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Do Teachers Have the Requisite Digital and Technology Skills for Online Learning?: The Case of A State University in the Philippines

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Abstract: Do Teachers Have the Requisite Digital and Technology Skills for Online Learning?: The Case of a State University in the Philippines. Objective: This study was conducted to determine the digital and technological skills of the teachers using the TPACK framework. **Methods:** This study employed a cross-sectional explanatory design to determine the technological competence of 196 teachers in a state university in the Philippines. **Findings:** Results of the study show that the respondents have very high pedagogical and content knowledge. This reflects that the teachers demonstrated mastery of content and well-versed of various methodologies and approaches that they used in their teaching. Further analysis also reveals that those teachers who have a very high level of technological competence also have a high level of technology acceptance. Auxiliary to this, teachers who have high technological competence perceived that using technology was highly acceptable. **Conclusion:** This research suggests that educational institutions should continue to conduct intensive trainings and technical support among teachers to further develop their technological skills so that they will become well-versed in using technological tools which are indispensable during online learning.

Keywords: TPACK, technological competence, digital competence, online learning.

Abstrak: Apakah Guru Memiliki Keterampilan Digital dan Teknologi yang Diperlukan untuk Pembelajaran Daring?: Studi Kasus Universitas Negeri di Filipina. Tujuan: *Penelitian ini dilakukan untuk mengetahui keterampilan digital dan teknologi para guru menggunakan kerangka kerja TPACK.* ***Metode:*** *Penelitian ini menggunakan desain penjelasan cross-sectional untuk menentukan kompetensi teknologi dari 196 guru di sebuah universitas negeri di Filipina.* ***Temuan:*** *Hasil penelitian menunjukkan bahwa responden memiliki pengetahuan pedagogik dan konten yang sangat tinggi. Hal ini mencerminkan bahwa para guru menunjukkan penguasaan konten dan berpengalaman dalam berbagai metodologi dan pendekatan yang mereka gunakan dalam pengajaran mereka. Analisis lebih lanjut juga mengungkapkan bahwa para guru yang memiliki tingkat kompetensi teknologi yang sangat tinggi juga memiliki tingkat penerimaan teknologi yang tinggi. Tambahan untuk ini, guru yang memiliki kompetensi teknologi tinggi merasa bahwa penggunaan teknologi sangat dapat diterima.* ***Kesimpulan:*** *Penelitian ini menyarankan agar lembaga pendidikan terus melakukan pelatihan intensif dan dukungan teknis di antara para guru untuk lebih mengembangkan keterampilan teknologi mereka sehingga mereka menjadi ahli dalam menggunakan perangkat teknologi yang sangat diperlukan selama pembelajaran daring.*

Kata kunci: *TPACK, kompetensi teknologi, kompetensi digital, pembelajaran online.*

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INTRODUCTION

In recent years, technology has evolved into an indispensable tool, and it has changed how people live and work in a new global era. As a result of this evolution, we now face a new paradigm and challenge in the field of education. This challenge does not only relate to the future demands of students on their work but also forces us to adapt to the new approach to teaching and learning to best prepare future generations, such as in the COVID-19 era (Sakina et al., 2020). The digital revolution has had a significant impact on daily life, as evidenced by the widespread use of mobile devices and the seamless integration of technology into everyday activities such as purchasing, reading, and navigating (Anderson, 2016). According to Poushter (2016), as cited by Schindler et al. (2017), the usage of computers, mobile devices, and the Internet is at an all-time high, and it is anticipated to continue to rise as technology improves, especially for users in developing countries.

Technology adoption in the classroom has been accelerated. Chalkboards, textbooks, and desktops have all but disappeared from the conventional classroom, and today's teachers and students have access to hundreds of thousands of applications, videos, and online courses intended to improve the learning experience (Ring Central, 2020). Now, amid a global pandemic, technology plays an even bigger part in our students' education. At the height of the COVID-19 outbreak, over 1.5 billion children across the world were taken out of the classroom because of school closures, which, in turn, forced the widespread adoption of remote teaching technologies and the suspension of in-person instruction (World Bank, 2020). To minimize educational disruption, countries around the world have swiftly shifted to online and remote learning to ensure sustainable, high-quality, and flexible teaching and learning. At the center of many of these learning strategies is the use of technology. According to Mulyadi et al. (2020), the use of technology in the teaching and learning process not only assists the teacher in conducting the teaching process, especially during this pandemic, but it also aids the students in understanding the lesson.

Teachers can employ several instructional delivery modes at a flexible time and place by using a variety of technology in teaching-learning activities (Sakina et al., 2020). This is one of the options for adapting to the current situation regarding how the educational system must adapt to this new normal in the COVID-19 era. They further echoed that teachers must use technological innovations to run the process of teaching and learning in the new normal era as a replacement for face-to-face learning due to the COVID-19 pandemic.Technology is a powerful instrument that can help and transform education in several different ways, from making it easier for teachers to generate instructional materials to allowing students to learn and collaborate in new ways. With the Internet's worldwide impact and the widespread availability of smart gadgets that can connect to it, a new era of anytime, anywhere education is on the horizon. As a corollary to this, Mark and Seaman (2008) reported that technology provides innovative and resilient solutions in times of crisis to combat disruption and helps people communicate and even work virtually without the need for face-to-face instructions.

Society in the digital age is constantly evolving and advancing. Information and communications technology (ICT) tools have already played an important role in our lives. In the aspect of education, we cannot ignore their influence and the new challenges they have brought. Amid a constantly changing digital environment that contains the new conditions of interaction technologies, technological tools, and digitization, traditional literacy becomes outdated, and thus, technological competence has become

an important factor when people integrate into contemporary society, helping them adapt to the modern trends and improve their competitiveness (Zhao et al., 2019).

In today's information and knowledge era, where technology advances at a rapid pace and pervades every aspect of our lives, the concept of digital competence has become a hot topic. Technological competence is now recognized as a hallmark of 21st-century education understanding (Maderick, Zhang, Hartley, & Marchand, 2016), and its significance in participating in 21st-century societies and economies is growing (Napal-Fraile, Pealva-Vélez, & Mendióroz-Lacambra, 2018). Further, it has to do with technical information on the use of digital technologies, formal and informal digital environments of information in screening, assessment and management, communication and collaboration, digital content creation, digital media, providing safety and security, problem-solving, job employment, community inclusion, and learning about digital technology to achieve the goals of critical and creative thinking and in a confident manner (Ferrari, 2012). Furthermore, the closure of schools as a result of COVID-19 has been a significant worldwide occurrence that has prompted all of our countries to rethink how education works. One of the numerous changes brought about by the crisis is that digital technologies have been used to mediate all instruction (Pozo et al., 2021). With this, teachers that are primarily trained to work in a classroom face-to-face confront roadblocks while teaching online. As a result, teachers have been compelled to go online because of the COVID-19 pandemic and the consequent school lockdown to ensure that students can continue their lessons. This is not a simple transition, and educators must have the necessary skills, knowledge, and competencies to teach online (Winter, 2021). This coincides with Schlichter (2020), who emphasized that teachers who work online must adapt to the new pedagogical concepts and modalities of delivery for which they have not been trained. Towards this end, teachers should have sufficient technological knowledge and be well-versed in using technology. Although the shift to online learning has already become part of many education systems in the world, the extent to which it is employed and the way technology is used to achieve the quality of distance or online learning is considered to vary (Durako & Hoxha, 2020). Technology-related teaching skills are concerned with what teachers require to design, develop, and successfully execute their teaching activities, as well as to scaffold and assist students' learning processes using digital technology (Claro et al., 2018). In conjunction with these findings, Marpa (2021) suggested that teachers should adapt their teaching methods to the new normal, especially when digital tools and resources provide numerous opportunities for both teachers and students. To make the learning process a personal experience for every student, teachers can curate the best online learning tools for their topics and create learning playlists or menus. Nowadays, the challenges to accessing online learning are less because students have experienced the excellent opportunity of knowing and interacting with educational technology tools such as mobile-based learning, computer-based learning, and web-based learning (Pellegrini, Mirella, Vladimir Uskov, & Casalino, 2020; Byun, Sooyeon, & Slavin, 2020).

Furthermore, the emergence of innovative technologies and their increased integration into education, especially after the COVID-19 pandemic, has popularized the concept of technological pedagogical content knowledge (TPACK) in the educational field (Adipat, 2021). At the heart of good teaching with technology are three core components: content, pedagogy, and technology, plus the relationships among and between them (Hansson, 2013). The interactions between and among the three components,

playing out differently across diverse contexts, account for the wide variations seen in the extent and quality of educational technology integration. TPACK, or Technological Pedagogical Content Knowledge, is a framework for the integration of technology into the classroom (Mishra & Koehler, 2006). The TPACK framework is a helpful guide to providing students with a high-quality educational experience when technology is incorporated into the classroom. Meanwhile, inside the TPACK framework, the three categories of knowledge—TK, PK, and CK—are merged and recombined in numerous ways. Technological pedagogical knowledge (TPK) describes the relationships and interactions between technological tools and specific pedagogical practices, pedagogical content knowledge (PCK) describes the same between pedagogical practices and specific learning objectives, and technological content knowledge (TCK) describes the same between technologies and learning objectives. These three categories are then combined to form TPACK, which takes into account the connections between them all and recognizes that educators are working in a complicated environment (Kurt, 2018).

In a comparative case study examining the nature of teacher knowledge influencing technology integration in instruction, Hughes (2005) stressed that experienced teachers with less technology experience drew on their professional knowledge to develop innovative, technology-integrated activities because "veteran teachers' expertise can offer a subject matter or pedagogical-based focus to technology explorations that beginning teachers may not be able to do independently". Furthermore, in a study conducted by Nazari et al. (2019), experienced teachers were given significantly higher scores in terms of pedagogical knowledge and pedagogical content knowledge subscales. In contrast, novice teachers were given significantly higher scores considering their technological knowledge, technological content knowledge, and technological pedagogical knowledge. In conjunction with these findings, a study conducted by Basirat and Taghizadeh (2021) revealed that among the seven categories of the TPACK framework, students considered content knowledge and pedagogical knowledge the first and second most significant frames of knowledge for an online teacher, respectively whereas technological knowledge and technological content knowledge received the lowest one. In addition, other studies also pointed out that the knowledge dimensions of TPACK, including technology, are dependent on age and teaching experience. More specifically, Hofer and Harris (2017) highlighted the association of age and teaching experience in the adeptness of technology training or use in TPACK. This coincides with the study conducted by Cox and Graham (2009), who reported that there were differences in teachers' technological, content, and pedagogical knowledge according to their gender, teaching subjects, and teaching experience. Likewise, another study conducted by Arcueno et al. (2021) revealed that teachers rated themselves highly in the following TPACK components: content, pedagogy, pedagogical content, technological content, and technological pedagogical content knowledge.

In the Philippines, a study was conducted by Tanucal et al. (2021) among college teachers about the seven components of the TPACK framework. The findings of their study reveal that college teachers have an average level of preparedness to conduct remote digital teaching in all domains of knowledge of TPACK. They further added that the preparedness level of the teachers to conduct remote digital teaching in all domains of knowledge of TPACK is dependent on their age, sex, and teaching experience, except technological knowledge, as it is independent of their highest educational attainment. Hence, to successfully navigate a paradigm in education that

accentuates the utilization of technology and other digital platforms, teachers have to be equipped with the tri-relationship of knowledge—content, pedagogy, and technology—through capability-building activities that consider their demographics and background. At this point in time, there are few studies conducted to investigate the readiness of teachers by correlating their technological knowledge and skills to their acceptance and readiness in using technologies. Thinking along with these statements, it is imperative to analyze the technological and digital competence and readiness of teachers and students, who are the end users of technology.

METHODS

Participants

In the context of this study, the researcher believes that it is imperative to analyze the trends and patterns of technological and digital competence from the perspectives of teachers who are technology users. Hence, the respondents of this study involved full-time faculty members of a state university in the Philippines. Furthermore, the researcher used Cochran's formula in determining the ideal sample size given a 95% level of precision and a 5% margin of error. To identify those teachers who participated in the study, a proportionate stratified sampling technique was utilized. From these statistics, 196 teachers were randomly selected.

Research Design and Procedure

This study employed a cross-sectional explanatory research design. Cross-sectional studies provide data for describing the status of phenomena or relationships among phenomena at a fixed point in time. Generally, the main focus of this study is to determine the level of technological and digital competence of teachers and students. In the context of the present study, a cross-sectional study could be used to analyze whether the technological and digital competence can be correlated to users' behavioral intentions to use innovational technologies. Typically, the purpose of cross-sectional studies is to obtain reliable data that makes it possible to generate robust conclusions and create new hypotheses that can be investigated in future studies.

In this study, the researcher gathered information about teachers' competence in using innovational technologies through the use of TPACK framework. Based on the collected statistical data, the researcher established a link between these constructs and users' behavioral intention to use technology in teaching and learning. The researcher observed ethical considerations in the conduct of this study starting from the pre-data collection to the post-data analysis. Proper research ethics measures and protocols were strictly observed by providing informed consent from the target teacher-respondents. The participants were clearly informed about the process and reasons for the study, the benefits that might be derived from the research, and they were ensured that their participation will be voluntary. Furthermore, the confidentiality and anonymity of their responses were highly considered.

Research Instrument

Consistent with the cross-sectional research design adopted in this study, online questionnaires for teacher-respondents was employed. To determine the teachers' technological-related knowledge and skills, the researcher adopted the TPACK survey developed and validated by Schmidt et al. (2009). The internal consistency reliability of this survey questionnaire ranged from 0.75 to 0.92 for the seven TPACK subscales, namely: technological knowledge (TK), pedagogical knowledge (PK), content knowledge (CK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), pedagogical content knowledge (PCK), and technological pedagogical content knowledge

(TPACK). Hence, the Cronbach's coefficients implying that the items are highly reliable and internally consistent.

Data Analysis

To answer the queries raised in this investigation, both descriptive and inferential measures were employed. Descriptive statistics such as mean and standard deviations were used to determine the technological knowledge and skills of the teacher-respondents. On the other hand, to examine whether there are significant differences in the respondents' acceptance of using technology when they are grouped according to technological knowledge and skills, Analysis of Variance (AnoVa) was used. Moreover, all statistical analyses were analyzed using the software program Statistical Package for Social Sciences (SPSS) Version 23, tested at a 0.05 level of significance.

■ RESULTS AND DISCUSSION

Teacher-Respondents' Technological, Pedagogical, and Content Knowledge

Table 1. Teacher-respondents' technological knowledge and skills using tpack

TPACK Components	Mean Rating	Verbal Interpretation
Technological Knowledge	3.80	High
Pedagogical Knowledge	4.42	Very High
Content Knowledge	4.26	Very High
Pedagogical Content Knowledge	4.13	High
Technological Content Knowledge	3.89	High
Technological Pedagogical Knowledge	3.90	High
Technological Pedagogical Content Knowledge	3.81	High
Over – All Mean Rating	**4.03**	**High**

Legend: *1.0 – 1.79 – Very Low; 1.80 – 2.59 – Low; 2.60 – 3.39 – Fair; 3.40 – 4.19 – High; 4.20 – 5.0 – Very High*

Table 1 shows the summary of the technological knowledge and skills of the teacher-respondents using the TPACK components. It can be gleaned in the analysis that among the seven TPACK components, pedagogical knowledge obtained the highest mean rating of 4.42. This data was followed by content knowledge having a mean rating of 4.26. These findings reveal that the teacher-respondents have very high pedagogical and content knowledge. This reflects that the teacher-respondents perceived that they demonstrated mastery of content and well-versed of various methodologies and approaches that they can be used in their teaching. This supports with the study of Nazari et al. (2019) which revealed that teachers have significantly higher ratings in terms of pedagogical knowledge and content knowledge among the TPACK components. On the other hand, the analysis also indicates that technological knowledge obtained the lowest mean rating of 3.80. This corroborates with the findings of Basirat & Taghizadeh (2021) which revealed that teachers generally perceived their technological knowledge to be the lowest TPACK component.

To further analyze the technological knowledge and skills of the teacher-respondents along the TPACK components, consider the following tables presented on the next pages.

Table 1.a. Teacher-respondents' perceived technological knowledge (tk)

Indicators	Mean Rating	Verbal Interpretation
1. I can learn technology easily.	4.24	Very High
2. I have the technical knowledge and skills I need to use technology.	4.16	High
3. I can keep up with popular new technologies that can be used in my profession.	3.89	High
4. I am able to facilitate my students to use technology to plan and monitor their own learning.	3.38	Fair
5. I can troubleshoot technical problems that could be encountered with online educational/ learning environment.	3.32	Fair
Over – All Mean Rating	**3.80**	**High**

Legend: *1.0 – 1.79 – Very Low; 1.80 – 2.59 – Low; 2.60 – 3.39 – Fair; 3.40 – 4.19 – High; 4.20 – 5.0 – Very High*

Table 1.a shows the extent of the technological knowledge of the teacher-respondents. Based on the analysis, the overall mean rating of 3.80 indicates that the respondents have a high level of knowledge about using technology. This reflects that the teacher-respondents are knowledgeable and skillful at using and applying educational technologies. In addition, further analysis reveals that the statement *"I can learn technology easily"* obtained the highest mean rating of 4.24, whereas the statement *"I can troubleshoot technical problems that could be encountered with online educational and learning environments"* got the lowest mean rating of 3.32. This finding implies that the teachers are very confident in their ability to learn how to use different technologies. However, they have fair knowledge in terms of troubleshooting some technical problems that they might encounter while using such technologies. This also reflects that despite that the teachers can learn how to use technology easily and have the technical knowledge and skills in utilizing technological innovations, still they have no enough knowledge and skills in dealing with technical problems that they encountered while using technologies in an online learning environment. This finding coincides with Compton (2009) which highlighted that teachers should have sufficient technological knowledge and be well-versed in using educational technology. This is also in conjunction with the study of Marpa (2021) which stressed that teachers should adapt to the needs and demands of the students in the new normal, especially in this time of new normal where the use of technological innovations is indispensable.

Moreover, as mentioned, among the seven TPACK components, technological knowledge got the lowest mean ratings as perceived by the teacher-respondents. This finding supports the study of Nazaro et al. (2019) and Tanucal et al. (2021) which revealed that teachers should be provided intensive trainings and technical support to be equipped with knowledge and skills needed in using educational technologies as well as in troubleshooting technical problems that they might encounter while using such technologies. This also corroborates with one of the findings of PSU-CODIFLO (2021) that technical support was one of the topmost support resources needed by faculty members in teaching online. Hence, it is essential to understand the faculty's perspectives and experiences with online teaching in relation

to promoting the use of Flexible Learning Environments as an Alternative Mode of Instruction and Learning Delivery at Palawan State University during and after the COVID19 crisis in order to provide proper training and technical support. As a consequence, a strong technological knowledge will increase the likelihood of using educational technologies in the classroom, and in turn, will help students become more engaged in the teaching-learning process.

Table 1.b. Teacher-respondents' perceived pedagogical knowledge (pk)

Indicators	Mean Rating	Verbal Interpretation
1. I know how to select effective and innovative teaching strategies and approaches to guide students thinking and learning for the lessons I teach.	4.56	Very High
2. I have the ability to design and deliver activities that are collaborative, highly interactive, and motivating.	4.51	Very High
3. I have the ability to use alternative assessment strategies that allow the students the opportunity to represent their knowledge in ways that are personally meaningful.	4.48	Very High
4. I can create a positive, supportive and interactive learning environment with mutual support and respect.	4.35	Very High
5. I have the ability to help my students to link concepts in my subject specialization with other disciplines and in real-life situations.	4.21	Very High
Over – All Mean Rating	**4.42**	**Very High**

Legend: *1.0 – 1.79 – Very Low; 1.80 – 2.59 – Low; 2.60 – 3.39 – Fair; 3.40 – 4.19 – High; 4.20 – 5.0 – Very High*

Table 1.b above depicts the level of pedagogical knowledge of the teacher-respondents. The data reveals that all of the five statements obtained mean ratings higher than 4.20. The overall mean rating of 4.42 indicates that the teacher-respondents have very high pedagogical knowledge. This implies that the teachers can apply a variety of teaching methodologies, approaches, and assessment strategies. This also stresses that the teacher-respondents have deep understanding of the processes and practices or method of teaching and learning. This coincides with Arcueno et al. (2021) which revealed that teachers rated themselves highly in terms of pedagogical knowledge.

Furthermore, it can be gleaned that the statement *"I know how to select effective and innovative teaching strategies and approaches to guide students' thinking and learning for the lessons I teach"* has the highest mean rating of 4.56. This data was also followed by the statement "*I have the ability to design and deliver activities that are collaborative, highly interactive, and motivating"* having a mean rating of 4.51. On the other hand, the statement *"I have the ability to help my students link concepts in my subject specialization with other disciplines and in real-life situations"* got the lowest mean rating of 4.21. This implies that in terms of pedagogy, the teacher-respondents were able to design and utilize

effective, innovative, and interactive teaching methodologies and strategies that will provide their students meaningful online learning experiences. These findings are in accordance with Cox & Graham (2009) and Bazirat & Taghizadeh (2021) which indicated that pedagogical knowledge is one of the most significant frames of knowledge.

Added to this, the respondents have the competence to select effective and innovative teaching strategies and approaches to guide their students' thinking and learning. They can also create and deliver learning activities that are collaborative, highly participatory, and stimulating.

Table 1.c. Teacher-respondents' perceived content knowledge (ck)

Indicators	Mean Rating	Verbal Interpretation
1. I have enough self-confidence to teach my subject specialization to my students.	4.38	Very High
2. I can deliver accurate and updated content knowledge of the subject.	4.36	Very High
3. I can utilize additional material/information from sources other than prescribed references.	4.21	Very High
4. I can teach the subject/lesson without completely relying on textbooks or teaching notes.	4.18	High
5. I can provide pertinent information about the subject matter and give additional ideas that could enrich the lesson.	4.15	High
Over – All Mean Rating	**4.26**	**Very High**

Legend: *1.0 – 1.79 – Very Low; 1.80 – 2.59 – Low; 2.60 – 3.39 – Fair; 3.40 – 4.19 – High; 4.20 – 5.0 – Very High*

Concerning the third domain of the TPACK framework, it can be gleaned from the analysis in Table 1.c that the overall mean rating of 4.26 shows that the teacher-respondents have very high content knowledge. This stresses that the respondents perceived that they demonstrated mastery of content. Likewise, the statement "*I have enough confidence to teach my subject specialization to my students"* obtained the highest mean rating of 4.38, which indicates that the respondents have sufficient knowledge about their subject matter.

This data was followed by the statement *"I can deliver accurate and updated content knowledge of the subject"*, having a mean rating of 4.36. This shows that the respondents continuously update themselves to be able to provide reliable and up-to-date information to their students. Furthermore, it can be noted that the teacher-respondents can utilize additional material and information from sources other than prescribed references. They can also teach the subject/lesson without completely relying on textbooks or teaching notes. These reflects that the teacher-respondent are highly confident in terms of the mastery of their content as they able to provide additional materials and information that will supplement their discussion. Likewise, the statement *"I can provide pertinent information about the subject matter and give additional ideas that could enrich the lesson"* has a mean rating of 4.15, which implies that the respondents are capable of providing additional information that could supplement their lesson. These corroborate with Tanucal et al. (2021), and Arcueno et al. (2021) which revealed that teachers demonstrated deep understanding of the subjects they taught.

Table 1.d. Teacher-respondents' perceived pedagogical content knowledge (pck)

Indicators	Mean Rating	Verbal Interpretation
1. I know how to select effective and innovative teaching strategies and approaches to guide students thinking and learning for the lessons I teach.	4.39	Very High
2. I can create a positive, supportive and interactive learning environment with mutual support and respect.	4.36	Very High
3. I have the ability to help my students to link concepts in my subject specialization with other disciplines and in real-life situations.	4.05	High
4. I have the ability to design and deliver activities that are collaborative, highly interactive, and motivating.	3.98	High
5. I have the ability to use alternative assessment strategies that allow the students the opportunity to represent their knowledge in ways that are personally meaningful.	3.87	High
Over – All Mean Rating	**4.13**	**High**

Legend: *1.0 – 1.79 – Very Low; 1.80 – 2.59 – Low; 2.60 – 3.39 – Fair; 3.40 – 4.19 – High; 4.20 – 5.0 – Very High*

In terms of pedagogical content knowledge, the data depicted in Table 1.d above shows that the teacher-respondents have sufficient knowledge to select appropriate teaching approaches and strategies in their lessons, as described by the overall mean rating of 4.13. Likewise, the item *"I know how to select effective and innovative teaching strategies and approaches to guide students' thinking and learning for the lessons I teach"* obtained the highest mean rating of 4.39, which strongly justifies that the teacher-respondents are highly confident in choosing appropriate teaching strategies that can be integrated into their lessons. This data was followed by the statement "*I can create a positive, supportive and interactive learning environment with mutual support and respect"* having a mean rating of 4.36, which implies that the teacher-respondents have thorough understanding on the importance of providing conducive environment among their students.

In addition, the mean rating of 4.05 indicates that the teacher-respondents demonstrates high knowledge with regard to the statement "*I have the ability to help my students to link concepts in my subject specialization with other disciplines and in real-life situations".* This supports with the study of Adipat (2021) which recognized the importance of an integrated curriculum which aims to connect the content and theories learned in the classroom, with authentic knowledge and experiences and allowing them to engage in relevant, meaningful activities that can be connected to real life. Furthermore, the item *"I have the ability to use alternative assessment strategies that allow the students the opportunity to represent their knowledge in ways that are personally meaningful"* got the lowest mean rating of 3.87.

Table 1.e. Teacher-respondents' perceived technological content knowledge (tck)

Indicators	Mean Rating	Verbal Interpretation
1. I can choose technology that enhances the content for a lesson I teach.	4.15	High
2. I can use technology to appropriately design instructional materials aligned with the needs of my students for an effective teaching and learning process.	4.09	High
3. I can use technology to support students in deeper inquiry about the content, concepts, and relationships with other subject matter.	4.06	High
4. I can use technology to provide students with learning opportunities in exploring content by themselves at their own individual pace.	3.85	High
5. I have sufficient knowledge of curriculum design and frameworks for online learning.	3.28	Fair
Over – All Mean Rating	**3.89**	**High**

Legend: *1.0 – 1.79 – Very Low; 1.80 – 2.59 – Low; 2.60 – 3.39 – Fair; 3.40 – 4.19 – High; 4.20 – 5.0 – Very High*

Table 1.e shows the perceived technological content knowledge of the teacher-respondents. Based on the statistical analysis, the overall mean rating of 3.89 indicates that the respondents have an understanding of how technology and content can both influence and push against each other. This implies that the teacher-respondents can consider appropriate educational technology tools for a specific subject matter or classroom.

Meanwhile, the data show that the item *"I can choose technology that enhances the content for a lesson I teach"* has the highest weighted mean of 4.15, indicating that respondents have a high level of knowledge in selecting digital tools that can enhance or transform the content of the lessons. This data was followed by the statement "*I can use technology to appropriately design instructional materials aligned with the needs of my students for an effective teaching and learning process"* having a mean rating of 4.09. This stresses that the teacher-respondents are well-versed in using technological tools in designing instructional materials that meet the needs of their students and will result for an effective teaching and learning experiences. Inversely, the item *"I have sufficient knowledge of curriculum design and frameworks for online learning"* got the lowest mean rating of 3.28, which stresses that the respondents have a fair knowledge of various curriculum designs and frameworks for online learning. These findings are in consonance with Marpa (2021) which justified that in order to make the learning experiences of every student meaningful, teachers should employ various technological tools that will augment their discussion. The findings also support with Mishra and Koehler (2006) that when technology is integrated in the classroom, teachers are able to provide students with a high quality educational experience.

Table 1.f. Teacher-respondents' perceived technological pedagogical knowledge (tpk)

Indicators	Mean Rating	Verbal Interpretation
1. I am confident in choosing the appropriate new technologies to motivate my students to learn.	4.27	Very High
2. I can use technology to develop interactive and engaging activities based on students' needs to enrich the teaching and learning process.	4.15	High
3. I can implement effective classroom management in the teaching and learning process in which technology is used.	3.91	High
4. I can apply various instructional approaches, techniques, methodologies, and strategies appropriate to individual differences with the help of technology.	3.80	High
5. I can develop appropriate assessment and evaluation tools by using technology.	3.35	Fair
Over – All Mean Rating	**3.90**	**High**

Legend: *1.0 – 1.79 – Very Low; 1.80 – 2.59 – Low; 2.60 – 3.39 – Fair; 3.40 – 4.19 – High; 4.20 – 5.0 – Very High*

As pertains to the teacher-respondents' technological pedagogical knowledge, the analysis presented in Table 1.f reveals that the overall mean rating of 3.90 clearly indicates that the teacher-respondents have a high level of technological pedagogical knowledge. This indicates that the respondents have enough knowledge to choose appropriate technologies that can be used in their teaching. Moreover, among the five statements, the item *"I am confident in choosing the appropriate new technologies to motivate my students to learn"* got the highest mean score of 4.27, which suggests that the respondents can use and select new technologies to increase their students' engagement in learning. This was followed by the statement "*I can use technology to develop interactive and engaging activities based on students' needs to enrich the teaching and learning process"* having a mean rating of 4.15. These findings are similar with the study of Sakina et al. (2021) which revealed that teachers are highly confident in utilizing variety of technological tools in the teaching and learning activities.

On the other hand, the statement *"I can develop appropriate assessment and evaluation tools by using technology"* obtained the lowest mean rating of 3.35, which indicates that the respondents have a fair knowledge of developing assessment and evaluation activities with the use of technology. This points out that teachers are confident in choosing the appropriate new technologies to motivate their students to learn and increase their engagement in learning. However, they just have fair knowledge in terms of developing appropriate assessment and evaluation tools by using technology. This is similar with the findings of Adipat (2021) that teachers maximized the use of technology in teaching their lessons, however, they stick to use traditional forms of assessment and evaluation tools.

Significant Differences in the Respondents' Technology Acceptance

Table 2. Differences in the respondents' technological innovations acceptance

espondents' Level of Technological Competence	Inferential Analysis		
	Mean Score	P-Value	Interpretation
Very High Competence	4.39	0.0001**	Significant
High Competence	4.25		
Moderate Competence	3.43		
Low Competence	-		
Very Low Competence	-		

Note: *1.0 – 1.79 – Unacceptable; 1.80 – 2.59 – Slightly Unacceptable; 2.60 – 3.39 – Fairly Acceptable; 3.40 – 4.19 – Acceptable; 4.20 – 5.0 – Highly Acceptable*

Legend: ***Significant at 0.05 level of significance*

Based on the analysis presented in Table 2, it can be gleaned that those respondents who have a very high level of technological competence also have a high level of technology acceptance, as indicated by the mean rating of 4.39. Auxiliary to this, respondents who have high technological competence perceived that using technology was highly acceptable, with a mean score of 4.25. It can also be gleaned from the analysis that there is a direct association between technological competence and technology acceptance. That is, as the level of competence of the respondents in using technology increases, their acceptance of its use also increases. This supports with Navarro (2021) that there exists positive relationship between user's technological competence and acceptance.

Meanwhile, the p-value of 0.0001 strongly indicates that there are significant differences in the technology acceptance of the respondents when they are grouped according to their technological competence. This finding is consistent with the findings of Garcia et al. (2020) and Navarro (2021), who revealed that teachers' acceptance of digital tools and platforms was positively influenced by their technological knowledge and skills. This finding strongly suggests that it is imperative to conduct training among teachers to develop their technological knowledge and skills as it has significant impact to their acceptance of technological innovations.

■ CONCLUSIONS

Among the seven components of the TPACK framework, PK got the highest mean rating of 4.42. This indicates that the teachers have very high pedagogical knowledge. Further, the data reveals that the teachers have the ability to apply a variety of teaching methodologies, approaches, and assessment strategies. Moreover, the teacher-respondents have also a very high content knowledge. This stresses that the respondents perceived that they demonstrated mastery of content. Contrariwise, unlike PK and CK, TK obtained the lowest mean rating of 3.80. This reflects that they are knowledgeable and skillful at using and applying educational technologies. In addition, the analysis reveals that the teachers are very confident in their ability to learn how to use different technologies. However, they have fair knowledge in terms of troubleshooting some technical problems that they might encounter while using such technologies.

As pertains to the teacher-respondents' TPK, the overall mean rating of 3.90 reflects that the teacher-respondents have a high level of technological pedagogical knowledge. This implies that the respondents have enough knowledge to choose appropriate technologies that can be used in their teaching. With regard to PCK, the teacher-respondents have sufficient knowledge to select appropriate teaching approaches and strategies in their lessons. They know how to select effective and innovative teaching strategies and approaches to guide students' thinking and learning for the lessons they teach. Further, with respect to TPACK, the respondents have an understanding of how technology and content can both influence and push against each other. This implies that the teachers have the ability to consider appropriate educational technology tools for a specific subject matter or classroom. They can choose technology that enhances the content of a lesson they teach. They also have sufficient knowledge of curriculum design and frameworks for online learning.

In the light of the findings and the conclusions developed, the following recommendations are offered to collective agencies: (1) The university can continue to conduct intensive trainings and technical support among faculty members to further develop their technological knowledge and skills so that they will become well-versed in using and operating technological tools which are indispensable during online learning; and (2) Once a new technological innovation is implemented, it is imperative to inform teachers about its features, functionality, and technical issues so that they may acquire a thorough understanding of the technology's functions and feel confident using it. Furthermore, the university can provide extensive training, workshops, and awareness programs on technology features, usage, and benefits to increase the use of such technologiess by teachers and students

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