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Bridging ICT Knowledge and Science Achievement: Exploring the Link Between Teachers' and Students' Tech Skills in the Philippines

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Abstract

Education plays a vital role in the world, for it equips people with the necessary skills to be meaningful members of society. Their learning from the academy, within the community, the environment, life experiences, and the internet constitutes who they are, which may lead to a better life. With the advent of technology, which learners are well acquainted with, there is a great chance for the education system, specifically in classroom instruction, to utilize these skills to create a more effective, efficient, and innovative pedagogy. This study aimed to investigate the relationship between Don Emilio Salumbides Elementary School (DESES) teachers' and learners' ICT knowledge and academic performance in Science. The researchers surveyed 258 randomly selected students and 10 science teachers by giving them researcher-made survey questionnaires. Analysis through SPSS revealed a negative correlation between Science Teachers' and Learners' ICT Knowledge and Academic Performance in Science. The level and frequency of usage of ICT knowledge by students and teachers do not contribute to academic performance improvement. The underlying evidence might still contribute to further research if it is situated in different schools. An investigation in science-focused or technology-based schools might change the results. Moreover, the current study is limited to the respondents' access to technology resources. It is recommended to study the correlation between ICT knowledge and academic performance in Science or in any discipline with little to no digital divide among respondents.

Keywords: Science, ICT, teachers' ICT knowledge, learners' ICT knowledge, academic performance

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Introduction

Education plays a vital role in the world for it equips people with the necessary skills to be meaningful members of society. Their learning from the academe, within the community, the environment, through life experiences, and the internet constitutes what they are, which may lead to a better life. However, it is formal education that is well-known and this is focused on delivering high-quality learning experiences in order to aid the students in reaching their full potential. With the advent of technology wherein learners are well-acquainted, it is a great chance for the education system, specifically in classroom instruction, to utilize these skills to create a more effective, efficient, and innovative pedagogy.

At present, technology is commonly used in classroom instruction in the form of Information and Communication Technology. This, according to the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2023), encompasses a range of technological resources utilized to transmit, store, create, distribute, or swap information. Spariosu (2018) further elaborates on this by including technoscience. It also involves the process of electronically collecting, storing, using and transmitting data with the use of computers and other electronic devices (Cambridge University Press, n.d.). It includes a range of digital tools and resources such as computers, tablets, smartphones, software, online learning platforms, multimedia tools, and the Internet. These tools can be used in the classroom to support and enhance teaching and learning. The Commission on Information and Communication Technology (CICT) in the Philippines is committed to the integration of ICT within the educational system. By actively working towards this goal, they aim to incorporate ICT into the process of teaching and learning (Dela Fuente & Biñas, 2020). Utilizing digital resources for learning in the classroom may increase student participation, assist educators and curriculum, and encourage flexible learning (Ansayam & Tan, 2021). In addition, students confidently use technological devices for their learning (Vasudeva, Colthorpe, Ernst, & Lam, 2019). It is also noted that students utilize laptops to take notes, watch lecture recordings, and access their phones to seek out concepts and use applications. Therefore, the use of technological devices has a positive impact on students' learning.

Teachers' and learners' ICT knowledge refers to the skills, competencies, and understanding of technology that they need to effectively integrate digital tools and resources in the teaching and learning process. Teachers who have acquired digital literacy and undergone ICT training can aid in fostering the growth of higher-order thinking skills among learners, providing them with inventive and tailored learning prospects, and improving their preparedness to embrace technological advancements (UNESCO, 2023). Allowing students to utilize ICT for learning results in meaningful experiences that are part of 21st-century skills (Ratheeswari, 2018). ICT knowledge is crucial given society's technological growth (Kumar, 2020). Therefore, teachers' and learners' ICT knowledge must be practiced to attain parallel improvement not only in the ICT knowledge itself but also in the quality of formal education which learners benefit the most.

ICT knowledge can be enhanced through consistent upskilling. The upskilling of ICT knowledge of teachers might benefit the learners' academic performance. Learners' academic

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performance can be affected depending on the magnitude of the digital literacy of their teachers and their understanding of how to integrate ICT into the curriculum (UNESCO, 2021). In particular, the learners' academic performance can be maximized when teachers know how to integrate their ICT knowledge into the curriculum. Thereafter, learners can improve their ICT knowledge together with their Science topic content mastery through exposure. The didactic nature of ICT can be seen in digital platforms, videos, lesson slides, and the like to support learners' activation of visual and verbal stimuli which is noted in the theory of Dual Coding by Allan Pavios (Burnage, 2022). Conceding that teachers can share digital instructional materials to be accessed by learners regardless of time and place supplement learning. ICT knowledge evident in classroom instruction is an innovative, effective, and efficient pedagogy. It holds a special place as a tool that improves teachers' and learners' ability to explain and comprehend the lesson. It is one of the tools for teaching difficult topics to learners (Minamatov & Nasirdinova, 2022). Incorporating information and communication technology (ICT) into the education system creates an interactive and forward-thinking atmosphere for teaching and learning Integrating information and communication technology (ICT) into education cultivates interactive, student-centered environments that heighten learner engagement and accessibility (Arnseth & Hatlevik, 2010; Altakhyneh & Abumusa, 2020; Timotheou et al., 2023), thereby enhancing the caliber of classroom instruction and making it more accessible to students. However, there is insufficient ICT-related upskilling for teachers. The lack of adequate teacher training programs and knowledge impedes the ability of teachers to effectively incorporate and utilize ICT support within the teaching and learning process (Tomaro & Mutiarin, 2018). Apart from this, despite the potential instructional benefits of integrating devices such as cell phones, tablets, and computers into the classroom there were issues noted at the national level. First, the Department of Education (DepEd) once prohibited the use of cell phones during class hours in reference to DECS Orders No. 70, s. 1999 and 26, s. 2000 (Prohibiting Students of Elementary and Secondary Schools from Using Cellular Phones and Pagers During Class Hours). Second, House Bill 5542 seeks to impose a nationwide ban on electronic devices among students aged 15 years and below inside school premises. The use of electronic gadgets in particular is subject to limitation under its exceptional condition. Other information on the process of permitting students to use them for lessons is not explicitly mentioned. Despite these contexts, both policies see electronic devices as a threat to academic performance. The acceptance of the usage of electronic devices in school premises is still questionable due to the need for strict monitoring by the teacher.

The teacher takes charge of managing the integration of ICT into the teaching and learning of Science. The Department of Education (DepEd) Quezon teachers show that 59% of them have basic ICT competence (DepEd Memorandum No. 113, s. 2019). It is also noted by the DepEd that teachers from Quezon who have basic ICT competence need training and retraining for continuous improvement of schools in the division. With that being said, insufficient ICT-related training for teachers has consequences for the teaching and learning process.

Consequently, teachers' limited understanding of ICT hinders them from reaching their full potential in the teaching profession (De Silva, 2022). The stated problem has an

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impact on the teaching and learning process in the field of science education. Science teachers with basic ICT skills may experience integration difficulties. The primary challenges that hinder teachers in effectively integrating ICT into their teaching practices include a lack of extensive teaching experience and inadequate training (Akram, et al., 2022). Having ICT training can help teachers to be literate in technology, by that, trained teachers can make effective teaching and meaningful learning. fAnd it was also found that professional development training programs for teachers also played a key role in enhancing students' quality learning. (Shah, 2022). Teachers must be knowledgeable about when and how to utilize technology in the classroom because it can be a valuable tool when used properly (Winter, et al., 2021). Because if a teacher fails to have digital literacy and fails to integrate it into the classroom, it will be one cause of low student performance. Motivation is one of the variables that can affect students' performance, and ICT is one of the ways that ICT can interactively motivate students. For instance, using various digital tools like movies, graphics, animation, and so on can encourage them to learn and pay attention. (Adelakun, 2023). Because motivated students are committed, energetic, and innovative, determined to achieve their goals (Hawthorne, 2021). In this generation, young people are more aware and knowledgeable about ICT, especially students. In addition, the young people in today's generation also known as generation Z are born as a digital native, meaning they are born when the world has been connected with sophisticated technology and devices (Muhtadi, et al., 2021). The students are more aware of using technological devices because they live with it. Because of that, it can give them more motivation and interest to listen more in the lesson. Aside from this, there is also another effect of this ICT to the learners. Technology has changed education in various ways, including by increasing student involvement and improving learning retention. However, there is a negative effect as well, which may result in the students performing poorly academically. Technology is a main source of distraction (Singh, 2023). In addition, the research revealed that students, on average, check their phones and other electronic devices more than 11 times every day (Gordon, 2021).

The world of education cannot overlook the undeniable impact of the widespread adoption of ICTs and their substantial influence on connected learning in the 21st century. According to Ratheeswari (2018), utilizing ICT in the classroom is essential to offer learners valuable chances to acquire and employ the essential skills required in the 21st century. Therefore, by leveraging ICT, the teaching and learning of primary science lessons can be enhanced to actively involve learners in the process, facilitating their engagement with Science concepts and content. Hence, the level of ICT knowledge among teachers plays a crucial role in effectively managing and utilizing the unique capabilities of devices and digital platforms applicable within the classroom setting. Numerous research studies examining the integration of ICT in education have reached the consensus that its utilization holds the capacity to provide innovative and diverse forms of support to educators, students, and the overall learning experience.

In locales, studies on the relationships between teachers' ICT knowledge and learners' science performance are extremely limited. Given this, the researchers aim to investigate the relationship between Don Emilio Salumbides Elementary School (DESES) teachers and learners' ICT knowledge and learners' academic science performance to determine and

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interpret the direction and resilience of the ICT impact. The interpretation of the local situation concludes and might recommend appropriate action if proven as there is a positive correlation. Moreover, this can be the basis for future research.

Purpose of the research

The study seeks to answer the following questions:

1. What is the level of ICT knowledge of Science teachers and learners in Don Emilio Salumbides School in terms of:
    1.1. ICT tools and equipment; and,
    1.2. Digital platforms?
2. What is the level of frequency usage of technological devices in the Science classroom like:
    2.1 School and/or classroom technological device/s;
    2.2. Personal technological device/s; and,
    2.3. Digital application/s?
3. What is the level of academic performance of learners in Science?
4. Is there a significant relationship between teachers' and students' ICT knowledge with academic performance in Science?

Methodology

This study involves a quantitative correlational design in describing and assessing the variables' statistical relationships and their strengths. Quantitative research involves the use of numerical measurements to examine variables, determine their correlation, identify the direction of the correlation, and assess their strength. It is a form of non-experimental research (Mbuva, 2018). In particular, the researchers use this design to describe and assess the direction of the relationship between the Don Emilio Salumbides Elementary School Science teachers' and learners' ICT knowledge and Grade 3 to Grade 6 learners. By this, a single number quantifies and summarizes the direction of the relationship between teachers' and learners' level of ICT knowledge and learners' science academic performance.

The target locale of the researchers is Don Emilio Salumbides Elementary School (DESES) in Lopez, Quezon. The respondents of this study are Grade 3 to Grade 6 teachers handling Science and 23 sections and science learners from Grade 3 to Grade 6 of DESES.

The researchers use simple random sampling techniques in order to select learners as respondents. The Grade 3 respondents consist of 190 learners from 6 sections. The Grade 4 respondents consist of 237 learners from 6 sections. The Grade 5 respondents consist of 207 learners from 6 sections. The Grade 6 respondents consist of 148 learners from 5 sections. A total of 782 respondents are to be selected. The sample size is determined using the Cochran formula with a 5% margin of error. In determining the number of respondents for the three grade levels, the simple random sampling technique was used in this study. For Grade 3,

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there are six sections (SPED, Cheerful, Thrifty, Courteous, Creative, and Resourceful) For Grade 4, there are six sections (SPED, Diligent, Dependable, Persistent, Helpful, and Generous). For Grade 5, there are 6 sections (SPED, Brilliant, Optimistic, Ambitious, Energetic, Versatile). For Grade 6, there are only 5 sections (SPED, Charitable, Courageous, Discipline, and Humility). The sample size for Grade 3 is 64 learners. The researchers randomly select 11 learners from SPED, 10 learners from Cheerful, 11 learners from Thrifty, 11 learners from Courteous, 11 learners for Creative, and 10 learners for Resourceful. The sample size for Grade 4 is 65 learners. The researchers randomly select 11 learners from SPED, 11 learners from Diligent, 10 learners Dependable, 11 learners from Persistent, 11 learners from Helpful, and 11 learners from Generous. The sample size for Grade 5 is 65 learners. The researchers randomly select 11 learners from SPED, 11 learners from Brilliant, 10 learners from Optimistic, 11 learners from Ambitious, 11 learners from Energetic, and 11 learners from Versatile. The sample size for Grade 6 is 64. The researchers randomly select 13 learners from SPED, 13 learners from Charitable, 12 learners from Courageous, 13 learners from Discipline, and 13 learners from Humility. Through simple random sampling, all of the learners were given equal opportunities to be selected and avoided biases.

A non-random technique selects the science teachers from Grades 3 to 6 as respondents. Particularly, the instrument uses a purposive non-random sampling technique. The science teachers have common characteristics in the sample. They teach the subject area to the learners throughout the school year 2022-2023.

To determine the relationship between the ICT knowledge of science teachers and learners with academic performance in Science, the researchers use researcher-made survey questionnaires. This questionnaire consists of various parts (level of knowledge in ICT, frequency of ICT knowledge usage, and Science academic performance for Quarter 3), and each part consists of a number of questions or statements. In order to assess the teachers' level of ICT knowledge, the participants will mark a checkmark to indicate their level of skills by selecting one of the following options for each question or statement: (4) advanced, (3) proficient, (2) basic, or (1) novice. In order to assess the frequency of ICT knowledge practice in teaching, the participant will select the range of hours spent using classroom technological devices if it is 8 hours above per day, 4-7 hours per day, 1-4 hours per day, or 0 hours a day. The use of personal technological devices and digital applications for teaching practice is categorized in descriptions namely: always (4), sometimes (3), seldom (2), and never (1). Another set of survey questionnaire for Science learners is given. The statements are modified to be age-appropriate for students. The questionnaires consist of the same parts for teachers except for one. The researchers added a scale to determine their academic performance in Science. The questionnaire categories like Outstanding (90-100), very satisfactory (85-90), satisfactory (80-84), fairly satisfactory (75-79), and did not meet expectation (below 75) were adapted from the K12 school report card, in which students place a checkmark in the column that contains their Science grade in Quarter 3 for School Year 2022-2023.

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The following procedures determine the Correlation Between Teachers' and learners'' ICT Knowledge and Learners' Science Academic Performance. The researchers prepare a survey questionnaire and then present it to validators. The researchers selected validators who have appropriate professional credentials or records for the topic at hand. The remarks given by the validators are applied to the survey questionnaires. After this, a draft of the manuscript is given to the research adviser. The research adviser assisted in organizing the research content. Once the paper passes the validation process, the researchers proceed to seek permission to distribute the survey questionnaires to respondents from the Office-In-Charge (OIC) of Don Emilio Salumbides Elementary School. The researchers conducted the survey after receiving approval from the OIC. The survey questionnaires will be distributed to the respondents during their free time. The researchers collect, score, tally, and tabulate the answers from the survey questionnaire.

Participants of the study

One hundred thirty-two novice teachers answered the online survey questionnaire introduced using Google forms and ten (10) participants for an online interview.

Table 1. Profile of Respondents

Code	Age	Rank	Years in Service
TP1	20	Teacher 1	1
TP2	21	Teacher 1	2
TP3	20	Teacher 1	1
TP4	20	Teacher 1	1
TP5	24	Teacher 1	3
TP6	21	Teacher 1	2
TP7	22	Teacher 1	2
TP8	23	Teacher 1	4
TP9	23	Teacher 1	3
TP10	25	Teacher 1	5

Research instruments

The researchers use Weighted Arithmetic Mean (WAM) on each part of the set of questionnaires to evaluate all of the data acquired with the purpose of determining the level of teachers' and students' ICT knowledge, usage frequency, and learners' academic performance in Science. Another statistical treatment is the Pearson correlation coefficient which assesses the relationship between two variables. The WAM from teachers' and students' ICT knowledge as the x-variable. The WAM of Science grades from Grade 3, Grade 4, Grade 5, and Grade 6 as the y-variable. A Statistical Package for the Social Sciences (SPSS) is an application used to compute and rule a decision on the correlation between teachers' and learners' ICT knowledge with academic performance in Science. *Data analysis*

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The Blended Teaching Readiness Instrument's mean scores were determined using statistical tools. The same software calculated the Cronbach's Alpha coefficient for the instrument's internal accuracy. The process ensured that the instrument adopted in the

Ethical consideration

The personal information and responses of participants asked their consent and not disclosed outside the university unless both researchers and participants agree otherwise. Furthermore, researchers completely abide by all laws and ethical guidelines set out by the university and the community throughout the conduct of the study.

Results and Discussion

3.1 Level of ICT Knowledge in terms of ICT tools and Equipment and Digital Platforms

Table 2. Results of teachers' ICT knowledge in terms of ICT tools and equipment, and digital platforms

	WAM	Int
ICT tools and equipment	3.2	Advanced
Digital Platforms	3.32	Advanced

1.00-1.75- Novice; 1.76 to 2.50- Basic; 2.51-3.15- Proficient; 3.26-4.00- Advanced

The table shows the Level of ICT knowledge of Science Teachers in DESES in terms of ICT tools and equipment and digital platforms. It represents that the teachers are advanced with ICT tools and equipment with an overall WAM of 3.2. The digital platforms show that the teachers are proficient with Digital platforms with an overall WAM of 3.32. In this regard, the ICT knowledge of learners concluded as advanced in both contexts.

The findings show that teachers are knowledgeable in terms of ICT tools and equipment and digital platforms. Moreover, they know how to integrate their knowledge into their teaching practice. We can infer from this that teachers' ICT knowledge is crucial for effective teaching and learning. In connection with the results of the study entitled "Teaching and Learning with Technology: Effectiveness of ICT Integration in Schools", shows that one of the key elements in the success of technology-based teaching and learning is teachers who are well-prepared with ICT tools and resources (Shah, 2022). Therefore, teachers with expertise in ICT can lead to effective teaching and high-quality learning.

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Table 3. Results of learners' level of ICT knowledge in terms of ICT tools and equipment, and digital platforms

	WAM	Int
ICT tools and equipment	2.94	Proficient
Digital Platforms	2.73	Proficient

1.00-1.75- Novice; 1.76 to 2.50- Basic; 2.51-3.15- Proficient; 3.26-4.00- Advanced

The table shows the Level of ICT knowledge of Science Learners in DESES in terms of ICT tools and equipment and digital platforms. It represents that the learners are proficient with ICT tools and equipment with an overall WAM of 2.94. The digital platforms show that the learners are proficient with Digital platforms with an overall WAM of 2.73. In this regard, the ICT knowledge of learners concluded as proficient in both contexts.

In this study, the findings revealed that teachers from DESES considered their ICT knowledge to be high-ranking. In comparison to the results of the Department of Education (DepEd) study of Quezon teachers more than half of them acquired basic ICT competence (DepEd Memorandum No. 113, s. 2019). The high level of ICT knowledge by DESES teachers can maximize the features of available devices and digital platforms applicable to teaching Science. Integrating ICT into the classroom is crucial for giving students meaningful experiences to learn and use 21st-century skills (Ratheeswari, 2018). ICT skills are one of the 21st-century skills that are considered important given the technological advancement in society (Kumar, 2020). Thus, teaching Science with proficient ICT knowledge can be an advantage for creating a positive learning experience in honing learners' 21st-century skills.

3.2 Level of Frequency in using of technological devices in the Science classroom like school and/or classroom technological device/s

Table 4 revealed that teachers and students of DESES utilize technological devices in the Science classroom. It further shows that it has a WAM of 2.31 with an interpretation of 1-4 hours daily. At the time of the study, Science class duration was set at 50 minutes per session. However, with the issuance of DepEd Order No. 010, s. 2024 which outlines the Policy and Guidelines on the Implementation of the Matatag Curriculum the allotted time for all learning

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areas in Grades 3 to 10 has been adjusted to 45 minutes per day to accommodate the diverse contexts of schools.

Table 4. Results of teachers' level of frequency usage of technological devices in classroom

	WAM	Int
Gen. Int	2.31	1-4 hours

1.00-1.75- 0 hour; 1.76 to 2.50- 1-4 hours; 2.51-3.15- 4-7 hours; 3.26-4.00- 8 hours above

The findings also suggest that teachers may integrate technological devices within classroom settings in Science. Additionally, the 1-4 hours of device usage surpasses the allotted 50-minute Science class period, indicating the application of ICT knowledge across various disciplines. In relation to this, teachers utilize technology to prepare and deliver course content effectively to students (Ocak & Karafil, 2021). Therefore, the use of technological devices plays a crucial role in enhancing the teaching and learning process within the classroom.

Table 5. Results of learners' level of frequency usage of technological devices in classroom

	WAM	Int
Gen. Int	**1.87**	**1-4 hours**

1.00-1.75- 0 hour; 1.76 to 2.50- 1-4 hours; 2.51-3.15- 4-7 hours; 3.26-4.00- 8 hours above

The findings indicated the frequency of use of mobile phones, tablets, laptops, and television by students in the classroom to learn Science. It shows that the Science learners in DESES got 1.87 WAM with an interpretation of 1-4 hours of using technological devices in the Science classroom in a day. It shows that learners might manipulate technological devices within a classroom setting in Science. Using technological devices has a positive impact on students. They were confidently using digital tools for their learning (Vasudeva et al., 2019). Therefore, students' learning is improved when they use technology in the classroom for educational purposes.

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3.3 Level of Frequency Usage of Personal Technological device/s and Digital Application

Table 6. Results of learners' level of frequency usage of personal technological devices, and digital application

	WAM	Int
Personal Technological Device/s	2.31	SE
Digital Application	2.19	SE

1.00-1.75- Never (N); 1.76 to 2.50- Seldom (SE); 2.51-3.15- Sometimes (SO); 3.26-4.00- Always (A)

The table shows the Level of Frequency of DESES Science Learners in Using Personal Technological device/s and Digital Application. It represents that the learners use personal Technological device/s seldom with an Overall WAM of 2.31. The frequency of digital applications of learners is seldom with the Overall WAM of 2.19. In this regard, the level of frequency of using Personal Technological device/s and Digital Applications of learners concluded as seldom in both contexts.

Table 7. Results of teachers' level of frequency usage of personal technological devices

	WAM	Int
Gen. Int	2.62	SO

1.00-1.75- Never (N); 1.76 to 2.50- Seldom (SE); 2.51-3.15- Sometimes (SO); 3.26-4.00- Always (A)

The findings show the frequency level of DESES science teachers using personal technological devices in teaching. It shows that it has a WAM of 2.62 with an interpretation of sometimes used. Teachers use their personal devices as a tool to supplement their teaching. It helps them to explain the lesson to students, especially the difficult topics (Minamatov & Nasirdinova, 2022). Therefore, they are not always using technological devices at all times, but they sometimes utilize them if it would help the students comprehend the lesson easier.

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Table 8. Results of teachers' level of frequency usage of digital applications

	WAM	Int
LMS Application	1.87	SE
Word Processor Application	3.16	A
Presentation software	2. 9	SO

1.00-1.75- Never (N); 1.76 to 2.50- Seldom (SE); 2.51-3.15- Sometimes (SO); 3.26-4.00- Always (A)

The findings show the frequency level of DESES science teachers in using different applications such as LMS application, Word processor application and Presentation software in teaching. It shows that the LMS application has 1.87 WAM with the interpretation of Seldom used; Word Processor Application has 3.16 WAM with the interpretation of Always used and the Presentation software has 2.9 WAM with the interpretation of Sometimes used.

The level of frequency supported the practice of ICT knowledge. ICT knowledge covers the skills of technology. In connection, the current study shows significant usage of digital applications in teaching. The Dual Coding theory of Allan Pavios claims representation of information using digital platforms such as in text and lesson slides helps learners encode and retrieve science concepts (Burnage, 2019). Thus, the frequent usage of digital application/s in teaching learners might help them to achieve learning intended outcomes.

3.4 Level of academic performance of learners in Science

The Department of Education's (DepEd) Grading System (DepEd Order No. 8, 2015) was used in this study to assess students' academic performance in science. The learners' grades are categorized in the grading scale in order to indicate their achievement in science as shown in the table below.

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Table 9. DepEd Grading System

Grading Scale	Descriptor	Remarks
90-100	Outstanding	Passed
85-90	Very Satisfactory	Passed
80-84	Satisfactory	Passed
75-79	Fairly Satisfactory	Passed
Below 75	Did Not Meet Expectation	Failed

Outstanding-5; Very Satisfactory-4; Satisfactory-3; Fairly Satisfactory-2; Did Not Meet Expectation-1

The academic performance of 258 science learners in DESES from Grade 3 to 6, who agreed to participate in this research study, were analyzed using the quantitative records of their grades in science in Quarter 3 provided by their teachers. The learners' marks, results, and the achievement level of the learners in Quarter 3 are shown in the table below.

Table 10. Results of learners' academic performance in Science of Quarter 3

Marks	f	Percentage	Result	Percentage	Achievement Level
90-100	*141*	*54.65%*	*Passed*		*Outstanding*
85-89	*92*	*35.66%*	*Passed*		*Very Satisfactory*

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80-84	*23*	*8.91%*	*Passed*	*100%*	*Satisfactory*
75-79	*2*	*0.78%*	*Passed*		*Fairly Satisfactory*
Below 75	*0*		*Failed*	*0%*	*Did not meet expectation*
Total	*258*			*100%*	

The table shows the learner's grades in Science during the 3rd Quarter of AY 2022–2023. 141, or 54.65%, of the learner's respondents got an Outstanding rate, 92, or 35.66%, got a Very Satisfactory Rate, 23, or 35.55%, got a Satisfactory rate, and 2 or 0.78% got a Fairly Satisfactory rate. In line with this, the teachers seldom use ICT tools, equipment, and digital platforms in teaching Science yet 100% of learners in DESES got a passing grade in Science.

3.5 Significant relationship between teachers' and students' ICT knowledge with academic performance in Science

Table 11. Results of the relationship between teachers' and students' ICT knowledge with academic performance in Science

	ICT Knowledge	**Academic Performance**
Pearson Correlation	1	-.431
Sig (2-tailed)		.213
N	10	10
Pearson Correlation	-.431	1

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Sig (2-tailed)	.213	
N	10	10

In Table 2, the results indicate that Science teachers and learners in DESES possess an advanced level of ICT knowledge in using ICT tools and equipment. Additionally, their proficiency in utilizing digital platforms is reflected as advanced in both contexts. Science teachers also demonstrate the ability to integrate their ICT knowledge into their teaching practices. These findings align with the study "Teaching and Learning with Technology: Effectiveness of ICT Integration in Schools", which emphasizes that the successful implementation of technology-based teaching and learning depends on teachers being well-equipped with ICT skills for utilizing digital tools and resources (Shah, 2022).

Meanwhile, in Table 3, the results also reveal that both teachers and learners are proficient with ICT tools and equipment in terms of ICT tools and equipment and the usage of digital platforms. These findings, highlights the commitment of the Department of Education's on their study on teachers in Quezon, which confirm that they possess basic ICT competency (DepEd Memorandum No. 113, s. 2019). In relation to the similar studies also conducted titled "Integrating ICT into the classroom is essential for providing students with meaningful learning experiences and fostering 21st-century skills", (Ratheeswari, 2018). Given the rapid technological advancements in society, ICT skills are considered a vital component of 21st-century education (Kumar, 2020). Therefore, teaching Science with proficient ICT knowledge can enhance the learning experience and help develop students' 21st-century skills effectively.

In Table 4, results of teachers' level of frequency usage of technological devices in the classroom reveal that teachers and students of DESES utilize technological devices in the Science classroom. It further shows 1 to 4 hours of its daily usage. At the time of conduct of the study, Science class duration was set at 50 minutes per session. However, with the issuance of DepEd Order No. 010, s. 2024 which outlines the Policy and Guidelines on the Implementation of the Matatag Curriculum the allotted time for all learning areas in Grades 3 to 10 has been adjusted to 45 minutes per day to accommodate the diverse contexts of schools.

Furthermore, in Table 5. findings indicate that learners frequently use mobile phones, tablets, laptops, and televisions in the classroom to study Science subjects. The recorded usage of these technological devices, ranging from 1 to 4 hours daily, suggests that students actively

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engage with and manipulate technology within the Science classroom. The integration of technological devices positively impacts students, as they demonstrate confidence in using digital tools for learning (Vasudeva et al., 2019). Therefore, incorporating technology into the classroom for educational purposes enhances students' learning experiences and overall academic performance. In Table 6, Results of learners' level of frequency usage of personal technological devices and digital application represents that DESES Science learners' seldom uses of personal technological devices and digital applications. However, Tables 7 and 8 present findings on the frequency of DESES Science teachers' use of personal technological devices and digital applications, revealing that they utilize these tools occasionally. Teachers often rely on their personal devices to supplement instruction, particularly when explaining complex topics to students (Minamatov & Nasirdinova, 2022). This suggests that while they do not consistently use technological devices in every lesson, they integrate them as needed to enhance student comprehension and learning.

Likewise, the findings indicate that DESES Science teachers utilize various applications, including LMS platforms, word processors, and presentation software, in their teaching. This supports the application of ICT knowledge, aligning with Allan Paivio's Dual Coding Theory, which emphasizes that representing information through digital platforms such as text and lesson slides—enhances learners' ability to encode and retrieve Science concepts (Burnage, 2019). Therefore, the frequent use of digital applications in teaching may contribute to achieving the intended learning outcomes.

In the level of academic performance of learners' in science, this study adopted the Department of Education grading system as stipulated in the DepEd Order No. 8, 2015 to assess students' academic performance in science. A total of 258 science learners in DESES from Grade 3 to 6 agreed to participate in this research study were analyzed using the quantitative records of their grades in science in Quarter 3.

In Table 10, the data reveals that all learners in DESES achieved a passing grade in Science during the 3rd Quarter of AY 2022–2023, despite the fact that teachers seldom used ICT tools, equipment, and digital platforms in their instruction. A majority of the learners, 141 (54.65%), attained an Outstanding rating, while 92 (35.66%) earned a Very Satisfactory rating. Additionally, 23 (8.91%) received a Satisfactory rating, and only 2 (0.78%) were classified under Fairly Satisfactory.

These results suggest that while ICT integration is often considered a crucial factor in enhancing teaching and learning, DESES Science teachers have been able to effectively deliver lessons and ensure student success even with minimal use of technology. This could indicate that other instructional strategies, such as traditional teaching methods, direct instruction, or hands-on experiments, are effectively supporting student learning. Furthermore, the high percentage of students achieving Outstanding and Very Satisfactory ratings may reflect the

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learners' adaptability, study habits, and motivation, as well as the effectiveness of the teachers' pedagogical approaches.

However, given the potential benefits of ICT in education—such as improving engagement, accessibility to information, and fostering 21st-century skills, integrating technological tools into Science instruction could further enhance student learning experiences. While the current performance is commendable, incorporating ICT more frequently might provide additional opportunities for deeper understanding, interactive learning, and real-world application of scientific concepts.

In Table 11, the findings indicate a significant correlation between ICT knowledge and academic performance in Science, specifically highlighting a negative correlation. This inverse relationship suggests that as students' and teachers' ICT knowledge increases, academic performance in Science tends to decrease. As a result, the null hypothesis (Ho) is rejected, reinforcing that ICT knowledge does not directly contribute to students' academic success in Science. These results align with the study "The Influence of ICT Use and Related Attitudes on Students' Math and Science Performance: Multilevel Analyses of the Last Decade's PISA Surveys", which found no positive correlation between students' use of ICT—both inside and outside the classroom and their performance in Science (Courtney, et al., 2020). This suggests that while ICT tools may offer supplemental learning opportunities, they do not necessarily enhance Science achievement and may even pose distractions or challenges in effectively mastering scientific concepts.

ICT plays a crucial role in education by enhancing student learning, but its integration is not always necessary for every subject. In Science, hands-on learning has been shown to be more effective in helping students retain information compared to digital-based instruction (Arnholz, 2019). The structure of the Science curriculum does not mandate ICT integration for every concept, as the nature of the subject often requires experiential learning methods. While ICT can be beneficial at times, it does not automatically lead to the achievement of learning objectives. Instead, the curriculum emphasizes the use of hands-on, minds-on, and hearts-on activities to actively engage students, encouraging deeper understanding beyond reliance on textbooks (Science Curriculum Guide, 2016). Therefore, ICT integration in Science education should be applied selectively, as it is not always aligned with the content and intended learning outcomes.

Conclusion

The study revealed a negative correlation between Science teachers' and learners' ICT knowledge and academic performance in Science. This suggests that regardless of the level or frequency of ICT usage in Science teaching and learning, it does not lead to improved academic performance. While the study was limited by respondents' access to technology

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resources, its findings provide a foundation for further research on the relationship between ICT knowledge and Science achievement. Future studies could explore this correlation in various educational settings, such as Science-focused or technology-based schools, to determine whether similar trends persist across different learning environments.

Recommendations

From the findings and conclusions of the study, the following recommendations were endorsed: 1) implement continuous professional development programs that focused on enhancing the ICT skills for science teachers. 2) ensure equitable access to ICT resources for both teachers and students, this could involve providing schools with adequate technology infrastructure, such as computers, tablets, reliable and effective internet connections, and provide more specialized science software. 3). implement programs to boost students' ICT skills along with their science courses. This could involve extracurricular activities, workshops, and integration of ICT projects into their science classes. 4). establish a system for monitoring and assessment on the Impact of ICT Integration on students' academic performance In science.

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