Assessing Teacher Readiness for Online Teaching in Cambodian Higher Education

[1*] Borey Be

[1] *College of Education, University of Cambodia, Phnom Penh, Cambodia*

*Corresponding Author: boreybe@gmail.com

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Abstract

The study examines Cambodian higher education teachers' readiness for online teaching using a structural equation modeling (SEM) approach. The framework centers around three key dimensions: teachers' self-efficacy in technological, pedagogical, and content knowledge (TPACK), their perceived online teaching presence, and the institutional support they receive. A quantitative survey was administered to 140 teachers at the university level. Teachers' online teaching experience positively influenced their TPACK self-efficacy. Online teaching experience also had a significant positive impact on teachers' perceived online teaching presences. Furthermore, teachers' perceptions of institutional support were positively associated with their online teaching experience. These results highlight the critical role of teachers' online teaching experience in shaping their readiness for online teaching and learning (OTL). The findings suggest that targeted professional development programs and institutional support mechanisms can effectively enhance teachers' self-efficacy, online teaching presence, and perceptions of institutional support in Cambodian higher education.

Keywords: Online teaching, TPACK, institutional support, higher education, Cambodia

Introduction

The TPACK framework has strongly influenced research and practice in teacher education and professional development and inspired extensive research and scholarship. Since 2009, there have been over 1200 journal articles and book chapters, over 315 dissertations, and 28 books with TPACK as the central construct (Zhang & Tang, 2021). Early in 2001, Pierson began to use the concept of TPCK. Pierson's TPCK referred to "Technology assisting PCK". Niess changed TPCK from a static concept to a dynamic one (Zhang & Tang, 2021). To effectively promote OTL readiness and competencies, professional development and teacher training programs need to be tailored to the teachers 'various needs and backgrounds.

Consequently, OTL research has been aimed at identifying the factors that may explain why or why not teachers consider themselves ready for OTL experience is one of these factors (Scherer et al., 2023). The COVID-19 pandemic prompted the adoption of new technologies, but traditional teaching methods still dominate. Quality and relevance, equitable access, institutional governance and management, strategic investment, and the alignment of higher education with national development are anticipated challenges (Sok & Bunry, 2023). Some concerns with online learning regarding the motivation of students, time management, and delay of feedback have been identified as potential limitations. However, these limitations could be addressed by having an instructor who is present and available through responses to students and timely feedback on assignments, which also fosters a sense of belongingness (Martin et al., 2019; Zhang et al., 2022). Instructors require plenty of opportunities for students to participate and to be engaged with each other, the material, the service-learning agency, and the instructors themselves (Branscum, 2024). The digitalization situation in Cambodia is contradictory, with limited skills for using the internet, smartphones, and social networks in rural areas. Access to the internet is still a challenge, but the government is working to solve this problem. Additionally, the research highlights the need for continuous support for both technical and pedagogical aspects of online instruction (Fabriz et al., 2021). Providing training and development for faculty members is key, as those who are open to change tend to have higher satisfaction with online and distance education (Chan et al., 2021).

More research is needed on the specific factors that influence teacher readiness, beyond just attitudes, technological competency, pedagogy, training, and time constraints. The existing frameworks are broad and require more nuanced studies (Baran et al., 2011; Scherer et al., 2021; Uerz et al., 2018). There is a lack of research comparing teacher readiness across different geographical locations and types of institutions. Most studies focus on a single context. Prior studies have identified significant gaps in technological infrastructure, digital literacy, and institutional support between urban and rural educational settings in developing nations (Adedoyin & Soykan, 2023; Almaiah et al., 2020; Chea et al., 2022; Hasyim et al., 2024). However, these works often isolate individual factors (e.g., technological access) rather than examining how institutional ecosystems mediate the relationship between teacher readiness in resource-constrained environments.

Technological Pedagogical Content Knowledge (TPACK)

Technological Pedagogical Content Knowledge (TPCK) was introduced to the educational research field as a theoretical framework for understanding teacher knowledge required for effective technology integration (Mishra & Koehler, 2006). TPACK is a theoretical lens for understanding teacher readiness for online teaching and learning. The framework is about designing and evaluating teacher knowledge for effective student learning in various content. Recent developments in digital technology and the COVID-19 pandemic have moved education online. This has made educators to upgrade their digital literacy and professional identity and

TPACK is a useful tool to improve teaching practices (Su, 2023). Zgheib et al. (2023) found that faculty readiness to teach online, female faculty are more prepared than male faculty in course design and attitude towards online learning. More years of teaching experience enhances pedagogy and course design. However, challenges such as unreliable internet and lack of advanced skills for interactive activities were noted. Technical skills had a big impact on faculty readiness, it is time to shift from traditional to innovative teaching methods in online education. Çam and Koç (2024) conducted a study on a professional development program to enhance teacher's TPACK. The program increased participants' self-confidence and ability to integrate technology into teaching. The study confirmed earlier research that TPACK-oriented training affects teachers to transfer their knowledge into practice. Moreover, Paetsch et al. (2023) found a positive relationship between pandemic-related experience, technology integration self-efficacy and support for ICT integration in post-pandemic teaching.

Teacher's Self-Efficacy

Teacher self-efficacy (TSE) is the teacher's beliefs in their ability to teach students and impact student learning outcomes (Gordon et al., 2023; Ramakrishnan & Salleh, 2019). It is a crucial factor affecting various teaching aspects, including instructional strategies, classroom management, and student engagement (Amin Mydin et al., 2022; Gordon et al., 2023). Researchers have developed several instruments to measure TSE, such as the Teacher Self-Efficacy Scale (TSES) and the Teacher's Sense of Efficacy Scale (TSES) (Corry & Stella, 2018; Gordon et al., 2023). These scales assess teachers' beliefs in their ability to perform specific teaching tasks and overall confidence in their teaching. Many studies have found that online teaching self-efficacy is related to years of teaching experience, grade level taught, and level of technological proficiency (Dolighan & Owen, 2021; Yang & Du, 2024). Teachers with higher self-efficacy are more confident in managing online learning environments and more likely to try out new teaching methods. Research indicates that educators frequently have difficulties in properly incorporating technology into their instructional methods, thus undermining their self-efficacy in online teaching (Corry & Stella, 2018; Dolighan & Owen, 2021). This challenge is especially evident for educators with less experience or training in online instruction.

Perceived Online Teaching Presence: Cognitive Activation and Feedback

The Community of Inquiry (CoI) framework, initially proposed by Garrison et al. (2000), has emerged as a foundational model for understanding online and blended learning environments. The research reviews the seminal work by Arbaugh et al. (2008) titled "Developing a Community of Inquiry Instrument: Testing a Measure of the Community of Inquiry Framework Using a Multi-Institutional Sample," which sought to operationalize and validate the CoI framework through a multi-institutional study.

The development of a Cognitive Activation (CA) emerged as a central construct of teaching quality, which identifies classroom management, student support, and cognitive activation as fundamental aspects of effective instruction (Kleickmann et al., 2020; Praetorius et al., 2018).

The framework, rooted in socio-constructivist principles, emphasizes the role of challenging tasks and discourse in fostering conceptual understanding (McLeod, 2025; VYGOTSKY, 1980). Empirical studies demonstrate that CA strategies, such as problem-solving reflection and collaborative learning, significantly enhance mathematics achievement across diverse student populations (Kleickmann et al., 2020). Hattie and Timperley's (2007) feedback model delineates four levels of feedback—task, process, self-regulation, and self—with the first three levels being most impactful for learning. Their framework posits that effective feedback reduces discrepancies between current and desired performance by addressing instructional clarity and cognitive engagement. Formative feedback, when timely and specific, improves self-regulation and reduces cognitive load, particularly in online learning environments (Garrison et al., 2000).

Institutional Support and Professional Development

Perceived Institutional Support (PIS), derived from organizational psychology, underscores the importance of institutional fairness, supervisor support, and resource allocation in fostering teacher readiness (Eisenberger et al., 1986; Kurtessis et al., 2017). In educational contexts, PIS aligns with the Academic Communities of Engagement (ACE) framework, which highlights the interplay between course-related support (e.g., instructor clarity) and external institutional structures (Garrison et al., 2000). Meta-analyses confirm that PIS correlates with higher job satisfaction, retention, and adaptive teaching practices (Kurtessis et al., 2017). Al-Samarraie et al. (2018) demonstrated that both instructors' and students' continuance satisfaction with e-learning is significantly shaped by institutional factors, including the quality of system infrastructure, information, and ongoing support services. Access to sufficient support and professional development opportunities is essential for improving teachers' preparedness for online instruction and learning. Continuous training, mentorship, and collaborative networks can enable educators to acquire the knowledge, skills, and confidence necessary to manage the intricacies of online education (Archambault & Crippen, 2009). Robust support and professional development are essential for facilitating teachers' smooth transition to online and blended education formats. Studies indicate that specialized training programs may markedly enhance educators' digital skills, self-assurance, and understanding of optimal online teaching techniques (Horvitz & Beach, 2011; Rafique, 2024). Studies have repeatedly shown that these programs may significantly enhance teacher self-efficacy, especially when customized to address the individual needs and concerns of the participating instructors (Baroudi & Shaya, 2022; Corry & Stella, 2018; Dolighan & Owen, 2021).

While the TPACK framework is well-established in Western contexts (Koehler et al., 2013), its application in Cambodia remains underexplored. Cambodian higher education faces systemic challenges. 78% of rural teachers lack reliable internet, and only 32% of universities offer formal online training (Sok & Bunry, 2023). This study addresses this gap by emphasizing low-resource adaptations. By contextualizing TPACK within Cambodia's digital divide, we

extend its theoretical relevance to under-resourced settings. Prior research often isolates individual competencies (e.g., Scherer et al., 2021), overlooking systemic barriers in developing nations.

The Purpose of the Study

This study draws from an integrated conceptual framework combining the Technological Pedagogical Content Knowledge (TPACK) model (Mishra & Koehler, 2006), the Community of Inquiry (Garrison et al., 2000), and institutional support theory (Baran & Correia, 2014). Online teaching experience is posited to enhance teacher readiness through three dimensions: (1) TPACK self-efficacy, (2) perceived online teaching presence (including clarity of instruction, cognitive activation, and feedback), and (3) perceived institutional support. The purpose of this study is to investigate the influence of online teaching experience on Cambodian higher education teachers' readiness for online teaching and learning (OTL), with a focus on the interplay among Technological Pedagogical Content Knowledge (TPACK) self-efficacy, perceived online teaching presence, and perceived institutional support. By employing a structural equation modeling (SEM) approach, the study aims to elucidate how online teaching experience shapes teachers' technological competencies, instructional practices, and perceptions of institutional backing within the unique context of Cambodia's digital divide. Specifically, the research addresses the following questions: (1) To what extent does online teaching experience enhance teachers' readiness for OTL across the dimensions of TPACK self-efficacy, perceived online teaching presence (including clarity of instruction, cognitive activation, and feedback), and perceived institutional support? (2) How do the relationships between online teaching experience and these readiness dimensions vary in strength and significance, reflecting their contributions to effective online instruction in a low-resource setting?

Methodology

Research Design

This study employs a quantitative cross-sectional design to investigate Cambodian higher education teachers' readiness for online teaching and learning (OTL), grounded in the Technological Pedagogical Content Knowledge framework (Mishra & Koehler, 2006) and the Community of Inquiry model (Garrison et al., 2000). Structural Equation Modeling (SEM) was selected to evaluate complex relationships between latent constructs (e.g., technological knowledge, instructional clarity) and observed indicators, aligning with methodologies used in prior studies of teacher readiness. The cross-sectional design, while effective for capturing a snapshot of teacher readiness, limits the ability to infer causal relationships between online teaching experience and readiness constructs. Although SEM models directional paths based on theoretical assumptions, the lack of longitudinal data precludes definitive conclusions about causality or changes over time. For instance, while online teaching experience significantly predicts TPACK self-efficacy, it is unclear whether this relationship reflects a

developmental process or pre-existing differences among participants. Future longitudinal studies are recommended to examine how readiness evolves with sustained online teaching exposure. Additionally, while the SEM model demonstrated excellent fit (CFI = 1.000, RMSEA = 0.000, SRMR = 0.038), the small sample size raises concerns about potential overfitting, particularly given the complexity of the model with latent constructs and multiple indicators. Robust fit indices and high factor loadings (> 0.80) suggest that overfitting was minimized, but caution is warranted in interpreting the results as broadly generalizable. Replication with larger samples and simpler model specifications could further validate the findings.

Participants

A stratified random sampling approach was used to recruit 140 instructors from diverse disciplines (sciences, humanities, social sciences, professional studies) across Cambodian higher education institutions. The selection criteria were meant to capture a wide range of views and experiences, thereby improving the reliability and generalizability of the findings. Participants ranged from novice to experienced educators (1–20+ years of teaching) to capture variability in online teaching exposure. Inclusion criteria required at least one semester of online teaching experience, ensuring relevance to the study's focus. Although the sample size of 140 meets the minimum threshold for SEM (typically n > 100 for models with fewer than 30 indicators), its small size remains a limitation in terms of generalizability. However, strong model fit indices (CFI = 1.000, RMSEA = 0.000) indicate that model estimates are robust. As suggested by Goretzko et al. (2021) and Shi et al. (2018), small samples may yield valid SEM results when the factor structure is strong and well-justified.

Data Collection Tools

The online survey form was utilized to collect the data, which stressed critical areas such as technical capabilities, pedagogical techniques for online teaching, institutional support mechanisms, and attitudes toward online education. The survey was sent through email and Telegram. The data-collecting period was extended from March to June 2024, while maintaining their identity and anonymity. This survey was particularly created to assess instructors' readiness for online teaching and learning in higher education institutions in Cambodia. The readiness for OTL measure contained three dimensions. First, the TPACK framework is adapted from Schmidt et al. (2009). The pedagogical and content-related dimensions are represented by TPK, TPCK, and TCK. Drawing from the measure, these dimensions were assessed as teachers' self-efficacy beliefs. Specifically, teachers were asked to indicate their agreement with ten statements about TPK (e.g., "I am confident in my ability to implement different methods of teaching online"; 4 items), TPCK (e.g., "I am confident in my ability to use technology to predict students' skills/understanding of a particular topic"; 4 items), and TCK (e.g., "I am confident in my ability to use various programs to deliver instruction"; 2 items) on a 5-point scale (0 = strongly disagree, 5 = I strongly agree).

Second, Perceived Online Teaching Presence (POTP), adapted from Arbaugh et al. (2008), captured the teachers' perceptions of the online presence with 3 categories: Instructional

clarity 4 items (e.g., "Overall, I can clearly communicate important course goals", feedback 2 items ("Overall, I provide feedback in a timely fashion", and cognitive activation 7 items ("Overall, I encourage course participants to explore new concepts in courses". Teachers responded to the items using a 5-point agreement scale (0 = strongly disagree, 5 = strongly agree). Third, perceived institutional support (PIS), adapted from Al-Samarraie et al. (2018), contained six items captured teachers' reports of the support they receive at their institution in general (e.g., "In our institution, there are clear objectives as regards online learning"; 6 items. This item set was based on a 5-point scale (0 =Strongly disagree, 5 =Strongly agree).

To ensure conceptual, linguistic, and cultural equivalence in Cambodian higher education contexts, the survey instruments underwent a rigorous cross-cultural adaptation process following established guidelines (Beaton et al., 2000). The adaptation began with a forward translation by the principal investigator, fluent in both English and Khmer, who translated the original English version of the scales into Khmer language. Key constructs were adapted to align with Cambodia's educational terminology. For example, "cognitive activation" was translated to reflect local pedagogical discourse, emphasizing the stimulation of understanding through critical thinking. Technical terms like "learning management systems" were contextualized as "technological tools" to ensure accessibility across urban and rural settings. Independent bilingual translator then back-translated the Khmer version into English. Adjustments were made, such as rephrasing "timely feedback" to emphasize pedagogical timing over speed. Final reliability testing demonstrated strong internal consistency (Cronbach's α = 0.89–0.93) for all-item questionnaires.

Reliability

The reliability and validity indices for the measurement model demonstrate robust psychometric properties (Table 1). Confirmatory Factor Analysis (CFA) confirmed construct validity, with all standardized factor loadings exceeding 0.80 ($\beta > 0.80$, $p < .001$). Internal consistency was excellent, with Cronbach's alpha (α = 0.88–0.97) and McDonald's omega (ω = 0.88–0.96) surpassing the conventional threshold of 0.70 (Nunnally, 1978). Convergent validity was established through Average Variance Extracted (AVE) values ranging from 0.82 to 0.89, exceeding Fornell and Larcker's (1981) minimum criterion of 0.50 and aligning with their recommendation that AVE ≥ 0.5 ensures adequate convergent validity.

Table 1. Reliability indices of the Readiness Constructs

Variable	α	Ordinal α	ω_1	ω_2	ω_3	AVE
TCK	0.904	0.916	0.861	0.861	0.861	0.852
TPK	0.952	0.964	0.938	0.938	0.940	0.874
TCPK	0.946	0.958	0.932	0.932	0.936	0.857
CoI	0.940	0.969	0.943	0.943	0.944	0.890
CA	0.967	0.979	0.964	0.964	0.974	0.879

Feedback	0.884	0.929	0.888	0.888	0.888	0.870
IS	0.945	0.963	0.948	0.948	0.957	0.822

Note: α = Cronbach alpha; ω_l = Omega; AVE = Average variance extracted

Data Analysis

The data were examined using SEM, using the Jamovi statistical program, which provides tools for model definition, estimation, and assessment. SEM was chosen for its capacity to handle complicated interactions between observable and latent variables, enabling a complete study of both measurement and structural models. A two-step approach (Anderson & Gerbing, 1988) was applied. First, Confirmatory Factor Analysis (CFA) evaluated factor loadings and model fit. Then, Structural Model is utilized to test the hypothesized relationships between OTL experience and readiness constructs.

Results

Descriptive Statistics

Table 2 indicates a generally positive self-assessment across various competencies and dimensions related to online teaching. Teachers' self-efficacy in TCK, TPK, and TPCK were rated at mean scores of 3.68 (SD = 1.082), 3.62 (SD = 1.068), and 3.54 (SD = 1.038), respectively. The overall perceived online teaching presence in terms of clarity of instruction, cognitive activation, and feedback was rated at 3.73 (SD = 0.927), 3.65 (SD = 0.932), and 3.64 (SD = 1.006). The perceived institutional support had a mean score of 3.50 (SD = 0.947). Teachers in the survey had an average age of 37.44 years (SD = 6.893), with an average of 10.26 years (SD = 7.040) of general teaching experience, and 1.97 years (SD = 1.158) of online teaching experience.

Table 2. Descriptives Statistics of the questionnaire items

Items	Mean	SD
...implement curriculum in an online environment.	3.71	1.162
...use various programs to deliver instruction.	3.64	1.103
...create an online environment which allows students to build new	3.65	1.128
...implement different methods of teaching online.	3.63	1.193
...moderate online interactivity among students.	3.58	1.097
...encourage online interactivity among students.	3.61	1.158
...use online student assessment to modify instruction.	3.56	1.136
...use technology to predict students' skills/understanding of a	3.51	1.163
...use technology to create effective representations of content that	3.55	1.124
...meet the overall demands of online teaching.	3.51	1.059
...can clearly communicate important course topics.	3.73	0.984
...can clearly communicate important course goals.	3.73	1.018
...provide clear instructions on how to participate in course learning	3.73	1.020

...can clearly communicate important due dates/time frames for learning	3.72	1.000
...am helpful in identifying areas of agreement and disagreement on	3.67	1.003
...am helpful in guiding the class towards understanding course topics in	3.65	1.019
...help to keep course participants engaged and participating in	3.63	1.051
...help to keep course participants on a task in a way that helps students	3.68	1.022
...encourage course participants to explore new concepts in courses.	3.71	0.966
...actions to reinforce the development of a sense of community among	3.57	1.015
...help to focus discussion on relevant issues in a way that helps	3.63	1.058
...provide feedback that helps students understand their strengths and	3.68	1.077
...provide feedback in a timely fashion.	3.58	1.049
There is a clear vision towards online learning.	3.46	1.181
There is a supportive environment as regards professional development	3.56	0.994
There are clear objectives as regards online learning.	3.55	1.064
The current ICT-possibilities and infrastructure as regards online	3.48	1.031
Attention is paid to the teacher change processes inherent to changing to	3.51	1.010
There is a professional development strategy towards online learning.	3.42	1.116
TCK	3.68	1.082
TPK	3.62	1.068
TPCK	3.54	1.038
POTP: CoI	3.73	0.927
POTP: CA	3.65	0.932
POTP: Feedback	3.64	1.006
PIS	3.50	0.947
Age	37.44	6.893
General teaching experience	10.26	7.040
Online teaching experience	1.97	1.158

SEM of Teachers' Readiness for Online Teaching and Learning

SEM was used to evaluate several constructs, including Clarity of Instruction (CoI), Cognitive Activation (CA), Feedback, Technological Content Knowledge (TCK), Technological Pedagogy Knowledge (TPK), and Technological Content Pedagogy Knowledge (TCPK), to determine how prepared teachers were for Online Teaching and Learning (OTL). As presented in Table **3**, the model demonstrated excellent fit, as evidenced by a nonsignificant chi-square statistic for the user model ($x^2(378) = 309$, $p = .996$) and strong fit indices (CFI = 1.000, TLI = 1.001, RMSEA = 0.000, SRMR = 0.038), aligning with established thresholds for model adequacy (Hu & Bentler, 1999). In contrast, the baseline model exhibited poor fit ($x^2(435) = 146{,}613$, $p < .001$). The chi-square (X^2) value for the user model was 309, with $p = 0.996 > 0.05$, suggesting a very strong fit (Peugh & Feldon, 2020).

Table 3. Model Fit Indices and Comparisons for SEM Analysis

Fit Index	Value	Conventional Criteria
Model Comparisons		
User Model	x^2 (378) = 309 p > 0.996	Very good fit
Baseline Model	x^2 (435) = 146,613 p < .001	Poor fit
Fit Indices		
SRMR	0.038	< 0.08: Excellent fit
RMSEA	0	< 0.06: Excellent fit
CFI	1	> 0.95: Excellent fit
TLI	1.001	> 0.95: Excellent fit
NNFI	1.001	> 0.95: Good fit
RNI	1	> 0.95: Good fit
NFI	0.998	> 0.95: Excellent fit
RFI	0.998	> 0.95: Excellent fit
IFI	1	> 0.95: Excellent fit
PNFI	0.867	Higher values indicate parsimony

Note. *SRMR = Standardized Root Mean Square Residual; RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; NNFI = Bentler-Bonett Non-Normed Fit Index; RNI = Relative Noncentrality Index; NFI = Normed Fit Index; RFI = Bollen's Relative Fit Index; IFI = Incremental Fit Index; PNFI = Parsimony Normed Fit Index. Dashes (—) indicate where p-values are not applicable. Fit interpretations follow conventional thresholds (e.g.,*(Hu & Bentler, 1999)*: RMSEA < 0.06, SRMR < 0.08, CFI/TLI > 0.95. The user model (x^2/df = 0.82, p = .996) demonstrates excellent fit, while the baseline model shows poor fit (x^2/df = 337.27, p < .001).*

Additionally, the Baseline Model generated an X^2 = 146,613, and p < .001. Despite the huge chi-square value in the Baseline Model, the user model's fit indices gave more useful information. The Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) both showed a perfect match (Goretzko et al., 2024; Stone, 2021). Other fit indices validated the model's adequacy with values of 1.001 and 1.000, respectively.

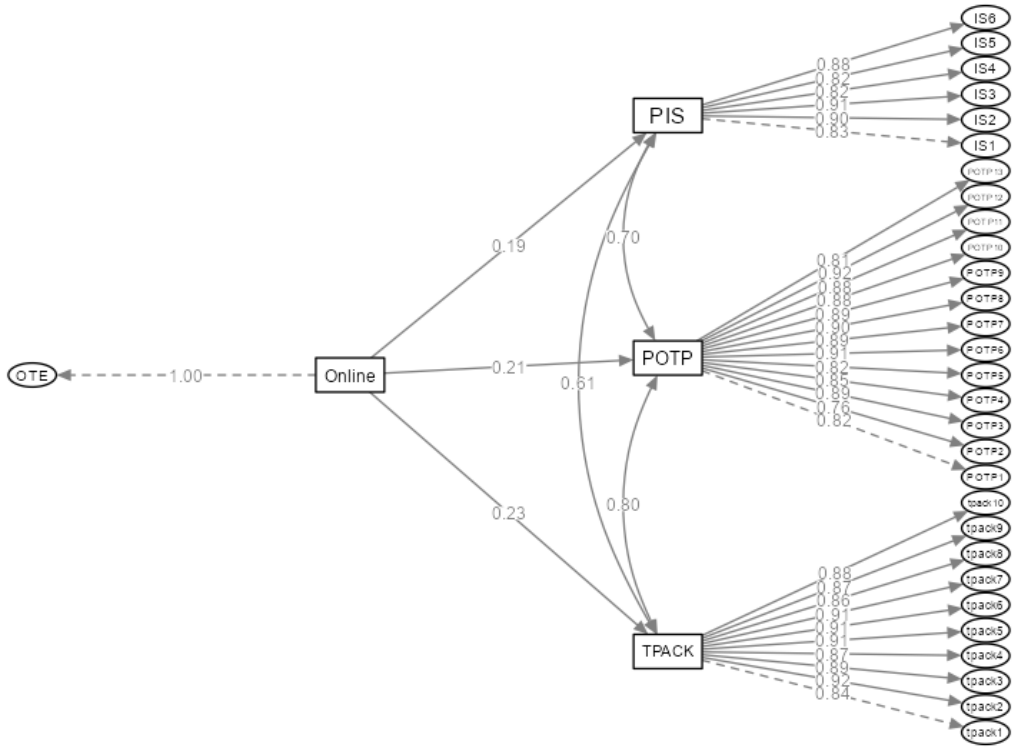

Figure 1. SEM Model of Teacher Readiness for Online Teaching in Cambodian Higher Education: Path Diagram

This structural model illustrates the hypothesized relationships between Online Teaching Experience (OTE) and latent constructs: TPACK, perceived online teaching presence (POTP), and perceived institutional supports (PIS) (See Figure **1**). The model includes factor loadings from observed variables (e.g., tpack1–10, Presence1–13, IS1–6) to their corresponding latent constructs. All standardized path coefficients from Online Teaching to the readiness dimensions are statistically significant ($p < .01$), with values ranging from 0.19 to 0.23, indicating small to moderate effect sizes. The model demonstrates acceptable fit indices despite the relatively small sample size of 140 participants, which meets minimum requirements for SEM analysis but represents a limitation for generalizability. The strong factor loadings and coherent structural relationships suggest that the theoretical framework combining TPACK, Community of Inquiry, and institutional support theories provides a valid foundation for understanding teacher readiness in resource-constrained environments.

Relationships Between Online Teaching Experience and Teacher Readiness

The study focuses on several dependent variables, including Technological Content Knowledge, Technological Pedagogical Knowledge, and various dimensions of perceived online teaching presence (POTP), such as Clarity of Instruction, Cognitive Activation, and Feedback. The impact on Institutional Support (SI) is also considered.

Table 4. Standardized and Unstandardized Estimates for the Effects of Online Teaching Experience (OTL) on Teacher Readiness Constructs

Dependent Variable	Estimate	SE	95% CI	β	z	p
TCK	0.164	0.048	[0.070, 0.257]	0.223	3.42	< .001
TPK	0.206	0.057	[0.094, 0.318]	0.254	3.59	< .001
TCPK	0.225	0.056	[0.116, 0.334]	0.274	4.05	< .001
CoI	0.19	0.058	[0.076, 0.305]	0.234	3.26	0.001
CA	0.197	0.048	[0.103, 0.291]	0.26	4.1	< .001
Feedback	0.218	0.068	[0.085, 0.352]	0.258	3.21	0.001
IS	0.175	0.059	[0.060, 0.290]	0.221	2.97	0.003

Note. OTL = Online Teaching and Learning Experience; SE = Standard Error; CI = Confidence Interval; β = Standardized estimate. All predictors are OTL. Confidence intervals reflect 95% bounds. p-values are two-tailed; values below .001 are denoted as < .001.

Online teaching experience significantly predicted higher Technological Content Knowledge (TCK: β = 0.223, p < .001), Technological Pedagogical Knowledge (TPK: β = 0.254, p < .001), and their integrated application (TCPK: β = 0.274, p < .001), underscoring its role in developing technological competencies (Table **4**). This shows that increasing online teaching experience correlates with better levels of technology competence among teachers. Online teaching experience had a significant positive effect on the clarity of instruction (β = 0.234, p = 0.001), cognitive activation (β = 0.26, p < .001), and feedback (β = 0.258, p = 0.001) dimensions of POTP. This indicates that more online teaching experience enhances teachers' perceptions of their instructional practices. Online teaching experience had a significant positive relationship with PIS (β = 0.221, p = 0.003), suggesting that teachers with more online teaching experience perceive greater institutional support.

Measurement Model of Teachers' Online Teaching Readiness

Table 5 presents the measurement model that evaluated the relationships between observed indicators and their corresponding latent constructs using confirmatory factor analysis (CFA). Standardized (β) and unstandardized (Estimate) factor loadings, standard errors (SE), 95% confidence intervals (CI), z-values, and significance levels (p) are reported. All factor loadings were statistically significant (p < .001), indicating strong associations between the observed indicators (e.g., tpack1–10, Presence 1–13, IS1–6) and their respective latent constructs (e.g., Technological Content Knowledge, Cognitive Activation, Institutional Support). The first indicator for each construct was fixed to 1.0 for scale identification. Results demonstrate robust psychometric properties, supporting the validity of the constructs in measuring teachers' perceived readiness for online teaching.

Table 5. Standardized and Unstandardized Factor Loadings from the Confirmatory Factor Analysis of Teachers' Online Teaching Readiness Constructs

Latent Construct	**Observed Indicator**	**Estimate**	**SE**	**95% CI**	**β**	***z***	***p***
OTL	Online teaching	1	—	[1.000, 1.000]	1	—	—
TCK	tpack1	1	—	[1.000, 1.000]	0.845	—	—
	tpack2	1.161	0.041	[1.080, 1.242]	0.981	28.1	< .001
	tpack3	1	—	[1.000, 1.000]	0.935	—	—
TPK	tpack4	0.949	0.022	[0.905, 0.993]	0.887	42.7	< .001
	tpack5	1.02	0.018	[0.983, 1.056]	0.953	54.8	< .001
	tpack6	1.008	0.02	[0.968, 1.047]	0.942	50	< .001
TCPK	tpack7	1	—	[1.000, 1.000]	0.945	—	—
	tpack8	0.951	0.022	[0.908, 0.994]	0.899	43.2	< .001
	tpack9	0.948	0.022	[0.904, 0.991]	0.896	43	< .001
	tpack10	0.981	0.018	[0.945, 1.016]	0.927	54.1	< .001
CoI	Presence 1	1	—	[1.000, 1.000]	0.937	—	—
	Presence 2	0.957	0.024	[0.909, 1.005]	0.897	39	< .001
	Presence 3	1.038	0.018	[1.001, 1.075]	0.972	55.2	< .001
	Presence 4	0.989	0.019	[0.951, 1.027]	0.927	50.8	< .001
CA	Presence 5	1	—	[1.000, 1.000]	0.874	—	—
	Presence 6	1.11	0.026	[1.057, 1.162]	0.97	41.5	< .001
	Presence 7	1.074	0.024	[1.027, 1.122]	0.939	44.2	< .001
	Presence 8	1.077	0.024	[1.028, 1.125]	0.941	43.6	< .001
	Presence 9	1.063	0.023	[1.016, 1.109]	0.929	45	< .001
	Presence 10	1.055	0.022	[1.010, 1.100]	0.922	46.4	< .001
	Presence 11	1.072	0.02	[1.033, 1.111]	0.937	53.6	< .001
Feedback	Presence 12	1	—	[1.000, 1.000]	0.975	—	—
	Presence 13	0.899	0.024	[0.850, 0.947]	0.876	36.3	< .001
IS	IS1	1	—	[1.000, 1.000]	0.912	—	—
	IS2	1	0.028	[0.945, 1.055]	0.912	35.7	< .001
	IS3	1.052	0.029	[0.994, 1.110]	0.96	35.4	< .001

IS4	0.936	0.031	[0.875, 0.996]	0.853	30.2	< .001
IS5	0.924	0.036	[0.853, 0.995]	0.842	25.5	< .001
IS6	0.992	0.03	[0.931, 1.052]	0.904	32.3	< .001

Note. *SE = Standard Error; CI = Confidence Interval; β = Standardized factor loading. Dashes (—) indicate fixed parameters for model identification. The first indicator for each latent construct was fixed to 1.0 to set the scale. p-values are two-tailed; values below .001 are denoted as < .001. Latent constructs are abbreviated as follows: OTL = Online Teaching and Learning, TCK = Technological Content Knowledge, TPK = Technological Pedagogy Knowledge, TCPK = Technological Content Pedagogy Knowledge, CoI = Clarity of Instruction, CA = Cognitive Activation, IS = Institutional Support.*

Discussion

Although this study is cross-sectional, SEM enables modeling of directional paths based on established theoretical assumptions (Kline, 2023). Significant standardized regression weights indicate medium effects for TPK, TCPK, and Cognitive Activation, using Cohen (1988) guidelines. These results imply that online teaching experience plays a substantive role in shaping teacher readiness dimensions. While these effects may appear limited compared to experimental studies, they hold practical significance in Cambodia's higher education landscape, where systemic barriers such as intermittent internet access (reported by 78% of rural educators; Sok and Bunry (2023)) and limited institutional training infrastructure constrain the potential for large-scale pedagogical transformations (MoEYS, 2023). The small-to-moderate effect sizes echo findings from Scherer et al. (2021), who observed similar magnitudes in TPACK studies across Global South settings, where fragmented technological adoption attenuates theoretical relationships.

The SEM results provide a comprehensive understanding of the constructs such as TPACK, Clarity of Instruction, Cognitive Activation (CA), Feedback, and Institutional Support (IS). The high Cronbach's alpha, ordinal alpha, and omega values for TCK, TPK, TCPK, CoI, CA, Feedback, and IS indicate strong internal consistency and reliability, consistent with findings by Teo and Khine (2009). The excellent model fit indices, including a nonsignificant chi-square value, SRMR, RMSEA, CFI, and TLI values respectively, underscore the robustness of the SEM model used in this study. These findings are comparable to those reported by Goretzko et al. (2021) and Shi et al. (2018), where high CFI and TLI values indicated good model fit in educational research. The excellent model fit indices, including a nonsignificant chi-square value, underscore the robustness of the SEM model used in this study (Goretzko et al., 2021; Stone, 2021). These findings are consistent with Shi et al. (2018), who found that high CFI and TLI values indicated strong model fit in educational research.

Effect sizes of the standardized path coefficients further clarify the practical significance of these relationships. Following Cohen (1988) thresholds (small ≥ .10, medium ≥ .30, large ≥ .50), all paths from Online Teaching Experience to the latent constructs demonstrated small-to-moderate effects. Notably, the strongest effects were observed on Technological Content Pedagogical Knowledge, Cognitive Activation, and Feedback. The moderate influence of online

teaching experience on TCPK and Cognitive Activation underscores the incremental nature of competency development in resource-constrained environments. The findings mirror Sok and Bunry's (2023) observations in Cambodian vocational schools, where limited access to sustained professional development resulted in gradual TPACK growth even among experienced instructors. The weaker association with Institutional Support (β = 0.16) may reflect systemic challenges identified in the introduction, including Cambodia's nascent digital infrastructure and uneven policy implementation(UNESCO, 2023), factors that dilute individual educators' perceptions of organizational backing. These results indicate that teachers with more extensive online teaching experience are more likely to integrate technology with pedagogy and content effectively and are better equipped to engage students cognitively and provide responsive feedback. Such findings affirm the importance of experience in building holistic readiness for online instruction in higher education, especially in under-resourced contexts like Cambodia

The favorable link between online teaching experience and TCK is consistent with other research that emphasizes the relevance of experience in establishing technical competence among teachers. This validates the estimate's accuracy and reinforces Mishra and Koehler's (2006) conclusions on the importance of technology content knowledge in the digital age. The considerable influence of online teaching experience on TPK is similar to the findings of Chai et al. (2013) which stress the cruciality of teaching experience in improving teachers' pedagogical understanding of technology. According to Koehler et al. (2013), the association between online experience and TCPK emphasizes the necessity of thorough knowledge integration in effective online education. Their findings also show that developing TPACK competencies is critical for instructors to effectively integrate technology into their teaching methods.

The significant positive effects on clarity of instruction, cognitive activation, and feedback dimensions of POTP corroborate the findings of Diamah et al. (2022) on efficiency of a training program based on technology pedagogical content knowledge and Bolkan (2016) on clear instruction, which can employ a variety of effective teaching behaviors, such as those that reflect the instruction, to increase the odds that students experience success in their courses. It was argued that the reason clarity works to influence student success is because of its ability to reduce learners' cognitive load experienced as receiver apprehension. The strong association between online teaching experience and PIS highlights the importance of institutional support in facilitating effective online teaching (Al-Samarraie et al., 2018).

Conclusion

The current study provides evidence of the crucial role that online teaching experience plays in enhancing Cambodian higher education teachers' readiness for online teaching and learning. Utilizing a SEM approach, the findings demonstrate that greater online teaching experience significantly bolsters teachers' self-efficacy in Technological Pedagogical Content Knowledge. Furthermore, online teaching experience positively influences teachers perceived

online teaching presence, as evidenced by improvements in Clarity of Instruction, Cognitive Activation, and Feedback provision, alongside heightened perceptions of institutional support. The results highlighted the interconnectedness of experience, technological competence, instructional effectiveness, and institutional backing in shaping teacher readiness within the context of Cambodia's evolving digital landscape. The excellent model fit indices affirm the reliability and validity of the SEM framework employed, highlighting its applicability to low-resource settings like Cambodia, where systemic challenges such as limited internet access and inadequate training persist. The findings align with prior research on TPACK and teacher self-efficacy, extending their relevance by contextualizing them within Cambodia's unique educational constraints. Notably, the stronger effect of online teaching experience on integrated TPACK (TCPK) compared to its individual components suggests that comprehensive professional development programs, which blend technology, pedagogy, and content, are essential for fostering holistic teacher readiness. Similarly, the pronounced impact on Cognitive Activation within online teaching presence indicates that experienced teachers are better equipped to engage students intellectually in virtual environments, a critical factor for overcoming the motivational and engagement challenges often associated with online learning.

Recommendations

Several recommendations may be made to teachers, higher education institutions (HEIs), and policymakers (MoEYS) to strengthen the readiness of teachers for online teaching and learning. Teachers should engage in continual professional development opportunities to strengthen practical skills. A study by Chea et al. (2022) proposed the TPACK framework for effective technology integration in teaching. Research has shown that teacher collaboration and the sharing of best practices can significantly improve online teaching skills and student outcomes (Chea et al., 2022; Dede et al., 2008; Prestridge, 2019). Several studies have demonstrated that instructors with a growth mindset are more effective in moving to online and blended learning environments (Dweck, 2024; Ertmer & Ottenbreit-Leftwich, 2010). Studies have underlined the significance of explicit learning objectives, regular feedback, and cognitive activation tactics to maintain student engagement and learning in online contexts (Means et al., 2010; Snook et al., 2009). Higher education institutions (HEIs) should invest in reliable digital infrastructure, including stable internet connectivity and user-friendly learning management systems, to support online teaching and learning (Means et al., 2010), and equipping teachers with the necessary skills and knowledge for effective online instruction (Baran & Correia, 2014; Schmidt et al., 2009). Providing technical assistance and tools for instructors is vital to address the difficulties and strengthen their online teaching abilities (Ertmer & Ottenbreit-Leftwich, 2010; Hermien & Wiyatini, 2019). It is encouraged to develop a culture of creativity and cooperation among teachers for effective online teaching approaches (Dede et al., 2008; Prestridge, 2019). Several studies emphasized the significance of clear guidelines and policy for the quality and consistency (Hermien & Wiyatini, 2019), collaboration with various

HEIs to address gaps in teacher readiness and competencies (Baran et al., 2011), and promotion of the online and blended learning integration to enhance access and flexibility for students (Means et al., 2010). MoEYS should implement a national professional development framework tailored to Cambodia's low-resource context, focusing on TPACK and POTP. This could include subsidized online courses or mobile-based training modules to reach rural teachers. The MoEYS should introduce incentives, such as certification or career advancement opportunities, for teachers who complete TPACK-oriented training programs, encouraging widespread adoption. It is imperative to facilitate partnerships between urban and rural HEIs to share resources and expertise, addressing gaps in readiness and promoting equitable access to quality online education

Limitations

One notable limitation of this study is the relatively small sample size, which may restrict the generalizability of the findings to all higher education institutions in Cambodia. While this sample meets the minimum criteria for structural equation modeling in models with moderate complexity, larger and more diverse samples are recommended for future studies to enhance statistical power and external validity (Kline, 2023). The findings should therefore be interpreted with caution, particularly when extending implications to broader institutional contexts or different educational systems. Finally, although online teaching experience showed strong associations with readiness indicators, this study's cross-sectional design limits causal inference. As Cambodian higher education continues adapting, longitudinal research is needed to capture dynamic changes in teaching readiness and to evaluate how system-wide reforms. This includes improvements in academic leadership, gender equity, and internationalization—impact OTL capacity (Le Fevre et al., 2024; Sok & Bunry, 2021). Further research should also undertake longitudinal studies to gauge how teachers' perceptions of OTL have changed. It is advisable to explore the viewpoints of students and other relevant stakeholders to have a broader understanding of online teaching and learning in HEIs in Cambodia.

Conflict of interest

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