

The technological, pedagogical and content knowledge of teachers in information and communication technology: Basis for a proposed ICT integration training

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Abstract: The utilization of technology for educational purposes is not a recent development; it can be traced back to the early era of television, when ambitious initiatives aimed at transforming the educational experience for students were first formulated. This study investigated the Technological Pedagogical and Content Knowledge (TPACK) of teachers and proposed an ICT integration training program based on the findings. It examined the teachers' profile, including age, academic rank, educational background, ICT training, and teaching experience, as well as school profile in terms of ICT facilities and support for ICT training. The study revealed that most teachers exhibited very high TPACK levels, irrespective of age, position, education, training, or experience. It was also found out that female teachers tend to demonstrate higher pedagogical knowledge. Interestingly, findings disclosed that sharing of resources among teachers could enhance their TPACK competencies, particularly for those facing challenges with ICT integration. The study recommended a training program to enhance TPACK, considering gender differences among teachers. It also proposed projects to improve internet connectivity in schools, which could potentially enhance teaching and learning processes. These findings underscored the importance of considering gender-specific needs and the benefits of collaborative resource-sharing in professional development programs aimed at enhancing TPACK through ICT integration.

Keywords: TPACK, ICT, Training Program

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INTRODUCTION

The integration of technology in teaching and learning is not a recent venture; its origins trace back to the early days of television, where ambitious aspirations to revolutionize education for students were initially conceived. (Perienen, 2020). As the world is rapidly transitioning to digital media and information. Information Communication and Technology's (ICT) role is widely acknowledged, and its presence has fundamentally transformed the practices and procedures of all forms of venture in education, business, governance, and personal life (Rana, 2020).

According to Lawrence (2018), the importance of information and communication technology (ICT) in man's daily lives and educational systems is growing. There is a burgeoning expectation that educational institutions will use ICT to teach students the skills and knowledge they will need in the digital age. The incorporation of ICT into the teaching and learning environment expands opportunities for teachers and students to collaborate more effectively in a globalized digital age. ICT has the potential to play a growing role in education, whether in the classroom, administration, online instruction, or other areas. Teachers and students have enormous potential to harness the power of ICT to improve the quality of teaching and learning in the classroom.

In the Philippines, the Department of Education urge to utilized the ICT resources provided by the government to effectively teach student using ICT. As outlined in DepEd Order No. 78 s. 2010 and DepEd Order No. 8 s. 2019 stipulated the utilization of Maintenance and Other Operating Expenses which pertains the procurement and maintenance of learning materials related to ICT. These legal mandates foster the urge to utilized ICT in pedagogical practices.

Furthermore, DepEd Order No. 42, s. 2017 on National Adoption of Professional Standard for Teachers (PPST) strengthened the necessity for using technology in the teaching and learning process in the Philippines. Domain 1 emphasized the beneficial application of ICT in teaching, with its indicators proposing practical approaches to enhance the teaching and learning experience through ICT. As Das (2020) emphasized, ICTs represent networks that expand the potential for teaching, learning, and training by delivering digital content.

Moreover, DepEd Memorandum No. 008, s. 2023 on Multi-Year Guidelines on the Results-Based Performance Management System-Philippine Professional Standards for Teachers provided a guideline on the Results Based Performance Management System or RPMS on its objective which focuses on the selection, utilization and used of appropriate ICT learning resources to enforce teaching. This centers on the effective use of ICT for teaching in the classroom observation and even on the daily teaching – learning process. In this regard, it was noted that the majority of teachers during class observations or demonstration lessons assumed that using simple powerpoint and video presentations in place of the customary chalk talk activity amounted to ICT integration. This situation ran counter to the idea put forth in the 21st Century Learning Design, or the 21st CLD, which suggested that the idea of ICT integration should go beyond the idea of simple ICT use and instead emphasize ICT manipulation and redefinition to improve student learning.

In Alegria District, Division of Surigao del Norte it was observed that only few teachers are integrating the use of technology in their pedagogical practices. Some teachers utilized technology as replacement of the visual aids thus, lacking utilization of ICT to improve the skills of the students. This prompted the researcher to conduct this study to further explore and assess the level of content knowledge of teachers regarding the concept of ICT integration, and to further propose an ICT training program for the aforementioned issue.

Problem Statement

This study investigated the level of teachers' Technological Pedagogical Content Knowledge (TPACK) as a Basis for a Proposed ICT Integration training program. Specifically, it sought to answer the following sub-problems:

1. What is the profile of the respondents in terms of the following:
 - 1.1 Age,
 - 1.2 Sex,
 - 1.3 Academic Rank,
 - 1.4 Educational Attainment,
 - 1.5 Trainings on ICT, and
 - 1.6 Teaching Experience?
2. What is the school profile of the respondents assigned school in terms of:
 - 2.1 Availability of ICT facilities,
 - 2.3 Availability of ICT Integration Trainer, and
 - 2.3 Additional support for ICT Training?
3. What is the level of teachers' Technological Pedagogical Content Knowledge (TPACK) in ICT integration?

4. Is there a significant difference in the level of the teachers' TPACK when they are grouped according to:
 1. Teacher's profile, and
 2. School profile?
5. Based on the findings, what ICT Integration training can be proposed?

Theoretical framework

This study was grounded in the Technological Pedagogical Content Knowledge (TPACK) theory. As highlighted by Koh (2019), it was originally and first introduced by Mishra and Koehler in 2006, TPACK offers a framework to identify the specific knowledge teachers require to seamlessly integrate technology into their teaching practices. It encompasses seven components, including content, pedagogy, and technology, along with four additional forms of knowledge: Technological Pedagogical Content Knowledge, Pedagogical Content Knowledge, Technological Content Knowledge, and Technological Pedagogical Knowledge.

The TPACK diagram serves as a visual representation of three fundamental components essential to effective teaching: content knowledge, pedagogical knowledge, and technological knowledge. These domains intersect to create a comprehensive framework for educators, as explained by Tanak (2020). Firstly, Pedagogical Content Knowledge (PCK) emphasizes the teaching process, integrating subject matter expertise with pedagogical strategies to enhance instructional practices across various content areas. This blend of content and pedagogy aims to foster better teaching methodologies. Secondly, Technological Pedagogical Knowledge (TPK), encompasses the skills necessary for educators to effectively leverage technology in support of specific pedagogical approaches. TPK enables teachers to choose the most suitable technological tools to enhance their instructional strategies, aligning technology with pedagogical goals. Lastly, Technological Content Knowledge (TCK) equips educators with the ability to seamlessly integrate technology into content-rich learning environments. This knowledge empowers teachers to create engaging learning experiences by incorporating technology effectively into their teaching practices, thereby enhancing student outcomes.

Enlighten of theory states that Teaching and Learning Resources help improve access and educational outcomes since students are less likely to be absent from schools that provide interesting, meaningful and relevant experiences to them. These resources should be provided in quality and quantity in schools for effective teaching-learning process.

METHODOLOGY

Research design

This study employed a Descriptive-Comparative Research Design. Descriptive-comparative research design involves the description of two or more groups on one or more variables. This design is used to compare groups to determine similarities and differences without manipulating any variables. The aim is to describe the characteristics of different groups and then compare these characteristics to identify patterns or relationships. The researcher observes and measures the variables as they naturally occur, ensuring that the comparisons are based on actual differences and not on experimental manipulation. This type of research is often used in social sciences, education, and health studies to compare outcomes across different populations or settings.

Locale of Study

The research was conducted in Alegria District, which was part of the Division of Surigao del Norte, situated in the Caraga Region. Alegria District encompassed ten elementary schools, namely: Alegria Central Elementary School, Alipao Elementary School, Budlingin Elementary School, Camp Eduard Elementary School, Don Epifanio Cedro Elementary School, Ferlda Elementary School, Lourdes Jamero Mordeno Elementary School, Ombong Elementary School, Pongtud Elementary School, and San Pedro Elementary School.

Respondents of the study

This study focused on 50 intermediate teachers from Alegria District who held regular or permanent positions and had been employed by the Department of Education for at least one year. These teachers were selected as respondents for their extensive experience and tenure within the education system.

Selection and Description of Respondents

The present study utilized a purposive sampling technique. The purposive sampling technique, alternatively referred to as judgment sampling, entails the deliberate selection of participants based on certain criteria that they possess. The applied technique is nonrandom and does not necessitate the utilization of underlying theories or a specified quantity of participants. (Etikan, 2018). Purposive sampling will be used in this regard as the respondents of this study were identified by researcher as all the teachers handling Grade 4 to Grade 6 of Alegria District who have at least 1 year of teaching experience regardless of their sex, demographic background, or religious affiliation.

Data Gathering Instruments

This study employed a survey questionnaire adapted from Elas et al. (2019) titled "Survey of Preservice Teachers' Knowledge of Teaching and Technology." The questionnaire comprised three sections. The first part gathered demographic information about the respondents, including age, academic rank, educational attainment, ICT-related training, and teaching experience. The second part collected information about the respondents' schools, focusing on the availability of ICT facilities, ICT trainers, and support for ICT training. Moreover, the third part of the questionnaire delved on the level of teachers' Technological Pedagogical Content Knowledge (TPACK) in ICT integration. The said questionnaire had 3 sections following the general concepts of TPACK namely Technology Knowledge, Content Knowledge, and Pedagogical Knowledge.

Data Gathering Procedure

Following the validation of the survey questionnaire and the incorporation of the suggested improvement from the survey questionnaires validators or evaluators. Before administering the instrument to respondents, a letter of intent addressed to the District Supervisor. After the approval, the researcher administered the survey questionnaire to stated target research participants. the researcher conducted a brief orientation among the identified participants explaining the purpose and goals of the research study as well as the contribution and impact of the study among the respondents. Hence, the principle on honesty, anonymity and confidentiality was inculcated to establish integrity among the respondents of the study. During the data gathering process, the researcher shall give ample time to the respondents in accomplishing the said survey questionnaire.

Data Analysis Procedure

After the data has been gathered, it was tabulated and consolidated in terms of the parts of the survey questionnaire. The weighted mean per item determined to identify the most observe result in all the aspect of the research questions of the study.

Moreover, in terms quantification of the data the following was utilized to determine the results of the study. The following quantification is applicable in terms of finding the level of Technological Pedagogical Content Knowledge (TPACK) of the respondents.

The study employed various statistical treatments to analyze the data collected. Frequency count was used to tabulate and consolidate the number of responses concerning the demographic characteristics of the respondents. Weighted mean was utilized to determine the average responses of the participants to the items in the research instrument. To assess differences in responses based on sex, the Mann-Whitney U test was applied by ranking the weighted means from both male and female respondents. Additionally, the Kruskal-Wallis test was employed to compare the average ranks among multiple groups, allowing for the identification of statistically significant differences across the respondents' profile variables.

DISCUSSION OF FINDINGS

Profile of the Respondents

The demographic and institutional profiles of the respondents and their schools reveal critical insights into the teaching workforce and ICT integration in the educational setting.

In terms of age, the majority of teachers surveyed fall within the 31–40 age group (40.0%), representing a cadre of mid-career educators who likely bring both experience and contemporary pedagogical knowledge. In contrast, only 10.0% are in the 20–30 age bracket, reflecting fewer early-career teachers in the sample.

Regarding **sex**, the teaching profession is markedly female-dominated, with women comprising 80.0% of the respondents. This gender imbalance invites further inquiry into the underlying societal, institutional, or cultural factors affecting male participation in education.

The teaching position distribution shows equal representation (42.0%) in both Teacher I and Teacher III ranks, indicating a workforce comprised of both entry-level and experienced teachers. The low percentage in the Teacher II category (6.0%) suggests potential bottlenecks in mid-level career progression.

As for educational attainment, nearly half of the respondents (46.0%) are master's degree unit earners, pointing to a strong inclination toward professional development. However, only 2.0% have completed doctorate degrees, suggesting room for advancement in higher academic qualifications.

In terms of ICT training, most respondents (74.0%) have attended only one training, indicating initial exposure but limited depth in digital capacity building. Only 4.0% have undergone more than three ICT-related trainings, highlighting a need for increased access to advanced digital training programs.

The teaching experience profile shows that over half (56.0%) of the respondents have more than ten years of teaching experience. This suggests a mature teaching population enriched with long-term classroom exposure, although the 10.0% representation of teachers with less than three years reflects a limited influx of new educators.

With regard to the school profiles, the availability of ICT facilities is generally high. Laptops, smart TVs, printers, and other technologies are widely present (92.0%), indicating substantial

investment in digital tools. However, significant gaps exist, particularly in the absence of digital cameras (0%) and limited wired internet connectivity (10.0%), which may impede more advanced ICT applications.

The availability of ICT integration trainers is strongest within departments offering basic IT training (56.0%), but 22.0% of respondents report having no access to ICT experts, suggesting disparities in support across institutions.

Finally, ICT training support is predominantly in-house, with 96.0% participation in school or LAC-based sessions. External training opportunities, particularly at the regional level, are less utilized, with only 4.0% participation, highlighting potential barriers in accessing broader-scale ICT development initiatives.

Overall, the findings depict a teaching workforce that is predominantly female, mid-career, and moderately trained in ICT. Schools demonstrate solid investment in basic digital infrastructure and internal capacity-building, but there remains a need to expand advanced training opportunities and address systemic gaps in technology access and professional advancement.

Level of Teachers' Technological, Pedagogical, and Content Knowledge (TPACK) in ICT Integration

The study presents a comprehensive evaluation of teachers' Technological Pedagogical Content Knowledge (TPACK) in the integration of Information and Communication Technology (ICT), focusing on three core domains: technological knowledge, pedagogical knowledge, and content knowledge. In terms of technological knowledge, teachers demonstrated a very satisfactory level of competence, as reflected in an overall weighted mean of 3.53. The highest-rated indicator was their confidence in using technology due to their basic technical skills, with a mean score of 3.68. This suggests that teachers are generally capable of resolving their own technological issues and are comfortable navigating routine digital tasks. However, the lowest score, 3.40, was attributed to the indicator regarding daily exploration of new technologies. While teachers feel capable of using technology, they may not consistently explore or engage with emerging technological tools, indicating an area for further improvement. These findings align with the work of Seufert et al. (2021), which emphasizes the foundational importance of technological knowledge in education. However, it contradicts the findings of Spangenberg and De Freitas (2019), who identified lower levels of technological confidence among teachers, often due to infrastructure and professional development limitations.

In the area of pedagogical knowledge, teachers also rated themselves very satisfactorily, with a notable overall mean of 3.90. The strongest indicators included classroom management (3.96), the ability to assess learners in multiple ways (3.90), and especially the ability to adapt teaching styles to diverse learners (4.04), all of which reflect a high level of pedagogical confidence. The lowest-rated item, "Using a wide range of teaching approaches in a classroom setting," still received a satisfactory score of 3.76, suggesting that while teachers are confident in their general teaching methods, they recognize the need to diversify instructional strategies further. The relatively low standard deviations in this domain indicate consistent perceptions among the respondents, suggesting a shared sense of competence in managing classrooms and delivering instruction effectively.

In contrast, teachers' content knowledge revealed a more modest level of confidence, with an overall mean of 3.39, interpreted as satisfactory. Among the subject areas assessed, literacy received the highest rating, with teachers expressing strong confidence in their knowledge and

ability to integrate ICT into literacy instruction (mean = 3.74). Mathematics and science showed moderate confidence levels, with teachers acknowledging the role of these subjects in developing critical thinking and having various strategies to improve understanding, but expressing uncertainty regarding their mastery of core concepts. Social studies emerged as the weakest area, with the lowest mean of 3.08 and the highest variability in responses, indicating a lack of confidence and inconsistency in perceived expertise. These findings point to the need for enhanced subject matter content knowledge (SMCK), especially in social studies and STEM-related areas. This is supported by Mafa-Theledi (2024), who emphasized that deep content knowledge is essential for effective teaching and meaningful interdisciplinary learning. Similarly, Abella and Bearneza (2022) found variations in content knowledge among preservice teachers based on academic achievement, underscoring the importance of continuous professional development.

In summary, the findings suggest that while teachers possess strong technological and pedagogical competencies necessary for ICT integration, their content knowledge, particularly in subjects beyond literacy, requires strengthening. Addressing this gap through targeted training programs that enhance digital skills, diversify pedagogical strategies, and deepen subject mastery can significantly improve ICT integration in the classroom. Such initiatives would not only elevate the quality of instruction but also better prepare both teachers and students for the demands of a digitally-driven educational landscape.

Test of Significant Difference in the Level of the Teacher's TPACK

The study investigated whether significant differences existed in the level of teachers' Technological Pedagogical Content Knowledge (TPACK) when grouped according to various teacher and school profile variables. Using the Kruskal-Wallis test, it was found that there were no statistically significant differences in the TPACK levels of teachers when grouped by age, teaching position, educational attainment, ICT trainings attended, or teaching experience, as all p-values exceeded the 0.05 threshold. This led to the non-rejection of the null hypothesis, suggesting that TPACK levels among teachers remain relatively consistent across different demographic and professional backgrounds. A likely explanation for this uniformity is the homogeneity of the sample, where the majority of teachers fell into similar profile categories. This finding supports the conclusions of Rana and Rana (2020), who argued that the limited use of ICT among teachers often stems not from demographic variables, but from insufficient proficiency in technology itself. Similarly, Hashemi and Kew (2021), referencing the works of Beggs and Balanskat, emphasized the lack of comprehensive training as a central factor contributing to teachers' demotivation and lack of confidence in ICT integration.

In contrast, the Mann-Whitney U-test revealed a statistically significant difference in TPACK levels between male and female teachers in the domain of pedagogical knowledge ($U = 121.000$, $p = 0.046$). Female teachers exhibited significantly higher levels of pedagogical knowledge than their male counterparts, as shown by higher mean ranks ($mf = 27.48$; $mm = 17.60$). This suggests that while overall TPACK levels do not significantly vary with most profile variables, gender appears to influence the pedagogical knowledge aspect of TPACK. In response to this finding, schools may consider promoting gender inclusivity in teacher hiring, particularly in subjects where pedagogical strategies and ICT integration are critical. Offering targeted support and professional development programs—especially for male teachers—may help reduce this disparity. Additionally, fostering collaboration among teachers with higher pedagogical competencies can encourage knowledge sharing and enhance teaching practices across the board.

Curriculum developers might also integrate more pedagogically focused ICT content in teacher training programs to address any underlying gaps.

The observed gender-based disparity in pedagogical knowledge finds mixed support in existing literature. Kumala (2022) found that male teachers were more adept at independently developing teaching media and explaining scientific content, suggesting higher TPACK levels in some areas compared to their female counterparts. However, this contrasts with the findings of Gómez-Trigueros and Yáñez de Aldecoa (2021), who observed limited competence among female educators in selecting and applying digital tools effectively. These contradictions highlight the complexity of gender-related differences in TPACK. Moreover, Baturay et al. (2018) noted that gender plays a minor but positive role in shaping educators' TPACK proficiency, particularly in relation to their attitudes toward Computer-Assisted Education (CAE), with female teachers often demonstrating stronger pedagogical knowledge while males showed strengths in technical aspects. Further research by Renninger et al. (2018), Espinoza and Taut (2020), and Ergen et al. (2019) linked gender stereotypes to self-concept and competency variations in technology and pedagogy, often favoring males in technological domains and females in pedagogical ones. Nevertheless, not all studies agree on the significance of gender as a determinant of TPACK. For instance, Yusuf et al. (2021) argued that gender-related influences on preservice teachers' TPACK tend to diminish once they undergo reflective and integrated teaching experiences, indicating that structured training can mitigate initial disparities.

In summary, the findings indicate no significant difference in TPACK levels across most teacher profile variables, suggesting a relatively uniform distribution of ICT integration competencies. However, the significant difference found between male and female teachers in pedagogical knowledge suggests that gender-specific support mechanisms may be beneficial. These results underscore the importance of continuous and inclusive professional development programs to ensure that all educators, regardless of gender or background, are well-equipped to integrate ICT effectively in their teaching practices.

Significant Difference in the Level of the Teacher's TPACK when they are grouped according to School Profile

The study revealed that variations in school profiles—such as the availability of ICT facilities, ICT integration trainers, and additional support for ICT training—did not significantly affect the levels of teachers' Technological Pedagogical Content Knowledge (TPACK). Based on the Kruskal-Wallis test results presented in Table 10, all p-values exceeded the 0.05 level of significance, leading to the non-rejection of the null hypothesis across all school profile variables. This finding indicates that regardless of differences in school resources or support structures, teachers demonstrated relatively uniform levels of TPACK. It suggests a shared context or similar capabilities among educators in the sampled schools when it comes to ICT integration, possibly due to common training experiences or standardized policies within the school system.

These results imply several important considerations for practice. First, schools could benefit from internal benchmarking strategies, wherein educators proficient in ICT integration can mentor colleagues who may be struggling. Such peer-to-peer support can foster collaborative growth and improve overall ICT implementation. Second, professional development programs must be prioritized, specifically those aimed at enhancing teachers' TPACK competencies. These programs should be responsive to individual teachers' challenges and tailored to their specific needs. Furthermore, the creation of inter-school benchmarking activities and professional learning

communities can offer platforms for sharing resources, strategies, and best practices, creating a broader support system for continuous improvement in ICT integration.

The findings also underscore the importance of promoting collaborative efforts among schools. Policymakers are encouraged to design frameworks that incentivize resource sharing, mentorship, and joint training programs to strengthen ICT capacity building. Additionally, regular monitoring and evaluation of ICT integration practices should be institutionalized to assess effectiveness, identify gaps, and refine interventions over time.

The conclusions of this study are consistent with those of Hill et al. (2020), who explored TPACK among mathematics and special education teachers in rural U.S. schools. Their research found that while teachers exhibited high confidence in pedagogical knowledge, their technological knowledge was weaker, and this imbalance influenced how technology was integrated in classrooms. Similarly, Ariani et al. (2018) found that primary school mathematics teachers possessed only moderate proficiency across TPACK components, with significant internal relationships among those components. Both studies highlighted that regardless of school level—primary, middle, or high school—variations in TPACK proficiency were more likely linked to individual teacher capacity than to school-level contextual factors.

In summary, the lack of significant differences in TPACK across school profile variables suggests that teacher competency in ICT integration is shaped more by individual readiness and access to professional development than by institutional infrastructure alone. This reinforces the need for sustained, personalized, and collaborative training efforts to ensure that all educators are equally empowered to integrate technology meaningfully into their teaching practices.

Proposed ICT Integration Training Program

The proposed ICT program of this study should adhere on the results which found relevant on this study. The proposed program should cater the competencies of both male and female teacher's vis – a- vis integration of mentoring and coaching program of those ICT competent teachers and struggling teachers. The proposed project of this study shall be coined as Project (ELTI) "Enhancing Learning Through ICT Integration". This project is a comprehensive initiative designed to elevate the quality of education by seamlessly incorporating ICT tools and resources into classroom environments. Over the course of an academic year, ELTI will focus on several key activities. Firstly, teachers will undergo rigorous ICT training workshops to enhance their familiarity with digital tools and their integration into instructional practices. This will be supplemented by the development of ICT-integrated lesson plans, ensuring that classroom activities are dynamic and engaging. Additionally, ELTI will also aim to improve ICT infrastructure within schools, ensuring access to computers, internet connectivity, and relevant software. Teachers will benefit from this project through the development of their ICT skills via hands-on projects and activities.

As one of the findings of the study, Project ELTI also envision to have a stronger internet connectivity and provision of tools among teachers as well as giving a capability building for both teachers regardless of their gender. The "Enhancing Learning Through ICT Integration" (ELTI) project recognizes the importance of tailored training for male and female teachers to effectively integrate ICT tools and resources into their teaching practices. The project will offer separate training sessions for male and female teachers to address any unique needs or preferences they may have. These sessions will focus on providing practical skills and knowledge that are relevant to their specific teaching contexts. Additionally, the project will create a supportive environment where male and female teachers can collaborate and share ideas, fostering a sense of community

and mutual learning. By considering the training needs of both male and female teachers, ELTI aims to ensure that all educators are equipped with the necessary skills to effectively integrate ICT into their teaching, ultimately enhancing the quality of education for all students.

CONCLUSION

In conclusion, the study underscores several key insights regarding teachers' Technological Pedagogical Content Knowledge (TPACK) and ICT integration in education. First, teachers, regardless of their diverse backgrounds and experiences, exhibit a generally consistent level of competency in incorporating technology into their teaching practices. This suggests that individual teacher readiness plays a more significant role than demographic or institutional variables. Second, promoting resource sharing and collaboration among teachers within schools can help uplift those facing challenges in ICT integration, fostering collective professional growth. Third, female teachers were found to demonstrate higher levels of pedagogical knowledge, indicating a stronger grasp of instructional strategies. This finding highlights the importance of addressing gender-specific strengths and needs to ensure balanced and effective ICT integration. Lastly, the implementation of ICT integration training programs has proven to be a valuable strategy, offering a supportive environment where teachers can exchange best practices, enhance their digital skills, and ultimately improve student engagement and learning outcomes through meaningful technology use.

REFERENCES

- Abella, A. J., & Bearneza, F. J. D. (2022). CONTENT KNOWLEDGE IN MATHEMATICS OF PRESERVICE ELEMENTARY TEACHERS. *Globus Journal of Progressive Education*, 12(1).
- Ahmed, M., Dharma, K. S., & Hakeem, S. (2019). The impact of information and communication technology (ICT) on teacher professional development in universities: A case study. *Journal of Educational Technology*, 48(1), 51-66.
- Alkamel, M. A. A., & Chouthaiwale, S. S. (2018). The use of ICT tools in English language teaching and learning: A literature review. *Veda's Journal of English Language and Literature-JOELL*, 5(2), 29-33.
- Arcueno, G. G., Arga, H. A., Manalili, T. A. C., & Garcia, J. A. S. (2021, March). TPACK and ERT: Understanding teacher decisions and challenges with integrating technology in planning lessons and instructions. In *DLSU Research Congress*.
- Ariani, D., Saad, N., Saad, B. N., Yusuf, Q., & Dalle, J. (2018). The Technological Pedagogical Content Knowledge (TPACK) among Mathematics Teachers In Primary Schools.
- Baturay, M., Gökçearsan, Ş., & Sahin, S. (2018). Associations among teachers' attitudes towards computer-assisted education and TPACK competencies. *Informatics in Education*, 16(1).
- Department of Education. (2010, June 10). DO 78, s. 2010 – Guidelines on the implementation of the DepEd Computerization Program (DCP). Retrieved June 17, 2024, from <https://www.deped.gov.ph/2010/06/10/do-78-s-2010-guidelines-on-the-implementation-of-the-deped-computerization-program-dcp/>
- Department of Education. (2017, August 11). DO 42, s. 2017 – National adoption and implementation of the Philippine professional standards for teachers. <https://www.deped.gov.ph/2017/08/11/do-42-s-2017-national-adoption-and-implementation-of-the-philippine-professional-standards-for-teachers/>
- Department of Education. (2019, May 2). DO 008, s. 2019 – Revised implementing guidelines on the direct release, use, monitoring and reporting of maintenance and other operating expenses allocation of schools, including other

funds managed by schools. <https://www.deped.gov.ph/2019/05/02/may-2-2019-do-008-s-2019-revised-implementing-guidelines-on-the-direct-release-use-monitoring-and-reporting-of-maintenance-and-other-operating-expenses-allocation-of-schools-including-other-fu/>

Dhital, H. (2018). Opportunities and challenges to use ICT in government school education of Nepal. *International Journal of Innovative Research in Computer and Communication Engineering*, 6(4), 3215-3220.

Elas, N., Majid, F., & Narasuman, S. (2019). Development of technological pedagogical content knowledge (TPACK) for English teachers: The validity and reliability. *International Journal of Emerging Technologies in Learning (IJET)*, 14(20), 18-33.

Ergen, B., Yelken, Y. T., & Kanadli, S. (2019). A meta-analysis of research on technological pedagogical content knowledge by gender. *Contemporary Educational Technology*, 10(4), 358-380.

Hashemi, A., & Kew, S. N. (2021). The barriers to the use of ICT in English language teaching: A systematic literature review. *Bilgi ve İletişim Teknolojileri Dergisi*, 3(1), 77-88.

Hill, J. E., & Uribe-Florez, L. (2020). Understanding secondary school teachers' TPACK and technology implementation in mathematics classrooms. *International Journal of Technology in Education*, 3(1), 1-13.

Irmak, M., & Tüzün, Ö. Y. (2019). Investigating pre-service science teachers perceived technological pedagogical content knowledge (TPACK) regarding genetics. *Research in Science & Technological Education*, 37(2), 127-146.

Jacob, O. N., Jegede, D., & Musa, A. (2020). Administration of information communication technology (ICT) in Nigerian secondary schools: Challenges and the ways forward. *Electronic Research Journal of Engineering, Computer and Applied Sciences*, 2, 50-63.

Kumala, F. N., Ghufon, A., & Pujiastuti, P. (2022). Elementary school teachers' TPACK profile in science teaching based on demographic factors. *International Journal of Instruction*, 15(4).

Ifinedo, E., Rikala, J., & Hämäläinen, T. (2020). Factors affecting Nigerian teacher educators' technology integration: Considering characteristics, knowledge constructs, ICT practices and beliefs. *Computers & education*, 146, 103760.

Lawrence, J. E., & Tar, U. A. (2018). Factors that influence teachers' adoption and integration of ICT in teaching/learning process. *Educational Media International*, 55(1), 79-105.

Muslem, A., Yusuf, Y. Q., & Juliana, R. (2018). Perceptions and barriers to ICT use among English teachers in Indonesia. *Teaching English with Technology*, 18(1), 3-23.

Nicolaou, C., Matsiola, M., & Kalliris, G. (2019). Technology-enhanced learning and teaching methodologies through audiovisual media. *Education Sciences*, 9(3), 196.

Odigwe, F. N., & Owan, V. J. (2020, November). Academic staff personal variables and utilization of ICT resources for research teaching and records management in higher education. In Odigwe, FN, & Owan, VJ (2020). Academic staff personal variables and utilization of ICT resources for research, teaching and records management in higher education. *Proceedings of the 8th Annual European Conference on Education (ECE, 2020)* (pp. 107-123).

Paños-Castro, J., Arruti, A., & Korres, O. (2022). COVID and ICT in primary education: Challenges faced by teachers in the Basque country. *Sustainability*, 14(16), 10452.

Pagunsan-Sumbise, G., & Montecalvo, F. (2021). Emerging trends and challenges in information and communications technology integration among public secondary schools in Samar, Philippines. *Asian Journal of Resource Management & Governance*, 1(1), 10-23.

Perienen, A. (2020). Frameworks for ICT integration in mathematics education-A teacher's perspective. *Eurasia Journal of Mathematics, Science and Technology Education*, 16(6), em1845.

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- Rana, K., & Rana, K. (2020). ICT integration in teaching and learning activities in higher education: A case study of Nepal's teacher education. *Malaysian Online Journal of Educational Technology*, 8(1), 36-47.
- Ramos, R. A., Babasa, E. E., Vergara, I. B., Manalo, B. I., Gappi, L. L., & Morfi, T. G. (2020). The TPACK confidence of preservice teachers in selected Philippine teacher education institutions. *International Journal of Education, Psychology and Counselling*, 5(37), 196-205.
- Seufert, S., Guggemos, J., & Sailer, M. (2021). Technology-related knowledge, skills, and attitudes of pre-and in-service teachers: The current situation and emerging trends. *Computers in Human Behavior*, 115, 106552.
- Spangenberg, E. D., & De Freitas, G. (2019). Mathematics teachers' levels of technological pedagogical content knowledge and information and communication technology integration barriers. *Pythagoras*, 40(1), 1-13.
- Soko, I. P., & Samo, D. D. (2023). The Analysis of In-Service Teachers' Practices of Implementing Technological Pedagogical Content Knowledge (TPACK). *European Journal of Education and Pedagogy*, 4(2), 64-71.
- Tanak, A. (2020). Designing TPACK-based course for preparing student teachers to teach science with technological pedagogical content knowledge. *Kasetsart Journal of Social Sciences*, 41(1), 53-59.
- Torii, A., Kamidate-Yamaguchi, M., & Kubota, K. (2019, July). The actual condition of teachers and the teacher training about ICT utilization in Leyte, the Philippines. In 2019 International Symposium on Educational Technology (ISET) (pp. 87-91). IEEE.
- Yushau, B., & Nannim, F. A. (2020). Investigation into the utilization of ICT facilities for teaching purposes among university lecturers: Influence of gender, age, qualification and years of teaching experience. *Pedagogical Research*, 5(2).
- Zhang, W., & Tang, J. (2021). Teachers' TPACK development: A review of literature. *Open Journal of Social Sciences*, 9(7), 367-380.