Article

Information And Communication Technology (ICT) Integration Towards Creative Learning in An Early Childhood Education Amidst Covid – 19 Pandemic

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Abstract

ICT is becoming a ubiquitous component of the physical and social worlds occupied by young children. It is an important part of the private and work lives of most people, including those who support young children's learning and development, whether as parents or early childhood educators. Therefore, ICT matters in early childhood education, because it already has an effect on the people and the environment that surround young children's learning and well-being. Along this line, this research was conducted to determine the integration of information and communication technology (ICT) towards creative learning in an early childhood education amidst COVID–19 pandemic at Marshall School, Mountain Village School and Pilot Station of Lower Yukon School District, Alaska, USA during the school year 2020 – 2021 as basis for an action plan. The study employed mixed-method of research design using the quantitative-qualitative method and convenient random sampling technique. The sample consisted of ECE educators/teachers. The data gathering tools employed were modified research survey questionnaire supplanted with interview. The following statistical tools were used namely: frequency, percentage, weighted mean, standard deviation, Kruskal- Wallis H test and t- test. A letter of consent was sought from the office of the College Dean, College of Education, CTU MC and School Principals of the aforementioned three schools at Alaska, USA and the respondent's survey checklist before the study commenced. The findings of the study revealed and implied that ICT offers new opportunities to strengthen many aspects of early childhood education practice and increase teacher proficiency in teaching strategies that can be an incredibly powerful tool that may yield meaningful increases in student achievement in class settings amidst COVD-19 pandemic.

Keywords: Information and Communication Technology, Integration towards creative learning

Introduction

In the 21st century, "technology" has become the information superhighway that connects most nations, making the word

indispensable in many disciplines, including education. The advancements and societal transformations that have resulted from the incorporation of technology have altered people's ways of thinking, working, and living (Jerald, 2009). Educators who want their pupils to succeed in "a knowledge society" should consider how to include ICT into the classroom experience (Lauwers, 2019; Shah, 2022).

"ICT integration in education" refers to using digital communication in regular classroom activities. According to Jadhav et al. (2022) teachers are the primary users of ICT in the classroom daily because of their capacity to create a stimulating and proactive learning environment for their pupils in tandem with preparing them for the present digital era. As a means of preparing students for the difficulties of modern globalization, ICT integration seeks to enhance the quality, accessibility, and cost-effectiveness of the delivery of teaching (Nayak et al., 2020). The ICT process option is not a one-time deal but a continuous process that backs up instructional materials and data banks (Morin & Curry, 2022). When discussing "ICT integration in education," we usually refer to using learning technologies in the classroom. Students' comfort with and success in a technology-based learning environment make classroom ICT integration a pressing concern for today's schools (Garves & Keane, 2023). The pedagogical aspects of education benefit significantly from the incorporation of technological tools. Learning using ICT and its various features and components will be efficient and fruitful. Because of their common ground in the foundational disciplines of mathematics, science, language, art, and the humanities, technological resources play an increasingly important role in the education of students across the curriculum (Paramati et al., 2022).

The global community will need to rely on other modes of education such as distance learning during the COVID-19 pandemic. Schools worldwide must close to prevent the spread of this deadly illness to the next generation (Manullang & Satria, 2020). Due to the closure, millions of students and teachers must complete their coursework online. The urgent need to move away from "face-to-face" classes and toward virtual teaching or online learning has reached even the realm of early childhood education (Adu et al., 2022).

In addition, ICT offers further aid and assistance to educators and learners. Learning is facilitated by application, with computers serving as auxiliary learning tools (Tang et al., 2021). Technology and computers are not a substitute for competent educators and they are merely an additional aid for enhanced classroom performance (Shehzadi et al., 2021). The importance of incorporating ICT into classrooms cannot be overstated. With the help of modern technological advancements, classroom instruction can take place even when great distances separate the instructor and student (Ghory & Ghafory, 2021). However, using ICT is not a static process but rather an ongoing one that results in a more proactive classroom setting.

Teachers and students can benefit from using ICT in many classroom settings to enhance their understanding of specific topics. Interesting educational videos, simulation, data storage, database usage, mind-mapping, guided exploration, brainstorming, music, and the World Wide Web (www) are just some of the ways that technology-based teaching and learning enrich the educational experience.

In the School District of Alaska, U.S.A., even before the COVID-19 pandemic, ICT integration has already been in use as part of the instruction delivery strategies. The closure of the schools strengthened its integration by utilizing all available resources to deliver instruction effectively to all levels of classes. With the advent of technology, the younger students almost effortlessly transitioned to online learning. They seem to possess digital skills that were helpful in the abrupt transition to online learning. Although technological devices such as laptops, desktops, and tablets were not readily accessible to all students, many have shown the ability to manipulate such devices as a learning medium.

ICT integration in classroom instruction is a tremendous help to both teachers and students during the pandemic. It has been beneficial to teachers in early childhood classes in measuring the pedagogy knowledge, technology knowledge, content knowledge, pedagogical content knowledge, technological content knowledge, technological pedagogical knowledge, and technological pedagogical content knowledge that the learners have acquired.

Along with this premise, it was the intention of this study to look into the extent of integration of ICT in the delivery of instruction by the teachers of early childhood classes, especially during the time of pandemic in the Lower Yukon School District, Alaska, findings of which served as the basis for the formulation of the action plan presented in next succeeding Chapter.

Methodology

This research employed the Mixed Method using quantitative and qualitative techniques. Under the quantitative process, the descriptive correlational design (Wisdom & Creswell, 2013) was employed. This inquiry approach describes the variables and the relationships that occur naturally between and among them. The descriptive correlational design gives researchers across research disciplines a rigorous process to answer research questions. Similarly, this research used the qualitative research technique with questions that allowed the respondents to freely express themselves on a given topic during the interview. They shared their ideas and feelings surrounding the challenges they had while integrating ICT, especially during the pandemic, when children and families are distressed. It is also considered a descriptive research method with the survey questionnaire as the research instrument. As described by Salaria

(2012), descriptive correlational research involves and employs the process of inquiry, interpretation, and attempts to develop knowledge. It describes and analyzes people's individual and collective beliefs, social actions, and the meaning that they assign to them. This research study was conducted at the three schools of Lower Yukon School District, Alaska, USA, namely: Marshall School, Mountain Village School, and Pilot Station School as the research environment.

Moreover, this study used the research survey questionnaire adapted, modified, and formulated. Answers were taken from the following sources: James Scott Peas, (2019) "Positive and Negative Influences of Technology in Early Childhood Classrooms: A Qualitative Study," S. Ghavifekr & W.A.W Rosdy (2015). "Teaching and learning with technology: Effectiveness of ICT Integration in Schools," Nada Mohammed Abuouf Hammed (2014) "Information and Communication Technology in Early Childhood Education: Challenges for Effective Implementation and Integration," and Rona Lynette Tyger, (2011) "Teacher Candidates' Digital Literacy and Their Technology Integration Efficacy."

Results and Discussion

Teachers Profile

The sample consists of 15 teachers, with 8 males and 7 females. In terms of age, the majority of teachers fall into the 51-55 age range, followed by the 56 years old and above category. Regarding marital status, the highest percentage of teachers are married. When it comes to ethnicity or race, the majority identify as White (Non-Hispanic White), followed by Asian and Two or More Races. In terms of educational attainment, an equal number of teachers have a Baccalaureate degree and have completed or are pursuing a Master's degree. The field of specialization is diverse, with English, Mathematics, and Science being the most common subjects taught by the teachers. The grade level teaching assignments vary, with Grade 7-12 being the most common, followed by Grades 5 and 6. On average, the teachers have a class size ranging from 20 to 49 students. They spend an average of more than 30 teaching hours per week. In terms of experience, the majority of teachers have been teaching for more than 26 years. Moreover, the sample of teachers is a mix of male and female educators, with a diverse range of ages, marital statuses, ethnicities or races, educational backgrounds, subject specializations, and teaching experiences. They teach various grade levels and subject areas, and most have a significant number of years of teaching experience.

Table 1. The mobile Device Used

Mobile Devices at Hand	RESPONSES (n = 15)	
	f	%
Smartphone	15	100.00
Tablet	15	100.00
Smartphone, tablet	15	100.00
Smartphone, smartwatch, handheld gaming consoles	12	80.00
Smartphone, handheld gaming consoles	10	66.66
Smartphone, tablet, handheld gaming consoles	12	80.00
Smartphone, E-readers	11	73.33
Smartphone, tablet, smartwatch, handheld gaming consoles	14	93.33
Smartphone, tablet, smartwatch, E-readers	12	80.00
Smartphone, Tablet, E-readers, handheld gaming consoles	13	86.66
Smartphone, tablets, E-readers	12	80.00
Smartphone, smartwatch	14	93.33

Table 1 showed that almost all teacher respondents commonly possessed nearly all of these mobile devices. Mobile computers have gradually been introduced into educational contexts over the past two decades. Mobile technology has led most people to carry small computers with exceptional computing power, such as laptops, personal digital assistants (PDAs), tablet personal computers (PCs), cell phones, and e-book readers. This large amount of computing power and portability, combined with wireless communication and context-sensitivity tools, makes one-to-one computing a great potential learning tool in both traditional classrooms and informal outdoor learning.

Mobile devices have various distinctive features such as individualized interfaces, real-time access to information, context-sensitivity, and instant communication and feedback. These features may enhance the effects of specific pedagogies, such as self-directed learning, inquiry learning, or formative assessment. However, it is noteworthy that the features of mobile devices are not sufficient conditions for positive learning effects. The minor effects of mobile-device-based cooperative and game-based learning in our study illustrated that instructional strategies are essential for effective learning with information technology (Lan, 2014; Lan et al., 2015; Liu et al., 2014). Researchers must find the "key" to integrating mobile devices with instructional strategies and ingeniously match the unique features

of mobile devices to resolve specific educational challenges. Doing so will maximize the impact of those features on learning outcomes.

Hence, the findings in Table 12 suggest that in this digital era, more and more schools in many countries are taking advantage of these new mobile devices that offer portability and ease of use. Although the use of technology in education is remarkable and has a positive trend, there is a need for concern, as several obstacles restrain the integration of technology (Vrasidas & Kyriacou, 2008). The existing process needs to be reassessed, and new methods may have to be implemented to be used in classrooms. Throwing these devices into classrooms to see what happens is terrible and will have negative consequences. Although the students favor mobile devices, they too have concerns.

The technology used effectively in the classroom enables students to be innovative while developing new skills and provides students with futuristic information (Saxena, 2013). Recently, the increase in the use of technology is shifting traditional teaching methods in the classroom by facilitating learning in new ways. Mobile learning is using mobile technology to enable learning anytime and anywhere.

According to Schuller et al. (2013) from the UNESCO report, mobile devices include any portable, connected technology, such as basic mobile phones, smartphones, e-readers, netbooks, tablets, iPads, and computers. Mango (2015) pointed out that today's students have not just changed incrementally compared to the past. They are the first generation to grow up with electric devices of new technology. He adds that they have been using video games, video cams, digital music players, cell phones, computers, and other toys and tools of the digital age almost from birth and are an essential part of their lives. He further says that mobile learning is a need but not a want today. Allowing students to use mobile devices in the classroom increases their motivation to learn and achieve (Kunzler, 2011). Hutchison & Reinking (2011) pointed out that these devices are becoming a reality just in the development of technology.

However, it is yet understood how learning and teaching will change with the access and use of these devices. Without such understanding, people are left with a preliminary analysis that creates the conditions for ill-informed policy decisions at educational institutes. Teachers must augment or change the way they teach to entirely educate students and prepare them for scientific and technological global competitiveness in the 21st century.

In addition, technology is developing at a rapid pace, and it is an ongoing process. Traxler (2010) considers that devices owned by students are not designed for educational use and are poorly suited for learning. Initially, tablets and similar devices were developed for personal use, but they are still intended for educational purposes. Innovative technology is growing at a rapid pace, and several apps for learning and teaching purpose are being introduced. The management

experience some stress in making decisions in choosing the apps that are best for learning and teaching. As Melhuish and Falloon (2010) noted, "for an application to be a part of an individual's learning pathway, they must be pedagogically sound in design, rather than focusing solely on content, engagement or edutainment." It is important to note that digital technology should enhance curricular goals and support student learning in new and transformative ways (Hutchison & Reinking, 2011). Educational institutions need to take note of this and look for safe, productive ways to integrate mobile learning devices into our curriculums. There has been very little research done on mobile learning, and there is a lot of scope for further study, especially in evaluation and assessment.

Table 2. Type of Internet Connectivity at home

Type of Internet Connectivity you have at home.	RESPONSES (n = 15)	
	f	%
Fiber to the home	14	93.33
Business internet	10	66.66
DSL, ADSL, SDSL, VDSL	12	80.00
Data from cell phone	13	86.66
Cable internet access	15	100.00
Dial-up access	11	73.33
Home internet (Tatto Home Broadband)	13	86.66
Satellite and Visat	12	80.00

Table 2 disclosed that all the teacher respondents have internet connectivity at home. Every teacher should have internet, whether on their mobile devices or at home, which is necessary. Lower Yukon School District is one school district that utilizes an online grading system (PowerSchool) and different interactive online learning (Mobymax, Brainpop) where the internet is needed. They need internet connectivity for teachers to manipulate such applications, prepare interactive lessons at home, update students' grades, and check their progress.

It could be implied that technology is changing the way things are done, including the work in all levels of institutions where the teaching and learning process requires a great deal of improvement—knowing fully that the internet is an essential tool for facilitating academic activities, not only in the tertiary institution but from preschool to 12th grade as well. For several years now, the managers of the academe of learning have invested heavily in establishing internet services in their schools. The services provided by the internet have had a significant impact on the university context, organization, and teaching and learning methods. The Internet has made computers across the globe interconnected.

The findings of the Household Information Technologies Use Research (2016) report implied that the frequency of internet use was every day in a week, the duration of internet connection with 1-2 hours every day, and teachers frequently stay connected to the internet at home with a computer and the frequency of mobile devices and social network use was every time. When the frequency of internet use and duration of connection to the internet is compared, teachers mostly responded to "every day" and "3-4 hours". When internet use frequency increases, the internet's connection duration also increases. The results show the importance of the internet in teachers' lives. Furthermore, a significant difference was found between the frequency of internet use and the environments in which teachers stay connected to the internet. It was also figured out that teachers indicated that they relate to the internet with "a connection belongs to their computer at home" during "3-4 hours".

Fasae and Aladeniyi (2016) pinpoint that for the developing countries to grow and attain their economic and social status, such countries must be fully ready to strengthen and empower their academic institutions, both in science and technological capacity. Hence, the students in their respective fields will need an array of reliable and interactive means of accessing and retrieving information without wasting much time. Similarly, using the Internet greatly depends on some associated factors such as purposes, students' experience, locations, Internet facilities, and services available, among others, on the students' academic pursuit in their institutions. Internet connectivity makes the digital era and technology more comprehensive in the scope of usefulness. With the internet, technologies have become alive and interactive and can reach the other end of the world. Thus, the internet is essential in utilizing technology, not only in classroom instruction but in everyday life as well.

Table 3. Number of Years of Using Computer in School

Number of Years of Using Computer in School (in years)	(n = 15)					
	Male (n = 8)		Female (n = 7)		GRAND TOTAL	
	F	%	f	%	f	%
21 – 25 years	6	40.00	4	26.66	10	66.66
16 – 20 years	1	6,66	2	13.33	3	20.00
11 – 15 years	1	6.66	1	6.66	2	13.33
TOTAL	8	53.33	7	46.67	15	100

Table 3 disclosed that ten (6 Males & 4 Females), or 66.66 percent of the teacher respondents have been going through between 21 to 25 years of using computers in their schools; three (1 Male & 2 Females),

or 20 percent of them have been exposed to the use of computers for the last 16 to 20 years, and two (1 Male & 1 Female), or 13.33 percent of them were experiencing the use of computers in the last11 to 15 years. The table shows that even at the beginning of the 21st century, teachers used a computer for class instruction. School districts are responsible not merely to provide computers for schools but also to foster a habit of infusing various ways computers can be integrated into teaching-learning. Teachers use computers for many purposes, such as: to update subject knowledge and teaching skills, develop lesson plans, prepare additional instructional material, notify others of relevant information via email, prepare assessments, grade students' work/assignments, report students' progress, professional development and many more.

For classroom instructions, teachers use computers to show educational videos in the class, showcase students' creative work, interactive class activities (e.g., Kahoot), online assessments, etc. Alsied & Pathan (2015) found in their study that more than three-fourths of the teachers in Central Schools in India use computers either often or at least sometimes. About 5-10% of teachers always use computers to teach other languages, and less than 10% never use them. Their study also showed that teachers more commonly use computers for teacher-directed students' assignments and to learn something from them. Thus, school districts and administrators should support teachers by giving them more time and training to equip themselves with technology to prepare/plan lessons and activities to best serve the students during instructional time, especially during this COVID pandemic.

Table 4. Extent of integration of ICT in teaching Early Childhood Education

Indicators	OWM	Verbal Description
Technology Knowledge	2.933	Agree
Pedagogical Knowledge	2.923	Agree
Content Knowledge	2.833	Agree
Technological Content Knowledge	2.853	Agree
Pedagogical Content Knowledge	2.885	Agree
Technological Pedagogical Knowledge	2.866	Agree
Technological Pedagogical Content Knowledge	2.914	Agree

The table shows the extent of integration of ICT (Information and Communication Technology) in teaching Early Childhood Education, as indicated by various knowledge domains. Each indicator is assigned a score on a scale, with higher scores indicating a greater extent of integration. In this case, all indicators have scores above 2.8, indicating agreement in the extent of integration of ICT.

The scores suggest that teachers possess a positive level of technology knowledge, pedagogical knowledge, content knowledge, technological content knowledge, pedagogical content knowledge, technological pedagogical knowledge, and technological pedagogical content knowledge. This implies that teachers have the necessary understanding and skills to effectively incorporate ICT in their teaching practices for Early Childhood Education. The implications of this high level of integration of ICT in teaching Early Childhood Education are significant. It indicates that teachers are well-equipped to leverage technology to enhance teaching and learning experiences for young children. By incorporating ICT, teachers can create more engaging and interactive lessons, customize instruction to meet individual student needs, and facilitate the development of 21st-century skills in early learners.

Furthermore, the integration of ICT in early childhood education can contribute to the development of digital literacy and technology fluency among young children. They can gain early exposure to digital tools and resources, fostering their ability to navigate and utilize technology effectively in their future academic and personal lives. Additionally, the integration of ICT in Early Childhood Education can help bridge the digital divide and promote inclusivity. It can provide access to educational opportunities and resources for children who may otherwise have limited access to educational materials or face socioeconomic barriers.

However, it is important to ensure that the integration of ICT in Early Childhood Education is balanced and developmentally appropriate. Teachers should consider the age-appropriateness of technology use, monitor screen time, and ensure that technology is used as a tool to enhance learning rather than replace essential hands-on experiences and interactions. Overall, the high level of integration of ICT in teaching Early Childhood Education, as indicated by the scores in the table, signifies the readiness and capability of teachers to utilize technology effectively in their instructional practices, thereby enhancing the learning experiences and outcomes for young learners.

Table 5. Significant Relationship between the Extent of ICT Integration in terms of Technology knowledge and Mobile Devices Used (N=15)

Variables in Association (1) Technology Knowledge and Mobile Devices Used	M	SD	Computed r Value	P-Value	Strength of Relationship	Remarks
Smart phones, smart watch, handheld gaming consoles	.80	.41	.097	.730	Very Weak	Non-significant
Smart phone, handheld gaming consoles	.67	.49	.400	.140	Weak	Non-significant
Smart phone, tablet, handheld gaming consoles	.80	.41	-.341	.213	Weak	Non-significant
Smart phone, E-readers	.73	.46	-.338	.218	Very Weak	Non-significant
Smart phone, tablet, smart watch, handheld gaming consoles	.93	.26	-.052	.854	Very Weak	Non-significant
Smart phone, tablet, smart watch, E-readers	.80	.41	-.292	.290	Very Weak	Non-significant
Smart phone, tablet, E-readers, handheld gaming consoles	.87	.35	.153	.586	Very Weak	Non-significant
	.80	.41	.000	1	None	Non-significant
Smart phone, smart watch	.93	.26	.261	.348	Very Weak	Non-significant

Table 5 presents the significant relationship between the extent of ICT integration in terms of technology knowledge and the mobile devices used by teachers in the sample of 15 individuals. The implications of these findings suggest that the extent of technology knowledge possessed by teachers does not necessarily determine the combination of mobile devices they use. It indicates that teachers may use different combinations of mobile devices regardless of their level of technology knowledge. However, it is important to note that the small sample size (N=15) and non-significant relationships in the data may limit the generalizability of these findings. Further research with a larger sample size is recommended to provide more conclusive results. Nevertheless, the non-significant relationships between technology knowledge and mobile devices used indicate that teachers may choose to use mobile devices based on factors other than their level of technology knowledge. These factors could include personal preference, accessibility, familiarity, and the specific educational purposes or functions the devices serve.

Educational institutions and policymakers can take these findings into consideration when implementing technology integration initiatives. It is crucial to provide teachers with professional development opportunities and support to enhance their technology knowledge and skills. However, the choice of mobile devices used by teachers should be based on their instructional needs, student requirements, and pedagogical goals rather than solely relying on their level of technology knowledge. In summary, the analysis suggests that while there is no significant relationship between technology knowledge and the specific combinations of mobile devices used by teachers, further research is needed to draw more definitive conclusions. The results emphasize the importance of considering various factors beyond technology knowledge when determining the mobile devices used for instructional purposes in educational settings.

Table 6 presents the significant relationship between the extent of ICT integration in terms of pedagogical knowledge and the mobile devices used by teachers in the sample of 15 individuals. The table includes variables in association, mean (M), standard deviation (SD), computed correlation coefficient (r value), p-value, strength of relationship, and remarks. The analysis of the data reveals that there is a significant relationship between pedagogical knowledge and the use of specific combinations of mobile devices by teachers. Specifically, a significant moderate positive correlation is observed between pedagogical knowledge and the use of mobile devices such as smartphones and E-readers, as well as smartphones and tablets. The implications of these findings suggest that teachers with higher levels of pedagogical knowledge are more likely to incorporate mobile devices such as smartphones and E-readers or smartphones and tablets in their

Table 6. Significant Relationship between the Extent of ICT Integration in terms of pedagogy knowledge and Mobile Devices Used (N=15)

Variables in Association (2) Pedagogical Knowledge and Mobile Devices Used	M	SD	Computed r Value	P-Value	Strength of Relationship	Remarks
Smart phone, smart watch, handheld gaming consoles	.80	.41	.107	.705	Very Weak	Non-significant
Smart phone, handheld gaming consoles	.67	.49	.410	.129	Weak	Non-significant
Smart phone, tablet, handheld gaming consoles	.80	.41	-.274	.322	Very Weak	Non-significant
Smart phone, E-readers	.73	.46	-.561*	.030	Moderate	Significant
Smart phone, tablet, smart watch, handheld gaming consoles	.93	.26	.301	.275	Moderate	Non-significant
Smart phone, tablet, smart watch, E-readers	.80	.41	-.046	.871	Very Weak	Non-significant
Smart phone, tablet, E-readers, handheld gaming consoles	.87	.35	-.006	.983	Very Weak	Non-significant
Smart phone, tablet, E-readers	.80	.41	.564*	.029	Moderate	Significant
Smart phone, smart watch	.93	.26	-.187	.504	Very Weak	Non-significant

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

instructional practices. This implies that pedagogical knowledge plays a role in shaping teachers' choices and decisions regarding the use of specific mobile devices.

These findings highlight the importance of providing teachers with not only technological knowledge but also pedagogical knowledge to effectively integrate mobile devices into their teaching practices. Teachers who possess a strong understanding of pedagogical principles can leverage the capabilities of mobile devices to enhance student engagement, facilitate personalized learning experiences, and support instructional strategies that align with educational goals.

Educational institutions and professional development programs can focus on equipping teachers with pedagogical knowledge related to mobile device integration. This can include training on effective instructional strategies, assessment methods, and classroom management techniques that maximize the potential of mobile devices in supporting student learning.

Additionally, the significant relationship between pedagogical knowledge and the use of specific mobile device combinations suggests the need for ongoing support and professional learning opportunities for teachers. Providing teachers with continued professional development, access to resources, and collaborative learning communities can further enhance their pedagogical knowledge and competence in utilizing mobile devices for instructional purposes.

In conclusion, the analysis demonstrates that pedagogical knowledge has a significant impact on the selection and integration of specific combinations of mobile devices by teachers. Teachers with higher pedagogical knowledge are more likely to incorporate mobile devices effectively in their instructional practices. These findings emphasize the importance of equipping teachers with pedagogical knowledge to maximize the educational benefits of mobile device integration in the classroom.

Table 7 presents the significant relationship between the extent of ICT integration in terms of content knowledge and the mobile devices used by teachers in the sample of 15 individuals. The table includes variables in association, mean (M), standard deviation (SD), computed correlation coefficient (r value), p-value, strength of relationship, and remarks. The analysis of the data reveals that there are no significant relationships between content knowledge and the specific combinations of mobile devices used by teachers. The correlation coefficients and p-values indicate non-significant or very weak relationships. The implications of these findings suggest that content knowledge does not appear to have a direct influence on the choice or utilization of specific mobile devices by teachers. It indicates that teachers may use different combinations of mobile devices regardless of their level of content knowledge.

Table 7. Significant Relationship between the Extent of ICT Integration in terms of content knowledge and Mobile Devices Used

Variables in Association (3) Content Knowledge and Mobile Devices Used	M	SD	Computed r Value	P-Value	Strength of Relationship	Remarks
Smartphone, smartwatch, handheld gaming consoles	.80	.41	.246	.377	Very Weak	Non-significant
Smartphone, handheld gaming consoles	.67	.49	.139	.621	Very Weak	Non-significant
Smartphone, tablets, handheld gaming consoles	.80	.41	-.410	.129	Weak	Non-significant
Smart phone, E-readers	.73	.46	-.222	.426	Very Weak	Non-significant
Smart phone, tablet, smart watch, handheld gaming consoles	.93	.26	.263	.344	Very Weak	Non-significant
Smart phone, tablet, smart watch, E-readers	.80	.41	.164	.559	Very Weak	Non-significant
Smart phone, tablet, E-readers, handheld gaming consoles	.87	.35	-.096	.732	Very Weak	Non-significant
Smart phone, tablet, E-readers	.80	.41	.410	.129	Weak	Non-significant
Smart phone, smart watch	.93	.26	.000	1	None or Very Weak	Non-significant

However, it is important to consider that the small sample size (N=15) and non-significant relationships in the data may limit the generalizability of these findings. Further research with a larger sample size is recommended to provide more conclusive results.

Although no significant relationships were found, it is still crucial for teachers to possess strong content knowledge in their respective subject areas. Content knowledge enables teachers to deliver accurate and meaningful instruction, provide relevant examples and explanations, and guide students in their learning.

While content knowledge may not directly influence the choice of mobile devices used, it remains essential for teachers to align their instructional practices with curriculum standards and educational goals. Integrating mobile devices effectively requires teachers to have a deep understanding of the content they teach and how technology can enhance student learning in that specific domain. Teachers should continue to engage in professional development opportunities that enhance their content knowledge, while also exploring ways to effectively integrate mobile devices that align with the subject matter. This could involve collaborating with colleagues, attending subject-specific workshops, and staying updated on best practices for integrating technology in content-specific contexts. In summary, the analysis suggests that while there are no significant relationships between content knowledge and the specific combinations of mobile devices used by teachers, further research is needed to draw more definitive conclusions. The results emphasize the ongoing importance of content knowledge for effective teaching, while recognizing that the choice of mobile devices used in instruction may be influenced by other factors.

Table 8 presents the significant relationship between the extent of ICT integration in terms of technological content knowledge and the mobile devices used by teachers in the sample of 15 individuals. The table includes variables in association, mean (M), standard deviation (SD), computed correlation coefficient (r value), p-value, strength of relationship, and remarks. Upon analyzing the data, it can be observed that there is a significant moderate negative correlation between technological content knowledge and the use of specific combinations of mobile devices by teachers. Specifically, a significant negative correlation is observed between technological content knowledge and the use of mobile devices such as smartphones, tablets, and handheld gaming consoles.

The implications of these findings suggest that teachers with higher levels of technological content knowledge are less likely to incorporate mobile devices such as smartphones, tablets, and handheld gaming consoles in their instructional practices. This implies that teachers with stronger technological content knowledge may rely less on these specific combinations of devices for teaching purposes.

Table 8. Significant Relationship between the Extent of ICT Integration in terms of technological content knowledge and Mobile Devices Used (N=15)

Variables in Association (4) Technological Content Knowledge & Mobile Devices Used	M	SD	Computed r Value	P-Value	Strength of Relationship	Remarks
Smart phone, smart watch, handheld gaming consoles	.80	.41	.160	.570	Very Weak	Non-significant
Smart phone, handheld gaming consoles	.67	.49	.176	.531	Very Weak	Non-significant
Smart phone, tablet, handheld gaming consoles	.80	.41	-.639	.010	Moderate	Significant
Smart phone, E-readers	.73	.46	-.155	.581	Very Weak	Non-significant
Smart phone, tablet, smart watch, handheld gaming consoles	.93	.26	-.104	.711	Very Weak	Non-significant
Smart phone, tablet, smart watch, E-readers	.80	.41	-.373	.171	Weak	Non-significant
Smart phone, tablet, E-readers, handheld gaming consoles	.87	.35	-.049	.863	Very Weak	Non-significant
Smart phone, tablet, E-readers	.80	.41	.248	.372	Very Weak	Non-significant

These findings highlight the importance of technological content knowledge in guiding teachers' choices and decisions regarding the use of mobile devices. Teachers who possess a deeper understanding of how technology intersects with content-specific areas can make informed decisions about the most appropriate and effective use of mobile devices in their instructional strategies. Educational institutions and professional development programs can prioritize the development of technological content knowledge among teachers. Providing training and support focused on the integration of technology in specific content areas can enhance teachers' ability to leverage mobile devices to enhance student learning experiences.

Furthermore, the significant negative correlation between technological content knowledge and the use of specific mobile device combinations suggests the need for ongoing professional development and support. Teachers should continue to develop their technological content knowledge to explore alternative ways of integrating technology that align with their subject matter and pedagogical goals.
It is important to note that further research with a larger sample size is recommended to strengthen the generalizability of these findings. The small sample size (N=15) may limit the generalizability of the results.
In conclusion, the analysis demonstrates that there is a significant relationship between technological content knowledge and the use of specific combinations of mobile devices by teachers. Teachers with higher technological content knowledge may be less likely to use certain combinations of devices in their instructional practices. These findings emphasize the importance of supporting teachers in developing their technological content knowledge to make informed decisions about the integration of mobile devices for effective teaching and learning.

Table 9 presents the significant relationship between the extent of ICT integration in terms of pedagogical content knowledge and the mobile devices used by teachers in the sample of 15 individuals. The table includes variables in association, mean (M), standard deviation (SD), computed correlation coefficient (r value), p-value, strength of relationship, and remarks. Upon analyzing the data, it can be observed that there are no significant relationships between pedagogical content knowledge and the specific combinations of mobile devices used by teachers. The correlation coefficients and p-values indicate non-significant or very weak relationships. The implications of these findings suggest that pedagogical content knowledge does not appear to have a direct influence on the choice or utilization of specific mobile devices by teachers. It indicates that teachers may use different combinations of mobile devices regardless of their level of pedagogical content knowledge

Table 9. Significant Relationship between the Extent of ICT Integration in terms of pedagogical content knowledge and Mobile Devices Used

Variables in Association (5) Pedagogical Content Knowledge and Mobile Devices Used	M	SD	Computed r Value	P-Value	Strength of Relationship	Remarks
Smart phone, smart watch, handheld gaming consoles	.80	.41	.389	.152	Weak	Non-significant
Smart phone, handheld gaming consoles	.67	.49	.118	.676	Very Weak	Non-significant
Smart phone, tablet, handheld gaming consoles	.80	.41	-.375	.168	Weak	Non-significant
Smart phone, E-readers	.73	.46	.050	.859	Very Weak	Non-significant
Smart phone, tablet, smart watch, handheld gaming consoles	.93	.26	-.200	.474	Very weak	Non-significant
Smart phone, tablet, smart watch, E-readers	.80	.41	-.236	.397	Very Weak	Non-significant
Smart phone, tablet, E-readers, handheld gaming consoles	.87	.35	.278	.316	Very Weak	Non-significant
Smart phone, tablet, E-readers	.80	.41	.319	.246	Weak	Non-significant

However, it is important to consider that the small sample size (N=15) and non-significant relationships in the data may limit the generalizability of these findings. Further research with a larger sample size is recommended to provide more conclusive results. While no significant relationships were found, it is still crucial for teachers to possess strong pedagogical content knowledge in their respective subject areas. Pedagogical content knowledge enables teachers to effectively connect the content they teach with appropriate instructional strategies, differentiation techniques, and assessment methods.

Although pedagogical content knowledge may not directly influence the choice of mobile devices used, it remains essential for teachers to align their instructional practices with educational goals and student needs. The effective integration of mobile devices requires teachers to have a deep understanding of how to leverage their subject-specific knowledge to enhance student learning experiences. Teachers should continue to engage in professional development opportunities that enhance their pedagogical content knowledge, while also exploring ways to effectively integrate mobile devices that align with their subject matter. This could involve collaborating with colleagues, attending subject-specific workshops, and staying updated on best practices for integrating technology in content-specific contexts.
In summary, the analysis suggests that while there are no significant relationships between pedagogical content knowledge and the specific combinations of mobile devices used by teachers, further research is needed to draw more definitive conclusions. The results emphasize the ongoing importance of pedagogical content knowledge for effective teaching, while recognizing that the choice of mobile devices used in instruction may be influenced by other factors.

Table 10 presents the significant relationship between the extent of ICT integration in terms of technological pedagogical knowledge and the mobile devices used by teachers in the sample of 15 individuals. The table includes variables in association, mean (M), standard deviation (SD), computed correlation coefficient (r value), p-value, strength of relationship, and remarks. Upon analyzing the data, it can be observed that there are no significant relationships between technological pedagogical knowledge and the specific combinations of mobile devices used by teachers. The correlation coefficients and p-values indicate non-significant or very weak relationships.

The implications of these findings suggest that technological pedagogical knowledge does not appear to have a direct influence on the choice or utilization of specific mobile devices by teachers. It indicates that teachers may use different combinations of mobile devices regardless of their level of technological pedagogical knowledge. However, it is important to consider that the small sample size (N=15) and non-significant relationships in the data may limit the.

Table 10. Significant Relationship between the Extent of ICT Integration in terms of technological pedagogical knowledge and Mobile

Variables in Association (6) Technological Pedagogical Knowledge & Mobile Devices Used	M	SD	Computed r Value	P-Value	Strength of Relationship	Remarks
Smart phone, smart watch, handheld gaming consoles	.80	.41	-.128	.649	Very Weak	Non-significant
Smart phone, handheld gaming consoles	.67	.49	.446	.096	Weak	Non-significant
Smart phone, tablet, handheld gaming consoles	.80	.41	.315	.252	Weak	Non-significant
Smart phone, E-readers	.73	.46	.603*	.017	Moderate	Significant
Smart phone, tablet, smart watch, handheld gaming consoles	.93	.26	.169	.548	Very Weak	Non-significant
Smart phone, tablet, smart watch, E-readers	.80	.41	.266	.338	Very Weak	Non-significant
Smart phone, tablet, E-readers,	.87	.35	.015	.956	Very Weak	Non-significant

generalizability of these findings. Further research with a larger sample size is recommended to provide more conclusive results. While no significant relationships were found, it is still crucial for teachers to possess strong technological pedagogical knowledge to effectively integrate technology in their teaching practices. Technological pedagogical knowledge involves understanding how technology can be used to enhance pedagogy, instructional strategies, and student learning outcomes.

Although technological pedagogical knowledge may not directly influence the choice of mobile devices used, it remains essential for teachers to align their instructional practices with educational goals and leverage technology appropriately. Teachers should continue to engage in professional development opportunities that enhance their technological pedagogical knowledge, while also exploring ways to effectively integrate mobile devices that support their instructional strategies. In summary, the analysis suggests that while there are no significant relationships between technological pedagogical knowledge and the specific combinations of mobile devices used by teachers, further research is needed to draw more definitive conclusions. The results highlight the ongoing importance of developing technological pedagogical knowledge to effectively integrate technology in teaching, while recognizing that the choice of mobile devices used may be influenced by various factors beyond technological pedagogical knowledge.

Table 11 presents the significant relationship between the extent of ICT integration and the number of years using the computer for each aspect of knowledge (technological knowledge, pedagogical knowledge, content knowledge, technological content knowledge, pedagogical content knowledge, technological pedagogical knowledge, and technological pedagogical content knowledge) in the sample of 15 individuals. The table includes variables in association, mean (M), standard deviation (SD), computed correlation coefficient (r value), p-value, strength of relationship, and remarks.

Upon analyzing the data, it can be observed that there are no significant relationships between the extent of ICT integration in terms of any aspect of knowledge and the number of years using the computer. The correlation coefficients and p-values indicate non-significant or very weak relationships.

The implications of these findings suggest that the number of years using the computer does not appear to have a direct influence on the extent of ICT integration in terms of different aspects of knowledge. It indicates that the duration of computer use does not necessarily determine the level of ICT integration in teaching practices.

Table 11. Significant Relationship between the Extent of ICT Integration and Number of Years Using the Computer

Variables in Association	M	SD	Computed r Value	P-Value	Strength of Relationship	Remarks
(1) Technological Knowledge and Number of Years	2.93	.321	3.405	.182	Weak	Non-significant
(2) Pedagogical Knowledge and Number of Years	2.92	.323	.449	.799	Weak	Non-significant
(3) Content Knowledge and Number of Years	2.83	.350	1.26	.532	Very Weak	Non-significant
(4) Technological Content Knowledge and Number of Years	2.85	.389	2.16	.340	Very Weak	Non-significant
(5) Pedagogical Content Knowledge and Number of Years	2.88	.354	1.88	.390	Very Weak	Non-significant
(6) Technological Pedagogical Knowledge and Number of Years	2.91	.350	.777	.678	Very Weak	Non-significant
(7) Technological Pedagogical Content Knowledge and Number of Years	2.91	.294	1.05	.591	Very Weak	Non-significant

However, it is important to consider that the small sample size (N=15) and non-significant relationships in the data may limit the generalizability of these findings. Further research with a larger sample size is recommended to provide more conclusive results.

While no significant relationships were found, it is still important for teachers to continue developing their knowledge and skills in using ICT. Professional development and training programs can play a crucial role in enhancing teachers' technological, pedagogical, content, and integrated knowledge, regardless of the number of years they have been using the computer. Teachers should actively seek opportunities to update their knowledge, learn new tools and techniques, and engage in reflective practices to improve their ICT integration in teaching. Ongoing professional development can help teachers stay informed about the latest advancements in technology and explore innovative ways to integrate ICT effectively in their instructional practices. In summary, the analysis suggests that there are no significant relationships between the extent of ICT integration in terms of different aspects of knowledge and the number of years using the computer. Further research with a larger sample size is needed to draw more definitive conclusions. The findings emphasize the importance of continuous professional development to enhance teachers' ICT integration skills, regardless of their prior computer use experience.

Conclusion

The study has delved into the profile and ICT utilization of a sample of 15 teachers, characterized by a rich diversity in terms of gender, age, marital status, race or ethnicity, educational attainment, subject specializations, and teaching experiences. The teachers predominantly teach in Grades 7-12 and carry significant teaching experience, with most having more than 26 years in the profession. They all utilize a variety of mobile devices, including smartphones and tablets, with a large proportion also using smartwatches, handheld gaming consoles, and E-readers. All teachers reported having internet connectivity at home, with the most common types being cable internet access and fiber to the home. The study assessed the teachers' extent of ICT integration in terms of various knowledge components: technology, pedagogy, content, technological content, pedagogical content, technological pedagogical, and technological pedagogical content knowledge. The teachers generally agreed with their competence in these areas, but the relationship between their level of ICT integration and the type of mobile devices used was mostly found to be weak and statistically non-significant, indicating no strong

association between the two. Notable exceptions include the moderate yet significant relationships between pedagogical knowledge and the use of smartphones with E-readers, and smartphones with tablets and E-readers. Similarly, a moderate significant relationship was found between technological pedagogical knowledge and the use of smartphones with E-readers. The study also found no significant relationship between the extent of ICT integration and the number of years teachers have been using the computer. In conclusion, while the teachers in this sample are ICT competent and use a variety of digital devices, the extent of their ICT integration in teaching is not significantly influenced by the type of mobile devices they use nor the length of their computer usage. These findings suggest that other factors, possibly related to training, support, and resources, might play a more significant role in effectively integrating ICT into teaching. Future studies should explore these additional factors to provide a more comprehensive understanding of ICT integration in education.

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