



Developing Information Technology Competence in Online Education with the TPACK Approach

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ABSTRACT

The integration of technology in education has become imperative, particularly in the context of online learning. The TPACK (Technological Pedagogical Content Knowledge) framework provides a comprehensive approach to developing information technology competence among educators. This study explores the application of the TPACK framework in online education, focusing on its effectiveness in enhancing educators' abilities to integrate information technology with pedagogy and content knowledge. By analyzing case studies, surveying educators, and assessing online teaching outcomes, the research highlights the pivotal role of TPACK in fostering a holistic understanding of how technology can be seamlessly incorporated into educational practices. The findings suggest that educators equipped with TPACK are better prepared to design and deliver engaging, effective online learning experiences, ultimately leading to improved student outcomes. This study underscores the necessity for professional development programs that emphasize TPACK to ensure educators are proficient in utilizing technology in their teaching methodologies in higher education institutions. This aligns with the prevailing trend of online teaching during the Covid-19 pandemic.

1. INTRODUCTION

The 21st century has been marked by rapid changes in the field of technology. Recent developments, particularly in information technology (IT), have opened up numerous opportunities as well as challenges across various domains, including education. In today's classrooms, there are no longer solely face-to-face classes but instead, classes that exist within a "virtual space" and an "open learning space" (Scott & Craig, 2013). Phan (2018) also assesses that education and training are confronting significant challenges in the era of the Fourth Industrial Revolution.

The history of IT application in education has gone through microcomputers and personal computers, networking and the internet, e-learning and digital resources, mobile learning and cloud computing, artificial intelligence and personalized learning. We do know the consequences that some of the multimedia technologies are having on teachers, students and the learning process. It is our goal as teachers to keep ourselves up to date, in order to offer the student adequate technical content, while providing proper motivation through the use of new technologies (Jose et al., 2012).

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Teaching methods using technology have positively transformed the approach to teaching and learning, fostering more comprehensive competence development. In traditional teaching, the teacher directly transmits learning content. In contrast, the new teaching methods associated with technology use involve teaching media that not only contain learning content but also contribute to replacing the teacher's function of conveying content to learners in a multi-dimensional way.

Therefore, whenever the teaching method employs technology with an IT foundation, learners can acquire knowledge and learn from various dimensions through different technical and technological means. The presented problems are real-world and require learners to perform tasks or engage in scenarios that simulate realistic interactions related to the learning topic. Teachers can access information about learners' progress throughout the learning process, adapting instruction to personalize learning and address specific challenges in each lesson (Goodrich, 2000; Jonathan, 2015).

Conducting research on the application of the Technological Pedagogical Content Knowledge (TPACK) model in teaching IT competence development within the online environment aims to establish a theoretical foundation for competence development. How can the TPACK model be effectively integrated into online IT courses to enhance competence development? and What impact does the TPACK model have on students' IT competence compared to traditional teaching methods in online environments? The study also seeks to evaluate the impact of the IT-based TPACK model in online teaching activities, highlighting its effectiveness, integration strategies, and contribute to improving online teaching methods and enhancing IT competence for teachers and students.

2. LITERATURE REVIEW

In Mihaela (2000), a thinking model was developed with the aim of enhancing learners' competence, consisting of six stages: (1) Reception; (2) Initial processing of knowledge and skills; (3) Formation of thinking models and structures representing relationships, application of existing knowledge structure models; (4) Expression in language and practical applications; (5) Second processing of the gained knowledge and abilities; (6) Transformation of abilities. According to the author, this forms the foundation for the human resource development process with six levels: (1) Reception. These thinking models and thinking philosophies have given rise to various directions in designing output products of the teaching process, including competence design, involving different research steps; (2) Data processing at level 1 (comparing data); (3) Processing data through models and formulas; (4) Describing and expressing in one's language; (5) Level 2 processing of results (comparing results); (6) Transfer.

Angeli and Valanides (2009) proposed the information and communications technology (ICT) with TPCK model structure as a new development series of the TPACK framework conceptualized as a unique body of knowledge that helps teachers have the competence to design learning based on improved technology. This approach represents a teacher's knowledge of pedagogical tools and methods synthesized into an understanding of how specifically the topics that are difficult for learners to understand, or difficult to represent by teachers, can be transformed and taught more effectively with ICT, in ways that demonstrate the added value of technology in terms of ICT elements with content, pedagogy, context, and learners, which creates the ICT-TPCK framework in education (Figure 1).

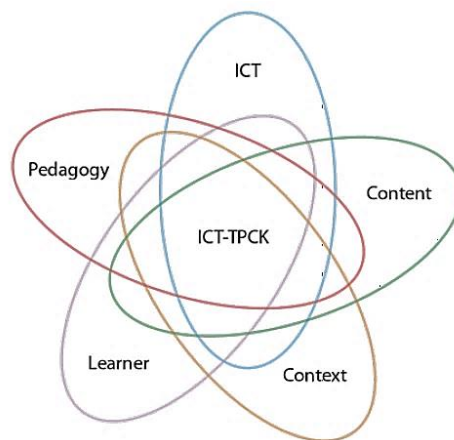


Figure 1. Educational technology model with ICT-TPCK (Angeli & Valanides, 2009)

Competencies and assessment criteria according to goals are clear; build a scale of assessment criteria and quantify results based on the scale. However, the classification according to levels, such as the competence assessment scale or the three competence assessment scales from the Bureau of Student Assessment of Public Schools in Chicago, USA, may not be appropriate and could be difficult to apply in high schools in Vietnam (Mihaela, 2000; Rodríguez et al., 2012).

The TPACK model, developed by Koehler et al. (2013), consists of three main components: (1) Content Knowledge (CK), (2) Pedagogical Knowledge (PK), and (3) Technological Knowledge (TK). The intersection, relationship, and interaction among these components form TPACK, which is essential knowledge for pedagogical students. TPACK emphasizes the integration of technology, pedagogy, and content knowledge, underscoring the importance of maintaining a balanced approach in teaching design with these three components.

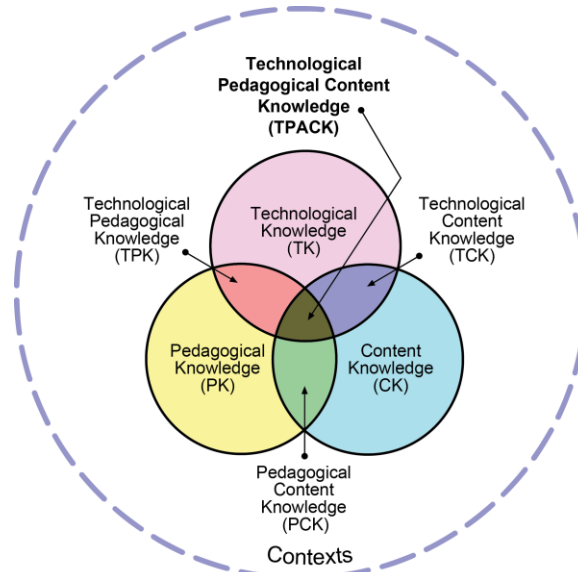


Figure 2. TPACK model framework (Koehler et al., 2013)

Figure 2 illustrates the development of knowledge areas formed by the interaction of the above three areas of knowledge during the teacher training process, including:

- Knowledge of pedagogical methods used in the field of teaching (Pedagogical Content Knowledge - PCK).
- Knowledge of IT and communications tools (Information and Communications Technology - ICT) specifically used in the field of teaching (Technological Content Knowledge - TCK).
- Knowledge of IT and communication tools that support specific teaching ideas and methods (Technological Pedagogical Knowledge - TPK).

Alongside other knowledge areas such as Technological Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), and Pedagogical Content (PC), teachers need a comprehensive understanding of all three knowledge domains. The application and proficiency in each block of knowledge must be flexible in specific situations and lessons for effective integration of IT into teaching.

TPACK serves as a theoretical framework, aiding educational managers in designing more effective teaching and training systems. The model forms the basis for analyzing the knowledge and skills essential for teachers, facilitating the development of training solutions to meet the demands of 21st century teaching. TPACK underscores that optimal learning occurs when teachers and learners harness the power of information and communications technology to explore knowledge within a learning environment closely linked to practical applications.

The advent of digital technology has significantly changed the habits and lifestyles in all areas of human life, and IT has paved the way for a change in the teaching model. Several research findings support the fact that online learning enhances learning as well as higher-order thinking. It is in line with previous studies in that there cannot be a digital environment when managers and lecturers do not have the right mindset about the digital environment (Davis et al., 2018).

The development of students' creative competence will help students participate and self-assess learning outcomes. The development of technology and its role in the inversion classroom model should be promoted and the growth of online learning environments should be enhanced (Chai & Kong, 2017; Thanh et al., 2021; Thanh et al., 2020). The results report that the use of an online environment combined with face-to-face classes have an impact on the development of thinking for students (Thanh et al., 2019). Over the past two decades, information and communication technology has developed rapidly. They have strongly influenced the change of education in general and teaching competency in particular (Bastari et al., 2021; Thanh et al., 2021). Teachers adopt the knowledge suggested in the TPACK framework together with being professionally developed, ICT can be integrated into the process of teaching and learning and potentially improve the process of teachers and learning (Abdulwahab, 2022).

As a result of the above research projects, it can be established that IT is not merely viewed as a tool for teaching; instead, it is recognized as an element that should be integrated with content and pedagogical methods in the teaching process. The TPACK model serves as a typical example of this integration. The structure of the ICT with TPACK model represents the teaching model's framework through the combination of tools and pedagogical methods. However, the aspect of integrating teaching elements with IT in the online environment has not been addressed. It becomes evident that enhancing IT competence, particularly teaching competence in the online environment, is an essential requirement for universities that aim to train teachers in the present era.

3. MATERIALS AND METHODS

The research uses mixed qualitative and quantitative methods for analysis and assessment. The qualitative methods are used to determine how to build a teaching model and assess learners' needs, and the quantitative methods to create statistics and calculate empirical value indexes of the proposed teaching model based on TPACK to enhance IT competence in online teaching.

Due to the limited scope of the research, the content of this section only focuses on experiential learning, which are experiences: group discussion, experiment practice for a specific subject.

The study surveys opinions of 510 teachers and pedagogical students who are teaching and studying at these schools: University of Danang - University of Science and Education, Hue University of Education - Hue University, Quang Tri Teacher Training College.

Survey methods: The questionnaire was distributed in multiple forms, including a paper copy, face-to-face interviews, and an online survey through platforms.

The survey data collected using the questionnaire was processed and analyzed by Microsoft Excel 2019, and IBM SPSS software version 22 to determine the necessity to develop the IT competence in online teaching mode.

4. RESULTS AND DISCUSSION

4.1. Results

4.1.1. Evaluating the outcomes of applying the TPACK model to enhance IT competence in online teaching

The purpose of this evaluation is to survey the current state of IT competence in teaching among teachers at universities and pedagogical colleges, aiming to assess the present status, analyze underlying causes, and provide a practical foundation for research content. This will help determine the feasibility of proposals related to building an IT competence framework for teachers in online teaching. The evaluation focuses on the theoretical basis of assessing teachers' IT competence in online teaching, then specifically surveying the needs and conditions of such competence. The survey targets teachers and final-year pedagogical students/teachers from institutions including the University of Danang - University of Science and Education, Hue University of Education, and Quang Tri Teacher Training College. The main survey method involves using questionnaires, designed with both closed and open questions to ensure clarity, objectivity, and logical content, which were sent directly to the respondents to gather diverse opinions.

The data processing tool uses Microsoft Excel 2019 software and common statistical algorithms.

4.1.2. Evaluating the actual results

The survey sample includes educators and pedagogical students (who will become future educators) from universities that train pedagogical students within the geographical scope of the research. This target application of the research results aims about enhance IT competences to integrate them into work of teachers. Survey of opinions

of 510 teachers and pedagogical students (including: 132 teachers and 378 students) who are teaching and studying at these schools: University of Danang - University of Science and Education, Hue University of Education - Hue University, Quang Tri Teacher Training College.

Survey methods: The questionnaire was distributed in multiple forms, including a paper copy, face-to-face interviews, and an online survey through platforms such as Google Forms, Facebook Fanpage, and other multimedia channels.

The results of the survey analysis for both teachers (currently applying) and pedagogical students (who will need equipment for future applications) are as follows:

Teachers' awareness of using IT in teaching

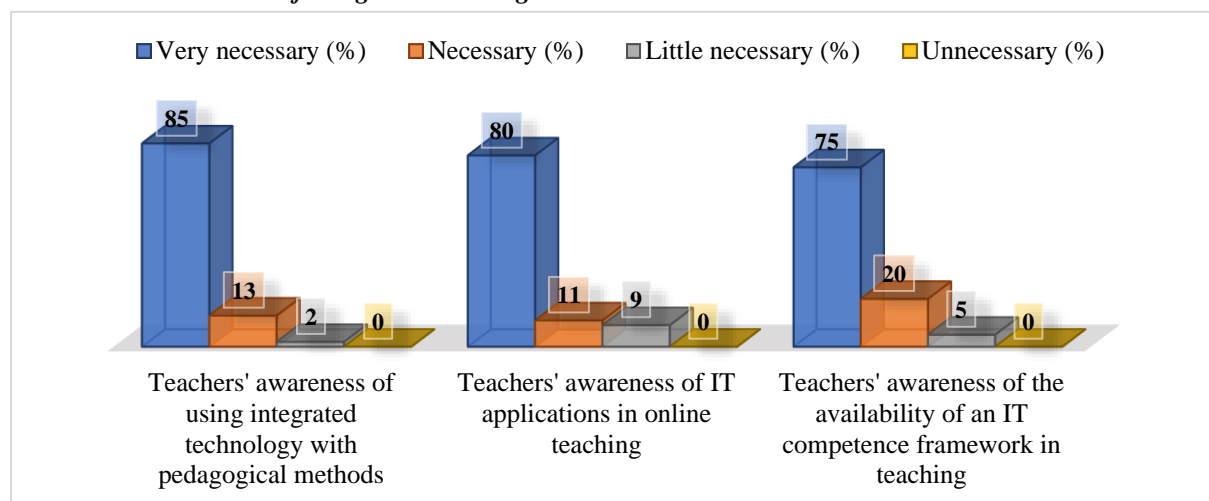


Figure 3. Teachers' awareness of using IT in teaching

Data analysis reveals that the majority of teachers exhibited a general awareness of the application of IT in teaching, with over 90% of the respondents stating that it is either necessary or very necessary. However, the fact that the teachers perceived their ability to use technology as limited underscores the urgent and vital task of boosting their confidence and competence in integrating technology and IT into teaching within the education sector.

In a direct survey, 85% of both teachers and students stated the necessity of incorporating IT in teaching. The remaining respondents expressed varying levels of confidence, with some feeling somewhat confident and others not confident when utilizing technology tools in teaching

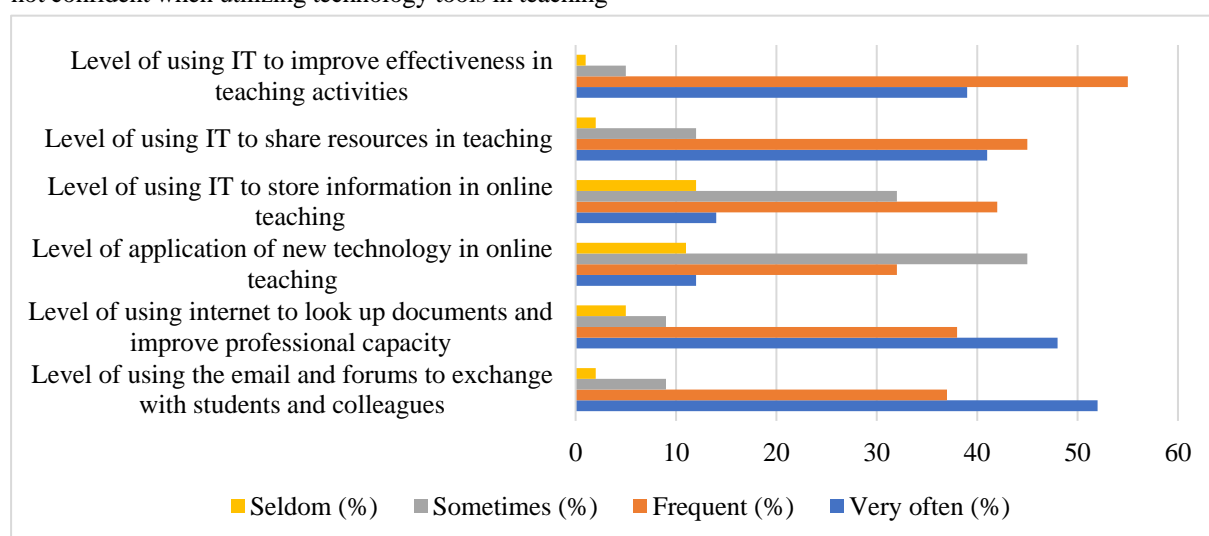


Figure 4. Teachers' purposes of using IT in teaching

The survey results indicate that the majority of teachers utilized the Internet as a tool for information searches to enhance their professional expertise. However, some (5%) had yet to fully exploit the Internet for this purpose. Additionally, some teachers employed various communication forms, including email, forums, and social networking sites, to effectively engage with colleagues, with a proportion exceeding 85%. Nevertheless, there were 8% of teachers who did not regularly embrace integrated technologies. Notably, a significant majority of teachers frequently integrated modern technology into their lessons, with over 28% doing so very often.

Several causes can be identified for the observed situation: A small proportion of teachers (5%) have not fully leveraged the internet for educational purposes. This might be due to: lack of familiarity or comfort with internet tools; Insufficient training or support in using online resources; Possible infrastructure or access issues, such as unreliable internet connectivity; Resistance to change or preference for traditional teaching methods. Frequent use of communication technologies was found with over 85% of teachers who frequently used email, forums, and social networking sites to communicate with colleagues. This indicates a high level of digital literacy among the majority of teachers; Recognition of the benefits of these technologies for professional collaboration and information exchange; Availability of platforms and tools that facilitate easy communication and collaboration.

Meanwhile, there were 8% of teachers who did not regularly use integrated technologies. Possible causes include: Lack of awareness or training on how to effectively integrate these technologies into teaching; Perceived complexity or time required to learn and implement new technologies; Potential technical issues or lack of access to necessary hardware and software. It is noteworthy that over 28% of the participants claimed to integrate modern technology into their lessons frequently. This suggests: Positive attitudes towards the use of technology in education; Understanding of the educational benefits of modern technology, such as enhancing student engagement and learning outcomes; Supportive policies or initiatives encouraging the use of technology in teaching; Availability of resources and tools that facilitate the incorporation of technology into lesson plans.

Overall, the situation reflects a generally positive trend towards the adoption of technology in education, with certain areas needing further attention to ensure all teachers can fully exploit internet resources and integrated technologies.

The need to develop teachers' IT skills in online teaching

Table 1. The need to develop teachers' IT skills in online teaching

Criteria	Teachers' IT skills in online teaching	Levels (%)			
		Very necessary	Necessary	Less necessary	Unnecessary
C.1	Ability to apply ICT in teaching and educational activities	44	52	4	0
C.2	Using IT in self-research, self-study, and self-training to develop teachers' professional competence	29	45	20	6
C.3	Skills in proficient use of electronic mail (email) and email support services)	40	55	5	0
C.4	Skills to search for information and resources on the internet	30	58	10	2
C.5	Skills in using common software that supports teaching (such as: Word, Excel, PowerPoint, Paint, Pdf, Unikey, WinRAR,...)	23	77	0	0
C.6	Skills in using specialized software and online teaching software systems	32	43	15	10
C.7	Skills in using devices with internet connection (such as: laptop, desktop, tablet, smart phone,...)	67	33	0	0

C.8	Skills in using online data storage systems (including: Google Drive, Dropbox, OneDrive, Apple iCloud Drive, Amazon Cloud Drive,...)	29	47	18	6
C.9	Skills in using external storage devices (including: USB, hard disk, memory card,...)	21	59	13	7
C.10	Skills to work on software and online support services (including: email services (Gmail, yahoo mail, outlook, iCloud mail,...), social networking sites (Facebook, Zalo, Viber, YouTube, Twitter, LinkedIn, Instagram, Google, group, blog, forum,...)	28	44	17	11
C.11	Practical skills in editing electronic lectures	32	59	7	2

* Note: criteria (C)

The survey results highlight several key issues related to the demand for enhancing teachers' IT skills for online teaching. These issues can be analyzed as follows:

High Demand for IT Skill Enhancement: There is a pronounced and consistent demand for improving teachers' IT skills for online teaching. This high demand indicates that both educators and stakeholders recognize the importance of proficient IT skills in delivering effective online education. Over 75% of the surveyed individuals believed that enhancing IT skills is either necessary or very necessary. This substantial percentage underscores the widespread acknowledgment of the critical role that IT competencies play in the current educational landscape.

Essential IT Competencies: The IT competencies are identified as essential for every teacher to develop. This implies that there is a consensus on the specific skills required to effectively use IT for online teaching, and these skills are considered fundamental for all teachers. The emphasis on these essential competencies suggests a structured approach to identifying and addressing the skills needed for successful online teaching.

Uncertainty Among Teachers: Despite the overall high demand for IT skill enhancement, a noteworthy proportion of respondents remained uncertain about some specific IT competencies that need further development. This uncertainty could stem from various factors, such as lack of transparent guidelines, insufficient training resources, or varying levels of IT proficiency among teachers. Over 20% of the teachers considered certain IT competencies to be less necessary, indicating a disparity in perceptions about which skills are crucial. This discrepancy could lead to inconsistencies in the implementation of IT skill enhancement programs.

Implications for Professional Development: The identified need for IT skill enhancement and the existing uncertainty highlight the importance of targeted professional development programs. Such programs should aim to clearly define the essential IT competencies and provide comprehensive training to address the gaps in teachers' skills. Addressing the uncertainty and varying perceptions among teachers requires a collaborative effort to ensure that all educators receive the necessary support and resources to develop the required IT skills for online teaching.

Overall, the current situation is driven by the recognition of the critical need for IT skills in online teaching, coupled with challenges related to the clarity and implementation of these skills. To effectively address these issues, focused and well-defined professional development initiatives are essential.

The necessity of developing and applying the IT competence framework for teachers in online teaching

The key issues focused on the survey include: (1) The urgency of the introduction of an IT competency framework for teachers, (2) The ability to self-assess the level of proficiency in using IT equipment in teaching, (3) Examining the connection between teaching methods and the application of IT in teaching, (4) Evaluating the level of IT application in teaching, from data storage, communication to exploitation and harnessing online resources for teaching.

The above issues are summarized into main groups of needs for teachers' IT competence framework in online teaching.

Based on the survey results the following observations can be made:

(1) *Teachers' awareness of the need for an IT competency framework:* Over 75% of the respondents believed it is necessary to establish a standard framework for IT competency in teaching. However, more than 20% of the survey participants expressed that it is less necessary or not necessary, indicating that addressing the need for human resources in IT poses a challenge for teachers in online teaching.

The causes for this situation can be multifaceted and are likely influenced by a range of factors:

Varied levels of IT proficiency among teachers: Teachers who are already proficient in IT may not see the need for a formal framework, believing that they can manage IT integration independently. Those with limited IT skills might feel overwhelmed by the idea of a formal framework, fearing it could expose their inadequacies or require significant effort to meet new standards.

Differences in perceived relevance: Teachers in subjects less reliant on IT (e.g., physical education or the arts) might perceive an IT competency framework as less relevant compared to those teaching STEM subjects. In schools with limited IT resources, teachers might not see the immediate applicability of a competency framework.

Experience and comfort with technology: More experienced teachers, who may not have had formal IT training, might be resistant to adopting new frameworks. In contrast, newer teachers, who are often more tech-savvy, might be more supportive. Teachers who are less comfortable with technology might fear that a competency framework will add pressure or require additional training they feel unprepared for.

Implementation challenges: Concerns about the availability of adequate training and ongoing support for implementing an IT competency framework. The perception that developing and maintaining IT competencies will increase teachers' workload and take time away from teaching.

Policy and administrative support: Absence of clear policies or administrative support for IT competency might lead to uncertainty or skepticism about its implementation. Inconsistencies in how IT policies are implemented across different schools or districts might contribute to mixed opinions on the necessity of a standardized framework.

Addressing these diverse perspectives and concerns requires a multifaceted approach, including providing tailored professional development, ensuring adequate resources and support, and clearly communicating the benefits and practical implications of an IT competence framework.

(2) *Teachers' attitudes toward integrating new technology with pedagogical methods:* Regarding the integration of teaching methods and the application of IT in teaching, 85% consider it very necessary or necessary. Only 6% believe it is not necessary, indicating that the majority of teachers recognize the importance of IT competence in teaching.

The situation described shows a strong consensus among teachers on the perceived importance of integrating new technology with pedagogical methods, with only a small minority viewing it as unnecessary. The causes for this widespread recognition and the minority dissent can be justified through various factors:

Regarding the causes of the majority recognition (85%), increased digital literacy and familiarity with technology, enhanced teaching and learning experiences, alignment with educational trends and policies, positive outcomes and evidence-based practice, support and infrastructure;

Regarding the causes for minority dissent (6%): Some teachers may feel anxious or lack confidence in their ability to effectively use new technology, leading them to view it as unnecessary. Inadequate training or professional development can leave teachers feeling unprepared to integrate technology into their teaching methods. Some teachers might be skeptical about the actual benefits of technology in education, believing that traditional methods are equally or more effective. Teachers who have been successful with traditional pedagogical methods might resist changing their practices, viewing new technology as an unnecessary complication. In schools with limited access to technological resources, teachers might find it impractical to integrate new technology and thus see it as less necessary. Teachers in certain subjects might feel that technology integration is less relevant or necessary for their specific teaching context.

Overall, while the majority of teachers recognize the importance of integrating technology with pedagogical methods due to various positive influences and support structures, a minority may still dissent due to personal, contextual, or practical issues. Addressing these concerns with targeted support and resources can help in achieving more widespread acceptance and effective integration of technology in education.

(3) *Teachers' behavior in assessing the level of application and development of IT resources in teaching:* This is indicated based on the level of using IT resources to enhance effectiveness in teaching, the extent of utilizing IT for communication with colleagues and document sharing, and the degree of using IT to store information in teaching. The majority responses fell within the categories of 'very necessary' and 'necessary', totaling 85%. This situation can be attributed to a variety of factors, pertaining to both the widespread recognition of IT's benefits in education and the specific challenges faced by a smaller group of teachers.

Overall, while the majority of teachers recognized the necessity of using IT resources to enhance teaching effectiveness, facilitate communication, and manage information efficiently, a minority might be hindered by skills gaps, resource limitations, time constraints, perceived irrelevance, and technical challenges. Addressing these issues through targeted training, adequate resource provision, and reliable IT infrastructure can help in achieving broader acceptance and effective use of IT in education.

In summary, the online survey results reflect teachers' and students' opinions on the conditions and needs of IT skills for online teaching. The survey was conducted through the Google Docs Forms tool, and the findings can be accessed through the following link:

https://docs.google.com/forms/d/1YWcpHIXp8PUNeQNpUAraCMI0srL7DFaK8-OPCqu_jKk/edit

<https://docs.google.com/forms/d/1kb2PZZ3gHYbF6EJeMUsuWkn9nGQ7-E5ZHkryiGrywpQ/edit>

The majority of teachers were cognizant of the significance of incorporating IT into teaching, aligning with the trend of innovating teaching methods in the digital age. There exists a crucial need for a standardized framework to assess students' IT application competence. Teachers play an essential role in this regard; they must adeptly combine teaching methods with the application of IT, utilize IT for storage and communication with colleagues, and harness IT resources to enhance teaching effectiveness.

The survey and assessment results underscore the necessity of IT competencies and the need for a framework to evaluate these competencies in teaching. Applying such a framework aligns with the ongoing trend of method innovation in teaching, moving towards the development of learners' abilities in today's digital era.

4.2. Discussion

The development of IT competence in teaching based on the TPACK model in the online environment represents a significant advancement in modern education. The TPACK model integrates professional knowledge (Content Knowledge - CK), educational knowledge (Pedagogical Knowledge - PK), and technological knowledge (Technological Knowledge - TK). Consequently, teachers gain the ability to seamlessly blend specialized knowledge with technological tools, fostering a rich and multidimensional learning environment. Inasmuch as the output framework of the study utilizes the findings of the study on TPACK model and teachers' online teaching attitude and ability, the TPACK-based Professional Development framework may be considered as a basis in the organization's professional development plan especially relating to TPACK development of faculty (Aquino et al., 2022).

The increased learning interaction in the online environment opens up numerous opportunities for engagement between teachers and students. The utilization of TPACK enables teachers to better comprehend how to integrate technology to stimulate curiosity, creativity, and interaction in the learning process. Educational policymakers and institutions should devise targeted initiatives to enhance TPACK competency, fostering a more equitable and inclusive approach to teacher education (Sreekala & Sabin, 2024).

With information and communication technology as the core tool, this direction is completely consistent with the online teaching method in education and training in educational institutions, and adapting to the current Covid-19 pandemic (Hung et al., 2021; Peterson et al., 2020).

IT-competence-in-teaching development based on TPACK not only aids students in mastering professional knowledge but also cultivates digital skills (Digital Literacy). Learners learn how to leverage technology to solve problems, locate information, and collaborate in group settings. Simultaneously, it validates students' satisfaction with teachers employing this model in online teaching, contributing to enhanced learning efficiency and improved outcomes (Thanh et al., 2020).

To implement the TPACK model in the online teaching environment, it is crucial to adequately prepare and train teachers. Mastery of all three facets of TPACK is essential for teachers to apply them flexibly and effectively. Despite

numerous opportunities for interaction, maintaining the quality of online learning poses a challenge. Solutions are needed for closely monitoring and evaluating learning performance. It also confirms the satisfaction of students with teachers using this model in online teaching to help students improve their learning performance as well as their learning results (Thanh et al., 2020; Hung et al., 2022).

5. CONCLUSION

The research results presented in this article are analyzed and assessed based on online teaching practices. The aim is to provide evaluations highlight the importance of the TPACK model in enhancing both teaching quality and IT competence within an online learning environment. This approach ensures a comprehensive assessment of educators' ability to integrate technology effectively into their teaching practices, ultimately fostering a more competent and adaptive educational experience for students.

IT applications have made education more accessible to a global audience, breaking geographical barriers and allowing students from different parts of the world to access quality education. Online teaching platforms provide the convenience of learning from anywhere, at any time; facilitate better communication and collaboration among students and between students and instructors. Tools like discussion forums, chat applications, and video conferencing enable real-time interaction, fostering a sense of community and support that is crucial for effective learning.

The future of IT applications in online teaching looks promising, with continuous advancements in technology expected to further enhance educational delivery. Innovations such as virtual reality (VR) and augmented reality (AR) are likely to create even more immersive learning experiences. Additionally, ongoing improvements in AI and machine learning will continue to refine personalized learning and assessment methods

While this approach offers numerous benefits, it also presents various challenges that require flexible and creative resolutions to optimize educational effectiveness. IT applications have had a profound impact on online teaching, transforming it into a dynamic, inclusive, and efficient mode of education. While challenges remain, the potential for continued growth and improvement makes IT an indispensable component of the modern educational landscape. Support and cooperation between teachers and students play a vital role in ensuring the meaningful and effective integration of IT in today's digitalized educational environment.

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REFERENCE

- Abdulwahab, A. (2022). The relationship between ICT teachers' professional development and TPACK framework for the process of teaching and learning. *International Journal of Education and Research*, 10(12), 69-82.
- Angeli, C., & Valanides, N. (2009). Epistemological and methodological issues for the conceptualization, development, and assessment of ICT-TPCK: Advances in technological pedagogical content knowledge (TPCK). *Computers & Education*, 52(1), 154-168. <https://doi.org/10.1016/j.compedu.2008.07.006>
- Aquino, A. B., Dadayan, A. A., Rosel, M. E., & Francisco, M. J. V. (2022). Development of a TPACK-Based Professional Development Framework for the new normal in Education. *International Journal of Information and Education Technology*, 12(10), 1012-1016. <https://doi.org/10.18178/ijiet.2022.12.10.1713>
- Bastari, N. A., Bandonno, N. A., & Suharyo, N. O. S. (2021). The development strategy of smart campus for improving excellent navy human resources. *Global Journal of Engineering and Technology Advances*, 6(2), 33-43. <https://doi.org/10.30574/gjeta.2021.6.2.0011>
- Chai, C. S., & Kong, S.-C. (2017). Professional learning for 21st century education. *Journal of Computers in Education*, 4(1), 1-4. <https://doi.org/10.1007/s40692-016-0069-y>
- Davis, D., Chen, G., Hauff, C., & Houben, G. J. (2018). Activating learning at scale: A review of innovations in online learning strategies. *Computers and Education*, 125, 327-344. <https://doi.org/10.1016/j.compedu.2018.05.019>

- Goodrich, A. H. (2000). Using rubrics to promote thinking and learning. *Educational Leadership*, 57(5), 13-18.
- Hung, V. T., Le, H. T., Phan, T. C., Hoang, L. P., & Phan, T. M. (2022). Flipped classroom in online teaching: a high school experience. *Interactive Learning Environments*, 32(4), 1385-1401. <https://doi.org/10.1080/10494820.2022.2120020>
- Hung, V. T., Thanh, C. P., Huy, T. L., Loc, P. H., Tien, M. P., & Hung, T. T. (2021). A Systematic Style-Based Blended Teaching for Competence Enhancement of Lecturers in the COVID-19 Pandemic Situation: A Case Study for Teaching in Higher Education. *Turkish Journal of Computer and Mathematics Education*, 12(11), 4394-4408. <https://doi.org/10.17762/turcomat.v12i11.6575>
- Jonathan, A. (2015). *ICT Transforming Education: A Regional Guide*. UNESCO Bangkok.
- Jose, M. C., Vicente, N., & Miguel, N. (2012). The history of technology in education. A comparative study and forecast. International Conference on Education and Educational Psychology (ICEEPSY), *Procedia - Social and Behavioral Sciences*, 69, 1086-1092.
- Koehler, M. J., Mishra, P., Kereluik, K., Shin, T. S., & Graham, C. R. (2013). The Technological Pedagogical Content Knowledge Framework. In *Springer eBooks* (pp. 101-111). https://doi.org/10.1007/978-1-4614-3185-5_9
- Mihaela, S. (2000). A cognitive model for developing a competence based curriculum in secondary education. In Al. Crisan (Ed.), *Current and Future Challenges in Curriculum Development: Policies, Practices and Networking for Change*. București: Education 2000+ Publishers. Humanitas Educational, pp. 121-141.
- Peterson, C. N., Tavana, S. Z., Akinleye, O. P., Johnson, W. H., & Berkmen, M. B. (2020). An idea to explore: Use of augmented reality for teaching three-dimensional biomolecular structures. *Biochemistry and Molecular Biology Education*, 48(3), 276-282. <https://doi.org/10.1002/bmb.21341>
- Phan, C. T. (2018). Industrial Revolution 4.0 - Development trend of online Education. *Vietnam Journal of Education*, 421, 43-46.
- Rodríguez, P., Nussbaum, M., & Dombrowskaia, L. (2012). ICT for education: a conceptual framework for the sustainable adoption of technology-enhanced learning environments in schools. *Technology, Pedagogy and Education*, 21(3), 291-315. <https://doi.org/10.1080/1475939x.2012.720415>
- Scott, A., & Craig, D. (2013). Teacher adaptation to open learning spaces. *Issues in Educational Research*, 23(3), 315-330.
- Sreekala S., & Sabin, C. (2024). Technological Pedagogical Content Knowledge (TPACK) Competency among B.Ed Students. *Educational Administration: Theory and Practice*, 30(5), 8957-8960.
- Thanh, C. P., Phuong, A. L., Tien, M. P., Loc, P. H., Huy, T. L., Thanh, T. N., Dung, T. N., & Hung, V. T. (2021). Identifying and Applying the Information Technology Competence Framework in an Online Teaching Environment. In *Handbook of Research on Barriers for Teaching 21st-Century Competencies and the Impact of Digitalization*, 356-382. <https://doi.org/10.4018/978-1-7998-6967-2.ch019>
- Thanh, C. P., Thanh, T. N., & Tien, M. P. (2019). Developing the information technology application competence of teachers in online teaching. *International Journal of Applied Research in Social Sciences*, 1(4), 124-137. <https://doi.org/10.51594/ijarss.v1i4.24>
- Thanh, C. P., Thanh, T. N., & Tien, M. P. (2020). Assessment of information technology use competence for teachers: Identifying and applying the information technology competence framework in online teaching. *Journal of Technical Education and Training*, 12(1), 149-162. <https://doi.org/10.30880/jtet.2020.12.01.016>