

An Analysis of College EFL Novice Teachers' TPACK Level and TPACK Cognition

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ABSTRACT

The use of intelligence technology encouraged teachers to develop their professional ability. For college EFL teachers, the integration of information technology has become an important topic. TPACK, as a key teacher knowledge framework, fosters their continuous professional development. However, the current reality is that novice teachers lacked confidence in their TPACK abilities and had a negative attitude towards the value of IT in education. It is also difficult for them to use information technology to enrich their instructional design. The purpose of this research is to investigate the TPACK level and TPACK cognition of college EFL novice teachers, which are (1) What is the TPACK level of college EFL novice teachers? (2) What is the TPACK cognitive level of college EFL novice teachers? (3) What is the relationship between novice teachers' TPACK cognition and their TPACK level? For this purpose, the paper will use quantitative research methods to find the answer and the descriptive analysis and linear regression analysis are used. This study finds that TPACK level and TPACK cognition of college EFL novice teachers are both at moderate level and TPACK cognition has great influence on the TPACK levels of novice teachers. The study concludes that improving teachers' TPACK awareness can help improve their practical application ability.

Contribution/Originality: This study advances TPACK research by validating the cognition-practice link among novice teachers, proposing a targeted training model for early-career educators, and contextualizing findings within China's regional education landscape. It bridges theory and practice, offering scalable strategies for improving technology integration in teacher development programs.

1. Introduction

With the rapid development of technologies, technological innovation in the education field has become an inevitable trend. In 2019, the Central Committee of the Communist Party of China and the State Council issued *the China Education Modernization 2035 plan*, which clearly included "building a high-quality, professional, and innovative teaching workforce" as one of the ten strategic tasks for advancing education modernization (Ministry of Education [MOE], 2019). For college EFL teachers, the integration of information technology into language teaching has become an important topic in foreign language education.

In 2006, American scholars Mishra and Koehler (2006) proposed Technological Pedagogical Content Knowledge (TPACK) which means integrating technology into subject-specific teaching knowledge. TPACK in college EFL teaching has become increasingly prominent, and the development of information technology has raised higher requirements for the TPACK of foreign language teachers. On the one hand, the TPACK framework helps teachers better understand and use technological resources for instructional design, ensuring the effectiveness of teaching and stimulating students' interest in learning. On the other hand, the development of TPACK is also a crucial aspect of teacher professional development, playing an important role in enhancing teachers' teaching abilities and research capabilities.

TPACK as a specific framework about technology integration has attracted the attention of researchers and teachers, providing a theoretical model for the integration of information technology in education.

Liu and Xiong (2016) indicated the importance of English teachers' TPACK levels in promoting English teaching quality and teachers' professional development. In recent years, information technology knowledge changes quickly, and thus many English teachers are not able to use the technologies effectively (Zhang & Chen, 2022). Information technology provided cognitive multi-dimensionality and special support for foreign language education. Therefore, it is necessary to fully apply information technology to foreign language teaching.

TPACK has now become a new model of English teaching in China, and novice English teachers, as the main force of future English teachers, directly influence the quality of English informatics teaching (Li, 2023). However, despite the importance of TPACK for teachers, some scholars have explored and researched TPACK English teaching in China and concluded that although Chinese English teachers have accepted the concept of TPACK, they have not mastered and appropriately applied it in English teaching (Kim & Lee, 2018; Li, 2022).

Novice teacher's TPACK level is the teacher's ability to integrate subject content, pedagogy, and technology into a new form of knowledge and apply it to the teaching process. Teachers' TPACK level plays an important role in guiding the development of novice teachers in the field of education, it is necessary to explore the TPACK competence of novice teachers. In the current research related to the field of teacher TPACK, we find the following practical problems.

Firstly, English teachers face many problems in using information technology (Li, 2022). They cannot fully grasp the concepts and connotations of TPACK nor understand the

dynamic interactions among the seven elements-TK, CK, PK, PCK, TCK, TPK, and TPACK. Moreover, novice teachers lacked confidence in their TPACK abilities and had a negative attitude towards the value of IT in education. It is also difficult for them to use information technology to enrich and improve their instructional design and implementation. Therefore, there is a need for a more nuanced understanding of how novice EFL teachers develop their TPACK over time. More longitudinal studies are needed to track the development of novice EFL teachers' TPACK and to identify the factors that facilitate or hinder this development (Liang, 2019; Li, 2022). A few studies have examined Chinese preservice English teachers' TPACK development and attitudes toward the components of TPACK (Feng & Wang, 2020), but few studies have examined novice teachers' cognition toward TPACK. Therefore, it is necessary to study the TPACK levels and cognition to understand their TPACK development.

Secondly, teachers' cognition and attitude towards the professional curriculum during their beginning years determine their level of skill mastery. Sun (2022) argued that teachers' cognition has a significant impact on their skill development. However, the extent to which cognition has an impact on the training process of the TPACK program during novice teachers should be further explored. Therefore, a detailed understanding of EFL novice teachers' TPACK level and their cognition toward TPACK can provide more insight into their professional development.

Most studies on TPACK have mainly examined the factors influencing in-service teachers' TPACK (Liu, 2020), there are fewer studies that have examined the novice teachers' TPACK level and cognition. Thus, there is a research gap in previous studies. And moreover, some studies (Liang, 2019; Zhang & Chen, 2022) have focused on understanding certain aspects of teacher training, such as language skills and pedagogy, but there is a lack of comprehensive research examining the information technology application in novice EFL teacher training.

The purpose of this research is to investigate the TPACK level and TPACK cognition of college EFL novice teachers. Moreover, it will determine the relationship between novice teachers' TPACK cognition and their TPACK level. For this purpose, the following questions were made in the quantitative dimension of the research: (1) What is the TPACK level of college EFL novice teachers? (2) What is the TPACK cognitive level of college EFL novice teachers? (3) What is the relationship between novice teachers' TPACK cognition and their TPACK level?

2. Literature Review

2.1. EFL Teachers' TPACK

Wang (2014) investigated the self-efficacy of English teachers' TPACK competence and found that foreign language teachers were not well-prepared for TPACK, and their self-confidence in effectively integrating technology into their teaching needed to be improved. Li (2023) investigated the TPACK levels of elementary school teachers as well as differences in dimensions and demographics in the city of N, Province J. The results showed that there were significant differences in teachers' TK dimensions with respect to variables such as teaching stage and teachers' gender.

EFL teachers' TPACK level and influencing factors is an important research topic because it is related to teachers' ability and confidence to teach English effectively. Min (2020)

measured the TPACK level of EFL teachers in different regions and different professional backgrounds. The study found that EFL teachers' TPACK levels were generally in the upper-middle range, but there were significant differences in TPACK elements. Zhang and Chen (2022) explored how to improve EFL teachers' TPACK levels, introduced some successful models of TPACK development. Wu (2021) found that teachers' teaching competence is influenced by cognitive and attitudinal factors. Guo and Sun (2022) conducted a questionnaire survey on high school teachers' TPACK and found that their TPACK levels were not yet satisfactory in general.

2.2. Cognitive Attitudinal Behavioral Theory

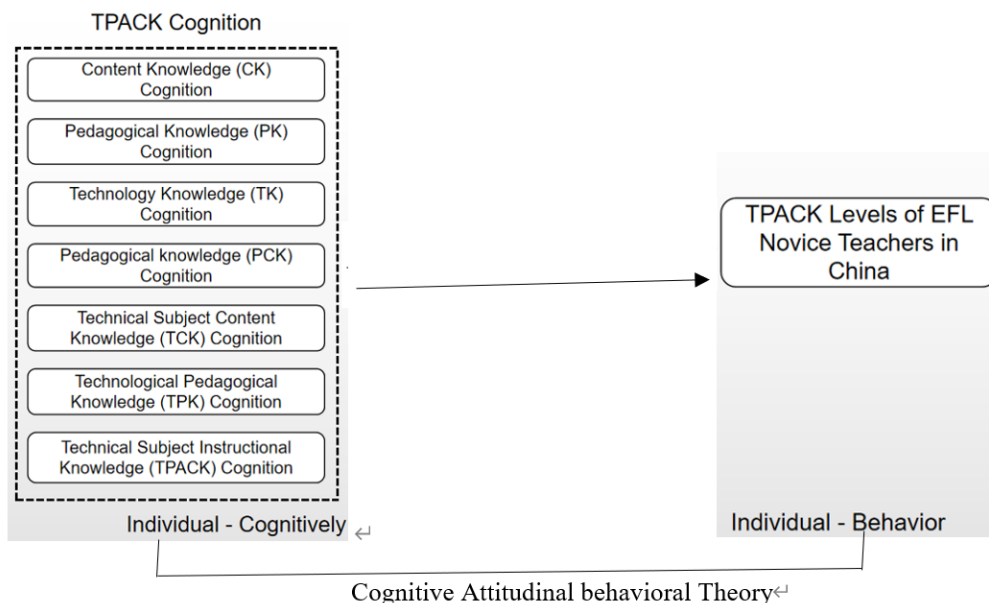
Cognitive Attitudinal Behavioral Theory (CABT) is a psychological theory based on the interaction of human attitudes, behaviors, and environments. Cognitive-attitudinal-behavioral theory is closely related to the study of education because education is an important way to influence people's attitudes and behaviors.

Wu's (2021) study indicated that teachers' teaching emotions are determined by teachers' cognitive forms. Some studies concluded that cognitive-attitudinal-behavioral theory can help teachers promote educational innovations and reforms, such as information-based education and lifelong education (Feng & Wang, 2020). Teachers can use the frameworks of cognitive-attitudinal-behavioral theories, such as TPACK to improve their ability to deal with the problems encountered in the teaching-learning process.

2.3. Conceptual Framework

The conceptual framework of this study is shown in Figure 1.

Figure 1: Conceptual Framework



There are fourteen variables in the quantitative research component of this study, including TPACK cognitive level (CK cognition, PK cognition, TK cognition, TCK cognition, PCK cognition, TPK cognition, TPACK cognition) and TPACK level (CK level, PK level, TK level, TCK level, PCK level, TPK level, TPACK level). TPACK level represents the actual ability to integrate technology, pedagogy, and content knowledge into teaching practices.

TPACK cognitive level represents novice teachers' awareness and understanding of their TPACK knowledge domains. There is a hypothesized positive correlation between TPACK cognitive levels and TPACK practical levels.

3. Research Methods

This paper uses a quantitative research approach to carry out the investigation. The TPACK level and TPACK cognition questionnaire will be answered by the participants. This study will be conducted in 125 colleges in Hebei Province of China in which the author works which is a region with a dense concentration of higher education institutions adjacent to Beijing, offers a representative microcosm of China's evolving tertiary education landscape. The target population of novice teachers in 125 colleges in Hebei Province is about 3,000. This study uses stratified sampling techniques to draw a stratified sample from the group of novice teachers in Hebei Province. In order to ensure representation across different colleges and demographic factors, a stratified sampling technique was employed. This method enhances the generalizability of findings by reducing sampling bias. Based on [Krejcie and Morgan's \(1970\)](#) sampling form suggested, for a population of 3,000 novice teachers, the table prescribes a minimum sample of 340 participants to achieve a 95% confidence level with a 5% margin of error. So the sample size in this study is 340 novice teachers.

As for the quantitative instrument, the TPACK level and TPACK cognition questionnaire was adapted from existing validated measures ([Durdu & Dag, 2017](#)). The questionnaire is designed based on a five-point likert scale to investigate the TPACK level and TPACK cognition of novice teachers. The scale 1-5 in the Lietke scale corresponds to the teachers' TPACK level and cognitive level (1-strongly disagree, 2-disagree, 3- Neither Agree or Disagree, 4-agree, and 5-strongly agree). Data was gathered via online, through Questionnaire Star Platform which is leading Chinese online survey platform widely used for academic research, market analysis and data collection.

After the data collection, the descriptive analysis will be used to analyze the TPACK level and TPACK cognitive level of college EFL novice. The descriptive analysis result will give answers to research question 1 and research question 2. As for the research question 3, the regression analysis will be used to explore the relationship between their TPACK level and TPACK cognition.

The researchers used the research ethics provided by the Research Ethics Committee of Universiti Teknologi MARA (UITM). All procedures performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional research committee. Informed consent was obtained from all participants according to the Application Form for Ethics Approval.

4. Results

4.1. Demographic Profile of the Respondents

In this study, just as [Table 1](#) shows, the total sample size was 340, of which 181 (53.24%) were females and 159 (46.76%) were males. English Education (170 or 50%), Business English (68 or 20%), Applied English (89 or 26.18%), and other (13 or 3.82%).

Table 1: Demographic Frequency Analysis

Item	Options	Frequency	Percentage (%)	Cumulative percentage (%)
Type	College EFL novice teachers	340	100%	100%
Gender	Female	181	53.2%	53.2%
	Male	159	46.8%	100%
Major	English Education	170	50%	50%
	Business English	68	20%	70%
	Applied English	89	26.2%	96.2%
	other	13	3.8%	100%

4.2. TPACK Levels of College EFL Novice teachers

As Table 2 shows, the average scores across TPACK domains range from 3.06 to 3.33, indicating moderate to high levels. For example, TPACK-pk average is 3.16 (SD = 1.11), showing consistent responses.

Table 2: Descriptive Analysis of Novice teachers' TPACK Levels

Item	Average	Standard deviation	Median	Kurtosis	Skewness
TPACK-pk	3.14	1.11	3	-.53	-.13
TPACK-ck	3.11	1.11	3	-.49	-.12
TPACK-tk	3.16	1.13	3	-.59	-.27
TPACK-pck	3.06	1.15	3	-.38	-.19
TPACK-tpk	3.26	1.22	3	-.80	-0.26
TPACK-tck1	3.33	1.22	3	-.92	-.27
TPACK-tpck2	3.19	1.22	3	-.77	-.10

As Table 3 shows, the average scores for TPACK cognition domains range from 3.04 to 3.33, indicating moderate to high perceived levels. For example, the cog-pk average is 3.04 (SD = 1.09), reflecting relatively consistent responses.

Table 3: Descriptive Analysis of Novice teachers' TPACK Cognition

Item	Average	Standard deviation	Median	Kurtosis	Skewness
cog-pk	3.04	1.09	3	-.35	-.02
cog-ck	3.10	1.11	3	-.49	-.12
cog-tk	3.25	1.13	3	-.59	-.27
cog-pck	3.08	1.15	3	-.38	-.19
cog-tpk	3.26	1.22	3	-.80	-0.26
cog-tck	3.33	1.22	3	-.92	-.27

The linear regression results in Table 4 show that all cognition components significantly predict TPACK levels ($p < 0.001$), with the model explaining 78.2% of the variance ($R^2 = 0.786$, adjusted $R^2 = 0.782$). Among the predictors, C-TPK has the strongest influence (Beta = 0.23, $t = 6.81$, $p < 0.001$), followed by C-TCK (Beta = 0.197, $t = 5.705$, $p < 0.001$) and C-PCK (Beta = 0.171, $t = 5.049$, $p < 0.001$).

From the above, we can find that the TPACK level and TPACK cognition of college EFL novice teachers are both at moderate level. But there is no significant difference between the TPACK elements. We also found that TPACK cognition has great influence on the TPACK levels of novice teachers. There is a significant positive correlation between

TPACK cognition and TPACK levels. The data analysis showed that teachers with a higher level of TPACK cognition also had a higher overall TPACK level. This means that the cognitive dimensions have an impact on different TPACK abilities. Among the specific cognitive dimensions, TK Cognition and TPK Cognition have the most significant impact on TPACK levels. This shows that the more thoroughly EFL teachers understand the role of technology in teaching, the more adept they are at integrating technology and pedagogy.

Table 4: Results of Linear Regression Analysis of TPACK Cognition on TPACK Levels

	Non-standardized coefficient		Standardized coefficient		t	P	VIF	R ²	Adjustment of R ²	F
	B	standard error	Beta							
a										
constant (math.)	0.404	0.083	-		4.8460.000***	-				
cog-PK	0.075	0.027	0.094		2.7650.006***	1.789				
cog-CK	0.108	0.028	0.132		3.8970.000***	1.769				
cog-TK	0.134	0.026	0.176		5.1880.000***	1.787	0.786	0.782	F=174.235	P=0.000***
cog-PCK	0.136	0.027	0.171		5.0490.000***	1.786				
cog-TCK	0.141	0.025	0.197		5.7050.000***	1.859				
cog-TPK	0.161	0.024	0.23		6.81	0.000***	1.767			
cog-TPCK	0.113	0.024	0.162		4.7920.000***	1.769				

Dependent variable: TPACK

Note: ***, **, * represent 1%, 5%, and 10% significance levels, respectively.

5. Conclusion

The findings of this study are consistent with the findings of a large body of existing literature. For example, many studies have pointed out that teachers' TPACK levels are closely related to their technology perceptions, and that teachers with better understanding of TPACK are more likely to implement technology integration in the classroom (Sun, 2022). This study further confirms this correlation among novice teachers.

As for the practical value of the research, these findings provide a basis for teacher training programs, by strengthening the knowledge of TPACK theory and practice among novice teachers, their overall TPACK level can be effectively improved.

These findings suggest that improving teachers' TPACK awareness can help improve their practical application ability. This is also a direction that future teacher training should focus on. In order to improve TPACK competency, it is a good way to strengthen TPACK cognitive training, as TPACK cognition is an important foundation for improving teachers'

TPACK levels. Therefore, training programs which were made according to this result can help teachers develop their professional ability in the practical application of technology.

Ethics Approval and Consent to Participate

The researchers used the research ethics provided by the Research Ethics Committee of Universiti Teknologi MARA (UITM). All procedures performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional research committee. Informed consent was obtained from all participants according to the Application Form for Ethics Approval.

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Conflict of Interest

The authors reported no conflicts of interest for this work and declare that there is no potential conflict of interest with respect to the research, authorship, or publication of this article.

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