International Journal of Instruction
e-ISSN: 1308-1470 ● www.e-iji.net

October 2022 ● Vol.15, No.4
p-ISSN: 1694-609X
pp. 147-166

Article submission code: 20211021214422

Received: 21/10/2021
Revision: 11/04/2022

Accepted: 05/05/2022
OnlineFirst: 20/07/2022

E-teaching Internships and TPACK during the Covid-19 Crisis: The Case of Saudi Pre-service Teachers

Dina Ahmed Ismaeel
Dr., Faculty of Education, King Faisal University, Saudi Arabia, *dismaeel@kfu.edu.sa*

Ensaf Nasser Al Mulhim
Dr., Corresponding author, Faculty of Education, King Faisal University, Saudi Arabia, *ealmulhim@kfu.edu.sa*

This paper main aim is to compare the effect of a new electronic teaching internship strategy and the traditional face-to-face teaching internship strategy on the pre-service teachers' Technological Pedagogical Content Knowledge (TPACK) skills. This paper highlights one consequence of the coronavirus (COVİD-19) pandemic on education in a Saudi university's college of education. The pandemic forced pre-service teacher educators to find alternative teaching internship strategies in place of the traditional face-to-face strategy. The research involved 120 pre-service teachers from two classes: 2019 (traditional) and 2020 (electronic). The results showed significant differences between the two research groups regarding their technological knowledge (TK) (p = 0.005), pedagogical knowledge (PK) (p = 0.001), pedagogical content knowledge (PCK) (p = 0.000), technological content knowledge (TCK) (p = 0.000), technological pedagogical knowledge (TPK) (p = 0.000) and technological pedagogical content knowledge (TPACK) (p = 0.000). These results strongly advocate the importance of blending traditional and online teaching internship strategies to develop pre-service teachers' TPACK skills. The current study may also inform stakeholders, curriculum developers, teacher educators, and designers of teacher preparation programs to develop content-specific and technology-enhanced learning opportunities linked to the most appropriate teaching methods. This may prepare pre-service teachers for their responsibility to support their instruction using technology, and to facilitate the digital transformation in education, one of the main programs of Saudi Arabia's Vision 2030.

Keywords: e-teaching internship, TPACK, e-learning, pre-service teacher, teacher education, Saudi Arabia, coronavirus, Covid-19

INTRODUCTION

In the 21st century, teachers' technological competencies are of great importance to the teaching-learning process. It becomes an integral component of the pioneer teaching

Citation: Ismaeel, D. A., & Al Mulhim, E. N. (2022). E-teaching internships and TPACK during the covid-19 Crisis: The case of saudi pre-service teachers. *International Journal of Instruction*, *15*(4), 147-166. https://doi.org/10.29333/iji.2022.1549a

practice (Bahri et al., 2020). With the development of both education and technology, technology's absence is no longer the most important barrier to its integration into education. Despite the availability of ICT in schools, it does not necessarily imply technology's effective integration (Malik et al., 2019). Integrating technology into teaching and learning requires adequate knowledge of how to use the technology for the given subject matter. Still, some teachers lack the comprehensive technology and pedagogical training that allows them to apply technology appropriately in their teaching. According to Jwaifell et al. (2018), pre-service teachers still lack to the required skills of using technologies in their practice.

Teacher preparation programs treat subject knowledge, pedagogical knowledge, and technology knowledge separately. Moreover, pre-service teachers are required to enroll in only one or two core technology courses that teach technological skills. Accordingly, many pre-service teachers do not believe they are adequately prepared to effectively use technology in their classrooms (Angeli & Valanides, 2009; Kay, 2006; Kramarski & Michalsky, 2010; Polly et al., 2010; Tondeur et al., 2012; Tondeur et al., 2020). Moreover, the findings from the study of Santos and Castro (2021) illustrate that there is a mismatch between teacher training programs and real-world classrooms in terms of technology application in teaching. This asserts that there is a gap between the knowledge they were taught and their ability to apply that knowledge effectively.

The Technological Pedagogical Content Knowledge (TPACK) model (Mishra & Koehler, 2006) is a response to the problem of separating technology and pedagogy, and a common language to discuss teaching, learning, and technology. TPACK is interested in integrative and transformative knowledge that requires teachers to be effectively and adequately prepared to integrate ICT in the classroom (Qasem and Viswanathappa 2016). The teaching internship course is where all realms of knowledge (subject-specific content, technology, and pedagogy) are connected and pre-service teachers are trained to apply it practically in their field.

As a result of the coronavirus (COVİD-19) pandemic and the urgent shift to distance learning in all educational matters, including teacher preparation programs, it is crucial to investigate the effect of these sudden changes on teaching internship quality and outcomes. The current study aims to compare traditional and electronic teaching internship strategies as they develop the TPACK competencies of pre-service teachers at the Faculty of Education, King Faisal University, Saudi Arabia.

Literature Review

Technological Pedagogical Content Knowledge (TPACK)

Technology integration in education is one of the main teaching competencies in the digital era. This creates more challenges for teacher education programs to prepare teachers who are able to cope with rapid technological developments. TPACK is a conceptual framework that helps convey the essential knowledge required for teachers to integrate technology effectively in their teaching (Baran et al., 2011; Mishra & Koehler, 2006). TPACK was developed from Shulman's (1986) theory of pedagogical content knowledge (PCK), which considered content knowledge and pedagogical knowledge constructs independently (Luckay, 2017). According to Brinkley-Etzkorn (2018), Shulman (1986) believes that possessing content knowledge and basic pedagogical strategies does not ensure effective teaching. TPACK further describes the interaction between technology and PCK (Koehler & Mishra, 2009). It could also serve as a teacher's understanding of subject-specific content knowledge, appropriate pedagogical strategies, and useful technologies (Wang et al., 2018).

TPACK consists of three main components of teacher knowledge (see Figure 1): content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK). Figure 1 shows the intersections of these components at which important interactions occur between and among them, namely PCK, TCK (technological content knowledge), TPK (technological pedagogical knowledge), and complete TPACK.

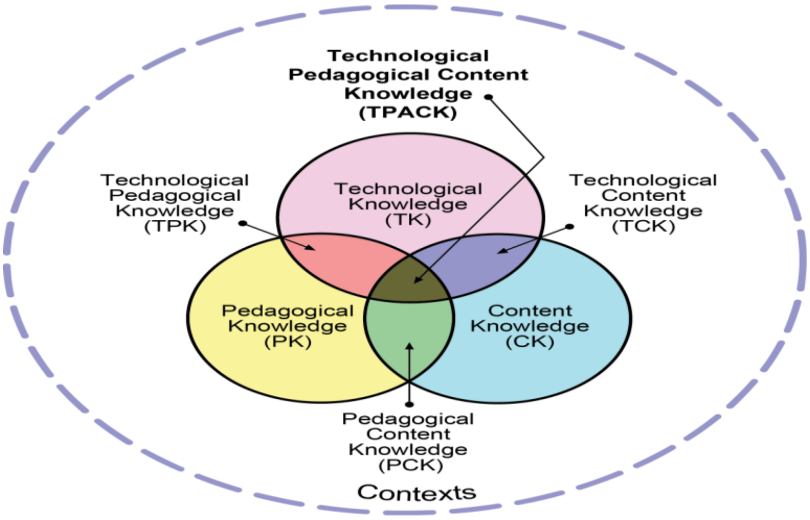

Figure 1
The TPACK framework as reproduced by permission of the publisher, © 2012 by http://tpack.org

Content knowledge (CK) refers to a comprehensive base of teacher knowledge on the subject matter to be learned or taught (Koehler & Mishra, 2009). That CK should comprise the subject matter that teachers need to possess, including knowledge of concepts, theories, ideas, organizational frameworks, evidence and proof, good teaching practices, and approaches toward developing this knowledge (Archambault & Barnett, 2010; Shulman, 1986). Santos and Castro (2021) confirmed the significance of mastering pre-service teachers of the CK of their specialization to be able to organize and use it more effectively for their students to understand. Then they will be capable to change the way they present information in response to the needs of any particular classroom in order to make it more understandable.

Pedagogical knowledge (PK) includes teachers' deep knowledge about teaching processes, practices, or strategies to improve student learning. Teachers need to understand how students learn, how to manage a classroom, plan lessons, and assess students' learning. PK further highlights that teachers need to develop a deep understanding of cognitive, social, and developmental learning theories and their impact on their practical teaching approaches and students' learning (Anderson et al., 2013; Archambault & Barnett, 2010; Shulman, 1986).

Pedagogical content knowledge (PCK) is a blend of CK and PK (Valtonen et al., 2017). It mainly concerns knowing what teaching approaches fit the content best (Messina & Tabone, 2013). It also covers the fundamental works related to teaching, learning, curriculum, and assessment that may promote learning. Further, PCK requires teachers to be aware of students' prior knowledge, be able to effectively use alternative teaching and assessment strategies, and be able to clarify common misconceptions (Koehler & Mishra, 2009).

Technological knowledge (TK) refers to the knowledge of standard technologies, the understanding of their possibilities and constraints, and the skills and ability to utilize them efficiently to accomplish a variety of different tasks. TK may expand to include teachers' interests in following the development of new technologies (Messina & Tabone, 2013; Mishra & Koehler, 2008; Valtonen et al., 2017).

Technological content knowledge (TCK) refers to teachers' knowledge of selecting the technologies that best suit the subject matter taught and how this content dictates or perhaps forces teachers to change technology. That also includes an understanding of how technology and content influence and constrain one another (Messina & Tabone, 2013; Mishra & Koehler, 2008; Valtonen et al., 2017).

Technological pedagogical knowledge (TPK) is "an understanding of how teaching and learning can change when particular technologies are used in particular ways" (Koehler & Mishra, 2009, p. 65). This understanding is important, as most technological applications are not typically designed for educational use. This requires teachers to be aware of the pedagogical affordances and constraints of a range of technological tools as they relate to the given subject matter, as well as have the ability to develop appropriate pedagogical designs and strategies (Koehler & Mishra, 2009; Valtonen et al., 2017).

TPACK is perceived as a specialized brand of teacher knowledge that goes beyond all three "core" components (content, pedagogy, and technology) to the dynamic interactions among them. Teachers need to intuitively understand teaching subject-specific content with appropriate pedagogical methods and select technologies (Koehler et al., 2007; Messina & Tabone, 2013; Mishra et al., 2011).

Many studies increasingly defend that it is extremely important not to consider TK and PK as isolated sets in teacher preparation programs (Al Mulhem, 2013; Al Mulhim, 2013; Ertmer & Ottenbreit-Leftwich, 2010). The literature views TPACK as a useful conceptual framework that teachers work within in terms of what they must know to integrate technology into teaching. Stover and Veres (2013) conducted a study in which they employed the TPACK framework in the higher education sector to understand participant content and technological and pedagogical learning. They claim that most undergraduate and professional development programs teach these components separately. Among the results of the study is that the participants had lower TK than PK and CK. Alsofyani et al. (2012) carried out a study that used Short Blended Online Training to develop TPACK skills to facilitate faculty members' use of e-learning. The training consisted of mixed pedagogies (presentation, demonstration, practice, and feedback) and technologies (learning management system). The training's evaluation with the Technology Acceptance Model shows its high acceptance. Similarly, Qasem and Viswanathappa (2016) present a blended ICT knowledge training to improve teachers' teaching competencies based on the TPACK model. The findings reveal that the teachers' ICT knowledge was above average, and the blended training proved its effectiveness in developing the teachers' knowledge of integrating technology into teaching. Similarly, Ersoy et al. (2016) aided pre-service teachers in focusing on the TPACK model for 11 weeks. They assert that the pre-service teachers' TPACK competencies increased and reached a satisfactory level, as did their ICT usage. Maeng et al. (2013) describe a study that investigated pre-service secondary science teachers' technology-enhanced inquiry instruction and their developing TPACK. Non-experimental and experimental inquiry experiences were introduced to the pre-service teachers along with general guidelines for integrating technology to support their science teaching content. The results of this investigation indicate that the pre-service teachers appropriately integrated technologies into their courses' content and context. Their selective and appropriate use of technology further evidenced their development of good TPACK competencies.

In Saudi Arabia, teaching internships are usually conducted in a traditional face-to-face manner. Because of the COVİD-19 pandemic, however, the country's teaching internships were implemented online for the first time, as detailed in the following section. Although online teaching internships may provide pre-service teachers innovative ways of teaching and learning using technology, this mode of delivery may also lack a number of practical teaching experiences that are available only from a traditional classroom, such as face-to-face social interaction with students, classroom management skills, and managing inappropriate student behaviors. This is what drew the researchers' attention to the importance of studying this case. Accordingly, this study explores how online teaching internships affect Saudi pre-service teachers' TPACK competencies comparing to the traditional face-to-face teaching internship strategy.

The Coronavirus (COVİD-19) Pandemic and Teaching Internships

The COVİD-19 pandemic appeared and spread extremely quickly in mid-January 2020, invading all sectors of several countries, including the Kingdom of Saudi Arabia. Due to the rapid and dangerous spread of this disease, the Saudi government was one of the first to take precautionary actions to confront and try to eliminate it (The Saudi Ministry of Education, 2020). One of the vital sectors that was negatively affected was education. One precaution the Saudi government implemented was to suspend in-person school and university attendance indefinitely until the pandemic ended; this required a complete and immediate shift to distance learning. Education in public K–12 schools transferred to countrywide learning management systems, such as the iEN National Education Portal, Future Gate, and later Madrasati. This sudden complete change was considered a huge and unexpected challenge for everyone, including teachers, students, administrators, and even parents, who were not familiar with distance learning.

Pre-service teacher preparation programs in colleges of education give broad attention to theoretical and practical teaching training. The extent to which a pre-service teacher is able to teach and employ educational technology properly is one of the major goals of these programs. The last semester (eighth level) of the program is devoted to field training in schools, or what are called teaching internships.

Teaching internships are one of the most important core courses that grant pre-service teachers experience as real teachers with real students in a real learning context (Nurhidayat & Fakhruddin, 2020). They can apply the theoretical knowledge and practical skills they learned during their years of preparation in educational contexts, design and plan daily lessons, and use various teaching strategies and methods. They can also experience different evaluation methods and classroom management skills, as well as address students' problems in a real learning context. Consequently, the teaching internship stage translates the theoretical knowledge and practical skills pre-service teachers learn. Furthermore, it plays an important and influential role in forming positive attitudes toward teaching and the teaching profession, and the acquisition of ethical values and principles related to teaching.

Considering the COVİD-19 pandemic, Saudi schools and universities were closed and pre-service teachers could not complete their internship experiences face-to-face as usual. Their supervisors could not monitor or evaluate them face-to-face either and had to find alternative evaluation tools to do so. Electronic evaluation methods were the subsequent choice. For instance, pre-service teachers could film themselves teaching at home, apply microteaching skills with peers during synchronous lectures in virtual classrooms, and share e-portfolios containing their theoretical daily lesson plans.

Many studies were also conducted during the pandemic to explore its consequences on teaching, learning, and internships. Kristiyani (2020), for example, explores the challenges brought on by the shift from face-to-face to online classes for pre-service teachers during their teaching internships in the pandemic. The study survey shows that the pre-service teachers had problems related to questioning, reinforcement, and classroom management skills. Kristiyani (2020) also adds that using technology and feedback from both lecturers and classmates facilitated the students' teaching internships, as well as prepared them for blended learning. Samu (2020) confirms that without the opportunity for practical teaching in a real context, teachers may find themselves unprepared for real teaching in classrooms. The study of Kartimi et al. (2021) on teachers' TPACK skills and attitude of online distance learning during the COVID-19 outbreak found that the teachers had to adapt their way of teaching and assessment by using various technology platforms for online distance learning. They also confirmed that training in the use of various technologies, and enhancement of the teachers' TPACK skills are still needed to provide better online distance learning. Ping et al. (2020) report that, during the pandemic, teachers tried to actively explore effective online teaching methods and various technologies such as livestreaming their classes, playing recorded course videos and organizing discussions using instant messaging apps and conference system online. This experience enabled them to better and more proper employment of technology and refined their online teaching skills. Meanwhile, Theelen et al. (2020) implemented two virtual internship models that consisted of video fragments of experienced teachers in a stressful real classroom context (e.g., disruptive students, lesson start). The findings of this experiment reveal that virtual internships may lower pre-service teachers' anxiety by familiarizing them with the teaching context without a real-life internship. However, the pre-service teachers who participated in this study report that the virtual internships did not add value for them. The study concludes that virtual internships could nevertheless be a valuable addition to pre-service teacher preparation programs.

A similar situation arose at King Faisal University, where more than 100 pre-service teachers who enrolled in the teaching internship course were not completely or properly evaluated while teaching in a real classroom with real students before the university's closure. During the university closure period, these pre-service teachers were not allowed to access the official online platforms to teach real students. As a result, their supervisors had to use social media–based tools, including Zoom, WhatsApp, and Skype, and learning management systems, such as Blackboard, Acadox, and Edmodo, to judge their students' knowledge and skills. From here arose this study's problem: are these pre-service teachers, who practiced their teaching knowledge and skills electronically away from real students and the traditional teaching context, well prepared according to the TPACK compared to pre-service teachers who did practice teaching in a traditional real (face-to-face) setting?

Research questions and hypotheses

The current study aims to compare the traditional and electronic teaching internship strategies as they develop pre-service teachers' TPACK competencies at the Faculty of Education, King Faisal University. The main guiding question of this study is:

How effective are teaching internship strategies (traditional versus electronic) in developing the TPACK competencies of pre-service teachers at the Faculty of Education, King Faisal University?

To answer this question, the following hypotheses are examined:

1. There are no statistically significant differences at the 0.05 level among the average TK scores per each teaching internship strategy (traditional and electronic).
2. There are no statistically significant differences at the 0.05 level among the average CK scores per each teaching internship strategy (traditional and electronic).
3. There are no statistically significant differences at the 0.05 level among the average PK scores per each teaching internship strategy (traditional and electronic).
4. There are no statistically significant differences at the 0.05 level among the average PCK scores per each teaching internship strategy (traditional and electronic).
5. There are no statistically significant differences at the 0.05 level among the average TCK scores per each teaching internship strategy (traditional and electronic).
6. There are no statistically significant differences at the 0.05 level among the average TPK scores per each teaching internship strategy (traditional and electronic).

7. There are no statistically significant differences at the 0.05 level among the average TPACK scores per each teaching internship strategy (traditional and electronic).

METHOD

This research follows the causal comparative approach as the most appropriate for finding the more effective teaching internship strategy (traditional or electronic) to develop pre-service teachers' TPACK competencies at the Faculty of Education, King Faisal University in Saudi Arabia. This approach was selected because it endeavors to explore the rationale for general and specific differences between the independent and dependent variables of pre-existing groups (Flechier, 2019).

Participants

The study involved 120 students randomly recruited from the College of Education at King Faisal University who enrolled in the teaching internship course. They were divided into two groups of 60 students each: electronic (students who applied to the online teaching internship during the COVİD-19 pandemic) and traditional (students who applied to the traditional face-to-face teaching internship). The traditional and electronic groups enrolled in the course in the second semester of the academic years 2018/2019 and 2019/2020, respectively.

Instruments

The study employed Schmidt et al.'s (2009) TPACK survey to measure the pre-service teachers' TK, PK, and CK. The original instrument consists of 46 items divided into 7 dimensions: TK, CK, PK, PCK, TCK, TPK, and TPACK, containing 6, 12, 7, 4, 4, 9, and 4 items, respectively. The survey measures each item on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

For the purpose of the study, some amendments were made to the original survey. For example, the dimensions CK, PCK, TCK, and TPACK each had similar items according to specific student majors, including mathematics, social studies, science, and literacy. The current study's survey rephrased and generalized these dimensions' items to suit any major. Therefore, the total survey items decreased to 28 (Appendix 1). The 5-point Likert scale was also amended to a 4-point Likert scale (strongly agree = 4; agree = 3; disagree = 2; strongly disagree = 1), as the original survey option neither agree or disagree does not reflect a definite response from the participants. This change enabled the participants to precisely indicate how knowledgeable they believe they are to facilitate ICT integration in the field with real students, as determined by each survey item.

The instrument's validity was assessed by a total of 10 experts from the fields of curricula, teaching methods, and educational technology. The experts suggested further rephrasing some items; these modifications were made, and the instrument then reached its final form.

Schmidt et al.'s (2009) TPACK survey indicates each dimension's reliability scores, as listed in Table 1.

Table 1
TPACK reliability scores by Schmidt et al. (2009)

TPACK Dimension	Internal Consistency (alpha)
TK	0.86
CK Social studies	0.82
CK Mathematics	0.83
CK Science	0.78
CK Literacy	0.83
PK	0.87
PCK	0.87
TPK	0.93
TCK	0.86
TPACK	0.89

To calculate the reliability of the current study instrument, the TPACK survey was administered to a pilot sample of 20 randomly selected students from the College of Education who were not involved in the main experiment. The pilot sample had already undergone their teaching internship. The scale's reliability was calculated via test-retest reliability. Pearson's coefficient indicated that the full scale was nearly 85% reliable.

Data Collection

The data was collected from the participants of both groups through the following:

- A broadcast message was sent to graduating students (electronic) and graduated students (traditional) via WhatsApp that explained the aim of the study and the TPACK survey. The students were asked to share the message with their colleagues to recruit the largest possible number of participants.
- The TPACK survey was created on Google Forms and then shared with the participants.
- The survey form was made available to the participants over 4 weeks during the summer vacation of the academic year 2019/2020.
- The data from the survey was processed and statistically analyzed to test the hypotheses using independent t-tests to measure the differences between the average scores of the traditional versus electronic groups.

The next section outlines the statistical data analysis and the findings' interpretations.

FINDINGS AND DISCUSSION

Hypothesis one

An independent samples t-test found the significance of the two research groups' (traditional versus electronic teaching internship strategy) differences in developing TK skills. Table 2 shows the average scores and standard deviations of the electronic teaching internship strategy (M = 19.83, SD = 2.423, N = 60) and the traditional teaching internship strategy (M= 18.42, SD = 2.999, N= 60).

Table 2
Independent samples t-test on the research groups' TK skills

Group	N	Mean	SD	df	T	sig.
Electronic strategy	60	19.83	2.423	118	2.846	0.005
Traditional strategy	60	18.42	2.999			

The results of the t-test analysis show that there are statistically significant differences at the 0.05 level between the average scores of the two research groups in favor of the electronic strategy. The TK scale scored $t = 2.846$ and $p < 0.05$. Thus, the first hypothesis was rejected.

The electronic group had to use technology intensively during their online internship, as it was the only way to practice their teaching skills and competencies during the pandemic. This led to greater TK skills than the traditional group, whose internships were not based on technology use. This finding is supported by Qasem and Viswanathappa (2016), Ersoy et al. (2016), and Maeng et al. (2013), who confirm that training through extensive technology applications can enable pre-service teachers to use technology appropriately depending on the context and content.

Hypothesis two

Table 3 shows the results of the independent samples t-test for CK skills, including the average scores and standard deviations of the electronic teaching internship strategy (M = 9.67, SD = 1.422, N = 60) and the traditional teaching internship strategy (M= 9.88, SD = 1.574, N= 60).

Table 3
Independent samples t-test on the groups' CK skills

Group	N	Mean	SD	df	T	sig.
Electronic strategy	60	9.67	1.422	118	0.791	0.430
Traditional strategy	60	9.88	1.574			

Unlike the TK dimension, the CK t-test did not determine any statistically significant differences at the 0.05 level between the research groups' average scores. The CK scale scored $t = 0.791$ and $p > 0.05$. Thus, the second hypothesis was accepted.

This result was expected, as the scientific content of each major was taught in the same way through the same courses and standards, which aimed for the same learning outcomes for both research groups. This is meant to prepare the pre-service teachers to be proficient in scientific content in their field of specialization. This result agrees with the argument of Santos and Castro (2021) who confirmed the importance of mastering pre-service teachers of the CK of their specialization to be able to organize and use it more effectively for their students to understand.

Hypothesis Three

Table 4 presents the findings from the PK skills independent samples t-test, including the average scores and standard deviations of the electronic teaching internship strategy

(M = 21.75, SD = 2.832, N = 60) and the traditional teaching internship strategy (M= 23.53, SD = 2.920, N= 60).

Table 4
Independent samples t-test on the groups' PK skills

Group	N	Mean	SD	Df	T	sig.
Electronic strategy	60	21.75	2.832	118	3.396	0.001
Traditional strategy	60	23.53	2.920			

Table 4 shows that there are statistically significant differences at the 0.05 level between the two research groups' average PK scores in favor of the traditional strategy group. The PK scale scored $t = 3.396$ and $p < 0.05$. Thus, the third hypothesis was rejected.

This result was not surprising either because the electronic group did not apply all teaching methods in a real context, despite the fact that they applied some of them during micro-teaching. This was ultimately not as effective as intended. This finding agrees with Kristiyani (2020), Samu (2020), and Theelen et al. (2020), who report that electronic training brings a major challenge to pre-service teachers and their educators. Relying on micro-teaching cannot replace real face-to-face training, but it can be used to reduce pre-service teachers' anxiety and as an additional prelude before immersing students in realistic training.

Hypothesis Four

For the PCK dimension, as illustrated in Table 5, the findings from the independent samples t-test identified the average scores and standard deviations of the electronic teaching internship strategy (M = 2.62, SD = 0.885, N = 60) and the traditional teaching internship strategy (M= 3.35, SD = 0.577, N= 60).

Table 5
Independent samples t-test on the groups' PCK skills

Group	N	Mean	SD	df	T	sig.
Electronic strategy	60	2.62	0.885	118	5.377	0.000
Traditional strategy	60	3.35	0.577			

Table 5 indicates that there are statistically significant differences at the 0.05 level between the two research groups' average PCK scores in favor of the traditional group. The PCK scale scored $t = 5.377$ and $p < 0.05$. Thus, the fourth hypothesis was also rejected.

The result is agreed with the studies of Kristiyani (2020), Samu (2020), and Theelen et al. (2020). These studies asserted the importance of providing traditional teaching internships to adequately train pre-service teachers on employ the proper pedagogical content knowledge deeper and more focused during the real teaching context.

This result may be attributed to how the traditional group practiced teaching realistically and employed different teaching methods more suited to the content in a real classroom, unlike the electronic group that did not have the opportunity to teach real students, even distantly, as they were not allowed to enter the Madrasati platform for actual practice.

Indeed, real teaching practice was replaced by other methods, such as micro-teaching, assignments, and lesson preparation, but these did not yield equal results.

Hypothesis Five

For the TCK dimension, as presented in Table 6, the results from the independent samples t-test indicated the average scores and standard deviations of the electronic teaching internship strategy (M = 3.45, SD = 0.769, N = 60) and the traditional teaching internship strategy (M= 2.85, SD = 0.840, N= 60).

Table 6
Independent samples t-test on the groups' TCK skills

Group	N	Mean	SD	df	T	sig.
Electronic strategy	60	3.45	0.769	118	4.082	0.000
Traditional strategy	60	2.85	0.840			

Table 6 shows statistically significant differences at the 0.05 level between the two research groups' average TCK scores in favor of the electronic strategy group. The TCK scale scored t = 4.082 and $p < 0.05$. Thus, the fifth hypothesis was rejected.

Kartimi et al. (2021) and Ping et al. (2020) findings support this result as they indicated that during the pandemic teachers needed to employ various technologies for online teaching and assessment such as platforms, livestreaming their classes, playing recorded course videos and organizing discussions using instant messaging apps and conference system online. This was a good enabler to enhance their technological skills.

The same situation was true for the electronic group mainly relying on various technological methods to process and present content through micro-teaching, assignments, and lesson plans as an alternative to traditional face-to-face teaching. This differs from the traditional group, which saw limited technology use to support classroom content.

Hypothesis Six

Table 7 presents the results of the independent samples t-test for the TPK dimension, including the average scores and standard deviations of the electronic teaching internship strategy (M = 29.92, SD = 3.993, N = 60) and the traditional teaching internship strategy (M= 26.27, SD = 5.608, N= 60).

Table 7
Independent samples t-test on the groups' TPK skills

Group	N	Mean	SD	df	T	sig.
Electronic strategy	60	29.92	3.993	118	4.107	0.000
Traditional strategy	60	26.27	5.608			

Table 7 indicates statistically significant differences at the 0.05 level between the two research groups' average TPK scores, favoring the electronic group. The TPK scale scored t = 4.107 and $p < 0.05$. Thus, the sixth hypothesis was rejected.

In the teacher preparation program, the educational technology courses taught to the pre-service teachers from different disciplines are few and completely separate from the teaching method courses. The electronic group was forced to use technology more practically and apply teaching strategies that depend on technological methods due to the nature of online education during the COVİD-19 pandemic. This is what helped develop their pedagogical technological skills. This result is in agreement with Al Mulhim (2013), Al Mulhem (2013), Ertmer and Ottenbreit-Leftwich (2010), and Stover and Veres (2013). These studies all discuss the importance of blended training that does not separate technological and educational knowledge in teacher preparation programs. This type of training has proven effective in developing teachers' knowledge of integrating technology as well as pedagogy.

Hypothesis Seven

Table 8 illustrates the results of the independent samples t-test for the TPACK dimension, noting the average scores and standard deviations of the electronic teaching internship strategy (M = 2.85, SD = 0.936, N = 60) and the traditional teaching internship strategy (M= 3.45, SD = 0.502, N= 60).

Table 8
Independent samples t-test on the groups' TPACK skills

Group	N	Mean	SD	df	T	sig.
Electronic strategy	60	2.85	0.936	118	4.378	0.000
Traditional strategy	60	3.45	0.502			

Table 8 confirms that there are statistically significant differences at the 0.05 level between the two research groups' average TPACK scores in favor of the traditional group. The TPACK scale scored $t = 4.378$ and $p < 0.05$. Thus, the seventh hypothesis was rejected as well.

The results favored the traditional group that taught face-to-face in the actual field. This internship strategy provided the pre-service teachers many of the basic skills and competencies necessary to prepare them for formal teaching, such as managing students, their problems, and the classroom. Kristiyani (2020), Samu (2020), and Theelen et al. (2020) argue that failure to provide a real, face-to-face internship may render pre-service teachers unprepared for real classroom instruction. Moreover, these studies reveal that virtual internships do not add any value to pre-service teachers, who subsequently continue to have problems with questioning, reinforcement, and classroom management skills. Still, based on these studies, a virtual internship can be used as a form of peer-to-peer training or to provide a set of positive models to reduce pre-service teachers' anxiety.

These results contradict those of studies that support electronic training's ability to increase TPACK skills (Alsofyani et al., 2012; Ersoy et al., 2016; Maeng et al., 2013; Qasem and Viswanathappa, 2016). This may be explained by the electronic group not actually teaching online to real students through the Madrasati platform. However, this result may be reversed in favor of the electronic group if the pre-service teachers are properly trained to teach online.

LIMITATIONS

The study has certain limitations. The study compared between the effect of a new electronic teaching internship strategy (who studied during the COVID-19 pandemic) and the traditional face-to-face teaching internship strategy on the pre-service teachers' Technological Pedagogical Content Knowledge (TPACK) skills only. The sample was limited to pre-service teachers who enrolled in Teaching Internship course at the College of Education at King Faisal University, Saudi Arabia. The traditional and electronic groups enrolled in the course in the second semester of the academic years 2018/2019 and 2019/2020, respectively. There is a possibility that if one or more of these conditions changed, the findings may be different. Therefore, generalizing the findings from this study should be done with care.

CONCLUSION

The COVİD-19 pandemic brought about new changes and challenges to all aspects of society, especially education. Although online learning tools were available before the pandemic, they were too rarely employed. However, the pandemic forced teachers to teach online, providing them valuable opportunities to practice integrating technology into their classroom teaching. This in turn affected their TPACK competencies.

Given the difference in teaching internship strategies before and during the pandemic, the current study aimed to compare traditional and electronic teaching internship strategies as they develop pre-service teachers' TPACK competencies at the Faculty of Education, King Faisal University.

The study concludes that the traditional strategy is generally better than the electronic strategy per the TPACK model. This highlights the weaknesses of teacher preparation programs, as they ignore the importance of blending teachers' technological and professional competencies. Additionally, the study findings emphasize the significance of developing teachers' online teaching skills so they are able to either shift to online learning any time or activate blended learning. Indeed, employing e-learning is not limited only to times of crisis or pandemics.

This study defends the importance of developing teachers' preparation programs by blending educational technology courses and curriculum and teaching methods courses. Furthermore, educational technology courses should pay more attention to the practical aspects of integrating technology into teaching and learning. This research could be a basis for policy makers in education sector in giving priority to allocate budget for training opportunities to both pre-service teachers and in-service teachers to acquire TPACK skills of distance learning. Teachers' preparation programs is recommended to adopt a blended teaching internship and should find chances and challenges for pre-service teachers to develop their TPACK skills into their lesson plans to be able to meaningfully integrate technology, pedagogy, and content into their teaching in the future.

ACKNOWLEDGEMENT

This work was supported by the Deanship of Scientific Research, Vice Presidency for Graduate Studies and Scientific Research, King Faisal University, Saudi Arabia [Project No. 210].

REFERENCES

Al Mulhem, A. (2013). *Developing an e-learning training package for academic staff in one university in Saudi Arabia* [Doctoral dissertation, University of Plymouth]. https://pearl.plymouth.ac.uk/bitstream/handle/10026.1/3081/2013almulhem10316037phd.pdf?sequence=1

Al Mulhim, E. (2013). *Designing, piloting and evaluating an ICT training programme for novice female primary teachers in Saudi Arabia* [Doctoral dissertation, University of Plymouth]. https://core.ac.uk/download/pdf/29819086.pdf

Alsofyani, M. M., Aris, B. B., Eynon, R., & Majid, N. A. (2012). A preliminary evaluation of short blended online training workshop for TPACK development using technology acceptance model. *Turkish Online Journal of Educational Technology*, *11*(3), 20-32. https://files.eric.ed.gov/fulltext/EJ989196.pdf

Anderson, A., Barham, N., & Northcote, M. (2013). Using the TPACK framework to unite disciplines in online learning. *Australasian Journal of Educational Technology*, *29*(4), 548-565. https://doi.org/10.14742/ajet.24

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

Archambault, L. M., & Barnett, J. H. (2010). Revisiting technological pedagogical content knowledge: Exploring the TPACK framework. *Computers & Education*, *55*(4), 1656-1662. https://doi.org/10.1016/j.compedu.2010.07.009

Bahri, A., Idris, I. S., Muis, H., Arifuddin, M., Fikri, M., & Nidhal, J. (2021). Blended Learning Integrated with Innovative Learning Strategy to Improve Self-Regulated Learning. *International Journal of Instruction*, *14*(1), 779-794. https://doi.org/10.29333/iji.2021.14147a

Baran, E., Chuang, H. H., & Thompson, A. (2011). TPACK: An emerging research and development tool for teacher educators. *Turkish Online Journal of Educational Technology*, *10*(4), 370-377. https://files.eric.ed.gov/fulltext/EJ946646.pdf

Brinkley-Etzkorn, K. E. (2018). Learning to teach online: Measuring the influence of faculty development training on teaching effectiveness through a TPACK lens. *The Internet and Higher Education*, *38*, 28-35. https://doi.org/10.1016/j.iheduc.2018.04.004

Drajati, N. A., Rakerda, H., Sulistyawati, H., & Nurkamto, J. (2021). Investigating the adoption of TPACK-21CL by English pre-service teachers in a COVID-19 teaching practicum. *Indonesian Journal of Applied Linguistics*, *11*(1), 124-133. https://doi.org/10.17509/ijal.v11i1.34625

Ersoy, M., Yurdakul, I. K., & Ceylan, B. (2016). Investigating preservice teachers' TPACK competencies through the lenses of ICT skills: An experimental study. *Education & Science/Egitim ve Bilim, 41*(186), 119-135. https://doi.org/10.15390/eb.2016.6345

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education*, *42*(3), 255-284. https://doi.org/10.1080/15391523.2010.10782551

Flechier, R. (2019). *The effect of computer-based instruction on students' SAT math scores: A causal-comparative study* [Doctoral dissertation, University of Phoenix]. https://search.proquest.com/dissertations-theses/effect-computer-based-instruction-on-students-sat/docview/2322787260/se-2?accountid=27804

Jwaifell, M., Abu-Omar, R., & Al-Tarawneh, M. (2018). The Readiness of Arabic Language Teachers for Integrating Flipped Classroom: Case of Ma'an. *International Journal of Instruction, 11*(4), 855-868. https://doi.org/10.12973/iji.2018.11454a

Kartimi, K., Gloria, R. Y., & Anugrah, I. R. (2021). Chemistry Online Distance Learning during the Covid-19 Outbreak: Do TPACK and Teachers' Attitude Matter?. *Jurnal Pendidikan IPA Indonesia*, *10*(2), 228-240. https://doi.org/10.15294/jpii.v10i2.28468

Kay, R. H. (2006). Evaluating strategies used to incorporate technology into preservice education: A review of the literature. *Journal of research on technology in education, 38*(4), 383-408. https://doi.org/10.1080/15391523.2006.10782466

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*, *9*(1), 60-70. https://www.learntechlib.org/primary/p/29544/

Koehler, M. J., Mishra, P., & Yahya, K. (2007). Tracing the development of teacher knowledge in a design seminar: Integrating content, pedagogy, & technology. *Computers and Education*, *49*(3), 740-762. https://doi.org/10.1016/j.compedu.2005.11.012

Kramarski, B., & Michalsky, T. (2010). Preparing preservice teachers for self-regulated learning in the context of technological pedagogical content knowledge. *Learning and Instruction, 20*(5), 434-447. https://doi.org/10.1016/j.learninstruc.2009.05.003

Kristiyani, C. (2020, October). *Online teaching practice activities for preparing the student teachers to the new learning contexts*. Language and Language Teaching Conference 2020. http://e-conf.usd.ac.id/index.php/lltc/lltc2020/paper/view/556

Luckay, M. (2017). *Developing and validating a new reliable instrument for assessing open distance learning educator's learning management system-TPACK* [Master dissertation, University of the Witwatersrand]. https://core.ac.uk/download/pdf/188769193.pdf

Maeng, J. L., Mulvey, B. K., Smetana, L. K., & Bell, R. L. (2013). Preservice teachers' TPACK: Using technology to support inquiry instruction. *Journal of Science Education and Technology*, *22*(6), 838-857. https://doi.org/10.1007/s10956-013-9434-z

Malik, S., Rohendi, D., & Widiaty, I. (2019). Technological pedagogical content knowledge (TPACK) with information and communication technology (ICT) integration: A literature review. *Proceeding of the 5th UPI International Conference on Technical and Vocational Education and Training (ICTVET 2018), Indonesia, 299,* 498-503. https://doi.org/10.2991/ictvet-18.2019.114

Messina, L., & Tabone, S. (2013). Technology proficiency, TPACK and beliefs about technology: A survey with primary school student teachers. *Research Education Media*, *5*(1), 11-29. https://lirias.kuleuven.be/retrieve/234353/#page=11

Mishra, P., & Koehler, M. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, *108*(6), 1017-1054. https://www.learntechlib.org/p/99246/

Mishra, P., & Koehler, M. J. (2008, March 24-28). *Introducing technological pedagogical content knowledge*. Annual Meeting of the American Educational Research. http://www.matt-koehler.com/publications/Mishra_Koehler_AERA_2008.pdf

Mishra, P., Koehler, M. J., & Henriksen, D. (2011). The seven trans-disciplinary habits of mind: Extending the TPACK framework towards 21st century learning. *Educational Technology*, *11*(2), 22-28. https://www.jstor.org/stable/44429913

Nurhidayat, E., & Fakhruddin, A. (2020). Pre-service English teachers' interpersonal identity in teaching internship. *Journal of English Language Learning*, *4*(2), 1-10. http://www.jurnal.unma.ac.id/index.php/JELL/article/view/2407

Ping, Z., Fudong, L., & Zheng, S. (2020, June). Thinking and practice of online teaching under COVID-19 epidemic. In *2020 IEEE 2nd International Conference on Computer Science and Educational Informatization (CSEI)* (pp. 165-167). IEEE. https://doi.org/10.1109/csei50228.2020.9142533

Polly, D., Mims, C., Shepherd, C. E., & Inan, F. (2010). Evidence of impact: Transforming teacher education with preparing tomorrow's teachers to teach with technology (PT3) grants. *Teaching and Teacher Education*, *26*(4), 863-870. https://doi.org/10.1016/j.tate.2009.10.024

Qasem, A. A. A., & Viswanathappa, G. (2016). Blended learning approach to develop the teachers' TPACK. *Contemporary Educational Technology*, *7*(3), 264-276. https://doi.org/10.30935/cedtech/6176

Samu, B. (2020). *Teaching practice in pre-service language teacher education: Challenges of the transition from face-to-face to online lessons*. 10th International

Conference the Future of Education–Conference Proceedings. https://conference.pixel-online.net/FOE/files/foe/ed0010/FP/6251-TPD4730-FP-FOE10.pdf

Santos, J. M., & Castro, R. D. (2021). Technological Pedagogical content knowledge (TPACK) in action: Application of learning in the classroom by pre-service teachers (PST). *Social Sciences & Humanities Open*, *3*(1), 100110. https://doi.org/10.1016/j.ssaho.2021.100110

Schmidt, D. A., Baran, E., Thompson, A. D., Koehler, M. J., Mishra, P., & Shin, T. (2009). *Survey of preservice teachers' knowledge of teaching and technology*. CEHD. https://news.cehd.umn.edu/wp-content/uploads/2009/06/TPCK_survey.pdf

Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, *15*(2), 4-14. https://doi.org/10.3102/0013189x015002004

Stover, S., & Veres, M. (2013). TPACK in higher education: Using the TPACK framework for professional development. *Global Education Journal*, *2013*(1), 93-111. http://web.b.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=1&sid=e81f537f-e8a5-423f-8bdb-3d8796d7c325%40pdc-v-sessmgr01

The Saudi Ministry of Education, (2020). *The Saudi MOE leading efforts to combat coronavirus pandemic COVİD-19*. https://iite.unesco.org/wp-content/uploads/2020/10/The-Saudi-MOE-Leading-Efforts-to-Combat-Coronavirus-Pandemic-COVİD-19.pdf

Theelen, H., Willems, M. C., Van den Beemt, A., Conijn, R., & den Brok, P. (2020). Virtual internships in blended environments to prepare preservice teachers for the professional teaching context. *British Journal of Educational Technology*, *51*(1), 194-210. https://doi.org/10.1111/bjet.12760

Tondeur, J., Scherer, R., Siddiq, F. & Baran, E. (2020). Enhancing pre-service teachers' technological pedagogical content knowledge (TPACK): a mixed-method study. *Education Technology Research and Development*, *68*, 319–343. https://doi.org/10.1007/s11423-019-09692-1

Tondeur, J., Van Braak, J., Sang, G., Voogt, J., Fisser, P., & Ottenbreit-Leftwich, A. (2012). Preparing pre-service teachers to integrate technology in education: A synthesis of qualitative evidence. *Computers & Education*, *59*(1), 134-144. https://doi.org/10.1016/j.compedu.2011.10.009

Valtonen, T., Sointu, W., Kukkonen, J., Kontkanen, S., Lambert, M., & Mäkitalo-Siegl, K. (2017). TPACK updated to measure pre-service teachers' twenty-first century skills. *Australasian Journal of Educational Technology*, *33*(3), 15-31. https://doi.org/10.14742/ajet.3518

Wang, W., Schmidt-Crawford, D., & Jin, Y. (2018). Preservice teachers' TPACK development: A review of literature. *Journal of Digital Learning in Teacher Education*, *34*(4), 234-258, https://doi.org/10.1080/21532974.2018.1498039

APPENDIX 1

The amended TPACK survey used in this study:

No	Item	Strongly agree	Agree	Disagree	Strongly disagree
TK (Technology Knowledge)					
1	I know how to solve my own technical problems.				
2	I can learn technology easily.				
3	I keep up with important new technologies.				
4	I feel comfortable when using technology.				
5	I know about a lot of different technologies.				
6	I have the technical skills I need to use technology.				
CK (Content Knowledge)					
7	I have sufficient knowledge about my specialization.				
8	I can use a suitable way of thinking for my specialization.				
9	I have various ways and strategies of developing my understanding of my specialization.				
PK (Pedagogical Knowledge)					
10	I know how to assess student performance in a classroom.				
11	I can adapt my teaching based-upon what students currently understand or do not understand.				
12	I can adapt my teaching style to different learners.				
13	I can assess student learning in multiple ways.				
14	I can use a wide range of teaching approaches in a classroom setting.				
15	I am familiar with common student understandings and misconceptions.				
16	I know how to organize and maintain classroom management.				
PCK (Pedagogical Content Knowledge)					
17	I can select effective teaching approaches to guide student thinking and learning in my specialization.				
TCK (Technological Content Knowledge)					
18	I know about technologies that I can use for understanding and doing my specialization.				
TPK (Technological Pedagogical Knowledge)					
19	I can choose technologies that enhance the teaching approaches for a lesson.				
20	I can choose technologies that enhance				

No	Item	Strongly agree	Agree	Disagree	Strongly disagree
	students' learning for a lesson.				
21	My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom.				
22	I am thinking critically about how to use technology in my classroom.				
23	I can adapt the use of the technologies that I am learning about to different teaching activities.				
24	I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn.				
25	I can use strategies that combine content, technologies and teaching approaches that I learned about in my coursework in my classroom.				
26	I can provide leadership in helping others to coordinate the use of content, technologies and teaching approaches at my school and/or district.				
27	I can choose technologies that enhance the content for a lesson.				
TPACK (Technology Pedagogy and Content Knowledge)					
28	I can teach lessons that appropriately combine content, technologies and teaching approaches.				