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Research Article

Instructional and Technology Leadership of School Heads, and Attitude Towards ICT: A Structural Equation Model on ICT Literacy of Public School Teachers

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ABSTRACT

The study was aimed at determining the best-fit structural model ICT literacy as influenced by the instructional and technology leadership of school heads and attitudes towards ICT. The respondents of this study were the 409 public elementary school teachers in the Caraga Region, Philippines, using correlational and structural equation modeling. Mean, Pearson r, Structural Equation Model were the statistical used in the study. The result showed that the levels of instructional leadership and technology leadership were very high, and attitudes towards ICT and ICT literacy were high. Further, all exogenous variables instructional leadership, technology leadership, and attitudes towards ICT showed significant correlations with ICT literacy. Finally, findings showed that Model 3 is the best-fit structural model. Model 3 revealed that exogenous variable instructional leadership of school heads was described by its two remaining indicators, namely, communicating the school goals and providing incentives for learning; exogenous variable technology leadership was explained by its two indicators, namely, leadership and vision and social, legal, and ethical issues, and the exogenous variable, attitudes towards ICT was measured using two retained indicators, namely, attitude towards obstacles and attitude towards social and cultural factors. On the other hand, the endogenous variable ICT literacy was described by its two retained indicators, namely, access and evaluation. This implies that in order to enhance ICT literacy, teachers may work on developing the retained indicators by way of establishing teacher effectiveness and improving student outcomes in an increasingly digital world. These insights contribute to the developing body of knowledge and align with DepEd's goals, supporting SDG 4 on quality education, which ultimately benefits the entire teaching community and the educational system.

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INTRODUCTION

Information and Communications Technology (ICT) Literacy creates global awareness and competitiveness in the digital world for policymakers and business leaders and even for ordinary citizens around the globe; it also plays a vital role in the academic arena (Aboderin, 2019). Some common challenges of ICT for both learners and educators are the focus on technical skills, limited access and support, and attitudes towards technology. Teachers may lack the skills to manage teaching materials, have low software competence, or lack specific knowledge about integrating technology with pedagogy, and some lack training in digital literacy or how to use ICT in specific subject areas. However, information and communication technology in school as a learning center serves as a training community where learning competencies are taught. Skills is one of many models for describing and managing competencies for ICT professionals for the 21st century (von Konsky, Miller, & Jones, 2016).

The relevance of ICT literacy in education is that it enhances school performance and enables school heads to manage and administer their schools in the digital age effectively. Also, it enhances their teaching methods, helps them stay updated with technological advancements, and enables them to create more engaging and effective learning experiences for students. Wherein the ADDIE model introduces a systematic approach for the effective presentation of the instructional design of behavioral outcomes, which are Analysis, Design,

Development, Implementation, and Evaluation.

Being the simplest, yet effective way of creating an instructional design, the ADDIE method is perfect for achieving your instructional goals. The success of teacher education via the internet depends on the function of technological literacy (Soufghalem, 2024; Arafah & Hasyim, 2023), especially in relation to information and communication technology. Modern cultures use information and communication technology to modify educational institutions, strengthen links between communities, educators, and students, and improve health and education. Technical and societal developments have affected every aspect of human life. On the one hand, characteristics, proficiency, abilities, and knowledge critical in earlier times have become less important (Fazli, Nejad, & Salimi, 2023). Because education is necessary to respond to the demands of an era of technological growth and technological integration, the challenges are growing more complicated. To create Human Resources (HR) with information and communication technology literacy abilities to progress education, digital literacy learning must be used to develop digital literacy competencies for teachers and students (Zamhari, Huda, Rosyada, & Nata, 2024).

The acquisition of knowledge of ICT literacy is increasingly important in 21st-century education in the quest for the battle of today's digital information. This perspective

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on ICT literacy is critical to the impact of social networking that can be managed with digital skills and proficiency with networks of people, mechanisms for information, and resources, and this could be an essential tool for the design of curriculum and assessment in education. Digitalization drastically changes professional and economic activities, job resources, and job design. As a result, it is important to continue researching how workplace digitalization affects employee engagement (Nikou, De Reuver, & Mahboob Kanafi, 2022). Moreover, it seems that teleworking would most likely be a hybrid or blended arrangement, in which employees operate partially remotely and partially in an office (Deschênes, 2024). In the 21st century, digital and ICT literacy are essential for successful education, especially for foreign language teachers who need to use a variety of technologies to supplement their teaching methods (Konovalenko, Nadolska, Poyasok, & Striuk, 2023). ICT literacy is increasingly relevant for student participation in this highly technology-dependent society (Lau & Yuen, 2014).

These ICT literacy skills create necessary information for students to help navigate and use the abundance of information available and to identify technology-related capabilities in growing concern of insufficient level to graduating trainee teachers' (Irvin & Markauskaite, 2007), usefulness to explore the impact of ICT literacy on the adoption of mobile learning influences technology-driven attitudes of students and educators. Also, it reveals the effectiveness on project-based learning that is integrated with e-learning

(Mac Callum & Jeffrey, 2014 Eliana, Senam, Wilujeng & Jumadi, 2016). Additionally, this ability to effectively use information and communication technology plays an important role in schools, workplaces, and people's daily lives (Senkbeil, 2022). According to some authors (Jan 2018; Keshtiarast & Salehi, 2020), the attitude and behavior of teachers and school leaders show a positive impact innovatively employing and measuring lifelong learning attitudes in digital literacy significantly.

Studies on ICT literacy correlate with different factors, namely, instructional leadership, technology leadership, and attitude toward ICT. According to a study by Saad and Sankaran (2021), there is a connection between ICT literacy and instructional leadership. Principals make a sincere effort to incorporate these behaviors into their daily lives because they understand how important it is to implement instructional leadership practices for the benefit of their schools' success. Instructional leaders must stay current with educational trends and practices to achieve high-quality teaching and learning. Educational leadership aims to improve the quality of education and the educational system overall. An essential element of successful educational leadership is cooperation between educators, learners, and parents. To attain academic achievement, educational leadership's primary objectives are to improve practices, materials, and training. Collaboration with a wide range of individuals, including educators, parents, students, public politicians, and members of the general

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public, is primarily how this is achieved (Noceto, 2022). Furthermore, the principal's job has evolved in light of this significant shift, according to the study of Berkovich and Hassan (2024). To investigate principals' digital instructional leadership, working processes, and results, school leaders had to transition from in-person interactions to remote leaders working digitally.

Additionally, as demonstrated by the research conducted by Dasmo & Sunardi (2021), a significant connection exists between the ICT literacy of educators and the technology leadership of school administrators, with all six aspects of technology leadership having a noteworthy positive impact on teachers' ICT literacy. To stay aligned with the digital age trends, where technology integration is highlighted as a crucial aspect, school leaders must assume technology-related roles that involve encouraging and collaborating with teachers to ensure effective technology integration. However, previous studies have primarily focused on how technology leadership influences the ICT literacy of teachers or the learning outcomes of students. The use of information and communication technology (ICT) in education greatly influences teachers. School administrators exert pressure on them to integrate ICT to enhance the quality of teaching and learning in the classroom. Nevertheless, teachers remain doubtful about their capacity to effectively implement pedagogical strategies using ICT (Ismail, Omar, & Raman, 2021). As information and communication technologies (ICT) become part of the curriculum, educators are tasked with

fostering ICT literacy in their students. This necessitates that teachers and school leaders possess substantial technological knowledge (TK) and technological-pedagogical knowledge (TPK) so they can consistently exhibit and enhance their technological leadership to provide optimal support for the integration of ICT. Additionally, teachers can incorporate ICT to align with the Redefinition phase, which introduces innovative and transformed approaches to teaching and learning (Regañon and Kastorff & Stegmann, 2024).

Furthermore, the research conducted by Nair and Karan (2024) identified a link between ICT literacy and attitudes toward ICT. Recognizing the significance of information and communication technology (ICT) and digital resources in the teaching and learning environment is essential. Teachers' perspectives towards ICT and digital resources play a crucial role in fostering positive student attitudes towards these tools. The connection between ICT literacy and teachers' attitudes towards ICT presents numerous crucial advantages for improving education. Increased ICT literacy gives educators the necessary skills and confidence to utilize technology effectively. This proficiency bolsters positive attitudes by alleviating obstacles such as apprehension regarding failure or unfamiliarity with digital tools. Educators who possess strong ICT literacy and optimistic attitudes play a significant role in enhancing students' information literacy and engagement. For instance, students instructed by teachers with supportive ICT outlooks exhibit greater

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digital competencies and critical thinking abilities.

Digital literacy (DL), the use of tablets and smartphones, previous training in computer use, and how often computers are used significantly influence students' perspectives on utilizing ICT (Jan 2018). The interplay between teachers' ICT literacy and attitudes towards ICT forms a basis for effective teaching methods, creative techniques, and enhanced student performance. This connection is crucial for equipping teachers and students for a future shaped by technology. Educators with a favorable outlook on ICT are more inclined to incorporate technology successfully into their teaching methods. Their confidence in the value of ICT enhances their enthusiasm to embrace new tools, resulting in a more dynamic and interactive learning experience for students. Teachers proficient in ICT are more likely to participate in professional development opportunities, enhancing their skills in utilizing technology efficiently in the classroom.

Meanwhile, in Figure 1 is shown the conceptual framework of the study, having exogenous variables and endogenous variables. This section deals with the review of related literature and studies gleaned from various research in both international and local settings that contributed substantially to the conceptualization of this study.

The first exogenous variable of instructional leadership is based on Pettiegrew (2013) with 10 indicators, namely: frame the school

goals, communicate the school goals, supervise and evaluate instruction, coordinate the curriculum, monitor student progress, protect instructional time, maintain high visibility, provide incentives for teacher, promote professional development, and provide incentives for learning. Generally, instructional leadership illustrates a genuine effort and consistently demonstrates kind behavior as part of their daily activities (Saad & Sankaran, 2021) and made to perform effective management, which stretches out to include more distributed models that emphasize distributed and shared empowerment among school staff, the accountability movement of the 21st century sheds new light on instructional leadership since this paradigm puts more emphasis on the learning outcomes for students and results to a broader perspectives practice that includes school communities.

The next exogenous variable is technology leadership; it is the art of harnessing the power of technology to propel an organization toward its goals and is inspired by the implementation of the Common Core State Standards, which contains skills related to technology and media use for students in all grade levels (Brunson, 2015) with 6 indicators namely: leadership and vision, learning and teaching, productivity and professional practice, support, management, and operations, assessment and evaluation, and social, legal, and ethical issues. Through strategic vision, resource allocation, and cultural changes, technology leadership has a substantial impact on the performance of teachers and the overall outcomes of learners, as supported by Guhao Jr. (2016),

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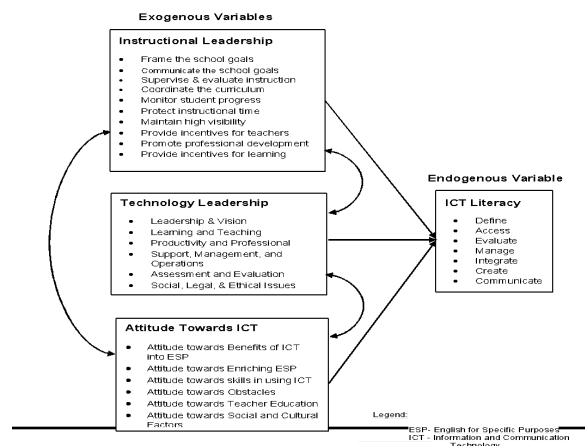
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Alajmi (2022), and Isik (2023). By employing tactics that strike a balance between cooperation, empowerment, and strategic alignment, technology leaders may foster creativity. Good technology leadership gives educators the digital knowledge and self-assurance they need to incorporate ICT into their lessons (Geresola & Lausa, 2024). By encouraging teachers to use technology creatively and offering training, principals may improve the quality of instruction.

Another exogenous variable is Attitude towards ICT, which refers to an individual's beliefs, feelings, and perceptions towards information and communication technology. It encompasses the individual's willingness to adopt, use and embrace technology in their personal and professional lives. Barriers in the exploitation of ICT in teaching and learning purposes is becoming one of the important challenges of new education curricula (Keshtiarast, & Salehi, 2020) with 6 indicators namely: attitude towards benefits of employing ICT in English for specific purposes (ESP), attitude towards enriching ESP courses, attitude towards skills in using ICT, obstacles to using ICT in ESP, attitude towards teacher education, and attitude towards social and cultural factors.

Similar to the study of Nair and Karan (2024), attitudes towards ICT have a big impact on how ICT skills affect teacher performance and education. While negative attitudes can impede this process, positive attitudes foster ICT integration, which improves teaching methods and student involvement. These views are greatly influenced by elements including teaching experience, perceived ICT proficiency, and ICT training. Successful ICT adoption is also influenced by social variables, such as community support and school leadership. Teachers may view technology differently depending on their culture, but focused training can help close the gap and create a more welcoming atmosphere. Teachers can overcome challenges and guarantee holistic performance by addressing these social and cultural elements and effectively utilizing ICT to improve teaching and learning outcomes.

Furthermore, the endogenous variable Information and Communication Technologies (ICT) literacy by Ali and Katz (2010) is the ability to use digital technology, communication tools, and networks to access, manage, integrate, evaluate, create, and transmit information to function in an information society with 7 indicators namely: define, access, evaluate, manage, integrate, create, and communicate. Teachers' overall performance is greatly impacted by ICT literacy since it improves their capacity to incorporate digital technology into their lesson plans. High ICT literacy teachers can access, manage, and produce educational content efficiently using digital tools, which enhances learning outcomes and student



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* **Figure 1.** A structural model comprising the exogenous variables instructional leadership, technology leadership and attitude towards ICT, and the endogenous variable ICT literacy.

engagement. Additionally, this literacy makes it easier for parents, instructors, and students to collaborate and communicate, creating a positive learning environment. Deschênes (2024) supported the idea of using technology to meet various learning needs and encourage students to use ICT; teachers who possess ICT literacy are better equipped to adjust to an information society. According to studies, effective technology integration depends on teachers' ICT proficiency and attitudes, affecting student performance and overall learning outcomes. To ensure holistic performance through improved teaching methods and student achievement, ICT literacy is therefore crucial for teachers to operate effectively in an information world.

Based on theoretical consideration, this study is anchored on Jan van Dijk's (2005) Digital Divide Theory, which highlights the critical role of instructional and technology leadership of school heads in shaping attitudes toward ICT and ICT literacy, ultimately impacting equitable access to technology and its effective integration into education. In examining these relationships, the theory highlights the need for strategic leadership to bridge the digital divide and promote equitable educational opportunities. By modeling effective behaviors, fostering self-efficacy, creating supportive environments, enhancing motivation, and promoting goal setting, instructional leaders can significantly impact technology integration in education. This approach improves teachers' ICT literacy and enhances student learning outcomes in an increasingly digital world.

This research plays a significant role in influencing instructional and technology leadership among school heads and shaping teachers' attitudes toward information and communication technology (ICT) literacy. The interplay of various components of the Digital Divide Theory can enhance the effectiveness of school leaders in promoting ICT integration and improving educational outcomes.

This study is anchored on Bandura's (SCLT) Social Cognitive Learning Theory (Nabavi, 2012), where instructional leadership is influenced through social observation, imitation, and modeling throughout the digital era. Teachers and learners increase their academic performance by using social interaction in digital practice. The empirical studies on leadership and leadership practices, including instructional leadership and the knowledge base in some nations, are still developing (Blas & Guhao, 2023; Hallinger, Adams, Harris, & Jones, 2018; Harris, Jones, Adams, & Cheah, 2019; Townsend, 2019).

Moreover, technology leadership is anchored by Rogers' (1962) Diffusion of Innovations Theory. To increase the effectiveness of achieving high-quality learning and education, teachers engage in innovative behavior, which is defined as the act of exploring opportunities, generating ideas, promoting ideas, realizing ideas, and reflecting in their professional work as a result of the accumulation of physical and cognitive work (Dasmo & Sunardi, 2021). This theory collectively contributes to the

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design, implementation, and evaluation of educational technology, ensuring effective and engaging learning experiences. One crucial and quickening aspect of the 21st century has been the growth of instructional technology. The developments in media technology, computer, and network technology, and most significantly, digitization, have a constant influence on our daily lives (Ouyang & Stanley, 2014). According to (Bongcayat, & Guhao Jr, 2020), the responsibility of technological leadership is to ascertain the links between school technology, mission, vision, and educational policy. The importance of computers and information technology for students must be understood by school administrators, who must also consider campus technology management when designing a technologically advanced learning environment.

This study's attitude toward information and communication technology (ICT) supports Bosnjak, Ajzen, and Schmidt's (2020) Theory of Planned Behavior with a high degree of accuracy; attitudes toward the conduct, subjective norms, and perceived behavioral control can be used to predict intentions to execute various activities. When combined with perceptions of behavioral control, these intentions explain a significant portion of the variation in actual behavior. The attitude towards ICT determines the incentive for practicing with it, which may directly affect ICT literacy. So, students' attitude, inter alia, is one of the substantial building blocks of ICT literacy, which in turn is an important component of improved student achievement brought about by it (Erdogdu &

Erdogdu, 2023). According to some authors (Jan, 2018, and Keshtiarast & Salehi, 2020) the attitude and behavior of the teachers and school leaders show a positive impact in innovatively to employ and measuring lifelong learning attitudes in digital literacy it significantly affects individuals' attitudes towards using ICT.

Furthermore, this study is anchored on Aziz & Hossain's (2024) and Pick & Sarkar's (2016) Digital Divide Theory to support information and communication technology (ICT) literacy of teachers in teaching and interact with learners in the way to use information, explain the knowledge, communicate, evaluate, adopt, and access in the digital world. The strengths and weaknesses of the digital divide theories are compared, and investigators can be informed on appropriate theoretical choices for settings. The 21st century brought forth several fundamental developments that immediately impacted the current educational system. Virtual reality-based learning, computer-assisted instruction (CAI), e-learning, online courses, electronic libraries, and mobile learning (m-learning) can all be made easier by integrating ICT into the educational system.

A prevalent deficiency in information and communication technology (ICT) literacy is the capacity to utilize ICT efficiently to address information-related issues. Research by Alayan (2022) has shown that, although incorporating technology into educational settings influences student achievement, there are still obstacles in utilizing ICT effectively for teaching. This discrepancy is

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notable due to the growing significance of ICT skills within contemporary curricula. This deficiency can appear in diverse manners among various demographic groups and educational environments, while there have yet to be studies undertaken in the Philippines. Moreover, most research above restricts their investigation to the bivariate association between the variables. The researcher was motivated to investigate the four variables using the Structural Equation Model (SEM) within the context of the Philippines.

The necessity of this study is amplified by the swift progression of educational technology and the urgent requirement for schools to effectively adapt to digital needs. Digital literacy in education necessitates that all participants in the learning process possess the skills to utilize various tools and platforms that support all educational activities. This research intends to address the current knowledge gap and provide practical insights that could greatly impact policy and practice, ensuring that educational leaders are prepared to facilitate successful technology integration and ultimately improve learning outcomes in the digital age.

This study determined the prognostic model on information and communication technology literacy of public-school teachers in the CARAGA Region as influenced by instructional leadership, technology leadership, and attitude towards information and communication technology. The findings of the study served as a proposed action plan. The study aims to investigate the findings to deepen their understanding of information

and communication technology through instructional leadership, technology leadership, and attitudes toward ICT. Specifically, this study aims: to assess the level of instructional leadership of the school head in terms of frame the school goals, communicate the school goals, supervising & evaluating instruction, coordinating the curriculum, monitoring student progress, protecting instructional time, maintaining high visibility, provide incentives for teachers, promote professional development, and provide incentives for learning; to determine the level of technology leadership of school head in terms of leadership & vision, learning and teaching, productivity and professional practice, support, management, and operations, assessment, and evaluation; and social, legal, & ethical issues; to ascertain the level of attitude towards ICT of school head in terms of, attitude towards benefits of employing ICT in English for Specific Purposes (ESP), attitude towards enriching ESP courses, attitude towards skills in using ICT, obstacles to using ICT in ESP, attitude towards teacher education, and attitude towards social and cultural factors, and to assess the level of ICT literacy of teachers in terms of define, access, evaluate, manage, integrate, create, and communicate.

Moreover, it also aims to determine the significant relationship between instructional leadership and information and communication technology (ICT) literacy, technology leadership and information and communication technology (ICT) literacy of school heads, attitude towards ICT and information and communication technology

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(ICT) literacy. It also determines the single or combined influence of exogenous variables on endogenous variables. Furthermore, it also aims to determine the best fit model for information and communication technology (ICT) literacy.

Likewise, the following hypotheses were tested at 0.05 level of significance; there are no significant relationships between instructional leadership and ICT literacy, technology leadership and ICT literacy, and attitude towards ICT and ICT literacy; instructional leadership, technology leadership, and attitude towards ICT do not significantly influence the ICT literacy public school teachers in the Caraga Region.

The significance of the study holds the potential to advance understanding of the instructional and technology leadership of school heads and attitudes towards ICT and ICT literacy of public school teachers will help them to improve their learned knowledge in integrating technology in teaching and fostering empowerment in their teaching practices. Moreover, being mindful of their responsibilities will help teachers to sharpen their behavior in addressing students who are struggling academically. In order to ascertain which of the aforementioned variables may influence or foretell the impact of a single variable on ICT literacy, the researcher chose to perform the study. The relationship between instructional leadership and ICT literacy, technology leadership and ICT literacy, and attitude toward ICT and ICT literacy has already been studied, but those studies focused on bivariate relationships and did not include all

three variables in a single study. This study contributed to new knowledge by addressing three variables and used one variable as the predicting construct. Furthermore, there are currently no essentially comparable studies addressing the variables in question being carried out in the CARAGA Region.

Furthermore, this study involves alignment with the Sustainable Development Goals (SDGs), mainly SDG 4 (Quality Education), to ensure an inclusive and equitable quality education for all. Policymakers must adhere to the particular recommendations made in this section in order to ensure that individuals with disabilities are included in the implementation of Sustainable Development Goal 4 (SDG 4) on quality education. Technology has always had an impact on contemporary education through the creation of new learning methods and technological tools, as well as through its contribution to educational discourse (An & Oliver, 2021). In addition to investigating ways that new digital technologies might be used to supplement the job of teachers, educators and students collaborate to build technology that supports positive interactions in the classroom. Moreover, the researcher can employ multivariate techniques to examine the impact of variables, such as factors related to the instructional and technology leadership of the school head and attitude towards ICT. The study helps to understand how the educational environment can affect teachers' ICT literacy, which in turn affects the quality of education that students receive. It also helps to uncover potential associations among them. Likewise, multivariate analysis

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offers a more profound knowledge of the factors impacting educational results, which can improve efforts to attain SDG 4.

The policy-making entity within the Department of Education may consider examining the allocation of teachers' workloads to mitigate the risk of excessive stress, which can negatively impact their professional effectiveness. This recommendation suggests that the Department of Education should evaluate potential policy modifications to enhance teacher dedication, such as augmenting tangible incentives for teachers. In addition, the provision of appropriate prizes and recognition can enhance their perceived value, increasing the probability of their retention within the organization. The findings of the study hold significance for educational researchers as they may prompt further investigation into the potential changes in teachers' ICT literacy over time among respondents and within the same location. This subsequent research could inform additional measures to enhance the country's educational sector and the teaching profession.

School heads will receive evidence-based information about the current trends in teachers' education in the twenty-first century, which will provide the foundation for their professional development. They will also be able to respond to the needs of the instructors about the incorporating of ICT in class discussions because they are the school's leaders. For successful implementation, these factors will therefore be carefully considered during the planning

stages of schooling. School leaders use both transformational and instructional leadership to help teachers become more proficient in using ICT to improve their teaching. Teachers and school administrators' attitudes and actions have a positive and creative influence on how lifelong learning attitudes in digital literacy are used and measured; they have a significant influence on people's attitudes toward utilizing ICT. Additionally, school administrators in the CARAGA Region might investigate methods for evaluating the dedication and drive of their faculty members, allowing them to create plans for improving their establishments. They can benefit from training opportunities provided by the Schools Division Office and the experience of seasoned teachers in their schools.

Because school management will have a better understanding of the current trend of integrating ICT into the curriculum and will be able to improve their instructional practices that may have implications for achieving desired student outcomes for developmental programs, this study will be beneficial to public school teachers who will be able to deliver quality instruction to the students effectively. The researcher will gain knowledge of the school head's instructional and technological leadership, as well as the public school teachers' attitudes and ICT literacy. Future researchers will use this study and its findings as a foundation for similar investigations in different domains, environments, and settings to investigate additional factors influencing school heads' technology and instructional leadership, as

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well as public school teachers' attitudes toward ICT literacy.

METHODS

This section showed the methodology of the present instructional and technology leadership of school heads and attitude towards ICT: a structural equation model on ICT literacy of public school teachers. It described the processes used to answer the problems of the present study. It also

included the research respondents, research material and instrument, research design and procedure for gathering the data, and the statistical tools for data collection and analysis throughout the research.

Research respondents

The study's respondents were the 409 public elementary school teachers throughout the CARAGA Region. There were 140 teachers with 127 teachers in 1-10 years of service, 12 teachers in 11-20 years of service, and 1 teacher in 21-30 years of service for teacher 1. There were 182 teachers, with 26 teachers in 1-10 years of service, 50 teachers in 11-20 years, and six teachers in 21-30 years of service for teacher 2. There were 175 teachers with 53 teachers in 1-10 years in service, 72 teachers in 11-20 years in service, & 50 teachers in 21-30 years in service for teacher 3. There were 9 teachers, with six teachers in 11-20 years of service and 3 teachers in 21-30 years of service for Master Teacher 1. Moreover, there were three teachers in the 21-30 years in service for Master Teacher 2, selected from the total population of more than 17,413 public elementary school teachers due to some reasons of teachers from retirement and newly hired teachers, who were not counted based on the data from the DepEd CARAGA regional office for this school year,

2023-2024. The public elementary school teachers were chosen as respondents of the study since the researcher was a public elementary school principal who observed the existing problems nowadays. The researcher's eagerness was motivated by the various literature where issues related to information and communication technology of public school teachers, instructional and technology leadership of school heads, and attitudes towards ICT have been perceived and observed.

To determine the necessary sample size for structural equation modeling, the researcher employed stratified random sampling. These involved dividing the study population into subgroups, or strata, based on shared characteristics, ensuring proportionate representation from each stratum in the final sample. It was determined using the Raosoft Sample Size Calculator that the total number of public elementary teachers is 17,413. In getting the sample size, it considered a 5 percent margin of error, a 95 percent

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confidence level, and a 50 percent distribution (Cabayag & Guhao, Jr., 2024).

This survey included every school division with the corresponding number of teaching personnel at the elementary level serving as respondents in the CARAGA Region, which were composed of 12 schools' divisions with eight (8) cities, namely: Bayugan City 17 teachers out of 720 public elementary school teachers, Butuan City 43 teachers out of 1,822 public elementary school teachers, Cabadbaran City 10 teachers out of 427 public elementary school teachers, Surigao City 20 teachers out of 846 public elementary school teachers, Bislig City 14 teachers out of 591 public elementary school teachers, Tandag City 9 teachers out of 369 public elementary school teachers, Siargao Island 21 teachers out of 904 public elementary school teachers, and Dinagat Island 19 teachers out of 819 public elementary school teachers; and four (4) provinces, namely: Agusan del Sur 102 teachers out of 4,372 public elementary school teachers, Agusan del Norte 45 teachers out of 1,890 public elementary school teachers, Surigao del Sur 87 teachers out of 3,219 public elementary school teachers, and Surigao del Norte 33 teachers out of 1,434 public elementary school teachers.

The researcher employed a stratified random sampling technique to ensure a fair and proportional representation of respondents across these divisions. The 409 respondents were distributed based on the actual number of public elementary school teachers in each division. These public elementary school teachers qualified as respondents and offered valuable information to test the hypothesis of the study.

Moreover, the selection of respondents followed the inclusion criteria: (a) public school teachers in elementary schools and (b) public elementary school teachers in the CARAGA Region. As to the exclusion criteria, those private and public school teachers in secondary, private elementary schools, and other regions were excluded. No coercion was used to compel study participants to participate. They have the option to stop participating in the study if they start to feel uncomfortable. Without their informed consent, the Data Privacy Act of 2012 safeguarded participants' inalienable rights to privacy. They were not allowed to expose their identities due to security concerns. Their survey replies were also confidential (Guhao Jr. & Quines, 2021).

Materials and Instrument

This study employed a researcher-adapted and modified instrument. It consisted of items designed mainly to measure the instructional and technology leadership of

school heads and attitudes towards ICT-on-ICT literacy of public school teachers. This study utilized four instruments specifically designed to address the research

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objectives. The first questionnaire focused on instructional leadership. This study used the Instructional Leadership Rating Scale based on Saad & Sankaran (2021), consisting of 10 indicators with 50 items. Likewise, the researcher also used the Technology Leadership Questionnaire based on Brunson (2015). It consisted of six (6) indicators with 30 items. Furthermore, based on Keshtiarast & Salehi (2020) Attitude towards ICT of school head it consisted of six (6) indicators with 40 items. Lastly, ICT literacy of public school teachers based on Ali & Katz (2010) with 22 items of seven (7) indicators. This scale was designed to assess the level of instructional and technology leadership of school heads, attitude towards ICT, and ICT literacy as perceived by teachers.

The final revision was developed, applying the corrections, comments, and suggestions observed in the drafting by expert validators. The ratings of the validators were 4.19 as computed and consolidated. Following revisions, a pilot test involving 50 respondents was carried out. The collected data was submitted to a statistician for evaluating the reliability and validity, assessed using Cronbach's alpha reliability coefficient, which should fall within the normal range of 0 to 1. A Cronbach's alpha of 0.70 and up is considered reliable and has a greater internal consistency among the items in the scale (Taber, 2018). Furthermore, the survey questionnaires modified, refined, and contextualized to fit the concepts within the local context. Six expert validators assessed the questionnaire's content to confirm its construct validity. The researcher took into account feedback from validators and

integrated any recommended modifications. Afterward, the questionnaires were piloted and tested with 50 respondents to evaluate Cronbach's alpha, with a value surpassing 0.70 for each variable, signifying the validity and reliability of the survey questionnaires.

The Cronbach's alpha of the variable's instructional leadership of school heads, technology leadership of school heads, attitude towards ICT, and ICT literacy were .956, .986, .980, and .976, respectively. Hence, the survey questionnaires were reliable. The Cronbach's alpha reliability coefficient of 0.70 to 1.0 is considered reliable (Taber, 2018).

Moreover, the researcher employed a survey method using questionnaires derived from online journals, which were validated and modified to contextualize local settings. The first draft of the research instrument was checked by the research adviser for comments, suggestions, and recommendations to improve its presentation with the corrections to be included and integrated. The final copies were submitted to the panel of experts for refinement. This two-part instrument was modified to fit in the context of this study. The first part determined the profile of the respondents. The second part of the instrument measures the different instructional and technology leadership of school heads and attitudes towards ICT-on-ICT literacy of public school teachers. It consisted of 5 indicators that deal on the different instructional and technology leadership of school head and attitude

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towards ICT-on-ICT literacy of public school teachers.

Below are the scales used to interpret the means of instructional leadership, technology leadership, attitude towards ICT, and ICT literacy. A five-point Likert scale was used using the following parameters for the range of mean of 4.01–5.00; the descriptive level was strongly agreed, and an interpretation of the measures mean that was evident at all times among public school teachers. For the range of mean of 3.26–4.00, the descriptive level is agreed, and an interpretation of the measures mean that

was evident most of the time among public school teachers. For the range of mean of 2.51–3.25, the descriptive level is somehow agreed, and an interpretation of the measures mean that was evident occasionally among public school teachers. For the range 1.76–2.50, the descriptive level is disagreed, and an interpretation of the measures mean that was evident in a few instances among public school teachers. For the range of mean of 1.00–1.75, the descriptive level is strongly disagreed, and an interpretation of the measures mean that was not evident at all among public school teachers.

Design and Procedure

Primarily, the researcher employed a descriptive-correlational research design, measuring each variable at different levels and establishing correlations to understand the associations or relationships between variables. Exploring of relationships within social science disciplines was a primary motivation for scientific investigation, transcending even the most nuanced distinctions between different research methods (Curtis, Comisky, & Dempsey, 2016).

Moreover, the researcher employed a quantitative, non-experimental design, utilizing structural equation modeling (SEM) to measure and analyze the connections between observed and latent variables. These allowed the researcher to examine these variables and provided a comprehensive view of the interconnections within a theoretical model. SEM allows for

the simultaneous examination of multiple relationships in a model, considering variables' direct and indirect effects (Civelek, 2018). This investigation also aimed to develop a best-fit model of information and communication technology (ICT) literacy among public school teachers. Subsequently, this research employed structural equation modeling (SEM), which technically integrates confirmatory factor analysis, utilized for apparent factor structures, and path analysis, typically employed to investigate causal relationships among variable sets (Kelloway, 1998). Notably, SEM enhanced path analysis by establishing connections between latent or theoretical variables, which cannot be directly measured, and observed or manifested variables (Streiner, 2006).

To determine the best fit structural model, the following indices were used with their

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corresponding criterion based on Kim, Ku, & Park (2016), namely Chi-Square/Degrees of Freedom ($0 < \text{value} < 2$) (Kline, 1998) & (Marsh & Hocevar, 1985), P-value ($> .05$) (Joreskog & Sorbom, 1996), Normed Fit Index (NFI) ($> .95$) (Schumacker and Lomax, 2004), Tucker-Lewis Index (TLI) ($> .95$) (Kim et al., 2016), Comparative Fit Index (CFI) ($> .95$) (West, Meserve, & Stanovich, 2012) & (Fan, Thompson, & Wang, 1999), Goodness of Fit Index (GFI) ($> .95$) (Kline, 2005) & (Hu, & Bentler, 1998), Root Mean Square of Error Approximation (RMSEA) ($< .05$) (MacCallum, Browne, and Sugawara, 1996), and P of Close Fit (PClose) ($> .05$) (Kim et al., 2016).

After obtaining approval, the researcher personally distributed and oversaw the administration of the survey questionnaires to guarantee the complete retrieval of all questionnaires. The survey was planned for the second semester of the school year 2023-2024, and the compiled data was organized, tabulated, analyzed, and interpreted by the research objectives. The researcher adhered to a face-to-face approach when conducting and gathering the data. Due to the advancement of technology, he engaged in the use of Google Forms in collecting the data, if necessary, especially for those schools in the far divisions. Moreover, the use of this program permitted accurate data collection and presentation.

Likewise, the study utilized various statistical tools to measure and test hypotheses at a significant level of alpha 0.05. The Mean measured by the levels of instructional leadership, technology leadership, attitude towards ICT, and information and

communication technology (ICT) literacy. Pearson r measured the interrelationships between these variables, while regression analysis determined the strength of their relationships (Kim et al., 2016). This study examined the hypothesized relationships, beginning with a theory-based model translated into a path diagram. The data collection process involved the researcher obtaining permission from the Dean of Professional Schools to survey public elementary school teachers in the CARAGA Region. Then, approval was sought from the Regional Director of the DepEd Regional Office CARAGA to conduct the study in the 12 school divisions in the CARAGA Region. The initial draft of the questionnaire was sent to the research adviser for possible revisions and comments before being submitted to a panel of experts for reliability and validation.

Furthermore, ethical consideration is integral to this study by the guidelines established by the University of Mindanao Ethics and Research Committee (UMERC) Certificate of Approval, EMERC Protocol No. UMERC-2024-240 also verified the study. The ethical principles pertinent to the challenges associated with this research included ensuring the proper conduct of the study, maintaining confidentiality, and upholding anonymity. Moreover, the researcher was dedicated to upholding comprehensive ethical standards through protocol assessments and standardized criteria, particularly in managing aspects related to the population and data. These involved ensuring voluntary participation and granting subjects the freedom to participate without facing consequences,

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penalties, or loss of benefits. The researcher was committed to maintaining the privacy and confidentiality of respondents' personal information by the Data Privacy Act of 2012.

To address the potential risks, the researcher assessed the emotional, social, and physical preparedness of the respondents to minimize any potential discomfort or shame. Precautions were implemented to guard against fabrication, ensuring the absence of deliberate misinterpretation of the work and strict avoidance of data manipulation to create misleading statements. Falsification or

intentional misrepresentation of work was strictly prohibited, and there was no data manipulation to craft statements that could mislead others. To avoid plagiarism, the study used plagiarism detection tools such as Turnitin to ensure that no one would portray the work of others as the researcher's own. Regarding authorship, the researcher, a graduate of the Master of Arts in Education Major in Educational Management who is currently pursuing a Doctorate in Educational Management, will undergo content revisions based on recommendations from his adviser, who will also serve as a co-author in this study.

RESULTS AND DISCUSSION

The next part offers a comprehensive overview of the data collection process results. The results are presented in line with the pre-established objectives for this study. The study also entails revealing the outcome of the null hypothesis. Significant discoveries on teachers' perspectives and the resulting effects on their teaching efforts are also revealed by the study of their reactions to the integration of information and communication technology (ICT) in the classroom. The point of departure in this paper was to investigate the instructional and technology leadership of the school head and the attitude towards ICT and ICT literacy of public school teachers. The study of

teachers' responses to integrating information and communication technology (ICT) in education revealed significant findings regarding their perceptions and the resultant impact on their teaching efforts. In summary, the study underscores the critical role teachers' positive perceptions of ICT play in enhancing their commitment to integrating technology into their teaching practices. As they recognize the benefits of ICT, they are likely to exert additional effort in its implementation, ultimately leading to improved student educational experiences. However, addressing existing barriers remains essential for fully realizing the potential of ICT in education.

Instructional Leadership of School Heads

In Table 1 is presented the level of instructional leadership across various indicators, with the overall mean of 4.34, and

a standard deviation (SD) of 0.46, with the corresponding descriptive equivalent (D.E.) ratings of very high, confirming a strong and

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consistent perception of instructional leadership effectiveness among respondents. The overall rating reinforced the notion that the school leaders were perceived to be highly effective in their instructional leadership roles.

The data reflects a high level of effectiveness in instructional leadership as perceived by the respondents. All indicators of instructional leadership received mean scores above 4.20, indicating a Very High level of effectiveness. The highest mean score was for Frame the School Goals (4.40), closely followed by Communicate the School Goals (4.39) and Promote Professional Development (4.39). This suggests that the leadership was particularly strong in clearly defining and communicating the school's objectives. The standard deviations across all indicators ranged from 0.49 to 0.61, demonstrating relatively low response variability. This consistency suggests that respondents generally agreed on the effectiveness of instructional leadership practices.

Further, the overall very high response of public school teachers indicated that all domains of instructional leadership were consistently very high. Successful instructional leadership encompasses a range of practices that guarantee coherence. Between the school's goals and everyday activities, maintaining the high visibility of school leaders, encouraging teachers to use instructional time, and promoting an environment that supports teaching and learning. This indicated that by teaching and practicing new skills and concepts, they actively supported the students' academic progress to ensure that the classroom priorities of teachers were consistent with the goals and direction of the school. The overall rating reinforced the notion that the school leaders were perceived to be highly effective in their instructional leadership roles.

Table 1. *Level of Instructional Leadership*

Indicator	SD	Mean	D.E.
Frame the School Goals	0.49	4.40	Very High
Communicate the School Goals	0.53	4.39	Very High
Supervise and Evaluate Instruction	0.53	4.38	Very High

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Coordinate the Curriculum	0.55	4.38	Very High
Monitor Student Progress	0.55	4.36	Very High
Protect Instructional Time	0.52	4.32	Very High
Maintain High Visibility	0.61	4.24	Very High
Provide Incentives for Teachers	0.60	4.27	Very High
Promote Professional Development	0.56	4.39	Very High
Provide Incentives for Learning	0.57	4.30	Very High
Overall	0.46	4.34	Very High

Furthermore, instructional leadership was perceived very positively across all indicators and affects student learning (Berkovich & Hassan, 2024). The high mean scores and low standard deviations indicated a strong consensus among respondents regarding the effectiveness of their leaders in various aspects of instructional leadership. While the overall findings were encouraging, the slightly lower scores in maintaining high visibility and protecting instructional time may indicate areas for improvement, suggesting a focus on increasing leader presence and minimizing interruptions during instructional periods.

Instructional Leadership of School Heads

In Table 2 is provided an overview of the level of technology leadership as assessed across various indicators, along with the overall mean of 4.31 and a standard deviation (SD) of 0.55, with the corresponding descriptive equivalent (D.E.) ratings of very high. The results indicated a consistently very high perception of technology leadership effectiveness among respondents.

Moreover, this study was indirectly linked to the study by Ma and sMarion (2021), which found that maintaining high visibility and protecting the instructional time of school leaders effectively communicated the school's mission (Ali, 2012), reinforced superior performance by teachers (Mannan, 2017), and examined the classroom curriculum to ensure it met the school's curricular objectives, as similarly studied by Tep (2024).

All indicators received mean scores above 4.20, categorizing them as very high. The indicators leadership and vision and productivity and professional practice both achieved the highest mean scores of 4.35, reflecting strong leadership capabilities in guiding the technological direction of the school and promoting effective use of technology in professional practices. Learning and teaching and social, legal, and

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ethical issues received a mean score of 4.33, and assessment and evaluation received a mean score of 4.30, indicating that technology was effectively integrated into the learning process, enhancing teaching strategies and learning outcomes. The indicator support, management, and operations recorded the lowest mean score of 4.20, while still maintaining a very high rating. Suggesting that leaders were particularly effective in establishing a clear vision for technology integration and enhancing productivity in professional practices, it ensures that they were upgraded and incorporated into the school technology plan.

The standard deviations across the indicators ranged from 0.57 to 0.66, indicating a moderate level of agreement among respondents about the effectiveness of technology leadership practices. The relatively low variability suggested that teachers generally shared similar

perceptions regarding their leaders' effectiveness in these areas.

Further, the findings of the study on the overall response of public school teachers indicated that all domains of technology leadership were consistently very high. It indicated that technology provided opportunities for discussion to improve or expand its support, management, and operation usage and encouraged teachers to be creative and innovative. The overall rating reinforced the strong perception of technology leadership effectiveness (Beytekin, 2014) and indicated a very high level of confidence in leaders' abilities to navigate and implement technology initiatives in the educational setting. School leaders ensure to provide adequate, timely, and high-quality hardware and software replacement to upgrade technology support services for professional development in the school's vision for a digital age that impacts teaching and learning outcomes.

Table 2. Level of Technology Leadership

Indicators	SD	Mean	D.E.
Leadership and Vision	0.57	4.35	Very High
Learning and Teaching	0.59	4.33	Very High
Productivity and Professional Practice	0.58	4.35	Very High
Support, Management, and Operations	0.66	4.20	Very High
Assessment and Evaluation	0.63	4.30	Very High
Social, Legal, and Ethical Issues	0.64	4.33	Very High
Overall	0.55	4.31	Very High

This study was congruent with Afzal, Khan, Daud, Ahmad, & Butt's (2023) statement that

teachers technology access was adequate, timely, and high-quality technology support,

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management, and operation services (Pursan, Adeliyi, & Seena, 2023) for effective use of technology as a criterion for assessing the performance (Garza, 2023). Similarly, it helped meet the school's technology needs (Duncan, 2011). This suggests that while

leaders were perceived as effective in managing technology-related operations, there may be room for improvement in providing adequate support, management, and operation resources for technology integration (Theodorio, 2024).

Attitude towards ICT

In Table 3 is summarized the attitudes towards Information and Communication Technology (ICT) across various indicators, presenting the overall mean score of 4.13, standard deviation (SD) of 0.53, and descriptive equivalent (D.E.) of "high" highlight a generally positive attitude towards teacher education in ICT. Although some areas warrant attention, especially in overcoming obstacles and improving teacher education towards using ICT in their teaching. However, it was less consistent and slightly lower than other areas. Higher variability and slightly lower mean scores for attitudes towards obstacles, teacher education, and social/cultural factors

suggested areas where more consistent support or education might be needed. The standard deviations ranged from 0.57 to 0.83, indicating moderate variability in responses. This suggested a general consensus among respondents regarding the positive impact of ICT. The mean scores ranged from 3.91 to 4.32, indicating confidence in using technology effectively and also reflecting a favorable view of how ICT enhanced content and delivery. These suggest that while respondents see benefits, they were also aware of challenges and inadequacies in teacher training related to ICT.

Table 3. *Level of Attitude towards ICT*

Indicators	SD	Mean	D.E.
Attitudes towards Benefits of ICT into ESP	0.57	4.31	Very High
Attitudes towards Enriching ESP Courses	0.58	4.32	Very High
Attitudes towards Skills Using ICT	0.62	4.27	Very High
Attitudes towards Obstacles	0.76	4.00	High
Attitudes towards Teacher Education	0.83	3.91	High
Attitudes towards Social and Cultural Factors	0.77	3.96	High
Overall	0.54	4.13	High

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The findings generally showed a favorable attitude towards ICT in ESP, with strong recognition of its benefits and potential to enhance educational experiences that held more positive attitudes towards applying ICT to their teaching (Chaiban & Oweini, 2024) and contributed to self-access and the learning environment (Smith, Niboshi, Samuell, & Timms, 2024). The findings indicated a generally positive attitude towards ICT, with some areas showing high levels of concern. However, concern regarding obstacles and attitudes toward teacher education indicated areas for further development to leverage ICT's capabilities in education fully.

This study was supported by Hakimi, Shahidzay, Fazi, & Qarizada (2024) and Neves & Henriques (2020) in Integrating ICT-based activities, which can expand knowledge and information that teachers enable them to do more interesting and creative work by applying ICT to their teaching. The results highlighted a generally positive attitude towards ICT. However, some areas warrant attention, particularly in overcoming obstacles and improving attitude towards teacher education in using ICT in their teaching, as supported by Amir (2023).

Information and Communication Technology (ICT) Literacy

In Table 4 is presented the level of Information and Communication Technology (ICT) literacy across various indicators, detailing the overall mean score of 4.19, a

standard deviation (SD) of 0.49, and with descriptive equivalent (DE) of "High", indicated a strong level of ICT literacy among respondents. The findings highlight a strong overall literacy in ICT among respondents.

Table 4. *Level of Information and Communication Technology (ICT) Literacy*

Indicators	SD	Mean	D.E.
Define	0.54	4.21	Very High
Access	0.54	4.27	Very High
Evaluate	0.56	4.23	Very High
Manage	0.57	4.20	Very High
Integrate	0.58	4.15	High
Create	0.60	4.14	High
Communicate	0.62	4.15	High
Overall	0.49	4.19	High

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The standard deviations ranged from 0.54 to 0.62, reflecting moderate response variability, suggesting a consensus on the effectiveness of ICT literacy skills among respondents. The mean scores ranged from 4.14 to 4.27, indicating that while respondents possessed solid literacy skills, there was room for enhancement in integrating and creating content using ICT effectively. However, the classification of some indicators as high suggests potential areas for growth, particularly in the integration and creation of ICT content. All indicators received mean scores above 4.00, with four indicators classified as Very High. The highest mean score, Access (4.27), indicates that respondents feel particularly confident in their ability to access ICT resources.

The findings generally showed a favorable level of ICT literacy among respondents, with very high confidence in access, definition, and evaluation skills. However, the lower mean scores in integration and creation highlight opportunities for further development, emphasizing the need for

training in these areas to enhance overall ICT proficiency. The overall response of public school teachers indicated that most domains of information and communication technology (ICT) literacy were high. This suggested that teachers needed to create a data display to clarify significant avenues in supporting the use of technology when integrating ICT into their activities and feel very confident in these areas.

The results were aligned with recent research that showed how crucial ICT literacy abilities were created for today's workers, who chose which kinds of resources could provide the most valuable information (Romero-Hall & Jaramillo Cherrez, 2023). Additionally, the efficacy and perception of ICT integration and creation in educational settings clarified clusters of related information (Jashari, Fetaji, & Guetl, 2024), supported the use of technology, contained information that was appropriately current and pertinent, and adequately covered a study research area (Katz, Rijmen, & Attali, 2022).

Significance on the Relationship between Instructional Leadership of School Heads and Information and Communication Technology (ICT) Literacy

In Table 5 below is displayed the significance of the relationship between instructional leadership and Information and Communication Technology (ICT) literacy indicators. Results revealed that the overall r-value was .437 with a p-value of 0.000, which is less than the 0.05 level of

significance, thereby rejecting the null hypothesis. Therefore, there is a positive significant relationship between the instructional leadership of school heads and the information and communication technology (ICT) literacy indicators of public elementary school teachers. This indicates

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that the overall correlations indicated that higher levels of instructional leadership were consistently associated with improved ICT literacy skills across all indicators, reinforcing the importance of effective leadership in fostering a technology-rich educational environment.

Further, when the domains of instructional leadership such as Frame the School Goals, Communicate the School Goals, Supervise and Evaluate Instruction, Coordinate the Curriculum, Monitor Student Progress, Protect Instructional Time, Maintain Visibility, Provide Incentives for Teachers, Promote Professional Development, and

Provide Incentives for Learning were correlated to the overall ICT literacy of public school teachers result of the computation yielded the r-value ranged from 0.317 to 0.400, with all p-values less than 0.05, respectively, which can be all interpreted as significant. This overall values of each indicator of ICT literacy when correlated the overall instructional leadership were result showed that r - value ranged from 0.337 to 0.401 with all p-value was equal to 0.000 less than 0.05, therefore, significant correlation. These factors were significantly related to the domains of ICT literacy such as Define, Access, Evaluate, Manage, Integrate, Create and Communicate.

Table 5. *Significance on the Relationship between Levels of Instructional Leadership and Information and Communication Technology (ICT) Literacy*

Instructional Leadership	Information and Communication Technology (ICT) Literacy							
	Define	Access	Evaluate	Manage	Integrate	Create	Communication	Overall
Frame the School Goals	.337* (0.000)	.387* (0.000)	.356* (0.000)	.369* (0.000)	.332* (0.000)	.303* (0.000)	.285* (0.000)	.397* (0.000)
Communicate the School Goals	.350* (0.000)	.387* (0.000)	.351* (0.000)	.332* (0.000)	.297* (0.000)	.302* (0.000)	.284* (0.000)	.386* (0.000)
Supervise and Evaluate Instruction	.268* (0.000)	.332* (0.000)	.322* (0.000)	.290* (0.000)	.288* (0.000)	.258* (0.000)	.229* (0.000)	.333* (0.000)
Coordinate the Curriculum	.292* (0.000)	.408* (0.000)	.360* (0.000)	.374* (0.000)	.362* (0.000)	.322* (0.000)	.270* (0.000)	.400* (0.000)
Monitor Student Progress	.278* (0.000)	.339* (0.000)	.342* (0.000)	.352* (0.000)	.346* (0.000)	.323* (0.000)	.312* (0.000)	.386* (0.000)
Protect Instructional Time	.276* (0.000)	.306* (0.000)	.304* (0.000)	.288* (0.000)	.298* (0.000)	.252* (0.000)	.263* (0.000)	.334* (0.000)
Maintain High Visibility	.257* (0.000)	.251* (0.000)	.271* (0.000)	.294* (0.000)	.349* (0.000)	.239* (0.000)	.224* (0.000)	.317* (0.000)
Provide Incentives for Teachers	.248* (0.000)	.307* (0.000)	.308* (0.000)	.323* (0.000)	.339* (0.000)	.338* (0.000)	.295* (0.000)	.364* (0.000)
Promote Professional Development	.254* (0.000)	.333* (0.000)	.311* (0.000)	.300* (0.000)	.291* (0.000)	.336* (0.000)	.308* (0.000)	.359* (0.000)

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Provide Incentives for Learning	.236* (0.000)	.277* (0.000)	.277* (0.000)	.267* (0.000)	.312* (0.000)	.326* (0.000)	.318* (0.000)	.340* (0.000)
Overall	.337* (0.000)	.401* (0.000)	.387* (0.000)	.385* (0.000)	.390* (0.000)	.364* (0.000)	.338* (0.000)	.437* (0.000)

*Significant at 0.05 significance level.

In Table 5 is demonstrated significant and positive correlations between levels of instructional leadership and ICT literacy. The findings suggested that strong leadership practices, particularly in framing goals and coordinating the curriculum, were vital for enhancing ICT skills among educators (Willermark, Gellerstedt, & Nilsson, 2024). While all leadership indicators showed a

positive relationship with ICT literacy, some areas may have benefited from further focus to maximize their impact. This study was supported by Kastorff & Stegmann (2024) and Yeşilyurt & Vezne (2023), which stated that instructional leadership practices were associated and hold profound significance in shaping and enhancing the ICT literacy of public school teachers.

Significance on the Relationship between Technology Leadership and Information and Communication Technology (ICT) Literacy

In Table 6 is examined the significance of the relationships between various levels of technology leadership and Information and Communication Technology (ICT) literacy. The overall r-value was 0.461 with a p-value of 0.000 less than the 0.05, labeled as significant. Thus, the null hypothesis of no significant relationship between technology leadership and ICT literacy is rejected. Likewise, the correlation coefficient, $r = 0.461$, suggest that technology leadership of school heads is correlated to and can be explained by ICT literacy. The results further signify that when public elementary school teachers have strong learning and teaching, they have better ICT literacy.

Across all indicators, in Table 6 is shown a robust and favorable relationship between ICT literacy and technological leadership. The most significant relationships were found in learning and teaching, productivity, and leadership vision, indicating that effective technology leadership practices were crucial for enhancing ICT skills within educational settings. These findings emphasized the importance of fostering strong technology leadership to improve overall ICT literacy among educators (Schmitz, Antonietti, Consoli, Cattaneo, Gonon, & Petko, 2023).

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Table 6. *Significance on the Relationship between Levels of Technology Leadership and Information and Communication Technology (ICT) Literacy*

Technology Leadership	Information and Communication Technology (ICT) Literacy							
	Define	Access	Evaluate	Manage	Integrate	Create	Communication	Overall
Leadership and Vision	.335* (0.000)	.352* (0.000)	.362* (0.000)	.380* (0.000)	.355* (0.000)	.323* (0.000)	.326* (0.000)	.409* (0.000)
Learning and Teaching	.354* (0.000)	.386* (0.000)	.394* (0.000)	.393* (0.000)	.389* (0.000)	.366* (0.000)	.353* (0.000)	.443* (0.000)
Productivity and Professional Practice	.331* (0.000)	.357* (0.000)	.363* (0.000)	.359* (0.000)	.375* (0.000)	.381* (0.000)	.368* (0.000)	.427* (0.000)
Support, Management, and Operations	.306* (0.000)	.308* (0.000)	.304* (0.000)	.307* (0.000)	.355* (0.000)	.323* (0.000)	.303* (0.000)	.371* (0.000)
Assessment and Evaluation	.329* (0.000)	.342* (0.000)	.352* (0.000)	.332* (0.000)	.360* (0.000)	.354* (0.000)	.359* (0.000)	.408* (0.000)
Social, Legal, and Ethical Issues	.354* (0.000)	.342* (0.000)	.321* (0.000)	.332* (0.000)	.382* (0.000)	.366* (0.000)	.356* (0.000)	.413* (0.000)
Overall	.375* (0.000)	.389* (0.000)	.391* (0.000)	.392* (0.000)	.414* (0.000)	.394* (0.000)	.385* (0.000)	.461* (0.000)

*Significant at 0.05 significance level.

In Table 6 is illustrated a strong and positive correlation between technology leadership and ICT literacy across all indicators. The most significant relationships were found in the areas of learning and teaching, productivity, and leadership vision, indicating that effective technology leadership practices were crucial for enhancing ICT skills within educational settings. These findings emphasized the importance of fostering strong technology leadership to improve overall ICT literacy among educators (Schmitz, Antonietti, Consoli, Cattaneo, Gonon, & Petko, 2023).

Further, when the domains of technology leadership, such as leadership and vision, learning and teaching, productivity and

professional practices, support, management and operation, assessment and evaluation, and social, legal, and ethical issues, were correlated to the overall ICT literacy of public school teachers, the results were shown in Table 6. The overall r-value ranged from 0.371 to 0.443 with all p-values less than 0.05, showing a significant relationship. On the other hand, when the individual indicators of technology leadership were correlated with the overall indicators of ICT literacy, the r-values ranged from 0.357 to 0.414, with all p-values equal to 0.000 or less than 0.05; therefore, all showed a significant relationship. These factors were significantly related to the domains of ICT literacy, such as defining, accessing, evaluating, managing, integrating, creating, and communicating.

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Data indicated that the overall school heads technology leadership practices were associated with the ICT literacy of public school teachers (Mwawasi, 2014).

Moreover, these findings aligned with the study of Alayan (2022) that collectively indicated that strong technology leadership was essential for enhancing ICT literacy among public school teachers, as it fosters a supportive environment, encourages professional development, and promotes

innovative teaching practices (Husana & Velasco). This research highlights the significant correlation between the technological leadership practices of school heads and the frequency of ICT integration by teachers, emphasizing that effective technology leadership is crucial for improving teachers' ICT literacy (Ismail, Omar, & Raman, 2021) and their ability to integrate technology into their instructional practices (Alayan, 2022).

Significance on the Relationship between Attitude towards ICT and Information and Communication Technology (ICT) Literacy

In Table 7 is explored the significance of the relationships between attitudes towards Information and Communication Technology (ICT) and ICT Literacy of public school teachers. As indicated in the results, the overall r-value was 0.542 with a p-value of 0.000 less than 0.05, labeled as significant. This means the null hypothesis of no significance on the relationship between attitudes towards Information and Communication Technology (ICT) and ICT literacy is rejected. Hence, a positive significant relationship exists between attitudes towards Information and Communication Technology (ICT) and ICT literacy. The results further signify that when public elementary school teachers have strong attitudes towards enriching ESP and skills using ICT, they have better ICT literacy.

Further, in Table 7 is revealed the correlation between attitudes towards Information and Communication Technology (ICT) and ICT literacy. Each relationship between attitudes

towards Information and Communication Technology (ICT) and ICT literacy is presented. Moreover, when the indicators of attitudes towards Information and Communication Technology (ICT) were correlated to ICT literacy. This suggested that favorable attitudes towards ICT were associated with higher levels of ICT literacy. The highest individual correlation was observed for Attitudes towards Enriching ESP Courses, with an overall correlation of 0.564. This indicated that a positive attitude towards the enrichment of courses through ICT was particularly linked to enhanced ICT skills. The indicator Attitudes towards Skills Using ICT reflected strong correlations across all dimensions, with an overall correlation of 0.546. This implied that a positive attitude towards ICT skills translated into better performance in various literacy aspects, including managing and integrating ICT. Similarly, Attitudes towards the Benefits of ICT in ESP showed a strong correlation (0.484 overall), suggesting that

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recognizing the benefits of ICT significantly boosts literacy levels. The indicators Attitudes towards Social and Cultural Factors (overall correlation of 0.379), Attitudes towards Teacher Education (overall correlation of 0.324), and Attitudes towards Obstacles (overall correlation of 0.316) exhibit lower correlations compared to other attitudes. This suggested that while attitudes towards obstacles and teacher education were still positively related to ICT literacy, they have a lesser impact than other areas.

All correlations were statistically significant at the 0.05 level, reinforcing the reliability of the findings and indicating that these relationships were unlikely to be due to chance. In Table 7 is demonstrated a strong and positive correlation between attitudes towards ICT and various aspects of ICT Literacy. Positive attitudes, particularly towards the benefits and enrichment of ESP

courses, were closely linked to higher ICT Literacy levels. While attitudes towards obstacles and teacher education showed positive associations, their lower correlation values indicated areas where further focus may be needed to enhance overall ICT engagement and effectiveness.

The results of individual correlation analyses between attitudes towards ICT and various aspects of ICT Literacy indicators revealed r-values between 0.316 and 0.564, with p-values less than 0.05. This suggested the existence of substantial correlations. Furthermore, a significant correlation was observed between each of the ICT literacy indicators and the overall level of attitudes towards ICT, as indicated by R-values between 0.434 and 0.496 and the p-values less than 0.05; thus, the present findings suggested that the correlations were indeed substantial.

Table 7. Significance on the Relationship between Levels of Attitude towards ICT and Information and Communication Technology (ICT) Literacy

Attitude towards ICT	Information and Communication Technology (ICT) Literacy							
	Define	Access	Evaluate	Manage	Integrate	Create	Communication	Overall
Attitudes towards Benefits of ICT into ESP	.357* (0.000)	.446* (0.000)	.422* (0.000)	.413* (0.000)	.354* (0.000)	.422* (0.000)	.458* (0.000)	.484* (0.000)
Attitudes towards Enriching ESP Courses	.452* (0.000)	.509* (0.000)	.479* (0.000)	.495* (0.000)	.434* (0.000)	.483* (0.000)	.503* (0.000)	.564* (0.000)
Attitudes towards Skills Using ICT	.425* (0.000)	.463* (0.000)	.421* (0.000)	.474* (0.000)	.479* (0.000)	.495* (0.000)	.485* (0.000)	.546* (0.000)
Attitudes towards Obstacles	.245* (0.000)	.235* (0.000)	.243* (0.000)	.246* (0.000)	.335* (0.000)	.278* (0.000)	.290* (0.000)	.316* (0.000)

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Attitudes towards Teacher Education	.270* (0.000)	.199* (0.000)	.254* (0.000)	.262* (0.000)	.348* (0.000)	.284* (0.000)	.300* (0.000)	.324* (0.000)
Attitudes towards Social and Cultural Factors	.346* (0.000)	.280* (0.000)	.285* (0.000)	.315* (0.000)	.387* (0.000)	.320* (0.000)	.320* (0.000)	.379* (0.000)
Overall	.438* (0.000)	.434* (0.000)	.434* (0.000)	.456* (0.000)	.496* (0.000)	.473* (0.000)	.488* (0.000)	.542* (0.000)

*Significant at 0.05 significance level.

The study's findings aligned with the correlation between public school teachers' attitudes towards ICT and their ICT literacy. The results also supported the study of Mantoro, Fitri, and Usino (2017), which stated that fostering positive attitudes towards ICT was essential for enhancing ICT literacy among public school teachers, as these attitudes significantly influence their willingness and ability to integrate technology into their teaching practices effectively. The critical role that positive

attitudes towards ICT play in improving ICT literacy among teachers (Nair & Karan, 2024) emphasizes that such attitudes significantly contribute to effective learning processes in educational settings (Munna & Kalam, 2021). The critical role that positive attitudes towards ICT play in improving ICT literacy among teachers (Nair & Karan, 2024) emphasizes that such attitudes significantly contribute to effective learning processes in educational settings (Munna & Kalam, 2021).

Best Fit Model of Information and Communication Technology (ICT) Literacy

In this paper is presented a summary of the goodness-of-fit measures for three structural equation models examining the relationships between instructional leadership, technology leadership, attitude towards ICT, and Information and Communication Technology (ICT) Literacy. It can be gathered from the figure that instructional leadership to ICT Literacy commitment has a β -coefficient of

0.14; technology leadership to ICT Literacy has 0.25; and attitude towards ICT to ICT Literacy has 0.35. On the other hand, looking into the effect of the latent variables on each other revealed higher β -coefficient values: instructional leadership and technology leadership was 0.76; technology leadership and attitude towards ICT was 0.39; and instructional leadership and attitude towards ICT was 0.39.

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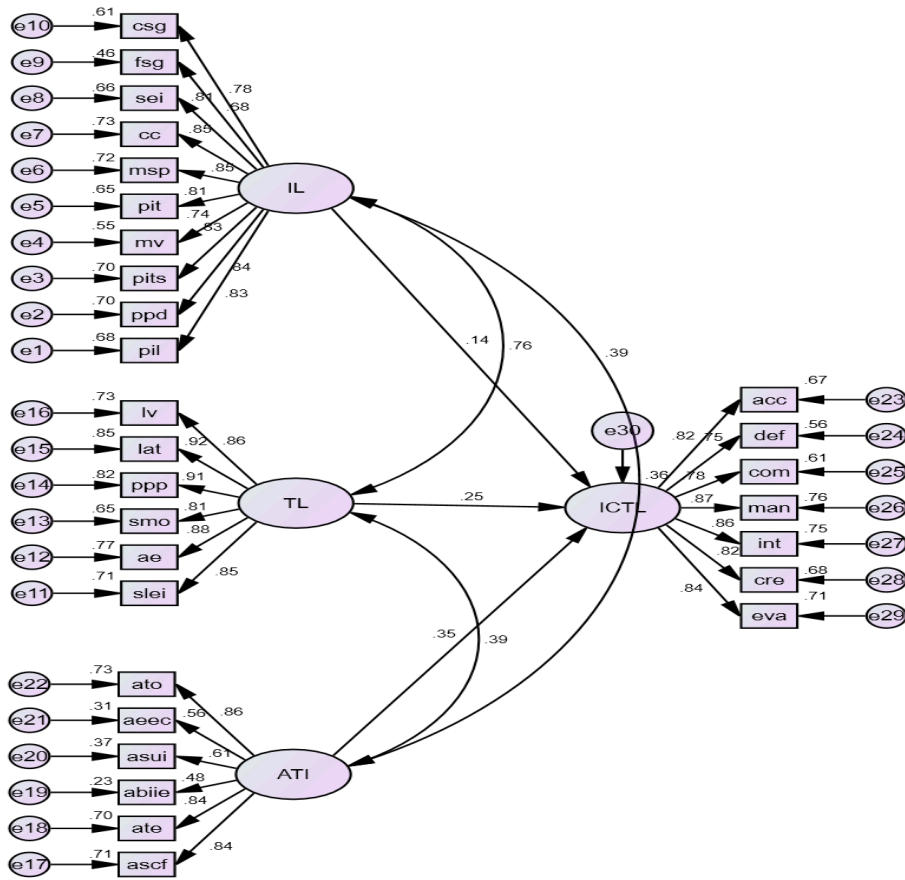


Figure 2. Structural Equation Model 1 in Standardized Solution

Legend: fsg – Frame the School Goals

csg – Communicate the School Goals

sei – Supervise and Evaluate Instruction

cc – Coordinate the Curriculum

msp – Monitor Student Progress

pit – Protect Instructional Time

mv – Maintain Visibility

pits – Provide Incentives for Teachers

ppd – Promote Professional Development

pil – Provide Incentives for Learning

IL –Instructional Leadership

lv – Leadership and Vision

lat – Learning and Teaching

ppp – Productivity and Professional Practices

smo – Support, Management and Operation

ae – Assessment and Evaluation

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slei – Social, Legal, Ethical Issues
TL – Technology Leadership

abiie – Attitude towards Benefits of ICT Integration into ESP
aeec – Attitude towards Enriching ESP Courses
asui – Attitude towards Skills in Using ICT
ato – Attitude towards Obstacles
ate – Attitudes towards Teacher Education
ascf – Attitude towards Social and Cultural Factors
ATI – Attitude towards ICT

def – Define
acc – Access
eva – Evaluate
man – Manage
int – Integrate
cre – Create
com – Communicate
ICTL – Information and Communication Technology (ICT) Literacy

The original proposed model outlined in Figure 1 requires some modifications to fit the data. There were three generated models presented in the study to determine their suitability for the data. In identifying the best fit structural model, all indices included must consistently fall within the acceptable ranges. The chi-square/degrees of freedom value should be less than 2 but greater than 0, with its corresponding p-value greater than 0.05. The root mean square error approximation value must be less than 0.05 and its corresponding P-close value must be greater than 0.05. The other indices, such as the Normed fit index, Tucker-Lewis index, comparative fit index, and goodness of fit index, must all be greater than 0.95.

Generated model 1. In Figure 2 is shown the generated structural model 1. It displayed the interrelationships of the exogenous

variables; instructional leadership with ten original indicators namely: frame the school goals, communicate the school goals, supervise and evaluate instruction, coordinate the curriculum, monitor student progress, protect instructional time, maintain visibility, provide incentives for teachers, promote professional development, and provide incentives for learning; technology leadership consist of six original indicators namely: leadership and vision, learning and teaching, productivity and professional practices, support, management and operation, assessment and evaluation, and social, legal, ethical issues; attitude towards ICT with six original indicators namely: attitude towards benefits of ICT integration into ESP, attitude towards enriching ESP courses, attitude towards skills in using ICT, attitude towards obstacles, attitudes towards teacher education, and attitude

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towards social and cultural factors; their causal relationship on the endogenous variable ICT literacy of public school teachers with seven original indicators namely: define, access, evaluate, manage, integrate, create, communicate. All indicators showed direct influences on the Information and Communication Technology (ICT) Literacy.

Further, the survey results indicated a model that did not fit well with the provided data and the required criterion for an acceptable fit; hence, Model 1 was a poor fit. The P-close and P-value of 0.000 contradict the required criterion of >0.05 , suggesting a lack of statistical significance. The CMIN/DF ratio of

6.642, surpassing the acceptable range of $0 < \text{value} < 2$, further supported the conclusion that the model did not adequately represent the data. The GFI, CFI, NFI, and TLI values falling below the criterion of >0.95 collectively indicated a suboptimal goodness-of-fit. Moreover, the RMSEA value of 0.118, exceeding the required criterion of <0.05 , further underscores that the model was not a good fit for the data. This calls for careful consideration and potential adjustment to improve the models' overall adequacy. The current model in Figure 2, as supported by the data in Table 8, failed to meet the basic criterion.

Table 8. *Goodness of Fit Measures of Structural Equation Model 1*

INDEX	CRITERION	MODEL FIT VALUE
P-Close	> 0.05	.000
CMIN/DF	$0 < \text{value} < 2$	6.642
P-value	> 0.05	.000
GFI	> 0.95	.661
CFI	> 0.95	.812
NFI	> 0.95	.787
TLI	> 0.95	.795
RMSEA	< 0.05	.118

Legend:

CMIN/DF	-	Chi-Square/Degrees of Freedom
NFI	-	Normed Fit Index
TLI	-	Tucker-Lewis Index
CFI	-	Comparative Fit Index
GFI	-	Goodness of Fit Index
RMSEA	-	Root Means Square of Error Approximation
Pclose	-	P of Close Fit
P-value	-	Probability Level

The findings were associated with the study of Schermelleh-Engel, Moosbrugger, & Müller (2003), with all indices indicating a lack of statistical significance and suggesting that the model did not adequately represent the data, which was above the required

criterion, further emphasizing that the model was not a good fit for the data. These findings suggest that the model fails to adequately represent the data, highlighting significant issues with its statistical validity and fit (Peugh & Feldon, 2020).

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Moreover, in Figure 3 is presented the goodness of fit measures for the initial structural equation model, incorporating the latent variables of instructional leadership, technology leadership, attitude towards ICT, and ICT Literacy. The figure showed that the β -coefficient from instructional leadership to ICT literacy was 0.12; from technology leadership to ICT literacy, 0.11; and from attitude towards ICT to ICT literacy, 0.50.

However, analyzing the interactions among the latent variables showed higher β -coefficient values: the correlation between instructional leadership and technology leadership was 0.73, between technology leadership and attitude towards ICT, 0.58, and between instructional leadership and attitude towards ICT, 0.55. The indicators for the variables were adjusted based on their magnitudes, considering the significant unique variance.

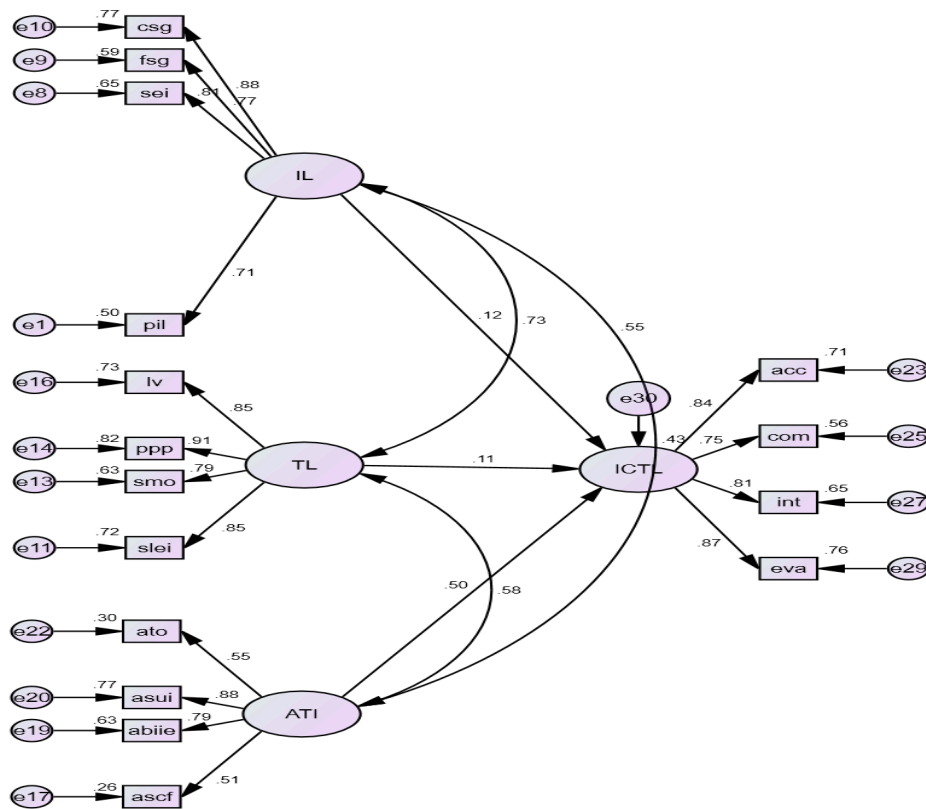


Figure 3. Structural Equation Model 2 in Standardized Solution

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Legend fsg – Frame the School Goals
 csg – Communicate the School Goals
 sei – Supervise and Evaluate Instruction
 pil – Provide Incentives for Learning
 IL –Instructional Leadership

lv – Leadership and Vision
 ppp – Productivity and Professional Practices
 smo – Support, Management and Operation
 slei – Social, Legal, Ethical Issues
 TL – Technology Leadership

abiie – Attitude towards Benefits of ICT Integration into ESP
 asui – Attitude towards Skills in Using ICT
 ato – Attitude towards Obstacles
 ascf – Attitude towards Social and Cultural Factors
 ATI – Attitude towards ICT

acc – Access
 eva – Evaluate
 int – Integrate
 com – Communicate
 ICTL – Information and Communication Technology (ICT) Literacy

The individuals with high coefficients and observable factors were emphasized for their instructional leadership. The two factors referred to were communicating the school goals ($\beta=0.88$) and supervising and evaluating instruction ($\beta=0.81$). The factors that significantly influenced technology leadership included productivity and professional practices ($\beta = 0.91$), and the two with the same values of coefficients were leadership and vision ($\beta = 0.85$), and social, legal, and ethical issues ($\beta = 0.85$). Conversely, attitude towards ICT encompasses the indicators of attitude towards skills in using ICT ($\beta=0.88$) and attitude towards benefits of ICT integration into ESP ($\beta=0.79$). ICT Literacy encompasses evaluate ($\beta = 0.87$) and access ($\beta = 0.84$) as

indices. Since each element has a substantial coefficient, it was clear how important they were in determining effective leadership and technology integration in learning environments.

Due to a structural modification the results in Figure 2, showed a reduction of indicators to fit the data from the original indicators.

Generated model 2: The generated structural model 2 was shown in Figure 3. It displayed the interrelationships of the exogenous variables, where some indicators with low values were removed. In instructional leadership, there were four out of ten original indicators, namely, communicate the school goals, frame the school goals,

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supervise and evaluate instruction, and provide incentives for learning demonstrated positive influence.

Similarly, technology leadership's positive influence was evident in its retained indicators, which consist of four of six original indicators, namely leadership and vision, productivity and professional practices, support, management and operation, and social, legal, and ethical issues. Attitude towards ICT, as indicated in the model, displayed a positive influence through its four retained indicators from six original indicators, which were attitude towards

benefits of ICT integration into ESP, attitude towards skills in using ICT, attitude towards obstacles, and attitude towards social and cultural factors. In contrast, the endogenous variable ICT literacy of public school teachers has four remaining out of seven original indicators, namely access, evaluate, integrate, and communicate. It was noteworthy that all remaining indicators exerted a direct influence on Information and Communication Technology (ICT) literacy, emphasizing the comprehensive impact of the three exogenous variables on the endogenous variable.

Table 9. *Goodness of Fit Measures of Structural Equation Model 2*

INDEX	CRITERION	MODEL FIT VALUE
P-Close	> 0.05	.000
CMIN/DF	0 < value < 2	5.590
P-value	> 0.05	.000
GFI	> 0.95	.858
CFI	> 0.95	.896
NFI	> 0.95	.877
TLI	> 0.95	.872
RMSEA	< 0.05	.106

Legend:

CMIN/DF	-	Chi-Square/Degrees of Freedom
NFI	-	Normed Fit Index
TLI	-	Tucker-Lewis Index
CFI	-	Comparative Fit Index
GFI	-	Goodness of Fit Index
RMSEA	-	Root Means Square of Error Approximation
Pclose	-	P of Close Fit
value	-	Probability Level

Furthermore, in Model 2 is exhibited significant improvement in various indices compared to Model 1. Notably, the CMIN/DF ratio improved from 6.642 to 5.590, although it still falls short of acceptability as it did not meet the required criterion of $0 < \text{value} < 2$.

The GFI also demonstrated an increase from 0.661 to 0.858, yet it remains below the necessary threshold of >0.95 for a satisfactory fit. Additionally, the RMSEA decreased from 0.118 to 0.106, but it remains unacceptable, failing to meet the

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required criterion of 0.05. Both P-value and P-close maintained the same value of 0.000 in both models, indicating a poor fit as they did not satisfy the criterion of >0.05 . Although the GFI jumped from 0.661 to 0.858, the CFI improved from 0.812 to 0.896, the NFI increased from 0.787 to 0.877, and the TLI rose from 0.795 to 0.872 closely meeting the acceptable criteria individually, it was essential to emphasize that achieving a good fit requires meeting all criteria collectively. Thus, despite improvements in certain indices, comprehensive adherence to

all criteria was imperative for deeming the model a good fit. Hence, a poor fit.

This finding was supported by the study of Goretzko, Siemund, and Sterner (2024) that these values still did not meet the acceptable thresholds, indicating a poor overall model fit. Therefore, despite some progress in specific metrics, comprehensive adherence to all fit criteria was essential for determining model adequacy, leading to the conclusion that the model still represents an overall poor fit (Sahoo, 2019).

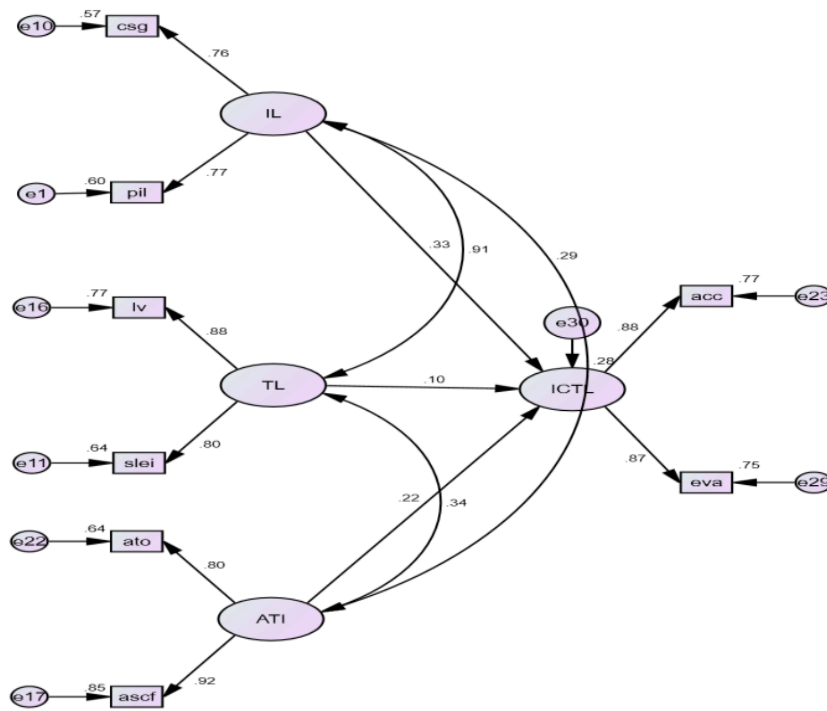


Figure 4. Structural Equation Model 3 in Standardized Solution

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Legend:

csg	–	Communicate the School Goals
pil	–	Provide Incentives for Learning
IL	–	Instructional Leadership
lv	–	Leadership and Vision
slei	–	Social, Legal, Ethical Issues
TL	–	Technology Leadership
ato	–	Attitude towards Obstacles
ascf	–	Attitude towards Social and Cultural Factors
ATI	–	Attitude towards ICT
acc	–	Access
eva	–	Evaluate
ICTL	–	Information and Communication Technology Literacy

As can be observed in Table 9, Model 3 has satisfied the criteria for a fitting model of the latent variables. This signifies that the third model exhibited a parsimonious fit. The results of this study provided evidence against the second null hypothesis, which posited that there was no optimal model for explaining the level of ICT literacy among public school teachers in the CARAGA region was likely predicted by the model with the best match. The results were comparable to those of Pettiegrew II (2013). Principals were portrayed by instructional leadership as the primary source of instructional competence when it comes to the use of ICT in a continuous and affective professional learning environment. The model demonstrated the significance of instructional leadership, technology leadership, and attitudes towards ICT as indicators of ICT literacy, which consistently indicate an excellent fit to the data, given that each index falls within its respective criterion.

Generated Model 3. As shown in Figure 4, two out of ten indicators of instructional

leadership remained significant predictors of ICT literacy: communicate the school goals and provide incentives for learning to promote a positive school environment. On the other hand, two out of six indicators of technology leadership were found to affect ICT literacy: leadership and vision and social, legal, and ethical issues. Similarly, two out of six indicators of attitudes towards ICT were found to affect ICT literacy: attitude towards obstacles and attitude towards social and cultural factors. Based on the result, the findings suggested that the ICT literacy among public school teachers in the Caraga region was best anchored on instructional leadership, which was measured in terms of communicate the school goals and provide incentives; technology leadership in terms of leadership and vision and social, legal, and ethical issues; and attitudes towards ICT in terms of attitude towards obstacles and attitude towards social and cultural factors.

As can be seen the results in Table 10, the model satisfied the set criteria for a close and excellent fit value. P-close and RMSEA values greater than 0.05 and less than 0.05,

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respectively, were thresholds for a model that was considered close-fitting (Kenny, 2015). In this model, the P-close is 0.867 while the RMSEA is 0.028. The rest of the criteria were satisfied in the model: where it

showed specifically from the table that CMIN/DF was 1.310; P-value was 0.192; GFI was 0.989; CFI was 0.997; NFI was 0.988; and TLI was 0.944. All fall within the acceptable ranges.

Table 10. *Goodness of Fit Measures of Structural Equation Model 3*

INDEX	CRITERION	MODEL FIT VALUE
P-Close	> 0.05	.867
CMIN/DF	0 < value < 2	1.310
P-value	> 0.05	.192
GFI	> 0.95	.989
CFI	> 0.95	.997
NFI	> 0.95	.988
TLI	> 0.95	.944
RMSEA	< 0.05	.028

Legend:

CMIN/DF	-	Chi-Square/Degrees of Freedom
NFI	-	Normed Fit Index
TLI	-	Tucker-Lewis Index
CFI	-	Comparative Fit Index
GFI	-	Goodness of Fit Index
RMSEA	-	Root Means Square of Error Approximation
Pclose	-	P of Close Fit
P- value	-	Probability Level

This means that the model fits well with the data and was therefore asserted as the best-fit structural model of the factors that affect ICT literacy. This was supported by Steiger (2007), denoting that CMIN/DF should be less than 2.0, and the Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI) should be greater than 0.95. Moreover, the RMSEA and PCLOSE values were supported by MacCallum, Browne, and Sugawara (1996), indicating 0.01, 0.05, and 0.08 as excellent, good, and mediocre fit, respectively, with P of close fit (PCLOSE) that was greater than 0.05. Arbuckle (2009) posited that the CMIN/DF should be < 2.0 and the p-value should be greater than 0.05.

Furthermore, P of close fit (PCLOSE) should be greater than 0.05 (Kenny, 2011), and the TLI and CFI should exceed .90 to indicate good fit (Hu & Bentler, 1999). Model 3 was found to be the best fit model among the three generated models because all of its indices fall within each criterion as shown in Table 10. Thus, there was no need to find another model for testing because it was already found to be the best fit among all the tested models. Therefore, the null hypothesis of no best fit model was rejected.

Additionally, the results of the generated structural Model 3 showed the direct causal link of the exogenous variable with the

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endogenous variable. Findings revealed a very high level of instructional leadership, a very high level of technology leadership, and high levels of attitude towards ICT and ICT literacy. There was a strong, positive, and significant correlation between instructional leadership and ICT literacy, technology leadership and ICT literacy, and attitude towards ICT and ICT literacy.

Further results showed that the best-fit model was model 3, showing the direct causal relationships of instructional leadership, technology leadership, and attitude towards ICT on ICT literacy. Moreover, the ICT literacy of the respondents was defined by the retained indicators, namely, Access and Evaluate. Instructional leadership was described with the following indicators: Communicate the School Goals and Provide Incentives for Learning. On the other hand, technology leadership was described in terms of the indicators of Leadership and Vision and Social, Legal, and Ethical Issues. Finally, attitude towards ICT retained the following indicators: Attitude towards Obstacles, and Attitude towards Social and Cultural Factors.

Since the current model was the best of all, testing another model was unnecessary. There may be an ideal model that accurately predicts CARAGA Region public elementary school teachers' ICT literacy. The model showed that instructional leadership, technology leadership, and attitude towards ICT can predict ICT literacy. Findings suggest that the policy-making body of the Department of Education should look into the provision of professional development,

workload allocations, and benefits of the teachers to further improve their ICT literacy.

Additionally, this finding supports the study of Noceto (2022). Both communicating school goals and providing incentives were integral to effective instructional leadership, directly influencing ICT literacy by fostering a collaborative and motivated learning environment. Effective communication of school goals was crucial for aligning the efforts of educators and stakeholders toward common objectives. Instructional leaders who articulate clear goals help create a shared vision that motivates teachers and students alike. This alignment was particularly important in the context of ICT literacy, as it ensures that all members of the educational community understand the importance of integrating technology into their teaching practices.

A study by Hallinger (2005) emphasized that instructional leadership positively impacts student achievement, highlighting the need for clear communication of goals to enhance educational outcomes. Providing incentives for learning was another critical aspect of instructional leadership that directly affects ICT literacy. Incentives can take various forms, such as professional development opportunities, recognition programs, or resources for technology integration. These incentives encourage teachers to adopt innovative teaching methods and utilize ICT effectively in their classrooms. Research indicated that when school leaders actively support teachers through incentives, it improves teacher performance and student

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outcomes. These indicators were essential for fostering an environment conducive to effective teaching and learning, particularly in integrating technology into educational practices.

Likewise, this finding aligned with the study of Mwawasi (2014). Effective leadership and a clear vision were crucial for integrating ICT into education. Leaders who articulate a strong vision for technology use-inspired and guided teachers and students to embrace ICT as a vital tool for learning. Addressing social, legal, and ethical issues related to technology use was essential for fostering a responsible approach to ICT integration. Leaders must navigate these challenges to ensure that technology is used ethically and inclusively in educational settings. This involved understanding the implications of data privacy, equitable access to technology, and the ethical use of digital resources. This research investigated how school leaders can effectively build teachers' capacities to integrate ICT into their teaching practices while addressing social, legal, and ethical issues. Both were fundamental components of technology leadership that directly influenced ICT literacy by creating a supportive framework for effective technology integration in education.

In contrast, the indicators of attitude towards obstacles and attitude towards social and cultural factors were significant in understanding how attitudes towards ICT influence ICT literacy. This study highlighted that teachers with a positive attitude towards overcoming obstacles were more likely to successfully integrate ICT into their

teaching practices, thereby enhancing their ICT literacy and that of their students (Bingimlas, 2009). Furthermore, this was consistent with the findings of Ziad (2016); that attitude toward social and cultural factors encompasses the beliefs and values that influenced how technology was perceived within different contexts. This includes considerations of equity, access, and the impact of cultural norms on technology use; it was emphasized that teachers' attitudes toward social and cultural factors significantly affect their willingness to adopt ICT. The findings suggested that understanding these factors can lead to more effective strategies for integrating technology into education, ultimately improving student ICT literacy. Both attitude towards obstacles and attitude towards social and cultural factors played crucial roles in shaping how individuals engaged with ICT, directly influencing their overall ICT literacy through their perceptions and responses to challenges and contextual factors.

Public school teachers demonstrated a strong dedication to their profession, suggesting potential for further improvement. Additionally, providing incentives and recognition can boost employees' self-esteem and their likelihood of staying with the organization.

Hence, Sustainable Development Goals (SDG) 4 emphasized quality education, which focuses on ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all. By focusing on these areas, educational institutions can contribute significantly to achieving quality

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education that promotes sustainability and empowers future generations. It explored the influence of school heads' technology leadership on teachers' ability to integrate

technology effectively (Bruton, 2018) in their teaching practices, thereby impacting overall ICT literacy within educational settings.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of the study, conclusions were drawn as follows:

The findings of this study highlight the crucial importance of leadership in instructional and technology in creating a positive educational atmosphere and improving ICT literacy among teachers. The results reveal a remarkable degree of effectiveness in both instructional and technology leadership, with a strong agreement among participants about the importance of maintaining high visibility and effective support, management, and operations in the workplace. Maintaining high visibility of instructional leadership is crucial for enhancing teacher effectiveness. It's not only boosts teacher self-efficacy and performance but also fosters a collaborative and supportive educational environment that prioritizes student learning outcomes, and the support, management, and operations of effective technology leadership support teacher effectiveness by enhancing their technological skills, encouraging instructional innovation, and streamlining administrative tasks. This improves teaching practices and contributes to a more efficient and supportive educational environment. Both are highly visible, and teachers benefit from a comprehensive support system that enhances their skills and practices, leading to improved student learning outcomes. The

combination fosters a collaborative and supportive educational environment where teachers feel more motivated, job-satisfied, and dedicated. Effective leadership results in increased quality of teachers' performance and student achievement. Instructional leadership impacts student achievement by affecting what happens in the classroom, establishing processes, tools, and a learning culture that enables effective teaching, ultimately improving student learning outcomes.

On the other hand, the level of attitude towards ICT of school heads remained high, as frequently observed. The heightened levels of the indicators, namely, attitude towards obstacles, attitude towards teacher education, and attitude towards social and cultural factors, contribute to the observed elevated level of attitude towards ICT in this study. To gain more benefits from ICT, enriching a healthy and productive school culture and skills using ICT may give serious consideration to implementing a program that is congruent with the vision, mission, and objectives of the Department of Education.

Moreover, the Information and Communication Technology (ICT) literacy of public-school teachers is high, indicating a

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frequent occurrence. The heightened levels of integration, creation, and communication contribute to the elevated degree of ICT literacy. In this tenet, the Department of Education may conduct a policy review to enhance teachers' innovation and promote digital literacy skills in 21st-century teachers. Furthermore, providing technology by continuing professional development training can enhance their ICT literacy skills as they perceive worthy, thereby increasing the chances of staying within the organization.

Furthermore, the research highlights a robust correlation between the instructional leadership of school heads and the ICT literacy and technology leadership of school heads and ICT literacy, indicating that there is a positive significant relationship; effective leadership is crucial for developing educators' technological skills. Likewise, a positive significant relationship exists between attitude towards ICT and ICT literacy. Respondents' positive attitudes towards ICT further reinforce the potential for integrating technology into educational practices.

SEM model 3 emerged as the best-fit model for analyzing the interrelationships among instructional leadership of school heads, technology leadership of school heads, attitudes towards ICT and ICT literacy, showcasing a strong alignment between the proposed relationships among instructional leadership, technology leadership, attitudes towards ICT, and ICT literacy. The model showed favorable goodness-of-fit indices, including CFI, TLI, and NFI, which surpassed

the recommended thresholds, indicating a very satisfactory fit. This indicates that the model effectively captures the relationships between the variables and provides a reliable framework for understanding their interactions (Fu, Wang, Qu, Skitmore, Yi, Sun, & Chen, 2024). The research findings corroborated Douma and Shipley (2022), who highlight that attaining a good fit across multiple goodness-of-fit indices signifies a well-defined model that accurately represents the relationships within the data. The theory of Jan van Dijk, the Digital Divide Theory, conforms to the study results. Educational institutions can create an environment that supports the development of ICT literacy through strong instructional and technology leadership. Fostering observational learning, leveraging leadership roles, and promoting positive attitudes towards technology will collectively contribute to improved educational outcomes and greater integration of ICT in teaching practices.

Based on the findings and conclusions of this research, several actionable recommendations can be made to enhance instructional and technology leadership, as well as ICT literacy among teachers. First, school leaders should prioritize maintaining high visibility in classrooms to engage directly with teachers and students, fostering a culture of collaboration and support. Regular walk through and feedback sessions can facilitate this engagement and provide constructive insights into teaching practices. Furthermore, policies must be developed to support management and operations in fostering effective learning delivery by

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ensuring that educational environments are well-organized, resourced, and conducive to teaching and learning. These aspects work together to foster learning, ensuring that educational institutions are well-prepared to provide effective learning experiences. Despite these positive outcomes, the study also identifies areas for improvement, particularly in maintaining high visibility and support, management, and operations. These factors suggest that while leaders are effective in many dimensions, there remains an opportunity to enhance their presence within classrooms and ensure that teaching time is safeguarded from unnecessary interruptions.

Professional development is crucial for ongoing improvement; therefore, establishing continuous training programs focused on both instructional strategies and technology integration will help support the management and operation to teachers stay updated with the latest practices and tools. Mentorship opportunities should also be created, allowing experienced teachers to guide less experienced teachers in integrating technology effectively into their teaching. Strengthening technology leadership is another key area for improvement. School leaders must develop a clear vision for technology integration that aligns with educational goals, ensuring that all staff understand the importance of ICT in enhancing learning outcomes. Adequate resources must be allocated for technology implementation, including hardware, software, and training.

To address attitudes toward ICT and strengthen principals' digital leadership practice, it is recommended to address attitudes toward teacher education, social and cultural factors, and obstacles. Principals can improve their leadership practice in the digital age, resulting in better educational outcomes and a more inclusive and effective learning environment. Conducting awareness campaigns highlighting technology's benefits in education can help shift negative perceptions and reinforce positive attitudes.

Additionally, providing training sessions for teachers' education that specifically tackle common attitudes towards obstacles to ICT integration will equip educators with strategies to overcome these challenges. Finally, fostering a collaborative environment is essential; promoting collaborative projects among staff will encourage teamwork and the sharing of best practices in instructional leadership and technology use. Establishing feedback mechanisms where educators can share their experiences with ICT will further cultivate a culture of continuous improvement. By implementing these recommendations, school leaders can enhance their effectiveness in both instructional and technology leadership, ultimately leading to improved ICT literacy among educators and better educational outcomes for students.

To integrate, create, and communicate as low-level indicators of information and communication technology (ICT) literacy among public school teachers, several recommendations can be applied:

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Professional Development workshops that focus on integrating into teaching practice and encourage teachers to collaborate on projects that require the integration of ICT, such as creating digital lesson plans or developing online assessments; Digital Communication Tools, provide resources. This helps teachers improve their ability to use ICT to create educational resources. Teach teachers how to utilize digital communication tools successfully, such as email, online forums, and video conferencing software, to improve contact with students, parents, and colleagues. A recent study highlighted the importance of teachers' technological knowledge (TK) and technological-pedagogical knowledge (TPK) in promoting ICT literacy among teachers. While the study found no significant relationship between school leaders' TK/TPK and teachers' ICT literacy, it emphasizes the need for teachers to possess these skills to effectively integrate ICT into teaching practices.

Further, it is recommended that school leaders promote professional development to stay up-to-date on ICT and technology use and emphasize the benefits of using

technology in education. The favorable correlation between instructional leadership, technological leadership, and attitude towards ICT with ICT literacy emphasizes the significance of a comprehensive approach to teacher assistance. The findings suggest that school leaders should improve ways to fully harness these interrelationships to promote teachers' ICT literacy. SEM model 3 highlights the importance of continual improvement in digital learning and provides learners with the abilities to develop their own competencies.

Moreover, the Department of Education needs to consider that the professional development and education programs or training concerning educational leaders and teachers should tackle and implement practices that emphasize instructional and technology leadership of school heads and strategies that encourage and improve teachers' ICT literacy. It is possible for schools to think about the basic idea of school-based management (SBM), which involves sharing leadership duties among many people working together on different aspects. The researcher also recommends conducting a new study further to update the data and findings on these concerns.

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