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INVESTIGATING PRE-SERVICE ENGLISH
TEACHERS' TECHNOLOGICAL PEDAGOGICAL
CONTENT KNOWLEDGE FRAMEWORK IN
TEACHER EDUCATION PROGRAMME
AT HULUNBEIR UNIVERSITY
IN CHINA



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UNIVERSITI PENDIDIKAN SULTAN IDRIS

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FACULTY OF HUMAN DEVELOPMENT
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ABSTRACT

The aim of the study is to develop a new framework to improve pre-service English teachers' Technological Pedagogical Content Knowledge (TPACK) in Hulunbeir University, China. A quantitative method was used. Statistical Package of Social Science (SPSS) was employed to examine the TPACK level, different backgrounds based on the data from 165 pre-service English teachers by representative sampling technique of Hulunbeir University, China. Structural Equation Modeling (SEM) with Analysis of Moment Structures (AMOS) was applied to construct, verify and modify the pre-service English Teachers' Technological Pedagogical Content Knowledge Model (PET-TPACK Model). The findings show that the overall TPACK level of pre-service English teachers is at moderately high level. For backgrounds, internship experience has a significant influence on Pedagogical Knowledge (PK), Content Knowledge (CK), Technological Pedagogical Knowledge (TPK) and TPACK, and Educational Technology Course has a significant influence on all seven components of TPACK framework. However, gender has no significant influence on TPACK of pre-service English teachers. Pearson correlation shows that there is a significant pairwise correlation between the seven components of TPACK framework. The modified PET-TPACK model has good fitting (CMIN/DF = 1.64; RESEA = 0.062; GFI = 0.801; TLI = 0.916; CFI = 0.925). Except GFI less than the fitting index 0.90, other fitting indexes reached the model standard. Based on the complexity of the model, the fitting degree of the model is considered to be ideal, and the PET-TPACK Model is adaptable for pre-service English teachers in Hulunbeir University, China. In conclusion, the study developed a new framework PET-TPACK Model for improving pre-service English teachers' Technological Pedagogical Content Knowledge (TPACK). The implication of the study is that the new PET-TPACK Model can effectively guide the Teacher Education Programme and provide important theoretical guidance for the training of information teaching ability of pre-service English teachers in Hulunbeir University, China.





MENINJAU KERANGKA PENGETAHUAN KANDUNGAN PEDAGOGI TEKNOLOGI GURU PRA-PERKHIDMATAN BAHASA INGGERIS DALAM PROGRAM PENDIDIKAN GURU DI UNIVERSITI HULUNBEIR CHINA

ABSTRAK

Matlamat kajian ini ialah untuk membangunkan rangka kerja baru untuk meningkatkan Pengetahuan Kandungan Pedagogi Teknologi (TPACK) guru bahasa Inggeris pra-perkhidmatan di Universiti Hulunbeir, China. Kaedah kuantitatif telah digunakan. Paket Statistik Sains Sosial (SPSS) telah digunakan untuk memeriksa tahap TPACK, latar belakang yang berbeza berdasarkan data daripada 165 guru bahasa Inggeris pra-perkhidmatan dengan teknik persampelan perwakilan Universiti Hulunbeir, China. Pemodelan Persamaan Struktur (SEM) dengan Analisis Struktur Momen (AMOS) telah digunakan untuk membina, mengesahkan dan mengubah suai Model Pengetahuan Kandungan Pedagogi Teknologi Guru Bahasa Inggeris pra-perkhidmatan (Model PET-TPACK). Penemuan menunjukkan bahawa tahap TPACK keseluruhan guru Bahasa Inggeris pra-perkhidmatan berada pada tahap yang sederhana tinggi. Untuk latar belakang, pengalaman latihan mempunyai pengaruh yang ketara terhadap Pengetahuan Pedagogi (PK), Pengetahuan Kandungan (CK), Pengetahuan Pedagogi Teknologi (TPK) dan TPACK, dan Kursus Teknologi Pendidikan mempunyai pengaruh yang ketara terhadap semua tujuh komponen rangka kerja TPACK. Walau bagaimanapun, jantina tidak mempunyai pengaruh yang ketara terhadap TPACK guru bahasa Inggeris pra-perkhidmatan. Korelasi Pearson menunjukkan bahawa terdapat korelasi berpasangan yang ketara antara tujuh komponen rangka kerja TPACK. Model PET-TPACK diubah suai mempunyai pemasangan yang baik ($CMIN / DF = 1.64$; $RESEA = 0.062$; $GFI = 0.801$; $TLI = 0.916$; $CFI = 0.925$). Kecuali GFI kurang daripada indeks pemasangan 0.90, indeks pemasangan lain mencapai standard model. Berdasarkan kerumitan model, ijazah pemasangan model dianggap ideal, dan Model PET-TPACK boleh disesuaikan untuk guru bahasa Inggeris pra-perkhidmatan di Universiti Hulunbeir, China. Kesimpulannya, kajian ini telah membangunkan rangka kerja baru Model PET-TPACK untuk meningkatkan Pengetahuan Kandungan Pedagogi Teknologi (TPACK) guru-guru Bahasa Inggeris pra-perkhidmatan. Implikasi kajian ini ialah Model PET-TPACK yang baru dapat membimbing Program Pendidikan Guru dengan berkesan dan menyediakan panduan teori yang penting untuk latihan keupayaan pengajaran maklumat guru bahasa Inggeris pra-perkhidmatan di Universiti Hulunbeir, China.



CONTENTS

	Page
DECLARATION OF ORIGINAL WORK	ii
DECLARATION OF THESIS	iii
ACKNOWLEDGMENT	iv
ABSTRACT	v
ABSTRAK	vi
CONTENTS	vii
LIST OF TABLES	xiii
LIST OF FIGURES	xvi
LIST OF ABBREVIATIONS	xvii
APPENDIX LIST	xix
CHAPTER 1 INTRODUCTION	
1.1 Introduction	1
1.2 Background of the study	2
1.3 Problem statement	5
1.4 Research objectives	11

1.5 Research questions	12
1.6 Research hypotheses	13
1.6.1 Hypotheses on research question two	14
1.6.2 Hypotheses on research question three	16
1.6.3 Hypotheses on research question four	18
1.7 Theoretical framework and conceptual framework of research	19
1.7.1 Technological pedagogical content knowledge (TPACK) theory framework	20
1.7.2 Conceptual framework	27
1.8 Operational definitions	31
1.8.1 Pre-service teachers	32
1.8.2 Technological pedagogical content knowledge (TPACK) for pre-service English teachers	33
1.8.3 Education informatization	36
1.8.4 Information teaching ability	36
1.8.5 Relationship of TPACK and information teaching ability	37
1.8.6 Teacher education programme	38
1.9 Limitation of study	39
1.10 Significance of research	40
1.11 Summary	43

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction	44
2.2 Study on information teaching ability	45
2.2.1 Study on China's official documents of information teaching ability	48

2.2.2 Study on perception and development of information teaching abilities for teachers	54
2.2.3 Study on development strategies of information teaching abilities for pre-service Teachers	58
2.3 Study on TPACK	61
2.3.1 Study on TPACK theory	63
2.3.2 Study on TPACK level	72
2.3.3 Study on different backgrounds influencing TPACK of pre-service English teachers	78
2.3.4 Study on teachers' TPACK development	81
2.3.5 Study on instruments of TPACK	96
2.4 Study on teacher education curriculum	118
2.5 Study on documents about teacher education programme in Hulunbeir University	121
2.5.1 Curriculum standards for teacher education (Trial)	124
2.5.2 Teacher Education Programme (Edition 2020) for pre-service English teachers in Hulunbeir University	126
2.5.3 Professional Competence Standards for Teachers of Normal School Students Majoring in Secondary Education (Trial)	132
2.5.4 Technical elements in Hulunbeir University Talent Training Programme	135
2.5.5 Technical elements in the syllabus of teacher education curriculums	137
2.5.6 Summary	139

CHAPTER 3 METHODOLOGY

3.1 Introduction	140
3.2 Research design	141

3.3 Research population and samples	146
3.3.1 Research population	147
3.3.2 Research samples	148
3.4 Ethical considerations	151
3.5 Research instruments	152
3.5.1 Questionnaire	153
3.5.2 Reliability of the instrument	159
3.5.3 Validity of the instrument	163
3.5.4 Normality distribution of data	168
3.6 Data collection of the study	171
3.7 Pilot study	173
3.7.1 Data collection of pilot study	173
3.7.2 Data screening	175
3.7.3 Demographic characteristics information of samples	175
3.7.4 Reliability and validity of the questionnaire in pilot study	176
3.8 Methods of analyzing data	180
3.8.1 SPSS data analysis	183
3.8.2 Structural equation modeling (SEM)	187
3.8.3 Exploratory factory analysis (EFA)	189
3.8.4 Confirmatory factory analysis (CFA)	190
3.9 Summary	193

CHAPTER 4 FINDINGS AND RESULTS

4.1 Introduction	195
------------------	-----

4.2 Data preparation prior to analysis	196
4.2.1 SPSS data tag processing	196
4.2.2 Missing and outliers of data	198
4.3 Findings to research questions	198
4.3.1 Findings related to research question one	199
4.3.2 Findings related to research question two	214
4.3.3 Findings related to research question three	225
4.3.4 Findings related to research question four	227
4.4 Summary	258

CHAPTER 5 DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction	260
5.2 Summary of the research	261
5.3 Discussion	265
5.3.1 Discussion on research findings	265
5.3.2 Discussion of research hypothesis of PET-TPACK model	292
5.4 Suggestions	297
5.4.1 Strategies on promoting teacher education programme of pre-service English teachers in Hulunbeir University from macro perspective	297
5.4.2 Strategies on optimizing teacher education curriculum based on course documents from micro perspective	347
5.5 Research implications	357
5.6 Future research	359
5.7 Conclusion	361



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REFERENCES

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LIST OF TABLES

Table No.		Page
1.1	Components of TPACK Framework	24
2.1	Official Documents of China's Ministry of Education on Education Information	53
2.2	List of Text Documents on Teacher Education	123
2.3	Curriculum Standards for Teacher Education (Secondary Pre-service Teachers)	125
2.4	Curriculum Setting of Teacher Education in Talent Training Programme	128
2.5	Educational technology requirements in the Standards	134
2.6	Information Technology Statistics in Personnel Training Programme	136
3.1	Demographic Characteristic of Participants	149
3.2	Detailed Information of Samples	150
3.3	Information of three questionnaires (Schmidt, Chai et. al and Wang)	155
3.4	Five-point Likert Scale of Questionnaire	159
3.5	Strength of Data and Internal Consistency of Cronbach's Alpha	162
3.6	Results of Reliability Analysis (N=165)	162
3.7	KMO Value and Bartlett Sphericity Test of TPACK (N=165)	168
3.8	Skewness Value and Kurtosis Value of the Questionnaire Variables	170
3.9	Samples' Information of Gender in Pilot Study	176
3.10	Reliability of Questionnaire in Pilot Study (N=60)	178
3.11	KMO Value and Bartlett Sphericity Test in Pilot Study (N=60)	179





3.12	Data Analysis of Research Problems	182
4.1	Data Tag in SPSS	197
4.2	The Criteria for Judging the Results of the 5-Point Data	200
4.3	Mean Scores of TPACK Components	200
4.4	Items of TK Component	202
4.5	Mean and Percentage of Items in TK Component (N=165)	203
4.6	Items of TK Component	204
4.7	Mean and Percentage of Items in CK Component (N=165)	204
4.8	Items of PK Component	205
4.9	Mean and Percentage of Items in PK Component (N=165)	206
4.10	Items of PCK Component	207
4.11	Mean and Percentage of Items in PCK Component (N=165)	207
4.12	Items of TCK Component	208
4.13	Mean and Percentage of Items in TCK Component (N=165)	208
4.14	Items of TPK Component	209
4.15	Mean and Percentage of Items in TPK Component (N=165)	210
4.16	Items of TPACK Component	211
4.17	Mean and Percentage of Items in TPACK Component (N=165)	211
4.18	Mean and Standard Deviation of TPACK Components Based on Gender	215
4.19	Results of Independent Sample T-test on Gender	216
4.20	Mean Scores of TPACK Dimensions Based on Internship Experience	218
4.21	Independent Sample T-test analysis of TPACK for pre-service English teachers having internship experience or not	219





4.22	Mean Scores of TPACK Dimensions Based on Educational Technology Course	222
4.23	Results of Independent Sample Test on Learning of Educational Technology	223
4.24	Pearson's Indices of Correlation	225
4.25	Results of Pearson Correlation of Seven Components of TPA (N=165)	226
4.26	Standard of Items of Offending Estimates.	228
4.27	Results of Total Variance Explained	230
4.28	Results of Rotating Component Matrix.	231
4.29	The model fit of Confirmatory Factory Analysis	235
4.30	Factor Loading and Results of AVE and CR	236
4.31	Results of Discriminate Validity (DV)	237
4.32	Model path assumptions	242
4.33	Indices of the Proposed Model (SEM)	244
4.34	Results of Standardized Regression Weights	245
4.35	Indices of the Modified Model (SEM)	250
4.36	Corrected Regression Weights	251
4.37	Results of Hypothesis Paths in the Model Testing	255
4.38	Standardized Direct Effects (Group number 1 - Default model)	257
4.39	Standardized Indirect Effects (Group number 1 - Default model)	257
4.40	Standardized Total Effects (Group number 1 - Default model)	257



LIST OF FIGURES

No. Figures	Page
1.1 TPACK Theory Framework	23
1.2 Conceptual Framework of the Study	27
3.1 Research Design	145
4.1 Confirmatory Factory Analysis Model	234
4.2 Path of Hypothetical PET-TPACK Structural Model	241
4.3 Hypothetical PET-TPACK Model	243
4.4 Revised Fit PET-TPACK Model	249
4.5 Revised Path Analysis of PET-TPACK Model	256
5.1 PET-TPACK Model	263
5.2 Framework of Teacher Education Curriculum Design	266



LIST OF ABBREVIATIONS

AI	Artificial intelligence
AMOS	Analysis of Moment Structure
ANOVA	Analysis of Variance
AVE	Average Variance Extracted
CFA	Confirmatory Factor Analysis
CFI	Comparative Fitness Index
CK	Content Knowledge
COVID-19	Corona Virus Disease 2019
CR	Composite Reliability
C.R.	Critical Ratio
Df	Degree of Freedom
EFL	English as a foreign language
ESP	English for Specific Purposes
et al.	and others
etc.	and so forth
EVA	Equal Variances Assumed
EVNA	Equal Variances Not Assumed
FITness	Fluency of Information Technology
GFI	Goodness of Fit Index
ICT	Information communication technology
KMO	Kaiser-Meyer-Olkin



MOOC	Massive Open Online Course
PCK	Pedagogy Content Knowledge
PCT.	Percentage
PK	Pedagogy Knowledge
SD	Standard Deviation
S. E.	Standard Error
SEM	Structural Equation Modeling
SPSS	Statistical Package of Social Science
TCK	Technology Content Knowledge
TK	Technology Knowledge
TPK	Technology Pedagogy Knowledge
TPACK	Technology Pedagogy Content Knowledge
TPSK	Technological Pedagogical Statistical Knowledge
X2	Chi-Square.

APPENDIX LIST

A Questionnaire

CHAPTER 1

INTRODUCTION

1.1 Introduction

In the information age, teachers organize teaching with the help of information technology, which can better enable students to understand the knowledge taught by teachers. How to improve teachers' information teaching ability in order to better carry out teaching is an important topic. In the teacher education system, pre-service teacher education plays an important role in the training of high-quality teachers. It is an essential professional quality for pre-service teachers to integrate technology into teaching, which has become the core content of the professional development of pre-service teachers. (Li, 2020). The quality of pre-service teacher education affects the development and stability of teachers in China to a great extent. Their information teaching ability directly affect the quality of education in the field of basic education



and the teaching staff. Therefore, it is particularly important to study the information teaching ability of pre-service English teachers (Zhou, 2020).

Information teaching ability is a key factor for pre-service teachers to adapt to teaching well in the future. Teacher education programmes are crucial elements in the development of pre-service English teachers. The English teacher education programme should be improved (Wu, 2022). Particularly, the setting of the curriculum system in teacher education programme directly affects whether pre-service English teachers can receive scientific education. Hulunbeir University is a normal university in China. This study aims to optimize the teacher education programme to improve the information teaching ability of pre-service English teachers in Hulunbeir University.

1.2 Background of the study

In the information age, emerging technologies affected all fields of human life and production, such as big data, cloud computing and artificial intelligence (AI) have rapidly (Liu, 2021). Meanwhile, information technology has also had a profound impact on the field of education. Education informatization has become an inevitable





trend with the rapid development of the Internet (Melash, Molodychenko, Huz, Varenychenko & Kirsanova, 2020). With the COVID19 pandemic bringing home the importance of technology in teaching and learning (Mishra & Warr, 2021; Zhang, 2020), information technology is used comprehensively and deeply to promote the process of educational reform and development.

Improving teachers' information teaching ability in order to better carry out teaching effectively has been an important topic in current academic research. Technology has caused the reform of education mode and teachers need to constantly improve their information teaching abilities. Technology has become an indispensable part of the lives of educators and students (Aktaş & Özmen, 2020). The increasing number of technological devices available in schools, aligned with curriculum guidance, set an expectation for teachers to incorporate these devices into their teaching (Bonafini & Lee, 2021). In order to promote professional development, teachers must conscientiously grasp the new trends and new ideas in the field of education based on valuable digital competence framework (Cabero-Almenara et al., 2020), conduct online teaching and innovation (Liu & Kleinsasser, 2023) and study new methods and new skills in practical teaching.



Pre-service teachers are the backbone in education and they are important groups to ensure the development of teachers' information teaching ability. Bonafini and Lee (2021) states that pre-service teachers need experiences that allow them to fully integrate technology in their teaching practice, and the pressure for integrating technology into teaching also makes latent the demand for them to use technology. According to Mishra and Warr (2021), teaching integrated by technology is not the same as just moving the content or processes onto the web, teaching with technology is complicated. Information teaching ability has become an essential professional quality for pre-service teachers, which has become the core content of the professional development of pre-service teachers in the information age (Li, 2020). As a result, the cultivation of pre-service teachers' information teaching ability becomes particularly important (Reisoğlu & Çebi, 2020). Therefore, it is urgent to develop the information teaching ability of pre-service teachers in universities.

The present study intends to research the current situation and promotion of information teaching ability of the pre-service English teachers (normal students) so as to develop more excellent future teachers to meet the development of information technology by developing teacher education programme.





1.3 Problem statement

The improvement of information teaching ability of pre-service English teachers is a new demand in digital age. The teaching concept, teaching method, teaching mode and teaching system have undergone great changes. Teachers have to get out of their comfort zone because of their lack of knowledge of the technology tools, lack of confidence knowing how to best integrate technology within their existing lesson plans, and so on (Mishra & Warr, 2021). Pre-service English teachers are the reserve army of future teachers, and the quality of future basic education and the strength of teachers are largely determined by the level of pre-service English teachers.



The information teaching ability of pre-service English teachers is insufficient. In recent years, the teachers trained in normal universities are still far from the requirements for the information ability of primary and secondary school teachers in the reform of basic education. There are few cognitive and behavioral studies on the integration of technology and subject teaching of pre-service English teachers (Liu, 2021). Based on the new requirements of pre-service teachers' ability, it is urgent to improve the level of pre-service English teachers' information teaching ability. There





are more and more research results on the integration of information technology and subject teaching at home and abroad.

As an authority document, teacher education programme in normal universities should be constantly updated according to the development and changes of technology, so as to develop more English teachers in the information age who meet the requirements of the reform of basic education in China. However, there is a phenomenon that the curriculum of pre-service teacher education lags behind the requirements in digital age. Based on previous studies, the problems include that the number of information teaching courses is small, that the subject knowledge of integrated technology is not ideal (Zhou, 2020), and the use of technology does not have a prominent position in the curriculum documents. These problems restrict the training effect of information teaching of English normal university students, partly resulting in a low overall TPACK level of normal university students (Wu, 2022; Zhang, 2021; Tang, 2020). According to the above research, as potential primary and secondary school teachers of basic education in the future, pre-service English teachers should keep pace with society and continuously improve their information teaching ability. From the perspective of research subjects, in China, there are more studies on TPACK for in-service teachers, and fewer studies on pre-service English teachers (Qin, 2021). From the perspective of research disciplines, most studies focus





on TPACK of the whole group of teachers, and there are relatively few studies that distinguish specific disciplines, especially those focusing on pre-service English teachers.

As one of the normal colleges, Hulunbeir university has always attached great importance to teacher education and made important contributions to the development of local society, especially the development of education. Since 2016, the school has been insisting on providing Educational Technology Courses for pre-service teachers (normal students). The overall level of technology construction in universities has been in a relatively stable position. Hulunbeir university has a stable and reliable campus network infrastructure platform that supports efficient Internet integration, basically realizes full coverage of campus wired network, and starts the construction of digital campus. In the construction of information teaching facilities, the classrooms were equipped with multimedia projection systems, and the audio - classrooms were configured with computers and software. Practical teaching rooms have also been built such as smart classrooms and micro-classrooms. Multimedia classrooms account for 80% of ordinary classrooms. It can be seen that Hulunbeir University provides a relatively rich information environment for the training of normal students. The school has certain typical characteristics in the information



teaching ability training of normal students, which can be used as the research object of this study.

However, the teacher education programme (Edition 2020) in Hulunbeir University fails to meet the requirements of the information age for the development of pre-service English teachers. Based on the analysis of the document materials on the teacher education programme for pre-service English teachers at Hulunbeir University, the researcher found that the current Teacher Education Programme (Edition 2020) and the teaching and examination syllabuses do not set up or involve much TPACK-related courses.



There are three problems in Teacher Education Programme (Edition 2020). First, the teacher education programme does not have the setting of TPK, TCK, and TPCK courses. Second, although TK, PK, PCK courses and the Educational Technology Course are set up including Teacher and Education Course, Computer Application course., there are no clear content requirements for the integration of technology into teaching. Third, in the Internship Experience section, the content and requirements of educational technology are not clearly defined. Furthermore,. Based on the fact that the number of female is larger than that of male, whether it is





necessary to emphasize the difference in teacher education curriculum. Therefore, the current Teacher Education Programme (Edition 2020) cannot satisfy achieving the goal of effectively developing information teaching abilities of pre-service English teachers, which is the “research gap” of the study.

Based on the research gap “The current Teacher Education Programme cannot satisfy achieving the goal of effectively developing information teaching abilities of pre-service English teachers”, this study conducted a quantitative research on pre-service English teachers aiming at improving the information teaching ability of pre-service English teachers by optimizing the teacher education programme.



TPACK provides an effective knowledge framework for the training of pre-service English teachers' information teaching ability. With the deepening of the integration of information technology and curriculum, the research results on the integration of information technology and subject teaching in the whole world are increasing, but the cognitive and behavioral studies on the integration of technology and subject teaching of pre-service English teachers are few and far between (Liu, 2021).



Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006) is a theoretical framework to support teachers' information teaching ability in the information age. As a theoretical basis for training teachers' information teaching ability, TPACK theory adds a new path for training pre-service teachers' education teaching ability (Qu, 2021). Technological Pedagogical Content Knowledge (TPACK) is a new knowledge framework of teachers' knowledge to integrate technology into specific subject in the era of information technology. As proposed by Melash et al. (2020), there are three dimensions of digital competence, the first one concerns the general digital competences, the second one is the competence to integrate technology into educational practice, and the third one involves professional digital competence. TPACK belongs to the second one which is the competence integrating technology into educational practice. Teachers' technological pedagogical knowledge (TPK), as defined in the TPACK framework, is considered an important prerequisite for effectively integrating technology (Baier & Kunter, 2020). TPACK framework can be used to guide research and development of teacher education curriculum (Mishra & Koehler, 2006).

This study takes pre-service English teachers in Hulunbeir University, China as the research participants, and develops a PET-TPACK model based on Wang's TPACK questionnaire (2020). The PET-TPACK Model optimizes teacher education

programme and improves the TPACK level of pre-service English teachers in Hulunbeir University, China.

1.4 Research objectives

The aim of the research is to develop the PET-TPACK model for optimizing teacher education programme to promote pre-service English teachers' information teaching ability, and determine direct and indirect effects of independent variables on dependent variable. Specifically, the study was to explore the TPACK level, TPACK components level of pre-service English teachers based on Internship experiences and setting of Educational Technology Courses, further to develop PET-TPACK model. Accordingly, the objectives of the study entails:

1. To investigate the level of English pre-service teachers' TPACK in Hulunbeir University, China.
2. To determine TPACK components level of pre-service English teachers in Hulunbeir University, China based on different backgrounds, including gender, Educational Technology Course and Internship Experience.



3. To explore the correlations between the components inside TPACK framework.
4. To test whether the proposed Pre-service English Teachers' Technology Pedagogy Content Knowledge Model (PET-TPACK Model) is acceptable for pre-service English teachers in Hulunbeir University, China.

1.5 Research questions

To achieve the objectives of the research, the following questions are prepared:



1. What is the level of English pre-service teachers' TPACK in Hulunbeir University, China?
2. Are there any differences in TPACK components level of pre-service English teachers in Hulunbeir University, China based on different backgrounds, including gender, Educational Technology Course and Internship Experience ?
3. What are the correlations between the components inside TPACK framework?
4. Is the proposed Pre-service English Teachers' Technology Pedagogy Content Knowledge Model (PET-TPACK Model) acceptable for pre-service English teachers in Hulunbeir University, China ?





1.6 Research hypotheses

Stating a hypothesis can help to focus on particular aspects of the research and help to choose the design and measures (Clark-Carter, 2009). Null hypothesis (H_0) refers to the hypothesis predicting that no difference exists between the groups being compared. Research hypothesis (H_1) or alternative hypothesis (H_a), refers to the hypothesis that the researcher wants to support, predicting that a significant difference exists between the groups being compared (Jackson, 2008), which are statements of what the researchers predict would be the outcome of the research (Clark-Carter, 2009). For research question two, null hypothesis was employed. For research question three, research hypothesis was employed. Directional hypotheses were used in research question three, which are created to examine the relationships among variables rather than to compare groups because the researcher has some evidence from past studies of the potential outcome of the study (Creswell, 2013). For research question two, 14 null hypotheses are proposed. For research question three, 10 directional hypotheses are proposed.



1.6.1 Hypotheses on research question two

Null hypotheses were put forward in this part for exploring differences in seven components of TPACK framework based on different backgrounds including gender, internship experience and educational technology course separately.

Null hypothesis: H0 2.1.1 There is no significant difference in CK of TPACK among pre-service English teachers based on gender.

Null hypothesis: H0 2.1.2 There is no significant difference in PK of TPACK among pre-service English teachers based on gender.



Null hypothesis: H0 2.1.3 There is no significant difference in TK of TPACK among pre-service English teachers based on gender.

Null hypothesis: H0 2.1.4 There is no significant difference in PCK of TPACK among pre-service English teachers based on gender.

Null hypothesis: H0 2.1.5 There is no significant difference in TCK of TPACK among pre-service English teachers based on gender.

Null hypothesis: H0 2.1.6 There is no significant difference in TPK of TPACK among pre-service English teachers based on gender.





Null hypothesis: H0 2.1.7 There is no significant difference in TPACK of TPACK among pre-service English teachers based on gender.

Null hypothesis: H0 2.2.1 There is no significant difference in CK of TPACK among pre-service English teachers based on internship experience.

Null hypothesis: H0 2.2.2 There is no significant difference in PK of TPACK among pre-service English teachers based on internship experience.

Null hypothesis: H0 2.2.3 There is no significant difference in TK of TPACK among pre-service English teachers based on internship experience.

Null hypothesis: H0 2.2.4 There is no significant difference in PCK of TPACK among pre-service English teachers based on internship experience.

Null hypothesis: H0 2.2.5 There is no significant difference in TCK of TPACK among pre-service English teachers based on internship experience.

Null hypothesis: H0 2.2.6 There is no significant difference in TPK of TPACK among pre-service English teachers based on internship experience.

Null hypothesis: H0 2.2.7 There is no significant difference in TPACK of TPACK among pre-service English teachers based on internship experience.

Null hypothesis: H0 2.3.1 There is no significant difference in CK of TPACK among pre-service English teachers based on Educational Technology Course.



Null hypothesis: H0 2.3.2 There is no significant difference in PK of TPACK among pre-service English teachers based on Educational Technology Course.

Null hypothesis: H0 2.3.3 There is no significant difference in TK of TPACK among pre-service English teachers based on Educational Technology Course.

Null hypothesis: H0 2.3.4 There is no significant difference in PCK of TPACK among pre-service English teachers based on Educational Technology Course.

Null hypothesis: H0 2.3.5 There is no significant difference in TCK of TPACK among pre-service English teachers based on Educational Technology Course.

Null hypothesis: H0 2.3.6 There is no significant difference in TPK of TPACK among pre-service English teachers based on Educational Technology Course.

Null hypothesis: H0 2.3.7 There is no significant difference in TPACK of TPACK among pre-service English teachers based on Educational Technology Course.

1.6.2 Hypotheses on research question three

The proposed model was put forward based on research question three (3) and research question four (4). Verification of correlations among components inside



TPACK framework was the basic foundation for the construction of the hypothetical proposed model in research question four (4). Null hypotheses in the part were put forward.

Null hypothesis: H0 3.1 There is no correlation between PK and TPK.

Null hypothesis: H0 3.2 There is no correlation between CK and PCK.

Null hypothesis: H0 3.3 There is no correlation between PCK and TPACK.

Null hypothesis: H0 3.4 There is no correlation between PK and PCK.

Null hypothesis: H0 3.5 There is no correlation between CK and TCK.

Null hypothesis: H0 3.6 There is no correlation between TK and TCK.

Null hypothesis: H0 3.7 There is no correlation between TK and TPK.

Null hypothesis: H0 3.8 There is no correlation between PCK and TPK.

Null hypothesis: H0 3.9 There is no correlation between TCK and TPACK.

Null hypothesis: H0 3.10 There is no correlation between TPK and TPACK.



1.6.3 Hypotheses on research question four

Research hypotheses in the part were associated with the proposed PET-TPACK model. There were ten paths in the hypothetical model, therefore, ten directional research hypotheses were put forward.

H 4.1 Pedagogical Knowledge (PK) is positive with Technological Pedagogical Knowledge (TPK).

H 4.2 Content Knowledge (CK) is positive with Pedagogical Content Knowledge (TCK).

H 4.3 Pedagogical Content Knowledge (PCK) is positive with Technological Pedagogical and Content Knowledge (TPACK).

H 4.4 Pedagogical Knowledge (PK) is positive with Pedagogical Content Knowledge (PCK).

H 4.5 Content Knowledge (CK) is positive with Technological Knowledge Content Knowledge (TCK).

H 4.6 Technological Knowledge (TK) is positive with Technological Content Knowledge (TCK)

H 4.7 Technological Knowledge (TK) is positive with Technological Pedagogical Knowledge (TPK).

H 4.8 Pedagogical Content Knowledge (PCK) is positive with Technological Pedagogical Knowledge (TPK).

H 4.9 Technological Content Knowledge (TCK) is positive with Technological Pedagogical and Content Knowledge (TPACK).

H 4.10 Technological Pedagogical Knowledge (TPK) is positive with Technological Pedagogical and Content Knowledge (TPACK).

1.7 Theoretical framework and conceptual framework of research

Pre-service teachers' development of technological pedagogical content knowledge (TPACK) has become paramount in pre-service teacher education (Andreas Lachner, 2021). This study takes pre--service English teachers of Hulunbeir University as the research subjects and adopts a quantitative research method to develop a PET-TPACK model for optimizing the teacher education programme of pre-service

English teachers, with the aim of improving the TPACK level of pre-service English teachers.

The research frameworks offer the guidelines in the process of constructing the proper approach for the present study. The theory framework of the study is Technological Pedagogical Content Knowledge (TPACK) theory framework. Conceptual framework explains the related theory, variables and organizations of the present research to achieve the research objectives based on literature review and research methods.

1.7.1 Technological pedagogical content knowledge (TPACK) theory framework

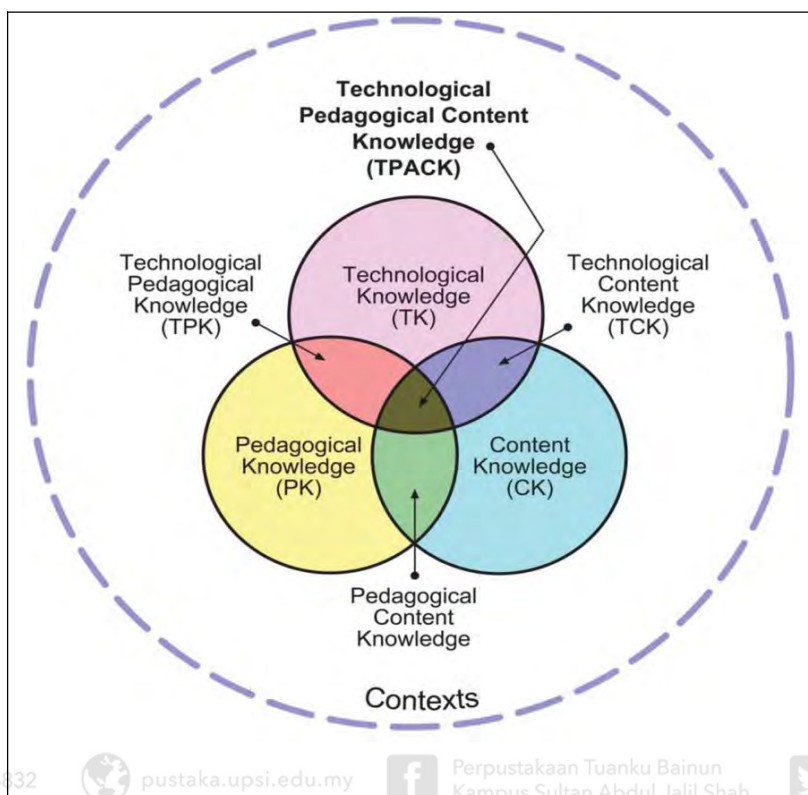
Technological Pedagogical Content Knowledge (TPACK) is a knowledge framework to integrate technology and specific subject teaching for teachers. Technological Pedagogical Content Knowledge is a framework based on technology for teacher knowledge (Mishra, & Koehler, 2006; Fahrurrozi, Budiyanto & Roemintoyo, 2019) in the 21st century.

TPACK is the development of PCK teaching framework. Shulman (Shulman, 1986) first put forward the concept of PCK (pedagogical content knowledge) in 1986. He points out that teachers should have professional knowledge of a certain subject, namely content knowledge (CK) and pedagogical knowledge (PK). Shulman proposed a PCK model, that is, pedagogical content knowledge (Xu, 2020). Based on PCK, TK technology element was added and the concept of TPCK was proposed for the first time by Mishra and Koehler (2006). According to Koehler, Mishra and Yahya (2007), they have built upon Schulman's (1986) work describing Pedagogical Content Knowledge, to highlight the importance of Technological Pedagogical Content Knowledge (TPCK) for understanding effective teaching with technology. Because TPCK is not easy to say and even it is a challenging thing for most people to get the letters in the correct order, the TPCK framework acronym is renamed TPACK for the purpose of making it easier to remember and to form a more integrated whole for the three kinds of knowledge addressed: technology, pedagogy and content (Thomason & Mishra, 2007). Thompson and Mishra think the new name TPACK has two meanings: first, they believe technology, pedagogy and content are essential building blocks for intelligent technology integration. Second, technology, pedagogy and content should be taken as an integrated whole for helping teachers take advantage of technology to improve student learning (Thompson & Mishra, 2007).



According to Mishra and Koehler (2006), the TPACK framework consists of seven types of knowledge associated with the integration of technology in instruction (see Figure 1.1): technological knowledge (TK), pedagogical knowledge (PK), content knowledge (CK), pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK), technological content knowledge (TCK), and technological pedagogical content knowledge (TPACK). Among the seven components, TK, PK, and CK are basic components; PCK, TCK, TPK and TPACK are composite components, as shown in Figure 1.1 TPACK theory framework.



Figure 1.1*TPACK Theory Framework*

Note, the three circles, Content, Pedagogy, and Technology, overlap to lead to four more kinds of interrelated knowledge.

Figure 1.1 shows that seven components of TPACK framework and the context are complementary each other. TPACK knowledge is now recognized as an essential knowledge for teachers to develop their information teaching ability. It should be added that the component "TK" mentioned in this study refers to information technology, mainly to improve the ability of normal university students to integrate information technology with courses. More detailed information refers to Table 1.1.

**Table 1.1***Components of TPACK Framework*

No.	Title	Constituent elements	Meaning in teaching	Example
01.	Basic components	Technology knowledge (TK)	It mainly includes traditional technology (such as book, blackboard, etc.) and modern information technology (network technology, communication technology, etc.).	Emerging information technologies, such as virtual reality, augmented reality, artificial intelligence, the use of interactive electronic whiteboards, etc.
02.		Pedagogy Knowledge (PK)	It is a kind of theoretical and practical knowledge, such as teaching methods, teaching strategies and teaching objectives, which are involved in the process of teaching and learning by teachers and students to achieve the teaching purpose.	Such as teaching method, discussion method, demonstration method and other teaching methods; Competitive and cooperative teaching strategies.
03.		Content Knowledge (CK)	It is the basic professional knowledge that teachers have. Including two aspects: specific knowledge in a subject; and a teacher's understanding of the relationship between different subjects.	The theoretical knowledge and principles of the subject. Such as, English words, grammar, structure and so on.
04.	Composite components	Pedagogy Content Knowledge (PCK)	It refers to that teachers choose appropriate teaching methods and strategies according to different subject content knowledge, so that students can better master subject content knowledge to achieve teaching objectives.	For example, when explaining the knowledge points of a certain subject, a teaching method is used to let students transfer the learning contents they have not learned.
05.		Technology Content Knowledge (TCK)	In the process of teaching implementation, appropriate information technology and teaching methods should be selected to help teachers teach and improve the teaching quality.	For example, play interesting videos and introduce new lessons to stimulate students' interest in learning. Use network chat software to discuss after class.





No.	Title	Constituent elements	Meaning in teaching	Example
06.	Composite components	Technology Pedagogy Knowledge (TPK)	It refers to the knowledge of how various technologies can be used in teaching, and to understanding that using technology may change the way teachers teach. (Schmidt, 2009)	For example, teachers think how to apply technology to specific teaching activities.
07.		Technology Pedagogy Content Knowledge (TPACK)	It is necessary to choose appropriate teaching methods and combine with the application of information technology to achieve the teaching objectives	Such as the use of augmented reality technology, explain the content of a certain knowledge point, and let the students through personal experience to get the actual feeling



Table 1.1 describes seven components in details, including three core

components and four composite components.

TPACK itself focuses on teachers' knowledge and use of technology, pedagogy, and content interactively that is, meaningful uses of technology to support instructional practice within a particular content area. This stands in contrast to frameworks that oversimplify technology integration by separating technology from pedagogy and content knowledge. After the first generation TPACK work focusing on the explanation and interpretation of its construct, the second generation TPACK is to





focus on the using the construct in both research and development projects (Baran, Chuang, & Thompson, 2011). In terms of English subject, Hargers from the University of Texas at Austin proposed the concept of E-TPACK, which refers to the unique TPACK knowledge type of English teachers.

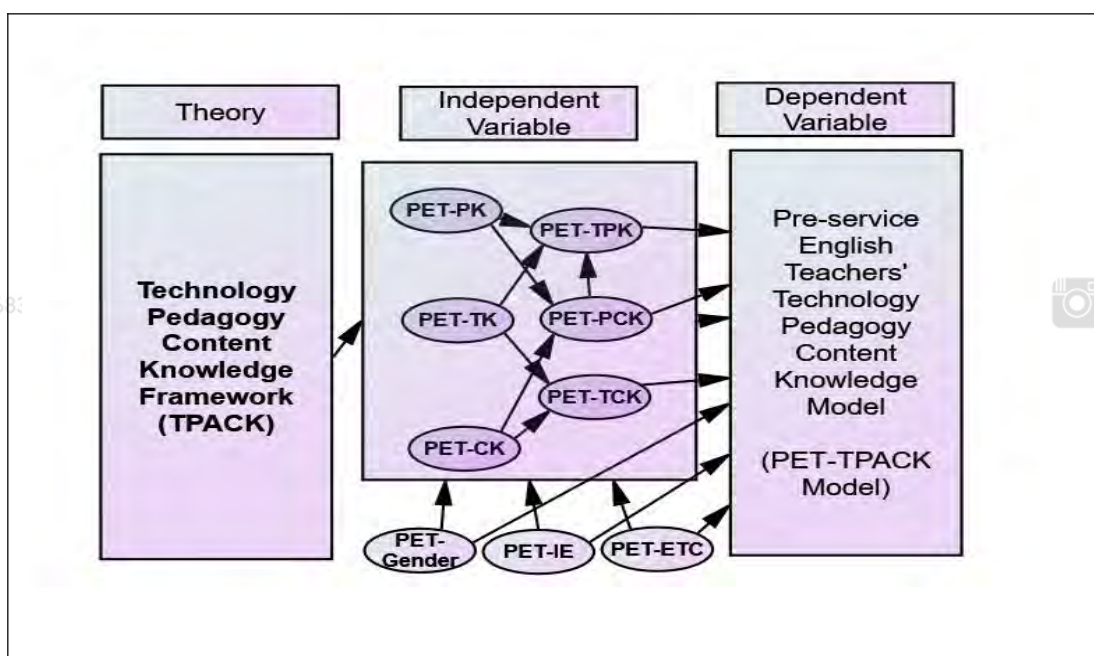
In the study, Technological Pedagogical Content Knowledge (TPACK) refers to a knowledge construct in relation to integrating technology into English subject teaching. For components of TPACK, “TK” refers to modern information technology related English teaching; “PK” refers to English theoretical and practical knowledge that pre-service English teachers should have; “CK” refers to the basic English professional knowledge that pre-service English teachers should have; “PCK” refers to the appropriate teaching methods and strategies that English teachers choose appropriate teaching methods and strategies based on different English subject content knowledge, so that students can better master English subject content knowledge to achieve teaching objectives. “TCK” refers to appropriate information technology and teaching methods selected to help English teachers teach and improve the English teaching quality. “TPK” refers to the knowledge of how various technologies can be used in English teaching.

1.7.2 Conceptual framework

A conceptual framework structures defines the variables, organization and flow of the research. The conceptual framework of the study refers to the Figure 1.2.

Figure 1.2

Conceptual Framework of the Study



Note, PET-TK: Pre-service English Teacher's Technological Knowledge; PET-PK: Pre-service English Teacher's Pedagogical Knowledge; PET-CK: Pre-service English Teacher's Content Knowledge; PET-PCK: Pre-service English Teacher's Pedagogical Content Knowledge; PET-TPK: Pre-service English Teacher's Technological Pedagogical Knowledge; PET-TCK: Pre-service English Teacher's Technological Content Knowledge; PET-TPACK: Pre-service English Teacher's Technological Pedagogical Content Knowledge; PET-IE: Pre-service English Teacher's Internship Experience; PET-ETC: Pre-service English Teacher's Educational Technology Course.



Figure 1.2 shows that the conceptual framework of the study and the arrows present direct or indirect relationships. This research framework is based on the Technological Pedagogical Content Knowledge (TPACK) theory framework and the literature review of previous studies to predict relationships between variables. An independent variable (predictor variable) is a variable which it is considered could affect another variable (Clark-Carter, 2009). A dependent variable (criterion variable) is a variable on which an independent variable could have an effect. In other words, the value which the dependent variable has is dependent on the level of the independent variable (Clark-Carter, 2009). In the conceptual framework, there are seven variables. It can be stated that the independent variable is treated as an IV (or predictor variable) and are used to predict the dependent variable treated as a DV (or criterion variable). Mediator is the intermediary through which the independent variable affects the dependent variable. One- way straight arrow means starting from the cause and pointing to the effect (Wong & Bus, 2002). In the present framework, the independent variables based on TPACK theory include three ones, PET-TK (Pre-service English Teachers' Technological Knowledge), PET--CK (Pre-service English Teachers' Content Knowledge), PET-PK (Pre-service English Teachers' Pedagogical Knowledge); mediating variables include three, PET-TCK (Pre-service English Teachers' Technological Content Knowledge), PET-TPK (Pre-service English Teachers' Technological Pedagogical Knowledge) and PET-PCK (Pre-service



English Teachers' Pedagogical Content Knowledge) based on research hypothesis and research questions. The dependent variable studied is PET-TPACK (Pre-service English Teachers' Technological Pedagogical Content Knowledge). In addition, the researcher analyzed the differences in TPACK of pre-service English teachers under different backgrounds, including gender, Educational Technology Course and Internship Experience.

Based on TPACK theory framework, literature review and researcher's teaching experience, PET-TPACK Model was developed among six variables PET-TK, PET-CK, PET-PK, PET-TCK, PET-TPK, PET-PCK and dependent variable PET-TPACK. PET-TPACK Model is used to optimize Teacher Education Programme for pre-service English teachers in Hulunbeir University, China. The study was also conducted to explore whether the two background factors, including gender, Internship Experience and Educational Technology Course have significant influence on seven components of TPACK framework, so as to put forward effective suggestions for the study on the improvement of TPACK ability of pre-service English teachers.



For the relationships among six variables, the pre-service English teachers' Technological Pedagogical Knowledge (PET-TPK), Pedagogical Content Knowledge (PET-PCK) and Technological Pedagogical Knowledge (PET-TPK) are predicted to affect pre-service English teachers' Technological Pedagogical Content Knowledge (PET-TPACK); the pre-service English teachers' Technological Knowledge (TK), Pedagogical Knowledge (PK) and Pedagogical Content Knowledge (PET-PCK) are predicted to affect pre-service English teachers' Technological Pedagogical Knowledge (PET-TPK); the pre-service English teachers' Pedagogical Knowledge (PET-PK) and Content Knowledge (PET-CK) are predicted to affect pre-service English teachers' Pedagogical Content Knowledge (PET-PCK); the pre-service English teachers' Technological Knowledge (PET-TK) and Content Knowledge (PET-CK) are predicted to affect pre-service English teachers' Technological Content Knowledge (PET-TCK).

It is illustrated that for pre-service English teachers in Hulunbeir University, Pedagogical Knowledge (PK) has a correlation toward Technological Pedagogical Knowledge (TPK) and Pedagogical Content Knowledge (PCK); Technological Knowledge (TK) has a correlation toward TPK and Technological Content Knowledge (TCK); Content Knowledge (CK) has a correlation toward Pedagogical Content Knowledge (PCK) and Technological Content Knowledge (TCK);



Pedagogical Content Knowledge (PCK) has a correlation toward Technological Pedagogical Knowledge (TPK) and Technological Pedagogical Content Knowledge (TPACK); Technological Content Knowledge (TCK) has a correlation toward Technological Pedagogical Content Knowledge TPACK; Technological Pedagogical Knowledge (TPK) has a correlation toward Technological Pedagogical Content Knowledge TPACK.

1.8 Operational definitions

This part provides a more explicit operational definition of the key terms in addition to the conceptual definition. Operational definition refers to a definition of a variable in terms of the operations (activities) a researcher uses to measure or manipulate it (Jackson, 2008).



1.8.1 Pre-service teachers

Pre-service teachers mainly refer to the students majoring in normal colleges and universities who are trained as future teachers. Pre-service teachers have the similar meaning with the words “normal students”, “student teacher” and “candidate teacher”. Majority of them will be teachers in primary and secondary schools after graduation. Their employment goal is clear, that is, mainly engaged in primary and secondary schools or educational institutions teaching management work, as the national education cause of teacher resources.



Pre-service teachers usually include three types of people. According to Ma, N. (2013), pre-service teachers are the general name of the following three types of people. As for the classification of teachers, they are usually divided into pre-service teachers and in-service teachers in the world. The first type is normal students who are still in the colleges or universities and have not formally entered the front line of education and teaching. The second category is the people who have obtained the teacher qualification certificate and have not been formally employed. The third group is those who are undergoing induction training and are interested in the teaching profession.



The pre-service English teachers in this study refer to the candidate teachers, as the first type mentioned above, who are undergoing undergraduate education study in Hulunbeir universities for 4 years and are trained as future English teachers in primary or middle schools in China.

1.8.2 Technological pedagogical content knowledge (TPACK) for pre-service English teachers

Technological pedagogical content knowledge (TPACK) is a kind of knowledge framework for teachers in digital era as it is expounded in the theory framework part above.

Drawing on the theoretical framework of TPACK (Mishra & Koehler, 2006) and focusing on English subjects, this study proposed the PET-TPACK model of teacher education curriculum to promote TPACK of pre-service English teachers. The PET-TPACK Model is an integrated technology teaching knowledge model from the perspective of curriculum for pre-service English teacher education. This following



part describes the elements and connotation of PET-TPACK Model and related knowledge in the present study:

1. Pre-service English teacher's Technological Pedagogical Content Knowledge (PET-TPACK) refers to the teachers' knowledge of using information technology to carry out English teaching and teaching English knowledge through information technology.

2. Pre-service English teacher's Content Knowledge (PET-CK) refers to English subject content knowledge.

3. Pre-service English teacher's Pedagogical Knowledge (PET-PK) refers to the knowledge about teaching and learning approaches, which mainly includes English teaching materials, pre-service English teachers' learning, English instructional design, English instructional organization, and English instructional evaluation, et.

4. Pre-service English teacher's Technology Knowledge (PET-TK) refers to information technology and application knowledge of information technology.

5. Pre-service English teacher's Pedagogical Content Knowledge (PET-PCK) refers to a kind of teacher knowledge that integrates the content knowledge of English subjects and pedagogical knowledge.





6. Pre-service English teacher's Technological Content Knowledge (PET-TCK) refers to a kind of teacher knowledge that integrates technical knowledge with English subject content knowledge.

7. Pre-service English teacher's Technological Pedagogical Knowledge (PET-TPK) refers to a kind of teacher knowledge that integrates technical knowledge with pedagogical knowledge.

8. Pre-service English Teachers' Technological Pedagogical Content Knowledge Mode, refers to as PET-TPACK Model for short. It refers to a kind of comprehensive teacher knowledge that integrates subject English content knowledge, pedagogical knowledge and technical knowledge from the perspective of curriculum for pre-service English teachers. It specifically refers to the teachers' knowledge of using information technology to carry out English teaching and teaching English knowledge through information technology.





1.8.3 Education informatization

Education informatization is accompanied by the popularization and development of information and communication technologies. Zhou, W., (2020) holds that education informatization is a process of comprehensively and deeply applying modern information technology in all fields of the education and teaching system under the overall planning and organization of the state and educational departments. In the present study, education informatization refers to a process of applying technology to all the fields of education system.



1.8.4 Information teaching ability

The purpose of information teaching ability is to give full play to the advantages of information technology in teaching, so that teachers can use various information technology tools to improve teaching effect. In the classroom teaching, the teacher's ability is gradually formed and evolved. Lu (2021) agreed that information teaching ability is a comprehensive ability, which is integrated into every link of the teaching



process. In the present study, information teaching ability refers to the ability that pre-service English teachers can use various information technology tools to improve their teaching effect.

1.8.5 Relationship of TPACK and information teaching ability

The information teaching ability mentioned in this study refers to: In each stage of the teaching process, teachers use technology, tools and resources to improve the efficiency of the class, and maintain the integrated ability of self-development.

TPACK is a knowledge framework which integrated technology into the subject content knowledge and pedagogy, and it has the dynamic character of continuous development. The two exist in similar parts, but not completely identical (Lu, 2021).



1.8.6 Teacher education programme

In a broad sense, teacher education programme includes public basic courses, subject specialized courses and educational courses set up by teacher education institutions to develop and train kindergarten, primary school and middle school teachers. Programmes are the official statements of what students are expected to know and be able to do. The teacher education programme is used to guide students in the learning process during the university.



In the present study, teacher education programme refers specifically to setting of educational curriculum including theoretical and practical educational courses as well as some principles, rules and strategies obtained through the finding of the study. English teacher education programme was optimized with the purpose to improve pre-service English teachers' TPACK. The English teacher education programme mentioned in this study refers to setting of educational curriculum by English Teaching Department of Hulunbeir University, which focuses on specializing in English teachers, to train pre-service English teachers. The related courses in the Teacher Education Programme (Edition 2020) mainly includes the following specific courses: English teaching theory courses, English subject content courses, English





teaching skills training courses, micro-trial courses, educational practice and other courses.

1.9 Limitation of study

This study only involves pre-service English teachers, therefore the findings of this study are only applicable to pre-service English teachers and are not applicable to teachers of other disciplines. The only measurement tool used in this study is the questionnaire to measure the TPACK level of pre-service English teachers. The measurement tool is not rich to collect data from other angles. This study only identified the relationships among seven components within the TPACK framework. The seven components include the relationship between TK, CK, PK, PCK, TPK, TCK, and TPACK, especially the influence of six other components on TPACK. The data in this study are only from pre-service English teachers' self-reports on their technology teaching knowledge and technology integration. Therefore, the data is the self-report of pre-service English teachers on TPACK, not the observation results of researchers in the teaching process. Only 165 pre-service English teachers from Hulunbeir University in Inner Mongolia of China were sampled in this study.





1.10 Significance of research

This study intends to improve the information teaching ability of normal university pre-service teachers under the framework of TPACK. It can promote the research of TPACK integrated subject teaching, and provide further basis for enriching and refining the relevant research of English teachers' professional knowledge and developing the theory of pre-service teacher education. The research findings will provide guidance for educators on teaching reform. Meanwhile a new model is constructed, and then the effectiveness of this model in course teaching is explored, which helps to improve the understanding and attention of normal university students of the information teaching ability.

This study can provide theoretical guidance for the development of basic education in China, promote the good development of information ability of pre-service English teachers, improve the professional comprehensive ability of normal college or university students, and have certain theoretical reference value for the in-depth research on the professional development of teachers in information age. The study offers suggestions to help pre-service English teachers improve their TPACK





level, thereby helping to improve their ability to integrate information technology and English curriculum teaching.

From the practical level, this study is helpful to understand the actual situation of information teaching ability of pre-service English teachers. Normal university students generally feel that their professional knowledge in information teaching is far from enough, and they do not know how to apply information technology in the classroom. The research on the information teaching ability of pre-service English teachers provides a reference for the way to develop the information ability of pre-service English teachers. It has a certain guiding effect on the exploration of information ability training of pre-service teachers in colleges and universities.

This study helps pre-service English teachers in Hulunbeir University to understand their TPACK status and problems and improve their knowledge structure in order to promote professional development. This study focuses on curriculum, information technology and English teaching knowledge, and deeply studies the positive influence of English major curriculum on the professional development of pre-service English teachers, which has practical significance. Therefore, promotion strategies of teacher education curriculum of improving English pre-service teachers'





TPACK ability in the study can contribute to the training of in college. The study on the degree of information in the curriculum setting of teacher education is related to the career development of pre-service English teachers. By optimizing the curriculum reform of English teacher education, the practical teaching ability of pre-service English teachers can be effectively improved, and the teaching and teaching skills of information can be enhanced, which can promote the vigorous development of basic education. It is conducive to improving the comprehensive TPACK practical ability of pre-service English teachers, and training more new teachers who adapt to the digital age for the development of basic education in Inner Mongolia, China.



This study can provide a reference for universities to make decisions and make them pay more attention to the importance of integrating information technology into teaching. Education decision makers can provide teachers with a platform to improve themselves and provide better learning resources, so as to enhance the information teaching ability of pre-service English teachers, so as to meet the needs of English curriculum teaching under the background of information.





1.11 Summary

The chapter is the introduction part of the research, which describes the study from the overall aspect, including background of the study, problem statement of the study, purpose of the study, research questions, theoretical and conceptual frameworks, operational definition, limitation of study and significance of research. Under the background of information technology, new requirements have been put forward for the education of pre-service English teachers, therefore new research questions have emerged. This study aims to develop the information teaching ability of pre-service English teachers to integrate technology into subject teaching. This study selected 165 pre-service English teachers of Hulunbeir Normal University as the research samples, focusing on improving their TPACK by optimizing teacher education programme. Based on the investigation and analysis of the current level of pre-service English teachers' TPACK in Hulunbeir University, and the text analysis of documents on teacher education courses, this paper constructed PET-TPACK model to optimize teacher education programme for integrating technology into English subject teaching. The proposed model would be helpful to bridge the research gap to guide educational instructors to design reasonable teacher education curriculum.

