out of control due to the students' divided attention	337.50	7.47	1.42E-05
	14. When ICT is used in the classroom, students pay less attention to the lesson because they are more focused on its features	336.50	7.45	1.55E-05
	15. When ICT is used in the classroom, students make no effort to learn	397.50	8.80	6.04E-08
4. Learning is more effective when ICT is used to support teaching activities	11. Because of its complexity and high cost, using ICT in the classroom is a waste of time	388.50	8.60	1.45E-07
	12. Students may learn best in the classroom without using ICT.]	305.00	6.75	1.90E-04
	13. When ICT is used in the classroom, classroom management may be out of control due to the students' divided attention	335.00	7.42	1.75E-05
	14. When ICT is used in the classroom, students pay less attention to the lesson because	334.00	7.39	1.91E-05

	they are more focused on its features			
	15. When ICT is used in the classroom, students make no effort to learn	395.00	8.75	7.71E-08
5. Teachers can use ICT to improve their teaching by using more up-to-date materials	11. Because of its complexity and high cost, using ICT in the classroom is a waste of time	439.00	9.72	8.47E-10
	12. Students may learn best in the classroom without using ICT.]	355.50	7.87	3.02E-06
	13. When ICT is used in the classroom, classroom management may be out of control due to the students' divided attention	385.50	8.54	1.93E-07
	14. When ICT is used in the classroom, students pay less attention to the lesson because they are more focused on its features	384.50	8.51	2.12E-07
	15. When ICT is used in the classroom, students make no effort to learn	445.50	9.86	4.19E-10
6. The use of ICT aids in the improvement of teaching quality and thus promotes meaningful learning	11. Because of its complexity and high cost, using ICT in the classroom is a waste of time	439.00	9.72	8.47E-10
	12. Students may learn best in the classroom without using ICT.]	355.50	7.87	3.02E-06
	13. When ICT is used in the classroom, classroom management may be out of control due to the students' divided attention	385.50	8.54	1.93E-07
	14. When ICT is used in the classroom, students pay less attention to the lesson because they are more focused on its features	384.50	8.51	2.12E-07
	15. When ICT is used in the classroom, students make no effort to learn	445.50	9.86	4.19E-10
7. ICT is beneficial in lesson preparation because it provides relevant teaching resources and materials	11. Because of its complexity and high cost, using ICT in the classroom is a waste of time	458.00	10.14	1.05E-10

	12. Students may learn best in the classroom without using ICT.]	374.50	8.29	5.42E-07
	13. When ICT is used in the classroom, classroom management may be out of control due to the students' divided attention	404.50	8.96	3.02E-08
	14. When ICT is used in the classroom, students pay less attention to the lesson because they are more focused on its features	403.50	8.93	3.34E-08
	15. When ICT is used in the classroom, students make no effort to learn	464.50	10.28	5.08E-11
8. Students are more active and engaged in the classroom when ICT is used	11. Because of its complexity and high cost, using ICT in the classroom is a waste of time	394.00	8.72	8.50E-08
	12. Students may learn best in the classroom without using ICT.]	310.50	6.87	1.25E-04
	13. When ICT is used in the classroom, classroom management may be out of control due to the students' divided attention	340.50	7.54	1.11E-05
	14. When ICT is used in the classroom, students pay less attention to the lesson because they are more focused on its features	339.50	7.52	1.20E-05
	15. When ICT is used in the classroom, students make no effort to learn	400.50	8.87	4.50E-08
9. When ICT is used in the classroom, teachers will have more time to cater to the needs of their students	11. Because of its complexity and high cost, using ICT in the classroom is a waste of time	375.00	8.30	5.17E-07
	12. Students may learn best in the classroom without using ICT.]	291.50	6.45	5.17E-04
	13. When ICT is used in the classroom, classroom management may be out of control due to the students' divided attention	321.50	7.12	5.27E-05
	14. When ICT is used in the classroom, students pay less attention to the lesson because	320.50	7.10	5.71E-05

	they are more focused on its features			
	15. When ICT is used in the classroom, students make no effort to learn	381.50	8.45	2.82E-07

Friedman-Nemenyi Test results exhibit that the following factors of ineffectiveness are significantly different from the influential ICT factors. Furthermore, these factors were also given less preference based on the weighted means.

Item 11. Because of its complexity and high cost, using ICT in the classroom is a waste of time

Item 12. Students may learn best in the classroom without the use of ICT.]

Item 13. When ICT is used in the classroom, classroom management may be out of control due to the students' divided attention

Item 14. When ICT is used in the classroom, students pay less attention to the lesson because they are more focused on its features

Item 15. When ICT is used in the classroom, students make no effort to learn

Table 7 presents the assessment of the effectiveness of ICT integration in teaching. The result shows that teacher-respondents had an average weighted mean of 3.24, which has a verbal interpretation of "Highly Effective."

The results indicate that ICT integration's effectiveness in teaching manifests from preparing teaching materials and updating them for improvement. With the use of ICT, the teaching and learning process is improved. It transforms the quality of teaching that makes the students more engaged because ICT supports activities that motivate them.

Table 8. Effectiveness of ICT Integration in Teaching

Indicators	Weighted Mean	Verbal Interpretation
1. Learning new computer skills and engaging in ICT-based activities gives me confidence in my ability to teach the subject.	3.47	Highly Effective
2. The ICT includes procedures that are easy to follow.	3.42	Highly Effective
3. ICT opens up a world of possibilities for effective teaching.	3.51	Highly Effective
4. Learning is more effective when ICT supports teaching activities.	3.51	Highly Effective
5. Teachers can use ICT to improve their teaching by using more up-to-date materials.	3.58	Highly Effective
6. ICT aids in improving teaching quality and thus promotes meaningful learning.	3.58	Highly Effective
7. ICT is beneficial in lesson preparation because it provides relevant teaching resources and materials.	3.61	Highly Effective
8. Students are more active and engaged in the classroom when ICT is used.	3.51	Highly Effective

9. When ICT is used in the classroom, teachers will have more time to cater to the needs of their students.	3.47	Highly Effective
10. With ICT, teachers can deliver effective lessons.	3.32	Highly Effective
11. Because of its complexity and high cost, using ICT in the classroom wastes time.	2.60	Effective
12. Students may learn best in the classroom without the use of ICT.	2.83	Effective
13. When ICT is used in the classroom, classroom management may be out of control due to the students' divided attention.	2.77	Effective
14. When ICT is used in the classroom, students pay less attention to the lesson because they focus more on its features.	2.78	Effective
15. When ICT is used in the classroom, students make no effort to learn.	2.62	Effective
Average Weighted Mean	**3.24**	**Effective**

Digital environments and technology use, whether in the form of basic ICT, multimedia materials, or collaborative spaces, have both benefits and drawbacks, and pedagogical methods play a significant role in determining how they affect student outcomes. Evidently, education and learning supported by technological means are more successful than conventional classroom instruction. This is because making use of various forms of information and communications technology (ICT) results in a learning environment that is more stimulating and productive for both the instructors and the students (Infante-Moro & Gallardo-Pérez, 2019). However, the teachers' limited ICT knowledge and skills appeared to act as impediments to making effective use of existing ICT resources in teacher education (Ngwu, 2014). Nonetheless, it was determined that their lack of sufficient technical skills contributed to the instructors' low degree of ICT use in the classroom.

3.3.2 Integration on Students' Learning

A) Availability of the Elements of ICT in School

Table 9 exhibits the results of the ANOVA test at alpha = 0.05, which was used to test the null hypothesis that factors of all ICT availability are equal.

Table 9. ANOVA Test Results

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	126.08	9.00	14.01	21.54	1.38E-33	1.89
Within Groups	657.02	1010.00	0.65			
Total	783.10	1019.00				

Based on the results in Table 9, we can see that the F value is greater than the F crit value, so we can reject the null hypothesis. At least one of the ICT availability groups is significantly different.

Friedman-Nemenyi Test was used to identify which ICT availability group had significant differences, and results are mentioned in Table 10 below.

Table 10 – ICT Availability Indicators with Significant Differences

group 1	*group 2*	*R sum*	*q-stat*	*p-value*
7. All ICT tools in my school go to waste and are used less by teachers	10. Teachers are given the freedom to design their teaching with the help of ICT	334.00	10.92	8.22E-13
7. All ICT tools in my school go to waste and are used less by teachers	8. Teachers are given more time to learn and be comfortable with the use of ICT in teaching	297.00	9.71	3.75E-10
6. There is enough training and professional development provided for teachers about ICT use in teaching	7. All ICT tools in my school go to waste and are used less by teachers	263.00	8.60	6.22E-08
4. Lack of support from the school's top management discourages me from using ICT	10. Teachers are given the freedom to design their teaching with the help of ICT	262.50	8.58	6.68E-08
2. Technical support is provided when teachers are faced with difficulties	7. All ICT tools in my school go to waste and are used less by teachers	258.50	8.45	1.17E-07
5. Teaching time are not enough for me to use the ICT for teaching and learning purposes	10. Teachers are given the freedom to design their teaching with the help of ICT	248.50	8.13	4.62E-07
3. Little access to ICT prevents me from using it in teaching	10. Teachers are given the freedom to design their teaching with the help of ICT	234.50	7.67	2.89E-06
4. Lack of supports from the school top management discourages me from using ICT	8. Teachers are given more time to learn and be comfortable with the use of ICT in teaching	225.50	7.37	8.89E-06
5. Teaching time are not enough for me to use the ICT for teaching and learning purposes	8. Teachers are given more time to learn and be comfortable with the use of ICT in teaching	211.50	6.92	4.70E-05
3. Little access to ICT prevents me from using it in teaching	8. Teachers are given more time to learn and be comfortable	197.50	6.46	2.23E-04

	with the use of ICT in teaching			
9. There is computer lab in my school in which I can bring students there to watch educational videos	10. Teachers are given the freedom to design their teaching with the help of ICT	193.50	6.33	3.42E-04
4. Lack of supports from the school top management discourages me from using ICT	6. There is enough training and professional development provided for teachers about ICT use in teaching	191.50	6.26	4.22E-04
1. The ICT facilities in our school are well-functioning and can be used	10. Teachers are given the freedom to design their teaching with the help of ICT	188.50	6.16	5.75E-04
2. The technical supports are provided when teachers are faced with difficulties	4. Lack of supports from the school top management discourages me from using ICT	187.00	6.12	6.70E-04
5. Teaching time are not enough for me to use the ICT for teaching and learning purposes	6. There is enough training and professional development provided for teachers about ICT use in teaching	177.50	5.80	1.71E-03
2. Technical support is provided when teachers are faced with difficulties	5. Teaching time are not enough for me to use the ICT for teaching and learning purposes	173.00	5.66	2.62E-03
3. Little access to ICT prevents me from using it in teaching	6. There is enough training and professional development provided for teachers about ICT use in teaching	163.50	5.35	6.19E-03
2. Technical support is provided when teachers are faced with difficulties	3. Little access to ICT prevents me from using it in teaching	159.00	5.20	9.12E-03
8. Teachers are given more time to learn and be comfortable with the use of ICT in teaching	9. There is computer lab in my school in which I can bring students there to watch educational videos	156.50	5.12	1.12E-02

1. The ICT facilities in our school are well-functioning and can be used	8. Teachers are given more time to learn and be comfortable with the use of ICT in teaching	151.50	4.95	1.69E-02
1. The ICT facilities in our school are well-functioning and can be used	7. All ICT tools in my school go to waste and are used less by teachers	145.50	4.76	2.69E-02
7. All ICT tools in my school go to waste and are used less by teachers	9. There is computer lab in my school in which I can bring students there to watch educational videos	140.50	4.59	3.89E-02

Table 11 presents the results of the assessment of the availability of ICT elements in the school. It showed that teachers had an average weighted mean of 2.79, corresponding to “Often” in frequency.

The ICT indicators that received the highest ratings and were often available included: "Teachers have the freedom to design their lessons with the assistance of ICT" (mean = 3.31), "Teachers are given sufficient time to learn and become comfortable using ICT in their teaching" (mean = 3.21), "There is sufficient training and professional development offered to teachers on using ICT in the classroom" (mean = 3.11) and "Technical support is provided when teachers encounter difficulties with ICT" (mean = 3.09). However, some indicators were rated lower and were only sometimes available, such as "Many of the ICT tools in my school go unused by teachers" (mean = 2.19) and "Lack of support from school leadership discourages the use of ICT in teaching" (mean = 2.46).

The findings imply that by utilizing ICT, teachers are given the ability to design their curriculum. They were given training on using ICT and integrating it into the learning and teaching process. When ICT-related issues emerge, technical assistance is also provided. Even though instructors are well-prepared and aware of ICT integration, it was discovered that ICT elements and tools are not permanently employed by teachers, resulting in the waste of these resources due to a lack of support from school administrators.

The most likely is the funding and the mindset of the school leaders, who believe that traditional teaching is incomparable to technologically aided education. On the contrary, It was found that resources are not available at the school and in the majority of secondary schools in general, and when they are, they are insufficient; those resources that are available are underutilized, and numerous factors contribute to underutilization that needs to be addressed. (Nwosu, John, Izang & Akorede, 2018) Further, most ICT school-based resources need to be more readily available, which means that even if teachers are adequately educated and ready to convey information to students, they cannot do so due to an absence of technological equipment and laboratory facilities. (Rana & Rana, 2020)

Table 11. Availability of the elements of ICT in school

Indicators	Weighted Mean	Verbal Interpretation
1. The ICT facilities are functional and can be utilized in our school.	2.75	Often
2. Technical support is provided to teachers when they encounter difficulties.	3.09	Often
3. Limited access to ICT hinders my ability to use it in teaching.	2.57	Often
4. Lack of support from school leadership discourages using ICT in teaching.	2.46	Sometimes
5. I need more teaching time to use ICT for learning and teaching purposes.	2.54	Often
6. There is sufficient professional development and training for teachers on using ICT in the classroom.	3.11	Often
7. Many of the ICT tools in my school go unused by teachers	2.19	Sometimes
8. Teachers are given enough time to study and get comfortable integrating ICT in the classroom.	3.21	Often
9. The school has a computer lab where teachers may bring children to watch instructional films.	2.68	Often
10. With the use of ICT, teachers can create their own pedagogical approaches.	3.31	Often
Average Weighted Mean	**2.79**	**Often**

B) Students' Attitude towards Computers

Table 12 exhibits the results of Anova test at alpha = 0.05, which was used to test the null hypothesis that factors of students' attitude are equal.

Table 12. ANOVA Test Results

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	12.61	9.00	1.40	3.62	0.00	1.89
Within Groups	391.21	1010.00	0.39			
Total	403.81	1019.00				

Based on the results in Table 12, we can see that the F value is greater than the F crit value, so we can reject the null hypothesis, and we can say that at least one of the students' attitude groups is significantly different.

Friedman-Nemenyi Test was used to identify which students' attitude groups had significant differences, and results are mentioned in Table 13 below.

Table 13. Students' attitude Indicators with Significant Differences

group 1	*group 2*	*R sum*	*q-stat*	*p-value*
2. It boosts interest when using creative instructional materials such as recorded videos, animated PowerPoint presentation, colourful pictures, and the like	9. Students can do more work with computers	137.50	4.50	0.05
4. Computers provide opportunities to learn many new things	9. Students can do more work with computers	137.50	4.50	0.05

Table 14 presents the assessment of students' perceived attitudes toward computers. The result shows that teacher-respondents had an average weighted mean of 3.35, which has a verbal interpretation of "Highly Effective."

Teacher-respondents assessed the following indicators that were found to be highly effective in students' attitude towards computers: Item 2 "It boosts interest when using creative instructional materials such as recorded videos, animated PowerPoint presentation, colourful pictures, and the like (mean = 3.47), Item 4 "Computers provide opportunities to learn many new things." (mean = 3.47), Item 3 "Students are more active in participating during classroom interaction/activities." (mean = 3.46), Item 7, "Learners see the importance of a computer in learning." (mean = 3.45), and Item 5, "Eagerness and willingness to learn are observed during discussion." (mean = 3.40).

There is great emphasis on comprehending and studying the range of abilities necessary to assess digital literacy when applied to modern technology and social media contexts (Shin, 2015). The findings show that students have a positive attitude toward information and communication technology (ICT), which could lead to a positive attitude about its inclusion into the learning process. This mindset is visible since their eagerness and motivation to study rise.

Table 14. Students' Perceived Attitude towards Computers

Indicators	**Weighted Mean**	**Verbal Interpretation**
1. Students are more engaged to learning using a computer.	3.39	Highly Effective
2. It boosts interest when using creative instructional materials such as recorded videos, animated power point presentation, colourful pictures, and the like.	3.47	Highly Effective
3. Students are more active in participating during classroom interaction/activities.	3.46	Highly Effective
4. Computers provide opportunities to learn many new things.	3.47	Highly Effective
5. Eagerness and willingness to learn are observed during discussion.	3.40	Highly Effective
6. Students are more comfortable/convenient working with a computer	3.29	Highly Effective

7. Learners see the importance of a computer in learning.	3.45	Highly Effective
8. Students learn more from online sources using computer than from books.	3.22	Effective
9. Students can do more work with computers.	3.17	Effective
10. Students are more focused in learning and improving knowledge by using computer.	3.24	Effective
Average Weighted Mean	**3.35**	**Highly Effective**

They got more involved in the process. ICT allows students to participate in interactive lessons using innovative instructional materials. They gain new skills and information from new approaches in this way. The findings corroborate with the work of Torres-Gastelú & Kiss (2016), who reported that students' perceptions indicated a strong preference for using ICT as a continuous mode of learning and social communication.

C) Skills and Competence

Table 15 exhibits the results of Anova test at alpha = 0.05, which was used to test the null hypothesis that all Skills and Competence factors are equal.

Table 15. ANOVA Test Results

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	4.86	9.00	0.54	1.64	0.10	1.89
Within Groups	331.49	1010.00	0.33			
Total	336.35	1019.00				

Based on the results in Table 15, we can see that the F value is less than the F crit value, so we can accept the null hypothesis, and we can say that none of the Skills and Competence groups is significantly different.

Table 16 presents the perceived assessment by teachers on how the integration of Information and Communication Technology (ICT) develops the skills and competence of the students. Results showed that the teacher respondents had an average weighted mean of 3.35, which has a verbal interpretation of "Highly Effective."

Teacher-respondents assessed that the following indicators show how highly effective is the integration of ICT in developing the skills & competence of the students. Item 5, "ICT is beneficial in creating instructional materials and other assessment tools." (mean = 3.44), Item 2, "The usage of ICT assists students in finding relevant knowledge and information for schooling." (mean = 3.42), Item 1, "Students can use ICT to become much more imaginative and innovative." (mean = 3.39), Item 10 "The ICT allows students to communicate with others (email, Facebook, Instagram, Snapchat, Twitter)" (mean = 3.39). Item 3, "Students are encouraged to interact with their classmates more when they use ICT." (mean

= 3.36), and Item 4, "The use of ICT boosts students' willingness to participate in the classroom actively." (mean = 3.35).

Table 16. Skills and Competence

Statement	Weighted Mean	Verbal Interpretation
1. Students can use ICT to become much more imaginative and innovative.	3.39	Highly Effective
2. The usage of ICT assists students in finding relevant knowledge and information for schooling.	3.42	Highly Effective
3. Students are encouraged to interact with their classmates more when they use ICT.	3.36	Highly Effective
4. The use of ICT boosts students' willingness to participate actively in classroom.	3.35	Highly Effective
5. ICT is very helpful in creating instructional materials and other assessment tools.	3.44	Highly Effective
6. The usage of ICT enhances students' abilities, particularly in both reading and writing.	3.33	Highly Effective
7. With technology, the students have improved behaviour and are easier to manage.	3.19	Effective
8. ICT enables students to convey their thoughts more effectively.	3.29	Highly Effective
9. With the help of ICT, teachers may create more interactive and interesting lessons for their pupils.	3.33	Highly Effective
10. The ICT allows students to communicate with others (email, Facebook, Instagram, Twitter)	3.39	Highly Effective
Average Weighted Mean	**3.35**	**Highly Effective**

The findings show that integrating ICT aids in the development of skills and competence not only among teachers but also among students. Teachers benefit from using ICT by accessing various digitally assisted instructional materials and assessment tools. For the students, it offers an opportunity to experience learning in ways other than the traditional classroom setting. ICT gives students relevant and helpful information while encouraging them to use their imagination and creativity. ICT communication enables students to participate more actively and engage with their peers. Besides, the ability of teachers to structure learning in innovative ways, appropriately invest in technology with pedagogy, create socially engaged classroom environments, and encourage cooperative interaction, collaborative learning, and group work will be critical to the successful integration of information and communication technologies into the learning environment.

UNESCO (2016) findings verify the assertion that education in ICT fosters creativity, communication, research, information management, problem-solving, and decision-making; as a result, educational programs ought to encourage an attitude of learning information and communication technology skills, which can be developed over the course of years of study and professional practice. Additionally, Alba & Trani (2018) confirm the findings that the purpose of ICT in

a digitalized society is to define, locate, recognize, assess, and apply gained information knowledge to practical educational challenges both within and outside the four walls of the classroom.

E) Professional Development

Table 17 exhibits the results of ANOVA test at alpha = 0.05, which was used to test the null hypothesis that factors of all Professional Development are equal.

Table 17. ANOVA Test Results

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	14.02	9.00	1.56	3.52	0.00	1.89
Within Groups	447.56	1010.00	0.44			
Total	461.58	1019.00				

Based on the results in Table 17, we can see that the F value is greater than the F crit value, so we can reject the null hypothesis and say that at least one of the Professional Development groups is significantly different.

Friedman-Nemenyi Test was used to identify which Professional Development group had significant differences, and results are mentioned in Table 18 below.

Table 18. ICT Effectiveness Indicators with Significant Differences

group 1	*group 2*	*R sum*	*q-stat*	*p-value*
1. Introductory courses on internet use and general applications (basic word-processing, spreadsheets, presentations, databases, etc.]	10. Have enrolled to other professional development opportunities related to ICT	186.50	6.10	0.00
1. Introductory courses on internet use and general applications (basic word-processing, spreadsheets, presentations, databases, etc.]	7. Have taken course on multimedia (using digital video, audio equipment, etc.) other teachers	150.00	4.91	0.02

Table 19 presents the assessment on the professional development of the teacher respondents in relation to ICT. Result shows that teacher respondents had an average weighted mean of 3.05, which has a verbal interpretation of "Effective" in terms of professional development.

Table 19. Professional Development

Statement	**Weighted Mean**	**Verbal Interpretation**
1. Courses covering the fundamentals of using computers and the internet (including word	3.36	Highly Effective

processing, spreadsheets, presentations, databases, etc.)		
2. Courses for the technically-inclined (advanced word-processing, complex relational databases, Virtual Learning Environment, etc.)	3.12	Effective
3. Learned the ins and outs of the internet (video conferencing, web design, etc.)	3.03	Effective
4. Participated in relevant training to the equipment (interactive whiteboard, laptop, tablet, etc.)	3.14	Effective
5. Have successfully completed courses on the pedagogical use of information and communication technology in teaching and learning	3.05	Effective
6. Have undergone subject-specific training on learning applications (tutorials, simulations, etc.)	3.04	Effective
7. Have taken multimedia courses (using digital video, audio equipment, etc.)	2.99	Effective
8. Engaged on online communities (e.g., mailing lists, groups, blogs) for professional discussions with	3.09	Effective
9. Select ICT topics for personal study.	3.15	Effective
10. Have enrolled to other professional development opportunities related to ICT	2.89	Effective
Average Weighted Mean	**3.05**	**Effective**

Teacher–respondents found this indicator as highly effective for professional development; Item 1 "Courses covering the fundamentals of using computers and the internet (including word processing, spreadsheets, presentations, databases, etc.)." (Mean = 3.36). Likewise, the following were also found to be effective for professional development: Item 9, "Select ICT topics for personal study." (mean = 3.15), Item 4, "Participated in a training that was relevant to the equipment (interactive whiteboard, laptop, tablet, etc.)." (mean = 3.14), and Item 2 "Courses for the technically-inclined (advanced word-processing, complex relational databases, Virtual Learning Environment, etc.)" (mean = 3.12). According to Albion, Tondeur, Baruch & Peeraer (2015), the professional development of educators ought to include examining the many kinds of knowledge needed for instruction and creating suitable procedures for managing various types of knowledge.

There are available training and seminars related to ICT for the professional development of teachers. Teachers should have a specialized foundation to utilize ICT in their teaching process effectively. The data suggest they already acquired knowledge and skills about using ICT's general applications and elements. It was very effective for teachers to set their learning courses to attend to that will capacitate them to address the ICT integrated teaching and learning process needs. Additionally, Albion, Tondeur, Baruch & Peeraer (2015) claimed that one indicator of knowledge management effectiveness is educators' ease of access to research-based knowledge to enhance practice. This is especially true in industries undergoing rapid development, such as educational applications of information and communications technology (ICT) and the utilization of networks and other

breakthroughs in information and communications technology to facilitate the flow of knowledge. This is essential for enhancing teaching capabilities, as the study's findings confirmed.

3.3 Relationship between Profile of the Respondents and Their Assessment on the ICT Implementation

Table 20 presents the result of the test of the significant relationship between the profile of the teacher respondents and their assessment of ICT implementation. The shape of the respondents includes their age, sex, highest educational attainment, years in teaching, academic rank/position, type of school, the average number of students they handled, and monthly income. On the other hand, the indicators on the assessment of ICT implementation include the effectiveness of integration in teaching, the significance of integration on student learning, availability of the elements of ICT in school, attitude towards computers, skills and competence, and professional development.

Results show that type of school has a significant positive relationship with the effectiveness of integration in teaching ($r = 0.400$, $p < 0.01$), point of integration on student's learning ($r = 0.426$, $p < 0.01$), availability of the elements of ICT in school ($r = 0.390$, $p < 0.01$), attitude towards computers ($r = 0.452$, $p < 0.01$), skills and competence ($r = 0.529$, $p < 0.01$), and professional development ($r = 0.417$, $p < 0.01$). This means that teacher – respondents from private schools have higher scores on assessing the ICT implementation. This indicates that private schools observe and practice more on ICT implementation more in terms of the said indicators than public schools.

Further, age has a significant negative relationship with effectiveness on integration of students learning ($r = -0.241$, $p < 0.05$) and skills & competence ($r = -0.229$, $p < 0.05$). This means that those teachers respondents who are younger have higher scores on assessing the effectiveness of ICT on student's learning and helps more in developing the skills and competence in ICT as compared to those who are older teacher respondents. This implies that, as today is a digital era, younger teachers may quickly adapt to technological advancement, particularly in ICT implementation in the teaching and learning process. Likewise, younger teachers can quickly help more students learn ICT skills and competence.

Table 20. Correlation between Profile of the respondents and the Assessment on the ICT Implementation

	Age	Sex	Highest Educational Attainment	Years in teaching	Academic Rank/ Position	Type of school
ICT	-0.05	-0.01	-0.16	0.019	-0.06	0.40**
EFFECT	-0.24*	-0.00	-0.06	-0.11	-0.14	0.43**
AVAIL	-0.02	-0.12	-0.27**	0.06	-0.15	0.39**
ATTI	-0.18	0.10	0.05	-0.14	-0.12	0.45**
SKILLS	-0.23*	0.07	0.00	-0.17	-0.12	0.42**
PROF	-0.10	-0.20*	-0.16	-0.08	-0.16	0.78**
ICT	-0.05	-0.01	-0.16	0.02	-0.06	0.40**

*. Correlation is significant at the 0.05 level (2-tailed).

Moreover, sex is negatively correlated to professional development ($r = -0.198$, $p < 0.05$). Male teacher respondents focus more on professional development in ICT than female teacher respondents. This implies that male teachers are more engaged in specialized training in ICT. This may be because information and communication technology are among the technical course that males commonly take.

Lastly, the highest educational attainment of the teacher respondents was also found to be negatively correlated to the availability of the elements of ICT in school ($r = -0.266$, $p < 0.05$). This means that teacher-respondents who have lower educational backgrounds are given more freedom to design their teaching with the help from the ICT as compared to teachers who have a higher educational experience. This implies that schools set priorities for teachers who will engage themselves or continuously learn and earn additional academic degrees. With this, these teachers are given chances to attend specialized training related to ICT.

With the analysis taken, the hypothesis is accepted. There is a significant relationship between the profile of the respondents and their assessment of ICT implementation.

3.4 Proposed Mathematics with ICT Integration Management Plan
The management plan was drafted based from the result of this study.

Rationale
DepEd's Computerization Program (DCP) aims to equip schools with the necessary technologies to improve the teaching and learning process and rise to the challenges of the twenty-first century. The modernization program implemented information technology to enhance and facilitate teaching and learning and improve educational management and operations.
Recognizing the impact of ICT integration in Philippine schools, it is also essential to consider the applicability of ICT in teaching and learning methods in the different subject areas, especially the subjects like Mathematics.

In light of this, based on the result of this research, Mathematics with ICT integration management plan is at this moment recommended.

Program Goals and Objectives
The ICT integration management plan is designed to establish a contextualized action plan and take appropriate actions to improve the performance of the teaching and learning process through the planned implementation of DepEd.

Specifically, this enhancement program will focus on: (1) reviewing existing policies and procedures; (2) strategic planning in ICT integration; (3) enhancing the skills and competencies of teachers; (4) raising awareness and changing the attitude of teachers and students towards integration of ICT in teaching; (5) evaluating existing ICT elements; and (6) encouraging full participation of stakeholders and coordination with financial providers.

Program Strategies
To make this enhancement program effective, this program will use strategies to cater the different objectives mentioned. The following strategies are defined as follows:
SOAR Analysis stands for Strengths, Opportunities, Aspirations, and Results. This analysis addresses the methods of identifying and tracking progress of ICT management plan, ensuring progress is being made and the overall policy of the DepEd is followed.

Capacity building involves the development of skills and knowledge that enable an individual or organization to adapt to change effectively. Schools may conduct activities, such as training, which help individuals and organizations acquire, improve, and maintain the necessary skills, knowledge, tools, equipment, and other resources to enhance teaching and learning.

Consultative meeting refers to exploring parameters and providing key content inputs for developing a certain project. The school may conduct meetings inviting professionals to help them advise and assist them in implementing and proceed with the effective programs and projects.

ICT trainings and ICT seminars give the teachers enough skills and competencies to integrate ICT into teaching and learning. ICT training and ICT seminars should be provided by professionals specializing in ICT.

Expected Outcomes
At the end of the conduct of the strategies and activities included in this ICT integration management plan, the projected desired outcomes are as follows: (1) enhanced school policies and procedures; (2) developed positive attitudes of teachers and students towards the digitally-aided teaching and learning process; (3) Eehanced teaching and learning process using ICT facilities; (4) sustained ICT training; (5) purchased up to date ICT Elements; (6) buil strong connections between the schools and prospective finance providers through MOA / MOU; and (7) informed stakeholders.

Monitoring and Evaluation
To track the changes and progress of the ICT integration management plan, continuous monitoring and evaluation includes the assessment of school, teachers, and students; the quality of the activities during the implementation of the plan; and whether the schools achieved their goals soon after the enhancement program.

4. Conclusion

The following conclusions can be drawn based on the study's results:
(1) Most elementary Mathematics teachers in the Division Schools of Cabanatuan City are middle-aged females who have completed MS/MA academic units. Most of them hold an academic position/rank as Teachers, earning an average monthly income of P30,001 to P40,000 a month. These teachers have been in the teaching profession for approximately 5 to 10 years and have an average class size of 26-35

students. The most common available information and communication technology equipment of the teachers that can be found both at home and in the school are android mobile phones, printers, flash drives, notebooks/netbook scanners/copiers, desktops, printers, Internet-connected laptops, tablet PC, and television;
(2) There is always an ICT based activity in teaching as shown in this research. Teachers were able to contact parents of students to provide feedback on their children's performance using ICT as a medium of communication. Similarly, ICT aids teachers in preparing, organizing, delivering, and monitoring academic tasks. It differs significantly from the traditional method of designing educational materials;
(3) The integration of ICT in teaching has been highly effective, as demonstrated by the preparation and improvement of teaching materials. ICT has enhanced the teaching and learning process and transformed the teaching quality, making students more engaged through ICT-supported activities that motivate them. ICT elements are often available in their schools, and teachers are free to design their curriculum with the aid of ICT. They have also received training on using and integrating ICT into the learning and teaching process. When ICT-related issues emerge, technical assistance is also provided. Students have a positive attitude toward ICT, which can translate into a positive attitude toward its incorporation into the learning process. This is evident in their increased eagerness and motivation to study. Using ICT, students can gain new skills and knowledge through innovative approaches.

The integration of ICT helps to enhance skills and competence not only among teachers but also among students. Teachers benefit from using ICT by accessing various digital instructional materials and assessment tools. At the same time, students are allowed to learn in ways beyond the traditional classroom setting. Practical training and seminars are available for teachers' professional development in ICT. Teachers need specialized training to utilize ICT in their teaching process effectively. It is also effective for teachers to set their learning courses to further develop their skills in ICT-integrated teaching and learning;
(4) Teacher–respondents from private schools have higher scores on assessing the ICT implementation (effectiveness on integration in education, force on integration on student's learning, availability of the elements of ICT in school, attitude towards computers, skills, and competence, and professional development) indicating that they observe and practice more on ICT implementation as compared to public schools;
(5) A management plan may be a handy tool in teaching Mathematics by integrating ICT platforms and serving as a guide for teachers in making teaching and learning more meaningful and relevant. The work's significant contribution to the existing knowledge is using mobile phones as a medium of instruction as it is the most common technological equipment found at home and in school.

5. Recommendations

The following suggestions were made based on the findings of the study:
(1) Collaboration between local government units (LGUs) and non-governmental organizations (NGOs) should be established to provide the necessary ICT

resources for schools, teachers, and students to ensure the consistent use of ICT in learning and teaching;

(2) Funding and support from school administration should be secured to provide the necessary elements of ICT, as well as technical assistance when needed, to ensure the sustainability of ICT implementation in schools;

(3) ICT-based activities should be regularly implemented in elementary schools to produce students who are comfortable with digital technology. Integrating ICT into teaching should be a priority, including preparing, organizing, delivering, and evaluating academic tasks. Teachers should also receive ongoing training and professional development related to ICT to effectively guide students in developing a positive attitude towards ICT and acquiring new skills and knowledge through new approaches;

(4) To fully adapt to the fast-changing teaching and learning environment with the use of ICT, there should be a long-term program and activities for teachers as part of a comprehensive ICT implementation plan;

(5) The proposed ICT management plan for Mathematics teachers in elementary schools was developed based on the findings of this study. It is recommended to implement this plan to ensure its effectiveness fully.

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