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Evaluating Chinese K-12 CFL/CSL Teachers' Readiness Toward Interactive Reading Platforms

Junying Qian[1], Satha Phongsatha[2]

Abstract

Purpose: This paper aims to investigate in-service Chinese teachers' perception of TPACK and readiness for integrating Interactive Reading Platforms when teaching Chinese as a foreign language (CFL) or as a second language (CSL) at K-12 and to determine the effect of TPACK on teachers' readiness for technology integration. **Research design, data and methodology:** The research is quantitative in nature, using questionnaires and survey to collect data from samples. 226 teachers responded to the online questionnaires which was based on TPACK model and contained 43 items in total after adjustment for item validation and reliability. The variables were content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK), technological knowledge (TK), technological content knowledge (TCK), technological pedagogical knowledge (TPK) and teacher readiness (TR). **Results:** Descriptive statistics showed overall high competency and readiness for technology integration, but participants were least confident about TK. Multiple linear regression supported the hypothesis that TPACK could affect TR statistically significantly. TPK had the greatest impact on TR; PK second; TCK third, CK had negative effect on TR. The remaining TK and PCK showed no influence. **Conclusions:** More study is suggested to investigate the effect of TK and CK on TR. Recommendations and suggestions for future research have been provided.

Keywords: Teacher Readiness, TPACK, Technology Competency, In-service CFL/CSL Teacher, CiteSpace

JEL Classification Code: I21, I23, C12

1. Introduction[1]

1.1. Background of the Study

The globalization has promoted people's enthusiasm for learning Chinese. To make a person proficient in a language, meaningful input in the process of language acquisition leads to competence in language output (Krashen & Terrell, 1983). In terms of language learning, listening and reading are classified as input because both are information-taking skills and improve significantly at a young age (Sticht & James, 1984). Therefore, it is important to provide K-12 students with rich input when learning Chinese as a foreign language (CFL) or Chinese as a Second Language (CSL).

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[1]*Junying Qian, Graduate School of Business and Advanced Technology Management, Assumption University of Thailand, Email: julianaqian0125@gmail.com

Authentic audio material is easier to find or create. However, it is quite difficult to obtain suitable Chinese printed books outside China. So, CFL/CSL teachers start to approach the interactive reading platforms (IRP) as a solution for students to access more reading material.

1.2. Interactive Reading Platforms

Interactive Reading Platforms (IRP) are digital forms of traditional graded readers, benefiting from the internet and internet-based technology.

Graded readers are books that are simplified to be understood easily, especially for language learners. Publishers usually issue 4-6 reader series to adapt to different skill levels. Similarly, Chinese IRP is a web-based adaptive reading application for K-12 CFL/CSL programs. With IRP, a student can take an online quiz and receive instant feedback after reading a book and watch the videos for every book. Students are motivated to make progress with reading skills.

There are many Chinese reading platforms available online, such as i Chinese Reader, Mandarin Matrix and DuDu.

Taking i Chinese Reader (https://ichinesereader.com/) for example, it offers more than 3,000 interactive e-books placed in 20 different levels, covering all grades aligned with the corresponding syllabi. It provides teachers information to monitor students' reading progress and make guidance for their future learning. It helps teachers engage students and enrich their learning experience.

1.3. Statement of the Problem

Obviously, IRP is a practice of cognitive theory of multimedia learning. When the teaching content is presented in text and graphics, not just text, the brain can process the information actively into working memory. Thus, a deeper learning occurs (Moreno & Mayer, 1999). So, the use of technology for scaffolding the learners to gain an unknown language interestingly and enthusiastically has been entrusted as the technological interference in second language education, and it will help to ensure the compelling comprehensible input (Krashen, 2016).

In addition, if we teach today's students the way we were taught, we rob them of tomorrow. In the 21st century, children are born and grow up with Information and communication technology (ICT).

With the rapid development of ICT being employed extensively in school and higher demands are placed on the teachers to integrate the teaching knowledge and skills of technology. The "Standards for Teachers of Chinese to Speakers of Other Language" has been updated by the Office of the Chinese Language Council (Hanban, 2015), emphasizing the ability to integrate technology into classroom practice.

However, what is CFL/CSL teachers' perception of technology competency and readiness?

To address the relationships and challenges between technology competency and technology readiness, Technological Pedagogical and Content Knowledge (TPACK) developed by Koehler and Mishra (2005) can guide this research as it outlines teachers' holistic competency of transforming their teaching with technology (Angeli & Valanides, 2009). Yet, in which TPACK research specific on language area, more studies evaluated English teachers' perceptions of TPACK (Tseng et al., 2022), with little attention paid to in-service CFL/CSL teachers' competency and development.

1.4. Research Questions

Based on the above considerations, two research questions were generated to guide this study:

1. What is in-service Chinese teachers' perception about their competency and readiness toward the utilization of Interactive Reading Platforms in teaching CFL/CSL at K-12?

2. How do the six components of TPACK influence in-service Chinese Teachers' Readiness (TR) toward the utilization of Interactive Reading Platforms in teaching CFL/CSL at K-12?

1.5. Research Objectives

Accordingly, the purposes of this paper were:

1. To identify in-service Chinese teachers' perception about their competency and readiness toward the utilization of Interactive Reading Platforms in teaching CFL/CSL at K-12.

2. To determine the six components of TPACK influence in-service Chinese Teachers' Readiness (TR) toward the utilization of Interactive Reading Platforms in teaching CFL/CSL at K-12.

1.6. Significance of the Research

This study expands research on TPACK and teachers' readiness for technology integration by contextualizing the specific technology used by K-12 CFL/CSL teachers.

It provides CFL/CSL teachers and training organizations with new insights of improving training program, as the data analysis shows technology integration readiness degree and which part of the TPACK is lacking most.

2. Literature Review

2.1. Technology Competency and TPACK

2.1.1. Technology Competency

Different scholars have different definitions of competency. Broadly speaking, competence is not just the application of prior knowledge and skills, but also the ability to effectively solve problems in an unfamiliar environment. In a narrower sense, the concept of competence can also be applied to a specific area (Cai, 2017); It was concluded by Van der Klink et al. (2007) that competencies include at least knowledge, skills, and attitudes.

So, competency is a kind of knowledge, skill, or ability that enables people to effectively perform the duties of a specific occupation or function to meet the expected working standards (Richey et al., 2001, p. 26). According to Yurdakul et al. (2012), TPACK is a technology integration model which can elucidate technology competency.

2.1.2. Science Mapping of TPACK

The conceptualization of TPACK derives mainly from Shulman's (1986) concept of pedagogical content knowledge. TPACK is a framework for teacher's knowledge structure, identifying three main components of knowledge: content, pedagogy and technology, which are equally important and interact with each other, forming four overlapping elements namely pedagogical content knowledge, technological content knowledge, technological pedagogical knowledge and TPACK (Koehler & Mishra, 2009).

There are numerous articles exploring TPACK since its first introduction. So, a visual analytic software called CiteSpace (https://citespace.podia.com/) was adopted in this study to recognize the remarkable literature and topical trend through co-citation analysis by utilizing the embedded algorithms to present the knowledge structure and to detect the emerging trends in research areas (Chen, 2006).

The bibliographic data of 1923 records between 2002 to 2022 were collected via Web of Science core collection, based on a search of "TPACK or TPCK" in titles, abstracts or keywords. After removing non-related areas and non-English/Chinese academic papers, the database was dropped to 1398. Figure 1 outlines the annual publication counts and citation numbers of 1398 records back to 20 years.

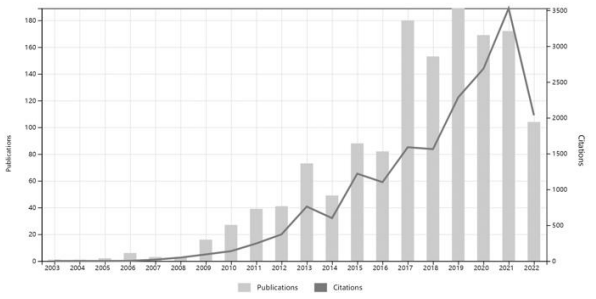

Figure 1: The combination of annual publications and citations of TPACK from 2002 to 2022

Remarkable Literature

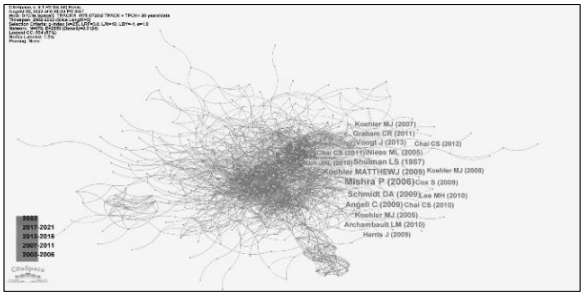

Figure 2: Key articles of TPACK from 2002 to 2022

A Co-citation network analysis performed by CiteSpace (version 6.2.R2) presents how frequently two references are cited by other articles simultaneously. Figure 2 shows the co-cited network with 678 article nodes for a 5-year time slice; hence the most cited literatures were identified. Generally, the literature with high citation counts means that it has been recognized by more scholars.

Topical Trend

The above 678 article nodes were grouped into clusters. The landscape view in Figure 3 presents the largest thirteen clusters. Each cluster in the co-citation network indicates a topic of research.

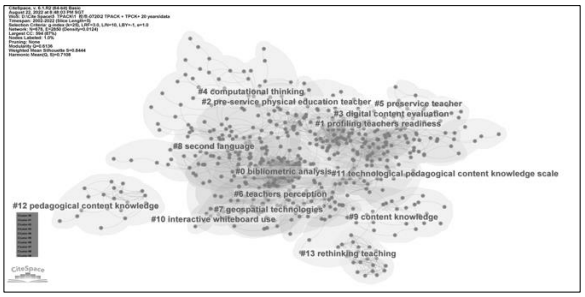

Figure 3: Landscape view of top thirteen topical cluster of TPACK research from 2002 to 2022

To properly examine each cluster, a timeline image of the co-citation network was generated as Figure 4. Clusters were listed vertically in descending order of the size. Size denotes the quantity of co-citation in a cluster. Larger clusters tend to be more representative than fewer ones (Chen et al., 2012).

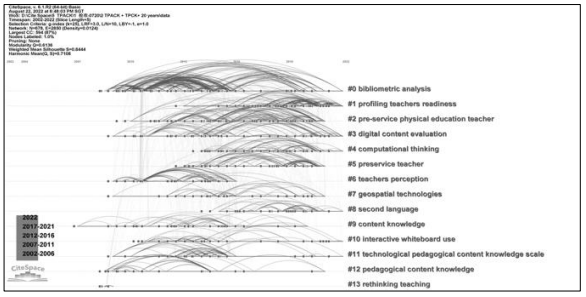

Figure 4: A timeline visualization of largest thirteen clusters of TPACK research from 2002 to 2022

Some topical research has been active long time, but others only continued a short period. It implies that these 13 clusters represented the most significant and topical trend in the TPACK area from 2002 to 2022. Generally, the topic of bibliometric analysis (cluster ID #0) is the most active area of research focused on measuring teachers' perceptions of TPACK, while in recent years more attention has been paid to examining faculty readiness for technology integration (cluster ID #1) and preparing student teachers with technology competencies (cluster ID #2).

Timeline of TPACK research

The development process of TPACK can be divided into three stages.

The first stage starts from 2005 to 2009, focusing on the theoretical exploration of TPACK. Beginning with Pierson's (2001) initial articulation of the idea, followed by several researchers suggested similar conceptions to define technology integration (Angeli & Valanides, 2005; Mishra & Koehler, 2006; Niess, 2005), it was finalized as TPACK by the research community (Thompson & Mishra, 2007).

From 2010 to 2016 is the second phase, developing instruments or assessment tools to validate the TPACK constructs and to prepare preservice teachers for technology integration in the classroom (Archambault & Barnett, 2010; Chai et al., 2013b; Schmidt et al., 2009). Most research focused on examining teachers' TPACK levels and exploring the factors influencing TPACK performance. Research has begun to touch the specific subjects.

A growing interest in TPACK research in 2017 marked the beginning of the third phase. TPACK research has

been associated with teacher training and TPACK application. It began to explore the relationship between TPACK and other aspects such as attitudes, beliefs, self-efficacy, other skills and characteristics of teachers and other specific technology integration or specific pedagogy (Chai et al., 2020; Jwaifell et al., 2018; Sun et al., 2017; Yang et al., 2021).

Narrative Summary

Synthesizing all the above information, it is a trend to connect TPACK research with other aspects since 2017 and more attention paying to faculty readiness for technology integration.

When associating TPACK with teacher readiness, the majority of the study directly used TPACK or its core components as a tool to illustrate teacher readiness (Al-Awidi & Aldhafeeri, 2017; Jwaifell et al., 2018), which were within TPACK framework. Only few scholars extended TPACK study, such as Li (2022) who explored teacher readiness based on Technology Acceptance Model and TPACK; another study tested teachers' readiness can affect on TPACK (Baharuldin et al., 2019).

No matter it's within TPACK framework or extend TPACK, most studies of subject specific were focused on science, mathematics and social studies (Voogt et al., 2013). Among the relative less publication targeting at language teachers (Tseng et al., 2022), there is even less research on CFL/CSL teachers.

There are general technology and subject specific technology, which are corresponding to TK and TCK (Chai et al., 2013a). It was also hypothesized by Angeli et al. (2016) that "some aspects of TPACK are domain-generic and others domain-specific". The specific educational technology utilized by language teachers may be different with what science teachers use in their instruction. Therefore, reviewing the six components of TPACK specially TK and TCK within the context of a specific technology in a specific subject domain could be important step to verify the generality and specificity attributes of TPACK (Angeli et al., 2016). There are no studies related to Interactive Reading Platforms concerning CFL/CSL teaching as far as the author's knowledge at this moment, so this study can be served as the respondence to the educational research community's call.

2.2. Teacher Readiness for Technology Integration

The technology readiness refers to people's propensity to adopt and use new technologies to achieve personal and work goals (Parasuraman, 2000). Readiness for change corresponds to the preparation phase, teacher readiness can be defined as the planning phase, in which teachers are positive about the transition and ready to act for the benefit of the students in the future (Holt & Vardaman, 2013).

New technologies offer new opportunities to support teaching and learning, as well as new challenges for teachers. Introducing technology into the classroom requires a paradigm shift in teaching and learning, and the success of this process will be determined by teachers' readiness to integrate technology (Al-Awidi & Aldhafeeri, 2017).

Teachers' self-efficacy belief is one of the important and measurable components that affects technology integration. It is also an indicator to identify how much teachers willing to use technology in teaching (Albion, 1999).

3. Research Methods and Instrument

It is important to understand the key variables and establish the conceptual framework to direct the research design.

3.1. Conceptual Framework and Hypothesis

In a systematic review of 30 frameworks addressing readiness, it was identified that technology competency is one of the strongest factors relating to teacher readiness (Demir & Yurdugül, 2015). So, in this research, in-service CFL/CSL teachers' technology competency was examined the effects on teachers' readiness toward the utilization of IRP in teaching Mandarin at K-12.

As TPACK is a technology integration model that involve teacher competence (Yurdakul et al., 2012). So, in this study, TPACK was used as a benchmark to measure the weight it exerts on teachers' readiness for technology integration. When taking TPACK to illustrate

the level of technology competency, this study not only measure the overall perception of TPACK, but also went further to check the variance of weights of its 6 components influence on teachers' readiness for interactive reading platforms. Meanwhile, self-efficacy beliefs were used as an indicator to examine the level of teacher preparation and the degree of willingness to use IRP in CFL/CSL lessons.

Therefore, the conceptual framework in Figure 5 was established by synthesizing TPACK model and Teachers' Readiness.

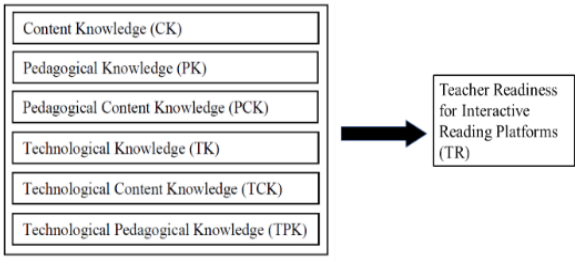

Figure 5: Conceptual framework

Accordingly, it was hypothesized that six independent variables, namely six components of TPACK, which are content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK), technological knowledge (TK), technological content knowledge (TCK) and technological pedagogical knowledge (TPK), would influence the dependent variable of Teachers' Readiness (TR) to utilize Interactive Reading Platforms in K-12 CFL/CSL teaching.

3.2. Research Design

Based on the conceptual framework, survey-based quantitative research with a multiple linear regression statistical method was performed to serve the purpose of this study.

Survey research is widely used to describe and study human behaviour in social and psychological research (Singleton & Straits, 2009) by obtaining information to learn about people's attitudes or opinions that are otherwise difficult to measure with observational techniques. One of the advantages of the quantitative method is that it can use smaller sample to infer larger groups with lower cost.

3.3 Population and Sample

3.3.1 Population Characteristics

The target respondents are all in-service CFL/CSL teachers who are teaching Mandarin at K-12. So, there are three major characteristics of the population, which are teachers who are teaching CFL or CSL; who experienced teaching CFL/CSL at K-12; who are in-service teachers not pre-service teachers.

3.3.2 Sample Size

This research used multiple linear regression as the statistical method. G*Power, that was developed as sample size estimation software to provide accurate performance analysis based on most statistical tests in behavioural science (Erdfelder et al., 1996), was used to calculate the sample size.

In this study, a priori analysis of required sample size was computed via the following value: a priori analysis for linear multiple regression, fixed model R2 departure from zero was selected. Then, the following data were chosen for the analysis of the sample size: .05 Effect size, .05 error probability, .95 power and 6 predictors. The results showed that this study need a minimum of 146 sample size.

3.3.3 Sampling Techniques

The purposive sampling method, which requires the researcher to identify the characteristics of samples that are qualified to be part of the study (Etikan et al., 2016), was employed to select the sample for pilot test and the actual study.

Since the population for this study is all working CFL/CSL teachers at K-12, which is not limited to specific educational institutions in China or other countries, the survey questionnaire was distributed purposively to the selected WeChat groups of CFL/CSL teachers as the potential participants because they share the same characteristics with research population. In addition, to ensure that participants had the same characteristics and knowledge sufficient for the study, a

screening question was included for all participants to confirm that participants had experience teaching CFL/CSL at K-12.

3.4. Research Instruments

Measurement is typically done through an instrument to obtain quantitative or qualitative data that represents the value or properties of the variable under study. An instrument can be a questionnaire, survey, interview, observation plan, and so on.

A web-based self-assessment questionnaire was developed and managed as an instrument in the current study. Grounded on the conceptual framework, the construct definitions for seven key variables were developed first.

Then conducting a thorough search to find a suitable instrument from previous research. In this study, the items and constructs were adapted from multiple sources by combining two instruments called TPACK Survey and Computer Technology Integration Survey (CTIS) to form a questionnaire. Instruments developed by Qiu et al. (2022), Chai et al. (2013b), Bostancıoğlu and Handley (2018), Jang and Tsai (2012), Yang et al. (2021), and Wu et al. (2022) influenced the design of the portion of TPACK evaluation, while the section for Teachers' Readiness adapted six items from CTIS instrument (Wang et al., 2004).

The instrument has been re-crafted, and the modification was made to specify all content or subject-related items as the CFL/CSL teaching, and the words of general technology were replaced with "Interactive Reading Platforms".

Finally, the operationalization table containing seven constructs of total 45 items was completed with the context to assess the readiness level of in-service CFL/CSL teachers when using interactive reading platforms in teaching Chinese at K-12.

3.4.1 Questionnaire

The questionnaire was organized into three parts based on the operationalization table.

Part I comprised two screening questions. The first one was asked for the agreement with the consent form to confirm the respondents fully understand the purpose of this study and participate anonymously. Following was a question to confirm the participants had experience teaching CFL/CSL at K-12. As the questionnaire was intentionally distributed to the selected WeChat groups of CFL/CSL teachers at different levels, it is important to have a screening question to remove unqualified samples that inadvertently responded to the survey, such as teachers teaching Mandarin to native Chinese speakers, or teaching CFL/CSL in colleges.

Part II consisted of the demographic background of the respondent, with seven questions such as gender, age, years of teaching and technology training experience.

Part III contained final 43 items based on a five-point Likert scale. The Likert scale, developed by Rensis Likert (Edmondson, 2005), aims to measure a person's agreement recognition of a position stated in the narration. The front 37 questions exhibited participants' perception on TPACK level, while the last 6 questions, adopted from the CTIS instrument (Wang et al., 2004), examined teachers' confidence in technology integration, indicating the level of readiness of teachers. Participants selected one of five options based on their opinion of TPACK and the willingness to integrate technology. The five options are 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree.

3.4.2 Questionnaire Translation

The original questionnaire was prepared in English and supplemented with a Chinese version, translated by the author, a native Chinese speaker who is teaching CFL/CSL at K-12, to create a bilingual instrument. Since CFL/CSL teachers are not limited to native Chinese speakers, the bilingual tool can be helpful for a better understanding of the issues addressed, but also for avoiding cultural bias.

Then the Chinese translation was further verified by two masters who were majoring in CFL/CSL teaching and English teaching respectively and one Ph.D. candidate of a native Chinese speaker.

3.4.3 IOC and Validity

"Validity" or "Accuracy" describes that the measurement is meaningful in making decisions and providing explanations relevant to the purpose of the study.

The researcher confirmed content validity by asking three experts to rate the IOC (Index of Item Objective Congruence) introduced by Rovinelli and Hambleton (1976).

The IOC form was used to determine the item quality via collecting the opinions from experts on all questions embedded in the questionnaire. On this form, the experts were asked to mark score for each item's content: Score =1, if the expert determines that this item does measure the attributes; If the expert is not sure whether the item measures the expected attribute, the score = 0; Score =-1, if the expert determines that the item does not measure attributes.

The following criteria were used to select a panel of three experts to validate questionnaire items: 1) possess a Ph.D. or Ph.D. candidate; 2) should be either active conduct researcher or have professional experience related to the research topic or experience in education.

Once IOC forms returned, the average of the experts' scores was calculated as the IOC index. It was found that out of 45 items, 2 items (PK7 and PCK6) were discarded in the IOC assessment because the IOC index for these 2 items was lower than .5. Qualifying items should have an IOC index of at least .5 (Brown, 2005). After discarding two items (PK7 and PCK6), 43 items left on the questionnaire would be processed Reliability Test.

3.4.4 Pilot Test and Reliability

Reliability or consistency describes that the measurement can gives the same results when different attempts are made to measure something.

Internal consistency reliability was used to assess the homogeneity between the scale's internal items through a pilot test. Then, Cronbach's alpha (Cronbach, 1970), one of the most commonly reported reliability estimates, was calculated for each scale.

If the sample size is larger, it will be more representative of the population according to the central limit theorem (CLT) proved by Liapounov (Mether, 2003). Normally, a sample of 30 is acknowledged in statistics, So, a purposive sampling technique was used to select a group of 30 on-duty K-12 CFL/CSL teachers to participate in the pilot test. The data from the pilot test was checked Cronbach's alpha value by jamovi statistics software version 2.2.5 (R Core Team, 2021; Revelle, 2019; The jamovi project, 2021). Table 1 showed that Cronbach's alpha values for all variables ranged from .759 to .899, all exceeding .7, which confirmed the instrument reliable and acceptable to collect the complete sample data (George & Mallery, 2003).

So, all that was left was a final instrument for processing the actual survey.

3.5 Data Collection Procedures

The survey was conducted through a self-report questionnaire to collect individual perception data on a voluntary basis.

Firstly, the questionnaire was generated by a web-based survey tool called Wenjuanxing; then the link to the questionnaire was distributed in the selected WeChat Groups of CFL/CSL teachers. To ensure the research is conducted ethically, a brief consent form was shown at the beginning of the questionnaire, explaining the nature and purpose of this research and declaring that all the information would be anonymous and limited to this study.

Secondly, the survey opened online for 2 weeks from July 16 till July 30, 2022.

Lastly all information collected was exported out and saved as an excel file on the researcher's computer for data processing after the closure of the survey window.

4. Results

The current research applied quantitative survey for collecting primary data. A total of 226 CFL/CSL teachers responded during a two-week survey window. Five questionnaires that disagreed with the consent form and 48 do not teach Chinese at the K-12 were removed, leaving 173 valid questionnaires, which was above the minimum sample size of 146.

Descriptive statistics (means, standard deviations) and multiple correlational analyses were employed to analyse the data via jamovi statistical software Version 2.2.5.

4.1 Internal Consistency Reliability (Cronbach's Alpha)

Table 1: Results of Internal Consistency of Variables (Cronbach's Alpha)

Variable	Items	Cronbach's Alpha	
		Pilot Test N=30	Actual Study N=173
Content knowledge (CK)	5	.759	.825
Pedagogical knowledge (PK)	7	.896	.874
Pedagogical content knowledge (PCK)	7	.854	.860
Technological knowledge (TK)	7	.895	.937
Technological content knowledge (TCK)	5	.830	.810
Technological pedagogical knowledge (TPK)	6	.873	.909
Teachers' Readiness (TR)	6	.899	.936

In Table 1, the Cronbach's Alpha Coefficient falls in a range between .825 to .937, all-surpassing .7, this indicates that high internal consistency was met for all research constructs, therefore the questionnaire developed for this study was testified again to meet the standard required for the reliability test per George and Mallery (2003).

4.2 Demographic Information

Table 2 exhibits a summary of demographic data. More female than male teachers took part in this survey, 135 (78%) and 38 (22%) respectively. As the top group of age was between 25 to 35 years old (46.2%), there were 30.1% of the respondents had less than 5 years of teaching experience.

Master's degree (47.4%) ranked at the top of the education background. While 62.4% of teachers had technology-related training, there still had 37.6% claimed they did not have any training of technology integration.

Table 2: Summary of Frequencies of Respondents' Demographic Profile (N=173)

Subjects	Counts	% of Total	Cumulative %
Gender			
Female	135	78.0 %	78.0 %
Male	38	22.0 %	100.0 %
Age Range			
18-24	23	13.3 %	13.3 %
25-35	80	46.2 %	59.5 %
36-45	40	23.1 %	82.7 %
46-55	22	12.7 %	95.4 %
Older than 55	8	4.6 %	100.0 %
Highest Education			
College Diploma	11	6.4 %	6.4 %
Bachelor	66	38.2 %	44.5 %
Master	82	47.4 %	91.9 %
Ph.D.	14	8.1 %	100.0 %
Teaching Experience			
New teacher	20	11.6 %	11.6%
Less than 5 years	52	30.1 %	41.7%
5~10 years	48	27.7 %	69.4%
11~15 years	27	15.6 %	85.0%
16~ 20 years	13	7.5 %	92.5%
More than 20 years	13	7.5 %	100.0%
Technology Training			
No	65	37.6 %	37.6 %
Yes	108	62.4 %	100.0 %

In terms of student range, some teachers taught one level, some working with two or more levels. But the respondents had more experience to teach Primary learners (64.74%). 46.82% of respondents teach at Junior High school, 37.57% at Senior High School and 30.64% at Preschool.

All the respondents served in 24 different countries. Among them, China, Thailand, and the USA are listed as the top three locations for employment.

4.3 Descriptive Statistics of Variables

Descriptive analysis refers to transforming raw data in a way that is easy to understand and explain. The descriptive statistics which describe characteristics and explain central tendencies & variability of data were collected, both mean and standard deviation were analyzed and reported.

4.3.1 Arbitrary Level of Questionnaire

Following the assessment criteria by Jwaifell et al. (2018), data interpretation shown in Table 3 was used to rate the respondents' perceptions with each statement presented in the questionnaire using the 5-point Likert scale.

Table 3: Arbitrary Level for Interpretation of Five Point of Likert Scale

Arbitrary Level	Rating of Perception	Interpretation
1 – 1.8	Strongly Disagree	Very weak
1.81 – 2.61	Disagree	Weak
2.62 – 3.42	Neutral	Medium
3.43 – 4.23	Agree	High
4.24 – 5	Strongly Agree	Very high

4.3.2 Descriptive Statistics of Variables

After processing jamovi, it was computed Mean and Standard Deviation for each variable explaining the Central Tendency and the Variability of scores respectively. Because the survey used a 5-point Likert interval scale, responses to each question could be counted as scores.

According to the data interpretation criteria, there is an overall high level of readiness status for in-service CFL/CSL teachers when integrating Interactive Reading Platforms to K-12 Mandarin instruction per the mean scores of Teachers' Readiness was 3.7, SD=.685 (see Table 4).

The result illustrated the means score for the seven factors ranging from 3.38 to 3.92, the average value of the mean ranked from high to low was: PK > CK > PCK > TR > TCK > TPK>TK. Out of all the TPACK constructs, teachers reported that they had high competency on the PK, CK, PCK, TCK, and TPK. The highest construct reported as highest competency was PK (M=3.92, SD=.563). On the other hand, TK was reported to have the medium level of competency (M=3.38, SD=.805). Other constructs had different mean value reported from respondents. However, all of them were interpreted within the same range, which was high level of competency. The mean value and standard deviation for each construct is shown in Table 4.

Table 4: Summary of Descriptive Statistics of Survey Responses (N=173)

Variable	Mean	SD	Level
Content knowledge (CK)	3.90	.614	High
Pedagogical knowledge (PK)	3.92	.563	High
Pedagogical content knowledge (PCK)	3.78	.580	High
Technological knowledge (TK)	3.38	.805	Medium
Technological content knowledge (TCK)	3.68	.617	High
Technological pedagogical knowledge (TPK)	3.61	.722	High
Teachers' Readiness (TR)	3.70	.685	High

4.4 Hypotheses Testing

Hypothesis

H_0: Six components of TPACK, which are content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK), technological knowledge (TK), technological content knowledge (TCK) and technological pedagogical knowledge (TPK), would not influence the dependent variable of Teachers' Readiness (TR) to utilize Interactive Reading Platforms in K-12 CFL/CSL teaching.

H_1: Six components of TPACK, which are content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK), technological knowledge (TK), technological content knowledge (TCK) and technological pedagogical knowledge (TPK), would influence the dependent variable of Teachers' Readiness (TR) to utilize Interactive Reading Platforms in K-12 CFL/CSL teaching.

Multiple Linear Regression analysis helps the researcher to test hypotheses by examining the influence of the independent variables on the dependent variable and to evaluate teachers' TPACK level influence on in-service Chinese Teachers' Readiness (TR) for integrating Interactive Reading Platforms in K-12 CFL/CSL instructions. The result of regression analysis in Table 5 revealed that:

1. Six components of TPACK positively and strongly related to Teachers' Readiness as the correlation values, most commonly Pearson's R, showed .855. If the net value of R_{xy} is greater than .7 in the range -1 to +1, this means a very large correlation between factors according to Cohen (1988). (Note: "-" or "+" indicates negative relationship or positive relationship respectively.)

2. The sample multiple correlations (R^2 or R-squared) were .73, indicating that approximately 73% of the variance of Teachers' Readiness can be accounted for by the linear combination of independent variables, namely six components of TPACK. The Coefficient of Determination (Wright, 1921) shows the percentage of the variance in the

dependent variables can be explained by the independent variables. The formula for the R-squared is:

$$r_{xy} = .855 \rightarrow r_{xy}^2 = (.855)^2 = .731$$

3. The linear combination of independent variables measures was statistically significant related to Teachers' Readiness F (6, 166) = 75.2, p <.001. And the common significance level to be used in Social Science is at the level of .05. If the P value is lower than the .05 level, then a conclusion can be drawn that the six components of TPACK contribute positively and significantly influence on in-service Chinese Teachers' Readiness for integrating interactive reading platforms in K-12 CFL/CSL instruction, following Sir Fisher's suggestion (1959) on the role of p-values and statistical significance in assessing the size of an effect or the importance of a result. The formula for the model of all independent variables toward Teachers' Readiness is:

$$\hat{Y} = -.22273X1 + .39486X2 + -.04883X3 + .00744X4 + .17330X5 + .57826X6$$

Table 5 *Model Fit Measures*

				Overall Model Test			
M	**R**	**R²**	**Adjusted R²**	**F**	**df1**	**df2**	**p**
1	.855	.731	.721	75.2	6	166	*

*Note: * denotes p<0.001*

The variance inflation factor (VIF) value of the independent variables in Table 6 is in the range of 2.23 ~ 4.14 which is less than 5.00, implying that the single-collinearity problem is not a critical issue in this study (Becker et al., 2015). The variance inflation factor (VIF) is used to measure the severity of multicollinearity in multiple linear regression models.

Therefore, this result will reject the null hypothesis, and support the Alternative Hypothesis, that is to say, the synthesized six components of TPACK, which are content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK), technological knowledge (TK), technological content knowledge (TCK) and technological pedagogical knowledge (TPK) did influence the dependent variable of in-service Chinese Teachers' Readiness (TR) to utilize Interactive Reading Platforms in K-12 CFL/CSL teaching. (Note that: p-value<=.05, Hypothesis is supported.)

Table 6: *Collinearity Statistics*

	VIF	**Tolerance**
CK	2.74	.366
PK	4.14	.242
PCK	2.23	.448
TK	2.65	.377
TCK	2.82	.355
TPK	2.88	.347

Note: VIF denotes variance inflation factor

In addition, the fixed-effect parameter estimates (Table 7) showed that technical pedagogical knowledge (TPK) has the greatest impact on teachers' readiness (β=.58, p<.001). The second greatest impact was pedagogical knowledge (PK) with (β=.39, p<.001). The third largest influencing variable was technological content knowledge (TCK) with (β=.17, p =.011). Finally, content knowledge (CK) showed a negative impact on teacher readiness at (β=−.22, p=.001). The other variables showed no statistically significant influence on teachers' readiness.

The Beta value for each independent variable represents the relative importance of each predictor. The larger the Beta value is, the greater the influence of this variable of TPACK on Teacher Readiness for interactive reading platforms.

Table 7: *Fixed Effects Parameter Estimates*

Names	**Estimate**	**B**	**df**	**p**
(Intercept)	3.69942	.0000	166	< .001
CK	-.24840	-.22273	166	.001
PK	.48064	.39486	166	< .001
PCK	-.05765	-.04884	166	.418
TK	.00633	.00744	166	.910

TCK	.19232	.17330	166	.011
TPK	.54875	.57826	166	< .001

5. Discussion and Conclusions

5.1 Answers to the Research Questions

5.1.1 Research Question 1

What is in-service Chinese teachers' perception about their competency (TPACK) and readiness toward the utilization of Interactive Reading Platforms in teaching CFL/CSL at K-12?

Descriptive statistics can provide information to answer the first research question.

According to the data interpretation criteria, there are overall positive perceptions of TPACK and high readiness status for the in-service CFL/CSL teachers when integrating Interactive Reading Platforms to K-12 Mandarin instruction. These findings of the current study corroborate the previous research (Hsu, 2016; Liu et al., 2015).

However, the degree of overall TR was just slightly above the cut-off range of High Lever Category (see Table 4), and the respondents perceived lower confidence when regularly incorporating interactive reading platforms into the lessons at the appropriate time for student learning (TR4: Mean=3.65, SD=.789). This can be related to the lower TK level (Mean=3.38, SD=.805). As the TK or the technical knowledge level is at the medium level only, it might lead to insufficient preparation and confidence in technology integration. Furthermore, the question of whether it was related to a lower TK can be examined via linear regression data analysis.

On the other hand, the participants were more competent at PK, CK, and PCK, less competent in TCK and TPK, and least with TK, which is in line with the previous study (Chai et al., 2010; Cheng, 2017; Jwaifell et al., 2018; Qiu et al., 2022; Schmidt et al., 2009; Wu & Wang, 2015).

Participants felt some confident about learning the technology of Interactive Reading Platforms (IRP) easily (TK2: M=3.61, SD=.839) and having good skills to use IRP effectively (TK1: M=3.5, SD=.893), but they did not think they were capable to solve problems when utilizing IRP (TK6: M=3.26, SD=.998) and to analyze learning data via IRP (TK7: M=3.27, SD=1.017).

As TK is one of the core components for TPACK competency to reflect technological knowledge about Interactive Reading Platforms, TCK and TPK are defined as the integration competency between IRP and Chinese language and pedagogical knowledge respectively. But this current study shows that the respondents' TCK (M=3.68, SD=.617) and TPK (M=3.61, SD=.722) level are not very high as well. Participants still felt relatively lower confidence to use IRP for CFL/CSL teaching (TCK1: M=3.49, SD=.860) and to utilize IRP to present the difference between cultures (TCK4: M=3.49, SD=.906). They were not fully prepared to use IRP to enhance the learning performance (TPK3: M=3.47, SD=.866) or to understand students' learning process through online assessment on IRP (TPK4: M=3.49, SD=.900).

All of these suggest that, although overall perception about TPACK competency and teachers' readiness (TR) for technology integration arrived at high level scale, but currently the in-service CFL/CSL teachers still have insufficient knowledge of interactive reading platforms' technology and are not good at dealing with technical problems related to interactive reading platforms during the teaching process, which also affects the ability and confidence of technology integration teaching.

5.1.2 Research Question 2

How do the six components of TPACK influence in-service Chinese Teachers' Readiness (TR) toward the utilization of Interactive Reading Platforms in teaching CFL/CSL at K-12?

Based on the Multiple Linear Regression analysis, the hypothesis was unsurprisingly supported that the synthesized six components of TPACK, did statistically influence the dependent variable of in-service Chinese Teachers' Readiness (TR) to utilize Interactive Reading Platforms in K-12 CFL/CSL teaching. In another word, in-service Chinese teachers who have a greater TPACK level may be more willing and more confident to use interactive reading platforms and perceive a higher

degree of preparedness for technology-integrated instruction.

The higher level of teachers' readiness for technology integration, the more likely they are to use technology to complete instructional tasks (Abbitt, 2011).

When checking specifically each of the independent variables' effect on the dependent variable, it is interesting to notice that CK showed a negative impact on teacher readiness. This may be because teachers tend to ignore technical knowledge and pay more attention to the subject and pedagogical knowledge when they are unskilled. As the majority of the respondents were young teachers (46.2%), 30.1% of the participants had less than 5 years of teaching experience. Sun et al. (2017) research also proved that there was a significant progress in readiness for technology integration over the increased teaching experience. This can be further explored by comparing the effect of TPACK of different age groups and teaching experiences groups on their readiness toward technology integration in future research.

As TK is considered to be one of the essential and core components for building up overlapping competency of TPACK, it was assumed positively associate with TR. But it was unexpected to discover that TK with the study participants has no impact on TR for technology integration. This finding is consistent with Sun et al. (2017) work. This calls for further research in the future to find out the possible reasons.

However, the current overall teachers' competency of the study participants has reached a high level despite the TK remaining the lowest competence, this could be in responding to Koehler and Mishra's view in 2009 that technology integration is not the over-simply increase of technological knowledge. Increasing technological skills and knowledge alone may not equate to integrating technology into teaching and learning environments. The integration or transformation that happens in a real classroom is complex and contextualized, requiring a high level of connection and synthesis between content, pedagogical and technological knowledge.

It is obvious that Information technology is gradually deconstructing and reconstructing the knowledge structure of language teachers. So, following the implication of the present study results, two recommendations are made for in-service CFL/CSL teachers:

1. **For individual teacher:** Sustainable professional development is very important and necessary to overcome the reluctance to use ICT and increase the readiness for technology integration. Building the TPACK concept, active practicing, positive reflection, and purposively learning those specific technologies which can effectively enhance the technology integration related with individual CFL/CSL class, rather than general technology or inappropriate tools.

2. **For teachers' collaboration:** Internet-based support groups or platforms for teachers to share experiences in specific regions or for specific grade level syllabuses will be applicable to help in-service Chinese teachers to solve the problem they face alone when they integrate technology in K-12 teaching and leads them toward constant improvement on technology integration instruction.

5.2 Future Research

Further investigation can be extended in the future.

1. An interview or other type of investigation can be conducted to seek the explanation for why TK has no impact on Teachers' Readiness for technology integration and why CK has negative influence on TR.

2. Only 226 responded from an estimated sample frame of around 2800. Even though the 8% rate is acceptable for an online survey (Fan & Yan, 2010), the sample may not represent all of the target population. Future researchers are suggesting having a bigger size of sample or increasing the response rate to improve the generalization of the result. Moreover, the current participants are scattered in 24 countries. It is suggested that an investigation may be conducted in a specific region or country in the future to better study the readiness of Chinese CFL/CSL teachers for technology integration.

5.3 Conclusion

Technology has great potential to improve the curriculum and teaching process. Effective integration of ICT into teaching and learning would largely depend on teachers' ability to teach with technology. Therefore, this study sought to identify in-service CFL/CSL teachers' perceptions of their technology competency (TPACK) and willingness to use interactive reading platforms (IRP) when teaching Chinese to K-12 students, and further determine the impact of TPACK on teachers' Readiness (TR) for technology integration.

Based on the valid self-evaluated questionnaires of 173 participants, findings obtained in this investigation revealed that:

1. There are overall positive perceptions of TPACK and high readiness for integrating IRP into K-12 CFL/CSL instruction.

2. Participants were more competent at PK, CK, and PCK, less competent about TCK and TPK, and least with TK.

3. High correlations were found between TPACK level and TR degree. Multiple Linear Regression analysis supported the hypothesis that six components of TPACK could statistically influence TR significantly.

4. Six components of TPACK have different effect on TR. TPK has the greatest impact on teachers' readiness; then PK second greatest impact; then TCK third largest influencing variable. It is interesting to notice that CK showed a negative impact on teacher readiness. The rest of the two variables (TK & PCK) showed no influence on teachers' readiness.

More study is suggested to seek the explanation for why TK has no impact on TR and why CK has negative influence on TR.

Although some limitations are occurring, this study has made some contributions to extending the exploration of TPACK to be connected with technology integration readiness. In addition, a couple of recommendations for teachers' development of TPACK competency and confidence with technology integration as well as some suggestions for future research have been provided.

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