ACTIVE LEARNING COURSE FOR DEVELOPING THE PROFESSIONAL TEACHING COMPETENCE OF CHINESE COLLEGE STUDENT TEACHERS OF GEOGRAPHY EDUCATION IN SHAANXI PROVINCE

By

XINYING YANG

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy (Education Management)

China-ASEAN International College

Dhurakij Pundit University

2022

Certificate of Acknowledgement of the Dissertation

China-ASEAN International College, Dhurakij Pundit University

Doctor of Philosophy Program in Education Management

Tile of Dissertation: Active Learning Course for Developing the Professional Teaching Competency of Chinese College Student Teachers of Geography Education in Shaanxi Province

Researcher	Xiuying YANG
Program	Doctor of Philosophy (Education Management)
Principle Supervisor	Asst. Prof. Dr. Peng-Fei Chen
Co-Supervisor	

Has been approved by

A. Leksansern ..... Chairman of the Committee

(Assoc. Prof. Dr. Arisara Leksansern)

Ye Jian Hong ..... Committee Examiner

(Dr. Jian-Hong Ye)

Wang, Hsuan-Po ..... Committee Examiner

(Dr. Hsuan-Po Wang)

Yi-Chang Chang ..... Committee Examiner

(Asst. Prof. Dr. Yuan-Chen Chang)

Peng-Fei Chen ..... Principal Supervisor

(Asst. Prof. Dr. Peng-Fei Chen)

Approved by the DPU China-ASEAN International College

Chun-Shuo Chen ..... Dean of China-ASEAN International College

(Assist. Prof. Dr. Chun-Shuo Chen)

Date 22 Aug. 2022

Thesis Title:

Active Learning Course for Developing the Professional Teaching Competency of Chinese College Student Teachers of Geography Education in Shaanxi Province

Author: *Xiuying YANG*

Dissertation Principal Supervisor: *Asst. Prof. Dr. Peng-Fei Chen*

Dissertation Supervisor: *N/A*

Program: *Ph.D. (Education Management)*

Academic Year: *2022*

ABSTRACT

Developing the professional teaching competence (PTC) of college student teachers is a vital task in initial teaching education (ITE) institutions and also the concentrated embodiment of teachers' professionalism. The aim of this research, which is based on a quasi-experimental design, is to apply an active learning course to develop the PTC of Chinese college student teachers of geography education in Shaanxi province of China. The participants are 96 student teachers in the field of geography education in China. Fifty of them are placed in the experimental group (EG) and the remaining 46 in the control group (CG). The intervention of active learning course is based on Bloom's taxonomy and *the Chinese Standards for the Teacher Professional*

Competence of Student Teachers Majoring in Secondary Education. The EG receives the experimental intervention for 16 lessons, while the CG is applied to the traditional teaching in the same teaching schedule. Otherwise, the Chinese Standards are applied as a pre-test and post-test, and the data is analyzed through an independent sample *t*-test, a paired sample *t*-test and a one-way ANCOVA. The results of this study show that the active learning course significantly improved the PTC of Chinese college geography student teachers in the EG. This study contributes empirically to the universities, educators, and researchers involved in ITE programmes in the geography field.

Keywords: PTC, active learning, student teachers, geography education, Bloom's taxonomy

ACKNOWLEDGEMENTS

When this dissertation has been finalised, my learning at Dhurakij Pundit University will come to an end. Looking back on my time here, I am filled with warmth and gratitude. The completion of this thesis is inseparable from my deep appreciation of my university, teachers, classmates, and family.

Firstly, I would like to express my sincerest thanks to my supervisor, Asst. Prof. Dr. Peng-Fei Chen. I have been deeply influenced by her profound knowledge, professional academic attitude, and love for her students. The most precious gift she gave me was not to give up. If I could, I would always be her student.

Secondly, I would like to thank Dr. Huang Jianhao, Dr. Zhang Yuancheng, Dr. Zhang Rencheng, Dr. Du Jiajing, and Dr. Zhou Xuanyi for teaching me professional knowledge and methods of researching education management, which will continue to guide my own future teaching and research.

Additionally, I would like to thank Dr. Arisara Leksansern, Dr. Jian-Hong Ye, Dr. Hsuan-Po Wang, and other committee examiners for their valuable suggestions for my thesis, which inspired me to further improve my work. Here, I also want to thank my classmates, JianYong Chen, MoFang Cheng, Ruini Wang, YuanYuan Yan, and Chen Han. Lastly, I am grateful for everything that has happened to me and everyone I have met.

Xiuying YANG

Table of Contents

ABSTRACT.....i

ACKNOWLEDGEMENTS..... iii

Table of Contents.....iv

Index of Tables viii

Index of Figures ix

CHAPTER 1 INTRODUCTION 1

1.1 Research Background.....1

1.2 Statement of Problem.....8

1.3 Research Objectives 9

1.4 Research Questions 10

1.5 Significance of the Study 10

1.5.1 Theoretical Significance 10

1.5.2 Practical Significance 11

1.6 Scope of the Study.....11

1.7 Structure of the Thesis.....12

CHAPTER 2 LITERATURE REVIEW 14

2.1 Phenomenon of Geography Student Teachers' Training.....14

2.2 Related Theories....16

2.2.1 Constructivist Learning Theory....16

2.2.2 Bloom's Taxonomy....17

2.3 PTC....20

2.3.1 Competency....20

2.3.2 Teachers' Professional Competency....21

2.3.3 Teachers' PTC....24

2.4 Active Learning....28

2.4.1 Definition of Active Learning....28

2.4.2 Active Learning Strategies....30

2.4.3 Related Research on Active Learning in China and Other Countries....31

2.4.4 Active Learning Strategies and Their Effect on Students' Learning Performance....33

2.5 Active Learning and Teachers' Professional Competency....35

2.6 Active learning, Bloom's Taxonomy, and PTC....36

2.7 Summary....38

CHAPTER 3 RESEARCH METHODOLOGY....40

3.1 Research Framework....40

3.2 Research Samples....42

3.3 Research Instruments....43

3.4 Research Procedure....46

3.4.1 Building a Course Design Based on Active Learning....46

3.4.2 Experiment....52

3.4.3 Pre-test and Post-test....54

3.5 Role of Researcher....57

3.6 Internal and External Validity....58

3.7 Data Analysis....59

3.7.1 Descriptive Analysis....59

3.7.2 Independent Sample T-test....59

3.7.3 Paired Sample T-test....60

3.7.4 A One-way ANCOVA....61

3.8 Ethical Issues....61

CHAPTER 4 RESULTS OF THE STUDY....63

4.1 Descriptive Analysis....63

4.1.1 Participants....63

4.1.2 Descriptive Analysis of PTC....64

4.2 Pre-test Results of Independent Sample T-test 65

4.3 Paired-Sample T-test 66

4.4 Analysis of Covariance (ANCOVA) 68

4.5 Summary 70

CHAPTER 5 DISCUSSION 71

5.1 Research Question 1 71

5.2 Research Question 2 73

5.3 Research Question 3 73

CHAPTER 6 CONCLUSION 77

6.1 Conclusion 77

6.2 Implications of the Study 79

6.2.1 Theoretical Contribution 79

6.2.2 Practical Contribution 80

6.3 Recommendations 81

REFERENCES 84

APPENDICES 101

Index of Tables

Table 3.1 Background of Experts Validated the Curriculum and PTC 44

Table 3.2 Summary of Experts' Opinions of the Evaluation Table on Student-Teachers' PTC 45

Table 3.3 Summary of Experts' Opinions on the Course Design 51

Table 3.4 Comparison of Course for EG and CG 53

Table 3.5 Background of Experts Who Participate in Pre-and Post-test 56

Table 4.1 Descriptive Analysis of the Participants 64

Table 4.2 Descriptive Analysis of Professional competence in Pre- and Post-tests 65

Table 4.3 Independent Sample T-test of Pre-test Results of PTC 66

Table 4.4 Summary of Paired Sample T-test Results of PTC in Different Dimensions and Overall.....67

Table 4.5 Descriptive Analysis of the Two Groups 69

Table 4.6 Summary of One-way ANCOVA of the PTC.....70

Index of Figures

Figure 2.1 Active Learning and Bloom's Taxonomy 20

Figure 2.2 Active Learning, Bloom's Taxonomy, and PTC 38

Figure 3.1 Research Framework 42

Figure 3.2 Flow Chart of Research Procedure 46

Figure 3.3 Flow Chart for Pre- and Post-tests 57

CHAPTER 1

INTRODUCTION

In the stage of ITE, it is essential to develop student teachers' PTC. There are all kinds of models and methods to reform teacher education and solve any emerging challenges. The motivation to conduct this research is explained in this chapter, and the background of the study is also presented, including a statement of the problem, the research objectives, research questions, the significance and scope of the research, and the research structure.

1.1 Research Background

Developing teachers' professional competency is a vital part of their professionalisation due to the close relationship between professional competency and work efficiency (Liakopoulou, 2011). Teachers' professionalisation has become a topic of concern in the international educational field, which refers to developing teachers' professional knowledge, skills and qualifications and the corresponding results based on professional educational standards (Wardoyo et al., 2017), categorised as three dimensions, namely, professional qualifications, professional identity and professional competency (Ubani, 2016). The latter dimension acts a crucial role in teachers' professional development. It has been found to predict teachers' burnout, which is a

negative aspect of the teaching profession (Lauermann & König, 2016) and positively affects students' educational outcomes and teaching quality (Kunter et al., 2013; Fauth et al., 2019). Therefore, teachers' professional competency seems to be a key predictor of teachers' occupational success and students' development.

Teaching competence is the most crucial of the many competencies required by professional teachers. It consists of the possession of a complete set of knowledge, capacities, and attitudes required to complete teaching tasks based on teaching activities, such as teaching design, performance and assessment (King & Newmann, 2001; Zeng, 2015). PTC is the center of teachers' professional competence and also the concentrated embodiment of their professionalism (Guan et al., 2016; You, 2015) and affect teachers' professional teaching performance (Gokalp, 2016).

In developing teachers' PTC, the important role of ITE institutions cannot be ignored because they ensure that high-quality teacher education graduates or student teachers are equipped with professional competence(Bhargava & Pathy, 2011), a professional mindset, meaningful teaching methods (Caena, 2014), and required to attend various pedagogical courses and practice in pre-service training from which they can form their first teaching experience in order to acquire an education degree and become certified teachers (Allen & Wright, 2014). ITE is deemed to be the first era of teachers' professionalisation, the so-called pre-professional phase (Hargreaves, 2000), when the professionalism of student teachers is positively and significantly affected and they seem to expend all their energy on developing their pedagogical competency

(Wardoyo et al., 2017). Student teachers' PTC has been found to be affected significantly by their participation in ITE (Goodwin & Oyler, 2008). Therefore, ITE can be regarded as the foundation of student teachers' PTC development. Hence, training and developing student teachers' PTC is a crucial task for ITE institutions.

Moreover, it is important to consider the reasonably flexible and accommodating characteristics of teachers' professionalisation in order to develop student teachers' PTC because it frequently changes based on policy requirements (Sachs, 2015). Reforming ITE has been deemed to be a policy lever to improve schools' teaching quality and transform teachers' professional development (Murray, 2016), e.g., in China it is stated that the contents of the reformed teacher education curriculum should guide prospective teachers to actively construct their pedagogical knowledge, and develop their PTC and innovative teaching mode based on *the Teacher Act No.6 2011* issued by the Ministry of Education (MOE) of China (MOE, 2011), which highlights the student-centered and practice-based orientation of Chinese student teachers' training. Then, *the Teacher Professional Competence of Student Teachers Majoring in Secondary Education (Trial)* was issued for the sake of improving Chinese student teachers' professionalisation, in which Chinese student teachers' professional competence was further defined and classified, and a series of specific directions and requirements for transforming the teacher education curriculum and developing student teachers' professional competence was proposed in the *Teacher Act No.2 2021* (MOE, 2021). Moreover, the *Geography Curriculum Standards for Senior High Schools (2017)*

was published to promote the reform of the Chinese high school geography curriculum, which is focused on the formation of high school students' geographic core literacy in a more active way of learning (MOE, 2018). This requires Chinese geography student teachers to develop their professional knowledge and PTC in time and requires the Chinese geography teachers' education curriculum to be actively updated to meet the challenges of the reform of the Chinese high school geographic curriculum and to cultivate qualified geography student teachers (Zheng & Zhao, 2022; Li, 2022). Hence, it's vital for Chinese geography student teachers to develop their PTC.

However, there are many challenges in reality due to the new policies and demands in relation to the Chinese ITE that affect the improvement of student teachers' PTC. Firstly, Chinese college geography student teachers' PTC is generally comparable to the requirements of a reformed high-school geography curriculum (Zhang et al., 2015), which is manifested by an unstable professional attitude, unfamiliarity with teaching knowledge and low teaching ability. Some researchers claim that geography student teachers in China lack basic teaching implementation, and practical competence, the ability to analyse and process the contents of textbooks (Wang & Zhang, 2021; Hu & Zeng, 2019). The evaluation requirements of student teachers at the school level affect their learning methods at the university level (Kember, 2013). Secondly, the curriculum for teacher education is mostly focused on theory and ignores the need for student teachers to have practical experience (Yang, 2016). This observation is consistent with the results of a nationwide survey of the training status of student

teachers in Chinese universities, which indicated the presence of a common phenomenon of emphasising theory and neglecting practice in teaching skills, methods, and strategies in Chinese ITE (Ding & Li, 2014). Thirdly, student teachers are commonly silent in teacher educational classes, so that learners are often described as passive and quiet recipients. Yan and He (2020) observe that Chinese student teachers are usually reticent in teacher education courses due to an educational environment based on teacher-centred pedagogies and ways of operation. Problems such as insufficient attention paid to students, inadequate practical training and boring content in the teacher education curriculum have long existed in Chinese ITE (Lo, 2009). What is worse, student teachers fall behind the needs of Chinese schools due to problems caused by the teacher-centred teaching model and have to be retrained in the way they were taught at university as soon as they enter a school to work as new teachers (Wang & Ma, 2009). Improving the quality of education requires the improvement of the teaching process, careful planning of the curriculum and the effective implementation (Abdullah & Hui, 2014). Therefore, restructuring Chinese ITE has been a critical requirement in terms of reforming the educational environment, mode of teaching, and teacher education courses, especially for college geography student teachers in China for developing their PTC.

Based on the existing literature, many factors or learning strategies, including self-regulated learning and experiential learning, can also affect and promote student teachers' professional competency (Kramarski & Michalsky, 2009; Lee, 2019).

According to the central tenet of constructivism, learning is an active process of knowledge construction, in which students are encouraged to actively participate in their learning and positively connected to their previous experience, rather than passively recording and receiving information, while teachers only facilitate learning (Bada & Olusegun, 2015; Brooks & Brooks, 1993). In a constructivist environment, active learning is a valid process where higher order requirements in learning are achieved (Anthony,1996). Active learning is regarded as "instructional activities involving students in doing things and thinking about what they are doing" (Bonwell & Eison, 1991). This type of learning has been widely utilised in science, engineering, and nursing instruction (Leong, 2015; White et al., 2015; Hedden et al., 2017; Berkhout et al., 2018). Additionally, active learning could increase undergraduate students' learning achievement, learning satisfaction, and engagement more than the traditional teaching method of lecturing (Freeman et al., Wenderoth, 2014; Armbruster et al., 2009). It is well-known that practice, training, communication with peers, and similar learning modes are important in these areas, whereas it is undesirable and disadvantageous for students to sit silently and listen in classrooms (Rao et al., 2018). Similar requirements are also highlighted in the field of ITE.

The gradual introduction of active learning to teachers' education (Ellerton, 2013; O'Grady et al., 2014) implies that this mode of learning is helpful for student teachers in terms of increasing their engagement, enhancing their learning effect (Preston et al., 2015), acquiring professional competence (Kramarski & Michalsky,

2009), and giving them an opportunity to acquire a deeper understanding of their professional competence (Tang et al., 2016a). Since it has been proved that there exists a strong positive relationship between active learning and student teachers' professional competence (Niemi, 2012; Virtanen et al., 2017). Active learning is maybe a choice that should be empirically examined as a component for developing the PTC of Chinese college geography student teachers in practice.

In addition, Shaanxi province is a major province for educational resources in northwest China. By 2020, there were 110 higher education universities and colleges, and 1,904,431 higher education students in Shaanxi Province (General Office of Shaanxi Provincial Government, 2021). With the implementation of China's Belt and Road Strategy, Shaanxi, as a new starting point of the Silk Road, should give full play to its cultural advantages and form a base for cultural exchange (National Development and Reform Commission, Ministry of Foreign Affairs, and Ministry of Commerce of the People's Republic of China, 2018). However, it is found from the study that there is a decline in the employment quality of teacher education graduates in Shaanxi province, as well as the number of graduates working in the education system (Li, 2021). How to develop the quality of ITE, integrate it into the Belt and Road Strategy, and develop higher teacher education in Shaanxi has become an important issue. This is why Shaanxi province became the area of research in this study.

Hence, based on analysing previous literature, a course was designed to develop the PTC of Chinese college geography student teachers based on active

learning, taking Shaanxi province as the research area in order to examine its effectiveness.

1.2 Statement of Problem

PTC plays a crucial role in teachers' future career and students' academic achievement. Early teacher education is a key stage for student teachers to form their professional competence, especially their PTC, which is the core of the teaching profession. However, the many practical problems related to the development of teacher professionalisation in China's ITE make it extremely difficult for Chinese student teachers, especially geography student teachers, to develop their professional competence. Two phenomena can be observed from the literature. Firstly, although the research on Chinese student teachers' professional competence has received the attention of many Chinese scholars, most of them have focused on examining the current situation (Cai, 2015) and discussing theoretical strategies for Chinese student teachers to use to develop their professional competence and teaching skill (Zeng, 2015; Hou, 2016; Li et al., 2015). Only a few empirical researchers have studied the PTC of Chinese geography student teachers, such as establishing a model to evaluate their teaching ability based on a second-order confirmatory factor analysis (Yang et al., 2021). Secondly, active learning has been widely used for different subjects, but it is fairly new to the field of teacher education (Lonka & Ketonen, 2012). The relationship between active learning and PTC has been explored by a few researchers based on questionnaire

surveys of Finnish student teachers' active learning experience and the development of their teacher professional competence in teacher education programmes (Niemi et al., 2016). However, there has been no in-depth analysis of how student teachers' PTC, which is the core ability of professional student teachers, is developed by active learning. Therefore, the study aims to expose college geography student teachers in China to an active learning experience in order to determine its effect on the development of their PTC.

1.3 Research Objectives

Since this study aims to apply a redesigned course based on active learning in order to develop the PTC of college geography student teachers in China, the research objectives are as follows:

A. To construct a teacher education course based on active learning for geography student teachers in a Chinese college.

B. To test the effect of applying the designed teacher education course based on active learning on developing the Chinese geography college student teachers' PTC.

C. To investigate the PTC of the Chinese geography student teacher who participated in the designed teacher education course based on active learning has been developed more than that of their counterparts who accepted a regular teacher education course.

1.4 Research Questions

According to the research objectives, the research questions are built as below:

Q1: What is a teacher education course based on active learning that is suitable for application to geography student teachers in a Chinese college?

Q2: How effective can a teacher education course based on active learning be in developing Chinese geography student teachers' PTC?

Q3: Can Chinese geography student teachers who participate in a designed teacher education course based on active learning develop their PTC better than their counterparts who participate in the regular teacher education course?

1.5 Significance of the Study

1.5.1 Theoretical Significance

Since the few previous researchers who explored the effect of active learning on student teachers' professional competency found a positive relationship between these two factors, it is suggested that subsequent research should reinforce the understanding of how active learning affects student teachers' PTC; moreover, it is important to verify these results in other countries outside Europe (Niemi, 2012; Virtanen et al., 2017). Therefore, a new teacher education course based on the use of active learning strategies was planned and designed in this research based on Bloom's taxonomy in order to test the effect of active learning on geography student teachers'

professional teaching competency in China. This study would make an important theoretical contribution in terms of enriching the empirical research on the effect of applying active learning in the field of Chinese student teachers' professional development.

1.5.2 Practical Significance

Developing teacher candidates' professional competence is considered as a valuable component of ITE (Pantić et al., 2011). Hence, a new teacher education course that applys active learning has an obvious practical significance for developing the PTC of Chinese geography student teachers and can be used as a basis for designing related courses. It is anticipated that the results of the research will facilitate the improvement of the science of ITE and provide an empirical contribution to student teachers' training.

1.6 Scope of the Study

In summary, an active learning course was built and conducted in this study, and its effect was examined via a quasi-experiment, which included an EG and CG. The latter was subjected to traditional teaching, while the former received an active learning intervention. Shaanxi Province was taken as a research area, and 96 geography student teachers were selected from a teacher training university in the eastern part of the province with the aim of applying an active learning course to develop their PTC. The research results were expected to provide theoretical and practical contributions to develop the ITE field.

1.7 Structure of the Thesis

According to the research questions, this thesis is divided into six chapters, as explained below.

Chapter 1 is the introduction, in which the research motivation and background are presented. The chapter begins with the importance of developing the PTC of Chinese geography student teachers by analysing the many challenges they face in this context. Secondly, the application of active learning in the field of education is analysed to demonstrate its potential application to develop student teachers' professional competence. This is followed by defining the research objectives and research questions, and finally, the significance of the research and structure of the thesis is introduced.

Chapter 2 contains an in-depth review of the literature to connect active learning and student teachers' PTC and then provides a theoretical framework. The review is mainly related to the theoretical basis, definition, dimensions and factors that influence teachers' professional competence, as well as active learning strategies and their effect on students' learning outcomes and teachers' professional competence.

Chapter 3 is devoted to the research methodology, in which a course design based on active learning strategies is presented to develop Chinese geography student teachers' PTC. An experimental design was applied whereby the CG would be taught using traditional lecture-based, teacher-centred strategies, while the EG was exposed to

active learning strategies. This was a 16-week experiment, of which the researcher was the teacher, and it was conducted over 16 lessons. The experimental data were analysed by a descriptive statistical analysis, an independent sample t-test, a paired sample t-test, and a one-way ANCOVA. The sample's background information was subjected to a descriptive analysis. An independent sample t-test was utilised to analyse whether there was any homogeneity between the EG and CG before the experimental intervention. A paired sample t-test was used to test if there was a significant difference between the two groups before and after the intervention. A one-way ANCOVA was utilised in the post-test controlling the pre-test to determine if there was a significant difference between the EG and the CG after the intervention.

Chapter 4 consists of the results of the teaching experiment, particularly the change of teachers' PTC under the intervention of active learning strategies in the EG. After explaining the differences, this chapter also contains the results of a focus group interview which was conducted to answer any newly-emerging questions.

Chapter 5 contains a comprehensive discussion of the research results in order to check if the research questions were properly answered and explain the key components according to the results in the previous chapter.

The main findings of this study and its implications are summarised in Chapter 6, which also includes some recommendations for the future research of student teachers' PTC in the Chinese context.

CHAPTER 2

LITERATURE REVIEW

This study involves the application of an active learning course to develop the PTC of China college geography student teachers. Therefore, the aim of this chapter is to explore the related theories and literature, as detailed below.

2.1 Phenomenon of Geography Student Teachers' Training

How to prepare student teachers for future teaching has attracted global attention, but training student teachers to teach geography or any subject is an all-encompassing task. Geography teachers need to possess various knowledge of natural sciences (e.g., geomorphology, water resources, biology, climate) and social sciences (e.g., nation, history, archaeology) and constantly update it, be able to reasonably explain the relationship among social phenomena, natural events, and geographical space, and apply educational technology to teach geographical knowledge (Karaca, 2020; Pirbhai-Illich & Martin, 2020).

Since every outcome must highlight the professional characteristics of geography teachers' teaching activities, the subjects to consider in the training programmes involve course content, teaching methods, and even technology. Many researchers have focused on specific interventions in training geography programmes.

For instance, micro-teaching was applied in the *High School Geography Teaching Methods* module (Thắng,2021) to develop geography student teachers' PTC. And the result was in line with that of other investigations that micro-teaching could improve geography student teachers' skill in teaching geography (Harte & Reitano, 2015). Moreover, interactive teaching methods were applied to the programme training geography student teachers, and the result showed that interactive learning positively improves the professional competence and willingness of geography student teachers in secondary schools to teach geography (Ferizat & Kuat, 2021). These outcomes highlight the importance of integrating active learning and practice in geography student teachers' training courses.

Other researchers focused on developing comprehensive courses or programmes, firstly about geography teaching content. In the *geography education methods course* designed for geography student teachers, Mitchell (2018) emphasised the teaching of geography student teachers of all types of geography content and methods, exploring strategies by integrating geographical content and other subjects and conceptualising geographical knowledge and design inquiry models. Secondly, in *Consciously Teaching Geography*, good teaching principles combined with explicit modelling for teaching methods, theory, reflection, connecting everyday geographical knowledge (Blankman et al., 2016a), forming a conceptual framework for key geography knowledge, and utilising active learning strategies (Blankman et al., 2016b) were designed and trained in the programme.

Based on the previous literature in respect of training geography student teachers, a comprehensive course that integrates geographical knowledge, teaching strategies, related theory and practice, needs to be built to prepare geography student teachers.

2.2 Related Theories

2.2.1 Constructivist Learning Theory

Active learning is developed based on the constructivist learning theory, in which theory learners are considered as active learners in need or no motivation from teachers. Piaget emphasises the individual essence of the learning process in which the learner's own knowledge is reconstructed by connecting and modifying existing knowledge and experience to new information (Bransford et al., 1999). When using active learning methods, learners are often explicitly required to link their new knowledge to their old thinking patterns, and teachers provide them with effective learning activities to help them to overcome the conflict between old and new knowledge and reconstruct their thinking patterns (Brame, 2016).

Meanwhile, according to Vygotsky's social constructionism theory, individuals' learning is built by communicating with partners in a group (Alexandra, 2014). Active learners tend to generate and apply knowledge collaboratively in discussions or cooperative problem-solving (Nonaka et al., 2005). Therefore, the socio-cultural branch of the constructivist learning theory provides a theoretical basis for

strategies of active learning that rely on group work, thereby emphasising the development of student's cognitive and mental models based on interaction among peers (Swiderski, 2011).

2.2.2 Bloom's Taxonomy

Active learning provides learners with valuable strategies to achieve their learning objectives. Bloom's taxonomy, which is a plan for classifying teaching objectives according to relevant standards, is often used as a tool for organising educational knowledge (Bloom et al.,1994), developing students' high-level skills, e.g., critical thinking (Horváthová & Naďová, 2021) and other professional competence (Li et al., 2020). In Bloom's taxonomy organisational structure, every objective arranged in one of its categories is provided commonly-understood meaning. The revised Bloom's taxonomy is based on six steps, namely, ***Remember***, ***Understand***, ***Apply, Analyse, Evaluate***, and ***Create,*** which are arranged in a hierarchical structure (Krathwohl, 2002), which is as shown as Figure 2.1. In the structure, *create* is the highest order of thinking. *Remember* is the lowest order.

On the other hand, according to the learning pyramid model developed by the National Training Laboratory, different learning methods have different information retention rates, as shown in Figure 2.1. Most students only remember approximately 5% of what they learn from a lecture (e.g., listening to a teacher in class and taking notes), but they retain 50% of what they cooperatively discuss with their classmates, 75% of practice by doing (e.g., encourage students to take what they learn

into practice), and even 90% of teaching others. Hence, *Lectures*, *Reading*, and *Audio-visual* materials such as videos are called passive learning due to their low information retention rate. The other four, namely, *Demonstration*, *Discussion*, *Practice doing*, and *Teaching others*, are called active learning due to their high retention rates (Education corner, 2021). The model highlights the importance of active learning for deeper learning and long-term memory because active learning is useful for simulating students' desire to increase their comprehension of knowledge by discussing it with their peers (Rodriguez, 2019). Furthermore, active learning has been proven to be useful tool for developing the quality of teaching and learning (Vonderwell & Turner, 2005).

In order to achieve the classifying objectives of Bloom's taxonomy, some appropriate teaching methods need to be considered. It has been reported that Bloom's higher-order cognitive goals, including *analysis*, *evaluation*, and *creation*, can be developed by active learning strategies and activities, including cooperative learning, role-playing, case study, problem-solving, discussion, and so on (Bonwell & Eison, 1991; Brame, 2016; Weber, 2019). Similarly, Bloom's taxonomy can also be utilised to guide instructors to apply active learning in the classroom according to designing questions (Tabrizi & Rideout, 2017), e.g., in an undergraduate *public health* course (Callaghan-Koru & Aqil, 2020), students are asked to recall their knowledge through *reading* at the *Remembering* level, they are asked to explain the given material through *discussion* at the *Understanding* level and *Analyse* and *Apply* the key concepts with a *case study*. At the *Evaluation* and *Create* level, they are expected to assess the course

concept and produce a report by *cooperative learning* in groups. Therefore, Bloom's taxonomy can be achieved by developing strategies for active learning, as shown in Figure 2.1.

Based on the constructivist learning theory and Bloom's taxonomy, this study is focused on the application of active learning strategies in a teacher education course for Chinese geography student teachers in order to help them to construct new professional knowledge, enrich their learning experience, develop their higher-order capacity and improve their learning performance. Bloom's taxonomy is used in the active learning course in this study as a tool for describing the learning objectives of every lesson. In other words, the learning objectives of every lesson are achieved through the six levels of Bloom's taxonomy. Firstly, it is hoped that students can reach the *Remember* level by *watching videos or reading* before class. Secondly, the teacher guides students in class to compare, define and summarise the key concepts in order to *Understand* them based on a *discussion* strategy, analyse the requirements or links of the main process knowledge (all under the *Analyse* level) via a *case study, visual-based instruction*, and then *Apply* criteria to implement the design based on *demonstration* or *role play*. Lastly, at the cumulative assignment stage, it is hoped that students *Practice by doing* in small groups, e.g., *Create* an original design and *Evaluate* other groups' design based on cooperative learning.

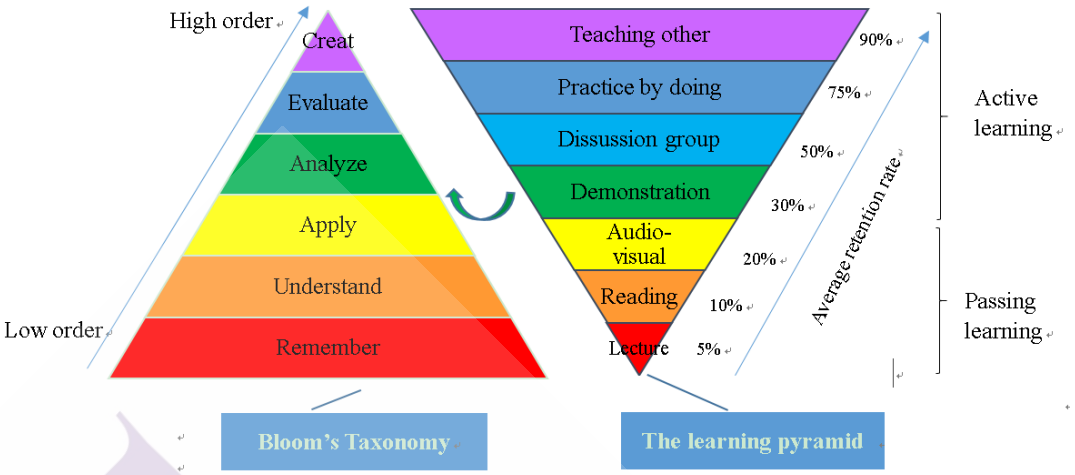


Figure 2.1 Active Learning and Bloom's Taxonomy

Note: Cited from "Planning Active Learning," by the Centre for Teaching Support & Innovation, University of Toronto, (https://tatp.utoronto.ca/teaching-toolkit/supporting-students/cdg/lesson-design/active-learning/). Copyright 2022 by Teaching Assistants' Training Program, University of Toronto.

2.3 PTC

2.3.1 Competency

"Competency" is a compound human behaviour that consists of the capacity to use knowledge, skills, values, and attitudes in a particular field, e.g., personal development with study or professional development with work. Different countries have different competency frameworks. In European, competence is stated as of responsibility and autonomy (Pirrie & Thoutenhoofd, 2013). The characteristics of a 21st-century core competency framework are defined in China as communication and collaboration, information, creativity and problem solving, self-perception and self-

control, critical thinking, learning skills and lifelong learning, civic responsibility and social participation (Shi et al., 2016). Although different countries and scholars have different views of the definition of competency, competence is regarded as a synthesis of knowledge, skills and attitudes that make it possible for a person to perform a given task well at work and in an organisation in a particular field (Boon et al., 2001).

2.3.2 Teachers' Professional Competency

2.3.2.1 Definition

Many institutions and scholars have paid great attention to teachers' professional competency. According to the European framework, teachers' professional competency in Europe has been considered as the complex synthesis, including the following three domains: extensive subject knowledge and pedagogy knowledge, human beings and society, such as the skills required to support learners, and the understanding social and cultural dimension of education (Kaiser & König, 2019). This comprehensive description of teachers' professional competence has a similar view within the Chinese framework. E.g., *the Chinese professional standards for primary and secondary school teachers* indicate that teachers' professional competency should include ethical competency, comprehension and thinking competency, and the ability to communicate and cultivate meaning (MOE, 2011). Obviously, the definition of teachers' professional competence is the one applied to the field of teachers' professional development, which is a career-orientated comprehensive task.

Besides the comprehensive characteristics of teachers' professional competence, other researchers have identified more specific characteristics. Campbell (2008) and Biesta (2012) regard teaching as a moral profession requiring a high ethical commitment and identified occupational values. Li and Feng (2013) suggest that the professional competency of teachers has a psychological characteristic because teachers are required to apply professional knowledge and methods in the teaching context based on advanced educational ideas. Niemi et al. (2016) highlight the social interactions, e.g., collaborating both inside and outside the school community, besides the knowledge and abilities equipped with for instruction. Teachers' professional competence even often interplays with their personal characteristics, e.g., self-efficacy and teaching styles (Gonzalez et al., 2017).

Therefore, teachers' professional competency is a very broad field that contains complex tasks. In addition, teachers' professional competency is learnable (Kunter et al., 2013; Wal et al., 2014); hence, competence-based teacher education should provide student teachers with a meaningful learning environment, in which they can develop performance-orientated capabilities that include the knowledge, skills, and attitudes necessary for their professional development.

2.3.2.2 Factors That Affect Teachers' Professional Competency

The factors that affect the professional competency of student teachers, according to the previous literature, are summarised below.

A. Learning of Professional Knowledge

It is vital for student teachers to improve their professional competency in the stage of ITE by learning professional knowledge, which includes content knowledge, pedagogical content knowledge, and pedagogical knowledge (Bouley et al., 2015). Hatlevik (2017) prove that theoretical understanding is important for pre-service students' professional competency and professional learning in ITE can significantly predict their professional competence (Tang et al., 2017). Moreover, the mastery of teaching skills or competency can be acquired by participating in general teacher training programmes (Hatlevik, 2017). Learning professional knowledge and training teaching skills may include practicing in fieldwork and learning in coursework in ITE, both of which activities have been found to predict pre-service teachers' professional competency, although the predictive relationship is partly mediated by non-cognitive factors (Tang et al., 2016b). Therefore, learning professional theoretical and practical knowledge is extremely vital for developing student teachers' professional competency.

B. Learning Strategy

The learning strategy employed by student teachers also plays an important role in developing their professional competency. According to Lee (2019), the application of an experiential learning strategy can effectively enrich student teachers' skills and knowledge of pedagogical content. Meanwhile, Tang et al. (2017) find that non-formal learning experience contributes to developing student teachers' professional competency because this learning style provides them opportunities to become involved in co-curricular activities, which enables them to construct their knowledge of

pedagogical content, as well as general pedagogical knowledge and knowledge of context based on practical experience and professional communication with group members. Moreover, it has been proved that student teachers' reflective skills and learning could positively affect their professional development (Körkkö et al., 2016). Whether non-formal learning, experiential learning, or reflection, these strategies all emphasise students' self-regulated and active learning. Therefore, student teachers need to reform their learning strategy in ITE, as well as pay close attention to learning professional knowledge.

C. Other Factors

The non-cognitive factors that affect student teachers' professional competency are composed of teaching motivation (Tang et al., 2016b) and teaching self-efficacy (Hatlevik, 2017; Bouley et al., 2015). The greater the motivation and self-efficacy of student teachers, the more willing they are to invest their energy and resources in learning professional knowledge and skills, and the more active they are in learning. Therefore, non-cognitive factors are also significant for improving student teachers' professional competency.

In summary, it has been found that both internal and external factors affect student teachers' professional competency. The internal factors are student teachers' learning strategy and professional knowledge, while the external factor is their interaction with stakeholders.

2.3.3 Teachers' PTC

2.3.3.1 Definition

As the core of teachers' professional competence, teachers' PTC has attracted the attention of many researchers. PTC is a synthesis of the knowledge and capacities necessary for teachers to effectively undertake their teaching activities in different kinds of teaching situations (Tigelaar et al., 2004). This is a set of capabilities future teachers need to acquire when they are studying in teacher universities, which are the requirements established by the educational authority (Oliva et al., 2016). Teachers' PTC pays more attention to some specific teaching situations and links than teachers' professional competence mentioned above.

Different experts have different opinions about the specific dimensions of PTC. Firstly, a competent teacher should be equipped with sufficient knowledge, including discipline knowledge (Kim & Kim, 2016; Vogt & Rogalla, 2009), general pedagogical knowledge, pedagogical content knowledge (Shen & Wang, 2000), and pedagogical technology knowledge (Hanifah et al., 2019). Secondly, a competent teacher should possess certain capabilities, including the ability to plan the course according to the learning objectives and students' learning prerequisites, and to arrange the teaching and learning process in a way that promotes students' active learning (Wang, 1980). Lastly, PTC seems to involve the implementation and management of the teaching and learning process (Hb et al., 2020). A professional teacher must be able to implement a planned course, evaluate and reflect on the teaching and learning outcomes, manage students' learning according to learning principles and criteria

(Lukasik et al., 2019), apply technology, and guide learners development (Astuty, 2015). These abilities are context-specific and necessary for solving problems in a real teaching context (Herppich et al., 2017).

Therefore, in this research, teachers' PTC is defined as a synthesis of specific PTC and knowledge to ensure that teaching activities and processes are effective in terms of the three dimensions of professional knowledge, teaching design competence, and teaching implementation competence.

2.3.3.2 Strategies for Developing Student-Teachers' PTC

Teaching practice is recognised as an essential part of teacher-preparing programmes (Abdullah et al., 2015), which has been determined to affect the PTC of prospective teachers (Ismail & Jarrah, 2019). The experience of learning in schools is related to student teachers' professional competency because it helps them to master their professional knowledge and enhance their PTC in the classroom (Tang et al., 2015b). This emphasises that student teachers should participate more in teaching training and practice teaching simulation in order to further improve their PTC (Hb et al., 2020).

Although practice in schools is very important for the professional learning of student teachers, the role of teacher education universities in the development of student teachers' PTC is also significant (Furlong, 2008). Teachers' universities provide many opportunities for student teachers to acquire conceptual experience, such as introducing the best teaching methods, analysing the hidden values behind different

teaching actions, helping students to master the methods to evaluate the learning effect, and applying knowledge to diagnose teaching practices to develop the necessary abilities (Furlong, 2013).

ITE can prepare student teachers with effective teaching knowledge, approaches, and practices (Lander et al., 2020). For instance, Zhao (2010) proposed a new model that combined activities, case studies, lectures, project-based learning, and a research approach for developing the PTC of English student teachers in China. Meanwhile, Wang (2015) integrated disciplinary knowledge and pedagogical knowledge and built a new teaching model supported by information technology in order to cultivate the teaching ability of Chinese music student teachers. Similarly, other researchers have also found and reported that a developed education course integrated with multimedia, podcasts and other information technologies can help student teachers to form or develop their competence and self-efficacy (Sediyani et al., 2017; Malushko, 2015). Isman et al. (2012) proved that student teachers' teaching skills could be effectively developed by using a quasi-experimental approach with blended learning. Therefore, developing a teacher education course and an innovative classroom teaching mode are necessary measures to develop the teaching ability of student teachers (Pantić & Wubbels, 2010).

In addition, the internal factors of student teachers may also affect their PTC. Sosu and Gray (2012) report student teachers' belief in the source of knowledge significantly affects their classroom teaching competence. Those with a greater sense

of belief may have stronger critical reflection and be more inclined to leave learners to explore themselves instead of directly providing them with answers in teaching practice. In other words, different levels of knowledge beliefs will prompt teachers to adopt different teaching practices, thereby affecting their teaching ability (Tanase & Wang, 2010). Other researchers have also found that student teachers' classroom teaching competence and pedagogical knowledge are based on their teaching motivation (König & Rothland, 2012; Tang et al., 2015a). Meanwhile, Mirzagitova and Akhmetov (2015) claim that the development of student teachers' PTC is a process of self-development. They suggest that teacher education universities provide the necessary conditions for the self-formation of future teachers' teaching ability, such as constructing a harmonious education process that supports the harmonious and positive participation of student teachers in teaching activities.

Hence, it could be concluded that potential teachers should actively participate in the professional learning activities provided by student teacher education universities and schools to acquire conceptual and practical professional experience to develop their PTC. At the same time, teacher educators should apply innovative teaching modes to create favourable conditions for student teachers to improve their PTC.

2.4 Active Learning

2.4.1 Definition of Active Learning

Active learning is regarded as a vital learning theory and teaching approach (Drew & Mackie, 2011). It is described by Bonwell and Eison (1991, p. 223) as 'instructional activities involving students in doing things and thinking about what they are doing.' According to Prince (2004, p. 223), 'active learning requires students to do meaningful learning activities and think about what they are doing'. Meanwhile, Allen and Tanner (2005, p. 262) describe active learning as "seeking new information, organising it in a way that is meaningful, and having the chance to explain to others." Based on the above descriptions, active learning can be considered to be any activity that inspires learners to participate in classroom learning and encourages them to think critically about extracurricular activities with the support of teaching materials provided by teachers (Adkins, 2018).

Active learning is contrary to traditional passive learning in that students are required to make a positive contribution to the lesson instead of just watching, listening, and taking notes as in a traditional lecture-based classroom (Stover & Ziswiler, 2017). Furthermore, the active practical activities for learners have behavioural, cognitive, and social dimensions, such as actively developing and utilising resources, thinking about learning experiences positively for constructing knowledge, and positively interacting and collaborating with peers (Watkins et al., 2007). While active learning is described as a constructivist learning and teaching model for learners to achieve independence and self-regulation (Diković & Gergorić, 2020), students are guided by student-centred, experiential and cooperative learning to help them to obtain knowledge, develop their

abilities and form their attitudes in a more positive way.

According to the above literature, active learning is a teaching strategy and model that is contrary to traditional passive learning because students are required to positively participate in the teaching and learning process, both inside and outside the classroom. They are encouraged to reflect on their behaviour and be responsible for their learning. Active learning as a teaching strategy is often described as openly dominating learners to connect new knowledge to their previous mental model in order to extend their understanding (Brame, 2016). This emphasises learners' role as active contributors to the learning environment and process.

Therefore, active learning is defined in this research as a constructivist learning and teaching model that requires learners to make a positive contribution to teaching and learning activities through cooperative and experiential learning, and actively utilise resources to construct knowledge and develop their abilities in a more positive way.

2.4.2 Active Learning Strategies

Different researchers have different perspectives on the strategies students can use during the course of active learning.

Bonwell and Eison (1991) described the most common strategies used in active learning classrooms as visual-based instruction, case studies, demonstration, guided design, cooperative learning, debates, drama, role-playing and simulation, peer teaching, and so on.

McClanahan and McClanahan (2002) summarised some effective active learning strategies for a biology class, which include matrix, partial outline, think-pair-share, debrief, brainstorming, mini-problem-based learning activity, reading reflection, and study journals.

Daouk et al. (2016) recommended many active learning strategies for language education courses, including visual-aids, clarification pauses, one-minute paper, affective response, reading reflection, submitting questions, anticipation guide, demonstration, delta chart, think-pair-share, rotating chair discussions, role-playing, drama, field study, jigsaw, and peer instruction.

McConnell et al. (2017) reviewed and summarised the active learning strategies used in a geoscience classroom consisting of case studies, problem-based activities, concept maps, concept sketches, gallery walks, jigsaw activities, lecture tutorials, minute papers, peer instruction, role-playing, teaching with models, and think-pair-share.

In this study, specific strategies of active learning, such as think-pair-share, role play, case-study, visual-based instruction, cooperative learning, and demonstration, are used as an instructional methods to design the curriculum according to the teaching objectives stated in Bloom's taxonomy.

2.4.3 Related Research on Active Learning in China and Other Countries

With the advance of educational reform, active learning, as a means to

reform traditional teaching, has attracted attention in the global educational field. Researchers have explored different active learning methods that could be used in high education (Herrmann, 2013; Leong, 2015; Fedoryshyn, 2018), and the concept and measurement of the active learning effect have been reviewed in the specific field of high education (Hartikainen et al., 2019). Active learning courses have been developed to transform high education (Lonka & Ketonen, 2012; Shaaruddin & Mohamad, 2017; Sumanasekera et al., 2020). Active learning has been found to significantly improve learners' positive emotions and learning performance in education programmes (Jeong et al., 2019; Dávila-Acedo et al., 2022). It has then been applied in teacher training to enhance student teachers' competence and offer a better learning outcome (Canaleta et al., 2014). A positive relationship between active learning and PTC has been reported in teacher education programmes (Niemi et al., 2016). Additionally, some new teaching models, e.g., flipped classrooms, have been used to transform active learning in recent years (Kerrigan & Prendergast, 2021).

Research on active learning in China seems to be just getting started compared to the thriving development in other counties. Active learning strategies have just been introduced in China. Some researchers have reported its definition and characteristics, as well as the strategies and challenges involved in developing active learning in China (Chen & Yang, 2007). Some specific active learning strategies are applied in Chinese education, e.g., problem-based learning (Deng & Zhang, 2019). There have been attempts to develop some active learning courses in Chinese higher

education, especially in the field of engineering (Chen, 2015; He et al., 2018).

Moreover, there seems to be a trend to integrate active learning courses with educational technology, e.g., MOOC (Du & Yuan, 2021) and WeChat (Shen, 2020). In terms of the outcome of active learning courses, most of the limited research shows that active learning enhances Chinese students' learning motivation and ability to learn, as well as communication and teamwork (Chen, 2015). Nevertheless, there are also some dissenting voices. According to the results of an investigation of student teachers' preference for teacher preparation programmes, most Chinese student teachers prefer passive teaching over active learning because passive learning is a convenient way for students to obtain higher scores based on memory-friendly assessments (Du et al., 2020), which demonstrates why active learning has not become the dominant teaching method in Chinese higher education (Chen & Yang, 2007). Therefore, it is necessary to strengthen the application of active learning strategies in the training of Chinese student teachers.

2.4.4 Active Learning Strategies and Their Effect on Students' Learning Performance

Active learning has been proved to effectively improve students' learning outcomes, e.g., in their research on the effect of implementing active learning strategies (e.g., role-playing) in a higher language education course, Togimin & Jaafar (2020) found that most of the students involved in active learning achieved a good academic performance in terms of improving their oral fluency, comprehension, communication

and writing skills. They also claimed that students experienced greater satisfaction with an active learning course because it provided them with more opportunities to explore their attitudes and prior experience, and effectively acquire knowledge (Daouk et al., 2016; Demirci & Akcaalan, 2020).

Other researchers have found that cooperative active learning strategies, including think-pair-share, demonstration, case studies, cooperative learning, collaborative learning, debates, and a whole class discussion, have helped students to understand the unit content, maintain their interest and attention, create a positive atmosphere for discussion, and effectively promoted students' participation in the course (Cavanagh, 2011; Khan et al., 2017).

Active learning strategies, ranging from games to simulations, have been proved to be effective in enhancing learning efficiency, even in a course on *the Rise and Decline of Human Civilisations* (Goetze, 2015). It has also been found in engineering education that problem-based learning strategies of active learning could better support students' learning than traditional instruction (Prince, 2004), and it increased students confidence to solve problems in an educational management course (Chen et al., 2020). According to the literature, active learning strategies have been utilised widely to effectively improve students' learning performance and develop their competencies. Therefore, active learning is an effective learning model and teaching strategy.

In this study, specific strategies of active learning, such as think-pair-share, role play, case-study, visual-based instruction, cooperative learning, and demonstration

are used as an instructional methods in the designed course according to the teaching objectives stated in Bloom's taxonomy, and examine the effectiveness in training Chinese geography student teachers.

2.5 Active Learning and Teachers' Professional Competency

Teachers' professional competency is a key achievement of student teachers. Other researchers have proved that student teachers' professional competence is also affected by active learning with the mode of actively constructing knowledge using cooperative learning and high involvement in learning activities (Niemi et al., 2016). Moreover, active learning strategies, including goal-orientated learning and autonomous group cooperation, promote the professional competence of student teachers with different self-regulation learning profiles (Virtanen et al., 2017). Student teachers' active learning experience has been found to have this positive effect, even when investigating the effect of other factors (e.g., research studies) on their professional competence.

The researchers as mentioned above, found that high involvement in learning tasks and a collaborative learning atmosphere are common modes and characteristics of active learning. There exists a strong correlation between active learning and student teachers' professional competence (Niemi,2012). Therefore, it can be assumed that collaborative strategies of active learning can positively affect student teachers' professional competency, including professional knowledge, teaching design

competence, and teaching implementation competence.

2.6 Active learning, Bloom's Taxonomy, and PTC

In terms of the relationship between active learning, Bloom's taxonomy, and PTC, on the one hand, Bloom's taxonomy is often used to reconstruct teaching objectives and activities in a specific teaching context. It has been found to be combined with all kinds of active learning strategies to develop a course (Callaghan-Koru & Aqil, 2020).

E.g., in an English-speaking course (Rampeng, et al., 2021), at the *Remembering* level, students are asked to recall their knowledge through *Working at White Boards*. At the *Understanding* level, they explain the given material through *Beach Ball Bingo*. At the *Application* level, they utilise their understanding through *Do an Interview* and at the *Analysis* level, they analyse the ideas shown in the given material and practice their skills through *Watch, Write and Talk*. At the *Evaluation* level, they assess the ideas through *Round Tables* to identify the best one, and at the *Creative* level, it is hoped that they can design a better plan based on ideas evaluated by *Making Students' Video*.

On the other hand, active learning strategies have been found to be related to student teachers' PTC. The active learning strategies of a case study, visual-based instruction, simulation, and role-playing can enhance geography student teachers' professional competence (Ferizat & Kuat, 2021). Cooperative learning is beneficial for

fostering geography student teachers' professional assessment ability (Bijsterbosch et al., 2019). Practice by doing with reflection (e.g., micro-teaching) can help geography student teachers to improve their ability to teach geography and acquire knowledge of geographical subjects (Harte & Reitano, 2015) and even knowledge of pedagogical content (Niiranen et al., 2020).

Bloom's taxonomy is applied as an instrument in this study to organise educational knowledge and describe the learning objectives of every lesson in six units in the active learning course designed for Chinese student teachers. The learning objectives of each unit in that course are achieved at the six levels of Bloom's taxonomy by repeating three modules in each unit: (1) preview, (2) lectures with in-class activities, (3) cumulative assignments. In the first module of each unit, students need to reach the *Remember* level by *watching videos and reading materials* before the class. A short quiz or paperwork is provided to enhance the students' recognition of *professional knowledge*. The second module consists of lectures with in-class activities planned to help students to reach the *Understand, Analyse, Apply* level. The teacher instructs them to compare, define, summarise and explain the key concepts of every unit (all the processes under the *Understand* level) with a *discussion (e.g., think-pair-share),* analyse the requirements or links of the main knowledge process (all those under the *Analyse* level) with a *case study*, *visual-based instruction* and *demonstration*. The student teachers are then expected to use criteria, judge others' designs, and show or implement their design (all under the *Apply* level) with *role play* and an oral report in

order to develop their teaching implementation competence. Finally, the student teachers are arranged in small groups for a cumulative assignment when it is hoped that they can *Create* an original teaching design and *Evaluate* other groups' designs through *cooperative learning* in order to develop their *teaching design competence*), as shown in Figure 2.2.

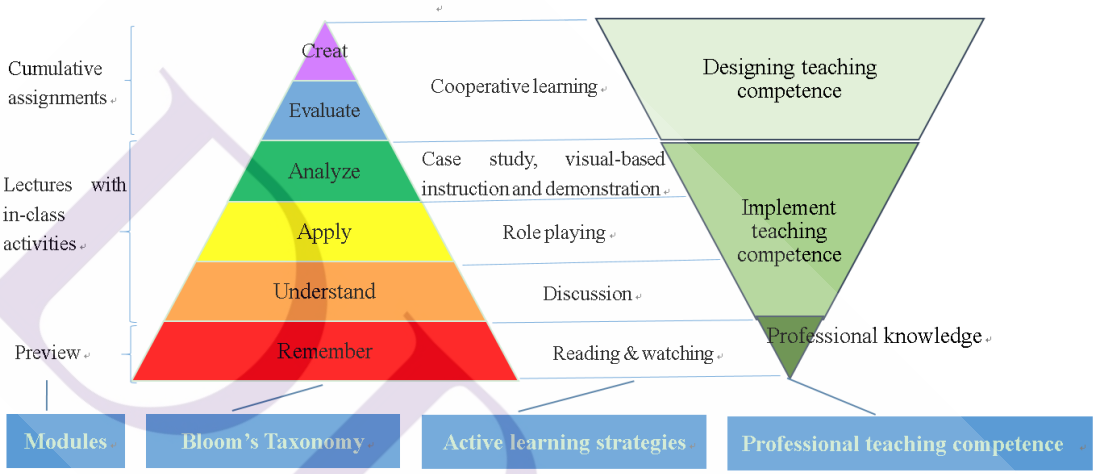


Figure 2.2 Active Learning, Bloom's Taxonomy, and PTC

Note: Developed for this research

2.7 Summary

PTC is a very important component of teachers' professional competence since it refers to the professional knowledge, teaching design competence, and teaching implementation competence that teachers are equipped with to complete teaching tasks in a specific teaching context. Developing the PTC of student teachers is the core work of ITE when student teachers are provided with the theoretical and practical professional learning of teaching ability by higher education and practice in schools.

Student teachers' PTC has been found to be affected by the instructive mode adopted in teacher education, and active learning is exactly the kind of model that has been widely applied to the educational field in order to effectively develop students' advanced order abilities. This type of learning has been proved to be useful in improving students' academic performance due to their positive participation in the learning activities and interactive communication with their peers. A few researchers of teacher education found that active learning, especially strategies that emphasise cooperation and positive knowledge construction, is closely related to student teachers' PTC. Therefore, there is a need to further explore the effect of active learning on the PTC of student teachers.

CHAPTER 3

RESEARCH METHODOLOGY

The aim of this research is to apply active learning strategies to train and develop geography student teachers' PTC in a teacher university in Shaanxi Province in China. The purpose of this chapter, which is divided into seven parts, is to introduce the design of the research and the methodology used to complete it, including the research framework, research samples, research instruments, research procedure, researcher's role, internal and external validity, ethical issues and the data analysis method.

3.1 Research Framework

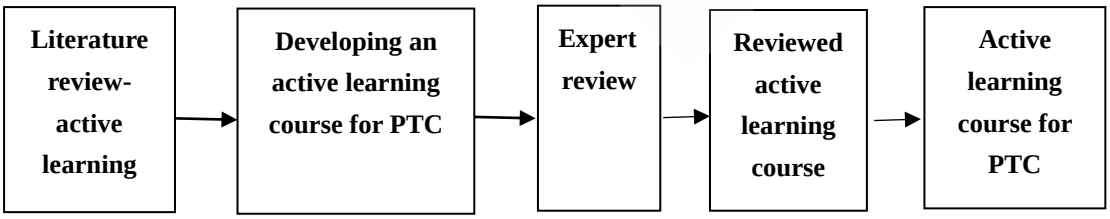
The research framework to be applied in order to achieve the research aim is shown in Figure 3.1. The study is conducted in two stages.

The aim of stage 1 is to develop an active learning course to promote Chinese geography student teachers' PTC. Firstly, some positive learning strategies that have been applied in other courses and have proved beneficial to developing students' abilities are selected from an analysis of the related literature. Secondly, the first draft of the active curriculum is built for developing geography student teachers' PTC. It includes specific active learning strategies to design corresponding learning activities in order to

achieve the different levels of learning objectives based on Bloom's taxonomy. Thirdly, five experts with experience in geography or education are invited to review the draft to obtain expert validity and suggestions. The draft of the active learning course is then modified based on those suggestions. Lastly, the revised active learning course for developing geography student teachers' PTC is used as the formal curriculum in the following study.

The aim of stage 2 is to examine the effectiveness of the revised curriculum in developing the student teachers' PTC. Firstly, a quasi-experiment is designed, in which 96 geography student teachers from a teacher university are selected as research samples. Fifty of them are placed in the EG, and the remaining 46 in the CG. The EG is exposed to a positive learning intervention for a 16-lesson period over 16 weeks, while the CG is subjected to traditional instruction for the same period. The geography student teachers' PTC is then scored in a pre-test and post-test, using the revised national Chinese standards as the research instrument. Lastly, the geography student teachers' PTC is compared using a t-test, ANCOVA.

Stage 1: Active learning course to develop student teachers' PTC



Stage 2: Research experiment of active learning course to develop student teachers' PTC

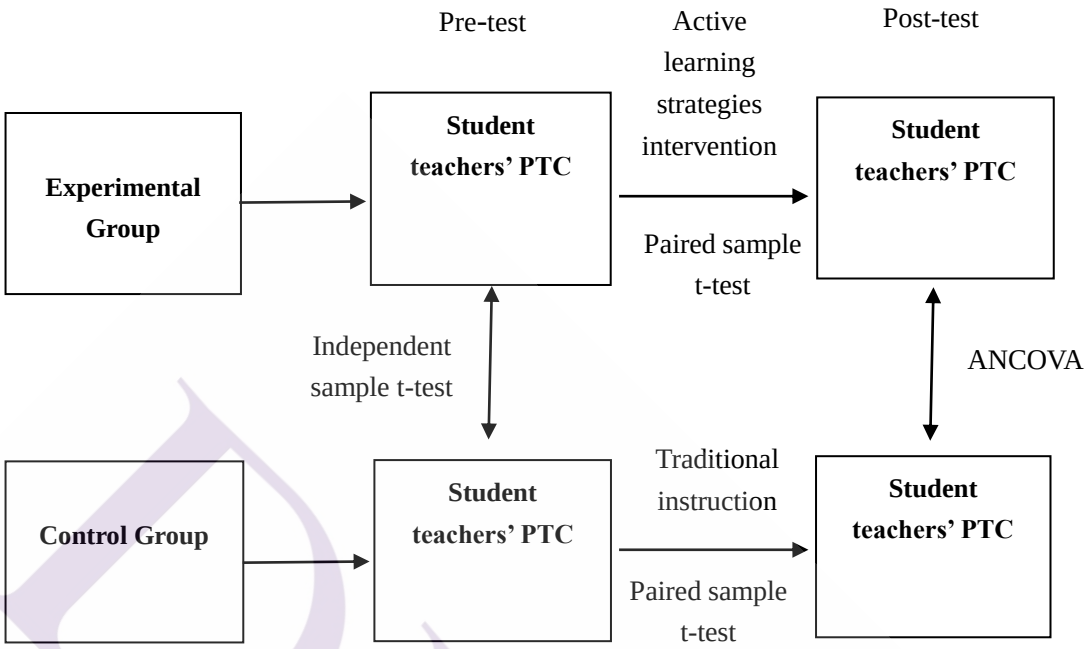


Figure 3.1 Research Framework

Note: Developed for this research

3.2 Research Samples

This is a quasi-experimental research design, which is widely utilised by researchers of social science (Aussems *et al.*, 2011). The sample is selected through a purposive sampling technique, which involves the deliberate selection of people who are deemed to best answer the research questions based on the researcher's personal experience (Ye, 2017). Shaanxi province's higher teacher education is an important force in the training of secondary school teachers in northwest China. The results of a follow-up survey of the employment of ordinary teacher university graduates in Shaanxi shows that the number of ordinary teachers employed in primary and

secondary schools or education bureaux is reducing year by year (Li, 2021). Shaanxi has six local ordinary teacher colleges, and the sample in this study is selected from one of these universities. This is the only teacher training university in the eastern part of Shaanxi Province that has always had the core target of developing student teachers' PTC and promoting their initial professional development. Ninety-six geography student teachers from this university are selected for this research. Fifty of them were placed in the EG, and the remaining 46 in the CG. The EG received the intervention of active learning strategies for a 16-lesson period in 16 weeks. The CG was exposed to the traditional teacher-centred lectures in the same period of the class schedule.

3.3 Research Instruments

The revised national Chinese standards were adopted as the research instruments. These Standards for The Professional Competence of Teachers majoring in Secondary Education for Student teachers (Trial) were issued by the Chinese Ministry of Education and included practicing teachers' ethical competence, teaching competence, comprehensive cultivating competence, implementing curriculum cultivating competence, and independent development competence (MOE, 2021). In line with the research objective, the PTC of Chinese national standards was selected as the basis for evaluating the geography student teachers' PTC.

Expert validity refers to the suitability of the questionnaire content as assessed by -10 invited experts with expertise in the research topic (Ye, 2017). Five

experts (A, B, C, D, and E) were invited to review the evaluation sheet of Chinese geography student teachers' PTC in this study and provide their judgement of the validity of the content, as well as some suggestions about every item (e.g., agree, need revision, and disagree). These experts are experienced, with a background in geography or subject teaching, as shown in Table 3.1. Their opinions of the evaluation table of the PTC of the student teachers are summarised in Table 3.2. The content validity index (CVI) of every item is calculated to range from 0.8 to 1, as shown in Table 3.2. Based on the suggestion that the CVI should be at least 0.78 or higher for three or more experts (Polit et al., 2007), the evaluation table of the Chinese geography student teachers' PTC could be considered to have good content validity.

Table 3.1 Background of Experts Validated the Curriculum and PTC

Experts	Educational background	Industry position	Experience (Yr)
A	Northwest Agriculture and Forestry University, Physical Geography, PhD	Associate Professor, dean of the College	16
B	Institute of Cold and Drought Sciences, Chinese Academy of Sciences, Physical Geography, PhD	Associate Professor	7
C	Northwest Normal University, Education, PhD	Professor, Dean of the College	26
D	Shaanxi Normal University Education, PhD	Associate Professor	12
E	Shaanxi Normal University Education, Master	Professor	37

Table 3.2 Summary of Experts' Opinions of the Evaluation Table on Student-Teachers' PTC

Indicators, descriptions & weight	Experts' opinion			CVI	Suggestions for Revision
	Agree	Needs Revision	Disagree		
1-1	5			1	Increase the weight of professional knowledge.
1-2	3	2		1	1. Indicate if they are senior high school or junior high school students. 2. Specify the geographical theory and method.
1-3	4	1		1	Explain the core accomplishment of geography.
1-4	5			1	
1-5	4		1	0.8	These two can be merged into one.
1-6	5			1	------
2-1	5			1	------
2-2	5			1	------
2-3	5			1	------
2-4	5			1	------
2-5	4	1		1	Reduce the weight of teaching implementation ability.
3-1	5			1	------
3-2	5			1	------
3-3	5			1	------
3-4	5			1	------
3-5	5			1	------
3-6	5			1	------
3-7	5			1	------
3-8	4	1		1	Teaching skills should be classified as teaching implementation ability.
3-9	4	1		1	Teaching skills should be classified as teaching implementation ability.

Lastly, the evaluation table was revised based on the experts' suggestions. And the revised evaluation table of geography student teachers' PTC was used as the research instrument in this study, as shown in Appendix *I*. The revised evaluation table includes three dimensions to assess the PTC of the Chinese geography student teachers, namely professional knowledge, teaching design competence, and teaching implementation competence, including 20 items and a 5-point Likert scale. There are 100 points in total, i.e., 30 points for professional knowledge, 25 points for teaching design competence, and 45 points for teaching implementation competence.

3.4 Research Procedure

As shown in Figure 3.2, the experimental research includes three steps, the first of which involves building a curriculum based on the active learning intervention, while the second entails conducting the course experiment, and the last is the evaluation of the curriculum design.

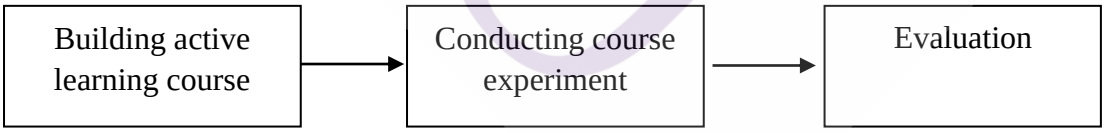


Figure 3.2 Flow Chart of Research Procedure

Note: Developed for this research

3.4.1 Building a Course Design Based on Active Learning

It is necessary to integrate and design active learning into pedagogical courses in Chinese ITE. In this study, according to stage 1 in the research framework,

the active learning course is built based on a literature review. Some active learning strategies are chosen and integrated into the course design model that includes four primary sections of identifying situation factors, learning objectives, teaching activities, feedback, and evaluation (Fink, 2013). The active learning course designed in this research is shown in appendix *II*.

Firstly, the designed Pedagogy of Geography Course is a compulsory course of ITE for undergraduates majoring in geographic sciences. It is also an applied theoretical course with a focus on the application of pedagogical theory in geography teaching practice in secondary schools. This course is designed for an audience composed of junior-year undergraduates who have majored in geographic sciences. The delivery method is face-to-face, and the duration of the teaching is 16 weeks, with one session of 100 minutes each week.

Secondly, the learning objectives are designed according to Bloom's taxonomy and *the Teacher Professional Competence of Student Teachers Majoring in Secondary Education (Trial)* (Bloom et al.,1994; MOE, 2021). The learning objectives are that, after completing the course, the students should be able to explain the fundamental theories and knowledge of geography pedagogy, design the main links of secondary school geography teaching, construct a geography teaching scheme, and apply basic teaching skills to teach geography, which respectively belongs to the three dimensions of Chinese student teachers' PTC, namely, professional knowledge, teaching design competence and teaching implementation competence. The learning

objectives and description of the course were discussed and agreed upon by the college teaching committee.

Thirdly, the teaching content of the course includes 6 units, namely, the introduction of geography teaching design, design of geographic teaching objectives, teaching content, teaching methods, teaching process, and teaching evaluation. Active learning needs to be incorporated into course activities and homework for the students to practice higher order skills (Anderson et al., 2001). The course activities and learning strategies consist of visual-based instruction, think-pair-share, case study, cooperative learning, role-playing, and demonstration.

As shown in Appendix *II*, the three dimensions of Chinese student teachers' PTC serve as the learning objectives for every unit. The course is preceded by teaching student teachers' professional knowledge from week 1 to week 2, and teaching design competence mainly from week 3 to week 16, and teaching implementation competence mainly from week 5 to week 16. *Remember (R)*, *Understand (U)*, *Apply (Ap)*, *Evaluate (E)*, and *Creat (C)* represent the different levels of sub-goals based on Bloom's taxonomy and unit themes.

Lesson 1: Introductory *class* in order to learn the content of *the characteristics of geography pedagogy, the research object of geography pedagogy, and its subjective nature* to train students in professional knowledge, using the visual-based instruction and think-pair-share strategies of active learning.

Lesson 2: *geography teaching design and its theoretical basis*, using visual-

based instruction and think-pair-share to analyse the content of *the definition of geography instructional design and the characteristics of modern geography* to increase the student teachers' professional knowledge.

Lesson 3: *Geography teaching objective and its design requirement* for the student teachers to learn the content of *the definition of geography teaching objective and the requirements of geography teaching objectives design* through a case study and visual-based instruction for the purpose of increasing the student teachers' knowledge and training their teaching design skill.

Lesson 4: *Compilation and presentation of geography teaching objectives, steps for developing geography teaching objectives, and common mistakes in teaching,* based on cooperative learning and case study, with the aim of training students' design teaching skills and learning of professional knowledge.

Lesson 5: *Introduction of design requirements of geography teaching content*, learning for knowledge through think-pair-share and case study strategies, using the content of *the definition and structure of the secondary schools' geography curriculum standards, and the requirements for designing geography teaching content*.

Lesson 6: *Design of geographic conceptual knowledge and geographic process knowledge*, train students' design teaching skills and implementation skills through role play, cooperative learning, and demonstration strategies.

Lesson 7: *Design of geographic principal knowledge and geographic regional knowledge*, using role play, cooperative learning and demonstration strategies

as teaching methods to train students' teaching design skills and implementation teaching skills.

Lesson 8: *"Promotion" and "Second Creation" of Geography Teaching Content,* using visual-based instruction and think-pair-share strategies of active learning to increase student teachers' professional knowledge.

Lesson 9: *Design of geographical teaching methods---lectures and talking,* learn by role-play, and think-pair-share with the aim of increasing students' knowledge.

Lesson 10: *Design of geographical teaching methods--- discovery method and situational teaching method*, using the strategies of demonstration and think-pair-share to increase students' knowledge.

Lesson 11: *Design of geographical teaching media---map*, by demonstration and role play strategies to increase students' knowledge and designing teaching skills.

Lesson 12: *Design of geography teaching process*, develop student-teacher's professional knowledge using strategies of visual-based instruction and role play.

Lesson 13: *Design of blackboard-writing*, utilising the strategies of demonstration and role-play to train student-teacher's designing and teaching implementation.

Lesson 14: *Design of geography teaching plan*. Student-teachers learn knowledge through a case study and cooperative learning.

Lesson 15: *Design of geography teaching evaluation* to develop students' knowledge and teaching implementation skills based on a case study and role-play.

Lesson 16: *Geography teaching reflection and redesign*, using role-play and cooperative learning to develop students' teaching implementation skills and knowledge. Lastly, the evaluation contains an oral report, quiz, paperwork and practice.

Table 3.3 Summary of Experts' Opinions on the Course Design

	Experts' opinion			CVI	Suggestions for Revision
	Agree	Needs Revision	Disagree		
Lesson 1	3	1	1	0.8	1. Learning outcomes should be expressed with specific verbs. 2. The evaluation of students' learning effects should be incorporated into the curriculum design
Lesson 2	1	3	1	0.8	1. Specific questions should be designed for the group discussion. 2. Attention should be paid to students' guidance. 3. The time required for the activity should be planned.
Lesson 3	5			1	-----
Lesson 4	5			1	-----
Lesson 5	4	1		1	Add some concrete cases to help students to master the method.
Lesson 6	4	1		1	The teacher should demonstrate correctly when the students have finished the presentation.
Lesson 7	5			1	-----
Lesson 8	5			1	-----
Lesson 9	5			1	-----
Lesson 10	4	1		1	Add some concrete cases.
Lesson 11	5			1	-----
Lesson 12	5			1	-----
Lesson 13	5			1	-----
Lesson 14	5			1	-----
Lesson 15	5			1	-----
Lesson 16	5			1	-----

Similarly, expert validity was used to evaluate the appropriateness of the content of the course design. The CVI was calculated according to the method of the scholars, as shown in Table 3.3. Based on the suggestion that the CVI should be at least 0.78 or higher according to three or more experts (Polit et al., 2007), the CVI of each item ranged from 0.8 to 1, indicating that the design had good content validity. In addition, the design was still modified according to the five experts' opinions and the revised course design of the active learning strategies is shown in Appendix *II*. The five experts were still expert A, expert B, expert C, expert D, and expert E, as shown as Table 3.1.

3.4.2 Experiment

According to stage 2 in the research framework, firstly, a quasi-experiment that involved 96 undergraduate geography students in a teacher university of China was developed and performed to address the proposed research questions. Its aim was to examine the effect of active learning strategies on student-teacher's PTC. As shown in Table 3.4, the researcher was the teacher in the experiment, which was conducted over 16 lessons, one lesson per week lasting for 100 minutes. The EG was exposed to active learning strategies, including visual-based instruction, cooperative learning, case study, role-playing, discussion, etc. Two or three kinds of active learning strategies were chosen according to the teaching objectives for every lesson and content and decorated in the lecture classroom. The method involved the student-teachers discussing the

questions with their peers and answering them or drawing concept maps based on the cases, materials, or video. Some of the activities provided them with an opportunity to design a teaching fragment based on the specific design requirements. There were even activities that required students to role play and simulate the teacher's teaching, such as teaching a topic using the teaching methods they had just learned. The CG was exposed to lecture-based, teacher-centred strategies and fewer activities, using the same teaching materials, teacher, teaching environment, teaching schedule, and similar class size.

Table 3.4 Comparison of Course for EG and CG

Items	EG	CG
Course	Pedagogy of Geography lesson intervened by active learning	Pedagogy of Geography lesson
Teaching method	Active learning strategies (e.g., visual-based instruction, cooperative learning, case study, role-playing, and discussion)	lecture-based, teacher-centred strategies
Teaching material	Geography Teaching theory (Second Edition)	Geography Teaching theory (Second Edition)
Course content	Positive activities based on combining each dimension of student teachers' and lesson theme	Fewer activities in each lesson
Instructor	The researcher	The researcher
Length	100 minutes per lesson, 16 weeks	100 minutes per lesson, 16 weeks

3.4.3 Pre-test and Post-test

The pre-test and post-test are conducted in stage 2 of the research framework. The measurement used in this stage is the revised evaluation table of geography student teachers' PTC, based on Chinese national Standards and expert validity, as shown in Section 3.3 and Appendix *I*. The evaluation table contains three dimensions with 20 items. There are four parts to the professional knowledge dimension, namely, education foundation, discipline literacy, information literacy, and knowledge integration. The dimension of teaching design competence has three parts, namely, familiar with course standards, learning situation analysis, and designing lesson plans. The dimension of teaching implementation competence has four parts, namely, creating environments, instruction organisation, instruction evaluation, and mastering skills. Each dimension has different items to test specific geography student teachers' PTC. The PTC of the testees is scored and tested by the experts according to their teaching performance, based on a 5-point Likert scale. There are a total of 100 points, i.e., 30 points for professional knowledge, 25 points for teaching design competence, and 45 points for teaching implementation competence.

Then the steps and procedure are detailed below and shown in Figure 3.3. In terms of the pre-test, a week before the experiment, the student teachers in the EG and those in the CG were all subjected to a PTC test.

First step: extract test questions. At the beginning of the test, all the students

in the two groups were asked to randomly draw a test topic from the lottery box. The topics were matched to balls with different numbers and were related to different types of geographic knowledge in the secondary school's geography teaching materials.

Second step: prepare test materials. After drawing their topic, the students were arranged in the computer room for three hours to complete the teaching design scheme and PowerPoint, and plan the subsequent teaching implementation. Then, they were required to engage in the teaching implementation in the multimedia classrooms according to the previous design. At the same time, their implementation teaching process was carefully recorded on a video. Finally, every student's testing materials, including video, teaching design scheme, and PowerPoint presentation, were numbered, named and preserved, so that they could be used to examine the performance of the student teachers' PTC. In order to be fair and protect their privacy, their private information, e.g., name and class, was not mentioned in the teaching design materials and teaching implementation process.

Third step: experts' evaluation. The teaching performance of the geography student teachers was scored by six experts who have rich experience in the context of geography education, based on the research instrument, *the evaluation table for geography student teachers' PTC*. Expert E was added to the original five experts, as shown in Table 3.5. The six experts were arranged into two groups: group 1 and group 2. The experts in each group were randomly assigned to grade the teaching performance of the students in the EG or CG. Before the official grading, all the experts were invited

to work together to mark the test materials of three students for training and practicing purposes with the aim of making the specific test procedures and assessment items better understood and unifying the test requirements, e.g., maintaining objectivity and confidentiality.

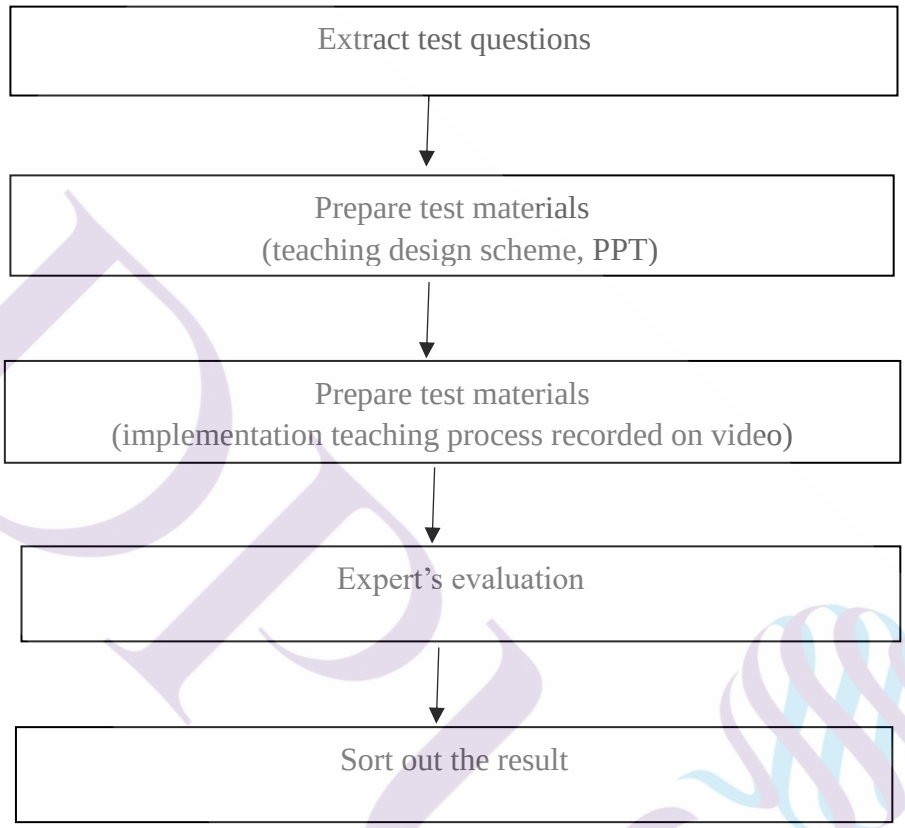
Table 3.5 Background of Experts Who Participate in Pre-and Post-test

Experts	Educational background	Industry position	Experience (Yr)
A	Northwest Agriculture and Forestry University, Physical Geography, PhD	Associate Professor, dean of the College	16
B	Institute of Cold and Drought Sciences, Chinese Academy of Sciences, Physical Geography, PhD	Associate Professor	7
C	Northwest Normal University, Education, PhD	Professor, Dean of the College	26
D	Shaanxi Normal University Education, PhD	Associate Professor	12
E	Shaanxi Normal University Education, Master	Professor	37
F	Northwest University, Physical Geography, PhD	Associate Professor	3

The students in the EG and those in the CG followed the same teaching schedule once a week for 16 weeks. After the experiment, the PTC of the two groups of student teachers was subjected to a post-test, which was the same as the pre-test. The only difference was that the group graded by the two groups of experts needed to be switched in order to reduce the threat of stereotyping, e.g., if the EG was tested by the experts in group A in the pre-test, they were swapped and tested by the experts in group

B in the post-test. Finally, the results of the pre-test and post-test were sorted to prepare for the data analysis.

Figure 3.3 Flow Chart for Pre- and Post-tests



Note: Developed for this research

3.5 Role of Researcher

The role of the researcher in this study is that of a teacher-researcher. Participation in research has been identified as a potential way to develop teachers' professionalisation (Chow et al., 2011). Playing the role of teacher-researcher can help the teacher to obtain feedback and information about the impact of the intervention on students (MacLean & Mohr,1999). In this research, the teacher-researcher's primary

responsibility was to design the syllabus and implement and supervise the teaching process of the EG and CG. The teacher-researcher organised the groups, arranged the learning tasks, provided learning materials, and encouraged the learners to positively engaging in the active learning course, especially those students in the EG.

3.6 Internal and External Validity

According to the report (Ye, 2017), experimental validity refers to the validity of an experimental result, including internal validity and external validity. Internal validity could be defined as the actual degree of the causal connection between the independent variable and dependent variable（Slack & Draugalis, 2001). Some arrangements were conducted in this study to improve the validity of the experiment and control the interference variables, such as adopting a CG, deciding which group would be the experimental or the CG by drawing lots, using the same teaching materials, the same teachers, the same teaching environment, and similar group sizes for the two groups. Additionally, the pre-test and post-test were measured by the same evaluation table that was reviewed and received expert validity. During the pre-and post-test, the experts involved in the assessment were not told which group was participating in the intervention, and the experts were switched to reduce the expectancy effect and threat posed by the pre-test results.

Extrinsic validity means whether the results of an experimental research are generalisable, which means that they can be generalised to other contexts (Slack &

Draugalis, 2001). In this study, active learning strategies were used to develop the PTC of geography student teachers from an ordinary local teacher university in a province in western China. The experimental results are expected to provide a reference for other teacher universities to improve the PTC of geography student teachers.

3.7 Data Analysis

In this research, the PTC of the geography student teachers was examined in a pre-test and a post-test, and then the data was analysed statistically. The inferential statistics used in this research were based on a 95% confidence level and a significance level of 0.05 (Chen & Wang, 2011). According to stage 2 of the research framework, the statistical analysis software, SPSS 25.0, was applied to analyse the collected data by means of descriptive statistics, an independent sample t-test, paired sample t-test, and an ANCOVA.

3.7.1 Descriptive Analysis

A descriptive analysis was utilised to determine the distribution of the sample's background information, such as the number of participants, gender, and the mean and standard error of the pre-and post-tests of the geography student teachers' PTC.

3.7.2 Independent Sample T-test

An independent sample t-test was applied to examine if there existed a significant difference between the EG and CG in the pre-test in order to ensure the

homogeneity between the two groups. According to the suggestion (Chen & Wang, 2011), if *P*<.05, there was a difference between the two groups of tested geography student teachers, indicating that they had a different level PTC before the experimental intervention; if *P*>.05, there was no difference, indicating the two groups of tested college geography student teachers possessed a similar level of PTC before the intervention. In order to further show the difference between the two groups' pre-test results, the effect size was used to indicate the practical significance. According to Cohen's proposal, the *d* value near 0.2 is a small effect, near 0.5 is a medium effect, and near 0.8 is large effect (Cohen, 1988).

3.7.3 Paired Sample T-test

A paired sample t-test was taken to test the existence of a significant difference before and after the intervention for the EG or CG. According to the suggestion (Chen & Wang, 2011), If *p*>.05, it could be concluded that there was no significant difference between the pre-and post-tests, indicating that the PTC of the student teachers had not significantly improved over the 16 weeks. On the contrary, if *p*<.05, it could be considered that there was a significant difference between the pre- and post-tests, demonstrating that the PTC of the student teachers had significantly improved over the 16 weeks. In other words, if the PTC of the EG of student teachers was different after the intervention, it would prove that the active learning course was effective, because this quasi-experiment involved implementing active learning strategies in the EG to enhance geography student teachers' PTC. In the same way,

effect size can be divided into small, medium, and large effect according to Cohen's criteria (Cohen, 1988), in which the *d* value near 0.2 is a small effect, near 0.5 is a medium effect, and near 0.8 is a large effect.

3.7.4 A One-way ANCOVA

A One-way ANCOVA was carried to examine if any statistically-significant differences existed between the EG and CG in the post-test results after controlling the pre-test. Firstly, the homogeneity of the regression coefficients and variation in the two groups must be tested before the analysis. Secondly, the difference between the two groups needs to be analysed. If $p<.05$, it would indicate that there was a significant difference between the score of the two groups in the post-test after controlling the pre-test (Chen & Wang, 2011). Additionally, the effect size of ANCOVA can be divided into a small, medium, and large effect, according to Cohen's criteria (Cohen, 1988), in which the value of Cohen's *f* near 0.1 is a small effect, near 0.25 is a medium effect, and near 0.4 is a large effect. Then, the main effect needs to be compared to determine if the EG had a better score by adopting the new strategies. If they did, it can be concluded that an active learning course is more effective than the traditional course in developing PTC of Chinese geography student teachers.

3.8 Ethical Issues

The rights and privacy of the research participants were considered in accordance with the requirements of Rules 7.3.5 and 7.3.6 in *the Ethical Guidelines for*

Research on Human Subjects in Thailand (Sueblinwong & Panichkul, 2007). Their personal information was effectively protected from exposure and disclosure in any possible way. Their names were replaced by numbers for the PTC test to maintain their anonymity. After the teacher-researcher introduced the objectives of the experiment and the analysis procedure, the participants were advised that they could quit at any moment without having to provide an explanation if they felt uncomfortable during the test.

CHAPTER 4

RESULTS OF THE STUDY

A presentation on the research results is contained in the chapter, according to the research objectives in chapter 1, the research methods in chapter 3 and the quantitative analysis on the data from the expert's evaluation of the Chinese college geography student teachers' PTC.

Active learning strategies were used for the intervention in the EG, and the results of a pre-test and post-test of the EG and CG were compared. The data was analysed using descriptive statistics, an independent sample t-test, paired -sample t-test, and a one-way ANCOVA analysis.

4.1 Descriptive Analysis

4.1.1 Participants

The 96 college geography student teachers in the EG and the CG received a pre-test and a post-test. There were 50 test-takers in the EG and 46 in the CG, as shown in Table 4.1, making a total of 96 participants. There were 15 male students and 35 females in the EG, and 15 males and 31 females in the CG.

Table 4.1 Descriptive Analysis of the Participants

Group	Items	Item Distinction	*n*	Valid percentage
EG	Gender	Male	15	30%
		Female	35	70%
CG	Gender	Male	15	32.6%
		Female	31	67.4%

4.1.2 Descriptive Analysis of PTC

The results of the descriptive analysis of the PTC in the pre-and post-tests showed the changes between the EG and CG according to the experts' evaluation before and after the experiment. The evaluation table was based on the Chinese Standard of professional competence from China's Ministry of Education for student teachers who may engage in secondary education in the future. The content was revised by five experts. This table contained 20 items, which were placed in three dimensions: professional knowledge, teaching design competence, and teaching implementation competence. The total test score for PTC was 100 points, 30 of which accounted for professional knowledge, 25 for teaching design competence, and the remaining 45 for teaching implementation competence. The specific information of the descriptive analysis of the PTC in the pre- and post-tests is shown in Table 4.2, which displays that the mean of the pre-test for the EG was 57.040, and it had risen to 80.687 in the post-test. The mean of the pre-test for the CG was 57.797, and it had risen to 67.638 in the post-test. As illustrated in Table 4.2, the average scores of the EG and CG were found to be higher in the post-test than the pre-test, especially those of the EG. This

demonstrated the effectiveness of active learning in enhancing college geography student teachers' PTC to some extent.

Table 4.2 Descriptive Analysis of Professional competence in Pre- and Post-tests

		Pre-test		Post-test	
Group	*n*	Mean	*SD*	Mean	*SD*
EG	50	57.040	5.037	80.687	7.852
CG	46	57.797	6.834	67.638	6.784

4.2 Pre-test Results of Independent Sample T-test

An independent sample t-test was applied to analyse the results of the pre-test to examine whether there existed any significant differences between the EG and the CG in terms of PTC. The statistical results are shown in Table 4.3, from which it can be found that the mean of the pre-test results of the PTC of the EG was 57.040, and the *SD* was 5.037. In contrast, the mean of the CG was 57.797, the *SD* was 6.834, and there was no significant difference between the two groups overall (t=-.621, p>.05, Cohen's d=.126), as well as the three dimensions of professional knowledge (t=-1.271, p>.05, Cohen's d=.259), teaching design competence (t=1.430, p>.05, Cohen's d=.291), and teaching implementation competence (t=-1.087, p>.05, Cohen's d=.221). This showed that there was no significant difference and a small effect size between both groups' PTC before the experimental intervention, which met the homogeneity requirement of the pre-test.

Table 4.3 Independent Sample T-test of Pre-test Results of PTC

Factors	Groups	*n*	Mean	*SD*	*t*	*Sig*	Cohen's *d*
Professional Knowledge	EG	50	19.213	1.628	-1.271	.207	.259
	CG	46	19.696	2.077			
Teaching design competence	EG	50	15.307	1.695	1.430	.156	.291
	CG	46	14.746	2.133			
Teaching implementation competence	EG	50	22.520	3.361	-1.087	.280	.221
	CG	46	23.355	4.153			
Overall	EG	50	57.040	5.037	-.621	.536	.126
	CG	46	57.797	6.834			

4.3 Paired-Sample T-test

A paired sample t-test was applied to analyse the teaching performance of the Chinese geography student teachers to determine whether there existed a significant difference between the PTC of the EG and CG before and after the intervention. The results are displayed in Table 4.4, from which it could be found that both groups had significantly progressed (p<.001), and there was a large effect size (Cohen's d>0.8) in the three dimensions, as well as the overall score, showing that the student teachers' pre-test and post-test results were significantly different, with the post-test results being higher than the pre-test ones. In addition, although there was also a difference between the CG's pre-test and post-test results, the results of the EG were better than those of

the CG. The mean value of the EG in the post-test was 80.687, while it was 67.638 for the CG, indicating that active learning strategies were obviously more effective than the lecture-based approach in improving the PTC of the Chinese geography student teachers over the 16 weeks.

Table 4.4 Summary of Paired Sample T-test Results of PTC in Different Dimensions and Overall

Factors	Groups	Tests	Mean	*SD*	*t*	Cohen's *d*
Professional Knowledge	EG	Pre-test	19.213	1.628	-15.840***	2.240
		Post-test	24.650	2.629		
Teaching design competence		Pre-test	15.307	1.695	-19.367***	2.739
		Post-test	21.140	1.849		
Teaching implementation competence		Pre-test	22.520	3.361	-26.094***	3.690
		Post-test	34.927	4.009		
Overall		Pre-test	57.040	5.037	-27.420***	3.878
		Post-test	80.687	7.852		
Professional Knowledge	CG	Pre-test	19.696	2.077	-9.036***	1.332
		Post-test	22.174	2.444		
Teaching design competence		Pre-test	14.746	2.133	-8.746***	1.289
		Post-test	17.594	2.359		
Teaching implementation competence		Pre-test	23.355	4.153	-8.217***	1.212
		Post-test	27.833	3.388		
Overall		Pre-test	57.797	6.834	-11.482***	1.693
		Post-test	67.638	6.784		

***p<.001

4.4 Analysis of Covariance (ANCOVA)

A one-way ANCOVA was used to further determine if there was a significant difference between the EG and CG in the post-test after controlling the pre-test. PTC was the dependent variable in the post-test, the groups became a fixed factor, and the PTC was a co-variable in the pre-test in order to conduct the ANCOVA analysis.

It was necessary to test the homogeneity of the regression coefficients in the two groups before the analysis, as well as the variation homogeneity, due to the ANCOVA assumption. The initial testing of the homogeneity of the regression coefficients in the group showed that there was no significant difference between the two groups in the overall (F=2.901, p=.092>.05.), as well as the three dimensions, professional knowledge (F=.164, p=.686>.05.), teaching design competence (F=1.657, p=.201>.05.), and teaching implementation competence (F=2.559, p=.113>.05.). In other words, there was no significantly different effect of the pre-test on the post-test in the two groups.

In the further covariate analysis, the results of the variation homogeneity test also displayed the two groups had the same variation with the same quality overall (F=1.683, p=.198>.05), as well as the three dimensions, professional knowledge (F=3.754, p=.056>.05), teaching design competence (F=.026, p=.872>.05), and teaching implementation competence (F=.612, p=.436>.05).

The results of the final analysis of covariables are shown in Tables 4.5 and 4.6. The mean and standard deviation of the EG and CG in the three dimensions and

overall are shown in Table 4.5, after re-estimating the mean of the pre-test. According to Table 4.6, there was a significant effect on the two groups in the post-test overall [F (1,93) =130.690, p<.05], as well as the three dimensions, professional Knowledge [F (1, 93) =41.597, p<.05], teaching design competence [F (1, 93) =68.586, p<.05], and teaching implementation competence [F (1,93)=139.422, p<.05], indicating that the score of the EG's PTC in the post-test, both in different dimensions and overall, was significantly higher than that of the CG. After the research intervention, the PTC of the EG in the post-test was better than that of the CG after controlling the pre-test. Additionally, according to Table 4.6, there was a larger effect size on the group in the post-test overall (Cohen's f=1.185), as well as the three dimensions of professional knowledge (Cohen's f=.688), teaching design competence (Cohen's f=.977), and teaching implementation competence (Cohen's f =1.175), which shows that the intervention of an active learning course had a significant effect on the improvement of the geography student teachers' PTC.

Table 4.5 Descriptive Analysis of the Two Groups

Factors	Groups	*n*	Mean	*SD*
Professional Knowledge	EG	50	24.824	.303
	CG	46	21.985	.316
Teaching design competence	EG	50	21.015	.273
	CG	46	17.730	.285
Teaching implementation competence	EG	50	35.147	.441
	CG	46	27.594	.460
Overall	EG	50	80.963	.824
	CG	46	67.337	.859

Table 4.6 Summary of One-way ANCOVA of the PTC

Factors	Source	*SS*	*df*	*MS*	*F*	*p*	Cohen's *f*
Professional Knowledge	Pre-test	183.180	1	183.180	40.147	.000	
	Groups	189.795	1	189.795	41.597	.000	.688
	Error	424.332	93				
	Total	53606.028	96				
Teaching design competence	Pre-test	123.115	1	123.115	33.373	.000	
	Groups	253.020	1	253.020	68.586	.000	.977
	Error	343.085	93				
	Total	719.221	96				
Teaching implementation competence	Pre-test	403.542	1	403.542	41.678	.000	
	Groups	1349.943	1	1349.943	139.422	.000	1.175
	Error	900.467	93	9.682			
	Total	97933.556	96				
Overall	Pre-test	1939.547	1	1939.547	57.221	.000	
	Groups	4429.803	1	4429.803	130.690	.000	1.185
	Error	3152.283	93	33.896			
	Total	541050.111	96				

4.5 Summary

The results of analysing the effect of using active learning strategies on Chinese geography student teachers' PTC were presented in this chapter based on descriptive statistics, an independent sample t-test, paired -sample t-test, and a one-way ANCOVA analysis. It was found that there was no significant difference between the PTC of the EG and CG before the intervention, but the PTC of both groups improved significantly after 16 weeks of the intervention. However, the progression of the EG was better based on the use of active learning strategies, which indicated that active learning has a more significant effect than traditional teaching on the development of Chinese geography student teachers' PTC.

CHAPTER 5

DISCUSSION

A quasi-experimental design was applied in this study to test the effectiveness of an active learning course to develop the PTC of Chinese student teachers in geography education in Shaanxi Province of China. The purpose of this chapter is to discuss the results and link them to the previous literature to respond to the research questions in Chapter 1.

5.1 Research Question 1

The first question was related to the substance of a teacher education course based on active learning that is suitable for application to geography student teachers in a Chinese college. Adopting and practicing active learning strategies in the course design of teacher education has become a crucial approach (Shaaruddin & Mohamad, 2017) in view of the disadvantage of young graduates in being unsuitable for teaching (Wang & Zhang, 2021; Hu & Zeng, 2019). Therefore, it is necessary to develop an active learning course for geography student teachers in Chinese ITE. The designed course, namely *Pedagogy of Geography Course*, is a compulsory course that all the geography student teachers must complete over 16 weeks in a public university in

northwest China. The aim is for student teachers to acquire the relevant professional knowledge of geography teachings and develop the competence of designing and implementing teaching based on Bloom's taxonomy and *the Teacher Professional Competence of Student Teachers Majoring in Secondary Education (Trial)* (Bloom et al.,1994; MOE, 2021). The course consists of 6 units, namely, introduction of geography teaching design, design of geographic teaching objective, teaching content, teaching strategies, teaching process, and teaching assessment. Active learning needed to be incorporated into course activities and homework for students to practice the higher order skills of Bloom's taxonomy (Anderson et al., 2001). The course activities and learning strategies consist of visual-based instruction, think-pair-share, case study, cooperative learning, role-play, and demonstration. The evaluation consists of an oral report, quiz, paperwork and practice.

More specifically, the teaching content of the course in this study is consistent with that of other researchers, who all emphasise the conceptualisation of different types of geographical knowledge and the modeling of geography teaching methods (Mitchell, 2018; Blankman et al., 2016a). In terms of the teaching methods, this course responds to the suggestion that active learning strategies should be utilised to design training programmes for geography student teachers (Blankman et al., 2016b). Previous similar studies have also been based on an attempt to integrate active learning into a pedagogy course to determine its effectiveness, albeit applied to undergraduate TESL students (Shaaruddin & Mohamad, 2017). The difference is that other active

learning strategies of micro-teaching, peer-reflections, feedback, and self-reflection were used to design a course based on the policy framework of Malaysian higher education. Additionally, it was found from the implementation results that the course designed in this study had effectively improved the PTC of the Chinese geography student teachers, thereby proving that the application of an active learning course is suitable for this purpose. This finding corresponds with that of other researchers, who applied active learning in Chinese higher education and proved that it improved Chinese students' learning motivation and ability, communication, and teamwork (Chen, 2015). This result could be considered as a starting point for other researchers who intend to apply active learning strategies to the framework of geography teacher education in the Chinese context.

5.3 Research Question 3

The third question was whether the PTC of Chinese geography student teachers would be better developed by participating in the designed teacher education course based on active learning than that of their counterparts who participated in the regular teacher education course.

According to the analysis in Section 4.4, the PTC of Chinese geography student teachers had better progressed when the active learning course was applied than the regular teacher education. This finding is consistent with that of previous studies, in which the achievement of students in an active learning classroom was shown to be

greater than that of those subjected to traditional teaching (Bishara, 2018; Prince, 2004), based on the existence of traditional lecture-based courses in university classrooms as a convenient, cheap and one-way method of communication (Fedoryshyn, 2018).

A possible reason why previous researchers have regarded active learning as being more effective than traditional teaching is that active learning is more focused on engaging students in activities (Stover & Ziswiler, 2017), which stimulates their desire to learn (Dávila-Acedo et al., 2022) and enhances their performance (Jeong et al., 2019). For instance, Chen (2015) reported that an active learning course enhances Chinese students' learning motivation, ability to communicate and teamwork ability.

On the contrary, a regular lecture-based classroom tends to cause students to be passive rather than engage in active learning. Their only goal is to pass the final exam (Canaleta et al., 2014). Du et al. (2020) found that the regular passive teaching model is more popular than active learning among Chinese students because it is more likely to help them to achieve high scores in tests that mainly evaluate their ability to memorise knowledge. This corresponds to the reasons active learning has not played a dominant role in Chinese higher education (Chen & Yang, 2007). Therefore, in the Chinese teacher education programmes of ITE, teachers need to stimulate students' intrinsic learning motivation, explain the purpose of active learning, and ensure that their active participation in learning is consistent with the learning assessment criteria (Herrmann, 2013).

5.2 Research Question 2

The second question was how effective a teacher education course based on active learning could be in developing Chinese geography student teachers' PTC.

According to the analyse in Section 4.3, the PTC of both groups had progressed overall after the intervention. This finding corresponds to previous studies, in which active learning was determined to be a positive way to improve students' learning performance (Daouk et al., 2016). It also provides empirical evidence for earlier studies that there is a strong positive relationship between active learning and student teachers' professional competence (Niemi, 2012; Bouley, 2012). Additionally, similar results were found in other courses for developing geography student teachers' competence that active learning strategies played an important role in developing their PTC. For example, Ferizat and Kuat (2021) found that geography student teachers' professional competence could be improved by the active learning strategies of a case study, visual-based instruction, simulation, and role play.

More specifically, the active learning course significantly improved the Chinese college geography student teachers' PTC in the three dimensions of professional knowledge, teaching design competence and teaching implementation competence. This result corresponds to that of previous researchers, who found that active learning is an innovative method that is beneficial for student teachers to develop their PTC (Kramarski & Michalsky, 2009; Tang et al., 2016a).

In terms of professional knowledge, the result of this research supports the

claim of some researchers that an active learning course offers learners more opportunities to effectively acquire and construct knowledge (Niemi et al., 2016; Daouk et al., 2016; Demirci & Akcaalan, 2020; Ishii, 2017). For example, according to Niiranen et al. (2020), the practice-by-doing principle of active learning can help geography student teachers to acquire both geographical knowledge and pedagogical content knowledge. The result of this study is further supported by the finding that the participants involved in active learning had more choices to practice the theoretical knowledge they learned, and develop their knowledge of the subject matter (Namli Altintas & Karaaslan, 2019).

As for the specific PTC, these results are consistent with the claim of other scholars, who reported that active learning could improve their specific PTC (Togimin & Jaafar, 2020; Laksana et al., 2019). For instance, Bijsterbosch et al. (2019) proved that the cooperative learning strategies of active learning could help geography student teachers to foster their professional teaching assessment ability. Therefore, subjecting them to an active learning course could effectively develop the PTC of Chinese student teachers.

CHAPTER 6

CONCLUSION

The aim of this chapter is to conclude the study with a report on the implications of the results of developing Chinese geography student teachers' PTC based on the application of an active learning course. Possible recommendations for further research in this field are provided at the end of the chapter.

6.1 Conclusion

The aim of this study was to apply an active learning course to develop the PTC of Chinese geography student teachers. The study was based on a quasi-experimental design consisting of two groups of student teachers. The EG was composed of 50 student teachers who were subjected to an active learning intervention, and the CG was composed of the remaining 46 student teachers who were taught using traditional teaching methods. The effective sample was 96 Chinese college geography student teachers in a public university in northwest China, and the intervention was conducted over 16 lessons.

After the experimental intervention, the PTC of both groups was found to have improved between the pre-test and the post-test based on the results of a t-test, but the PTC of the EG had progressed more than that of the CG. In summary, active learning

strategies were found to improve Chinese geography student teachers' PTC.

The findings of the study are consistent with those of previous researchers, who found the existence of a significant relationship between active learning and student teachers' PTC (Niemi et al., 2016; Niemi, 2012). In other words, the results confirmed that student teachers' PTC could be improved by active learning (Virtanen et al., 2017). Intervened by an active learning course, this empirical study demonstrates how active learning can be integrated into a teacher education course, and provides an applied framework for the empirical study of geography student teachers' PTC development in a Chinese community.

In summary, the research findings and discussions can be concluded as follows:

A. Bloom's taxonomy, combined with active learning strategies, can be used to design educational courses for student teachers in geography education.

B. The curriculum designed for the EG in this study, which was based on an active learning intervention, was able to highlight the improvement of Chinese geography student teachers' PTC.

C. Active learning strategies were designed in the pedagogy of the geography course as instructional methods to guide the teaching of every lesson. The relevant activities were designed and combined with a different theme in every unit in order to develop Chinese geography student teachers' PTC.

D. Active learning can effectively develop the PTC of Chinese geography

student teachers, including their professional knowledge, teaching design competence and implementation design competence.

E. Active learning is more effective in developing the PTC of Chinese geography student teachers than the regular instructional models.

6.2 Implications of the Study

An active learning course was designed in this study based on Bloom's taxonomy in an attempt to develop Chinese college geography student teachers' PTC. After the experimental intervention, it was found that an active learning course could greatly improve the PTC of Chinese college geography student teachers rather than a traditional course. The contributions of this study can be summarised as follows:

6.2.1 Theoretical Contribution

Firstly, the study provides a new empirical contribution to enrich the previous few empirical studies of Chinese geography student teachers' PTC, most of which were focused on researching the status quo of Chinese student teachers' professional competence and proposing theoretical suggestions (Hou, 2016; Li et al., 2015).

Secondly, the study provides a new framework for developing geography student teachers' PTC. Some specific interventions were used in previous studies in training geography programmes, e.g., micro-teaching (Thắng, 2021) and interactive learning (Ferizat & Kuat, 2021). In contrast, active learning was introduced and applied

to the field of geography teacher training in this study as a method widely used in science, engineering, and nursing education (Hedden et al., 2017; White et al., 2015; Berkhout et al., 2018). The experimental results proved that active learning is an effective method for developing geography student teachers' PTC.

Lastly, the results of the study reinforce and verify the effect of active learning on college geography student teachers' PTC in the Chinese context. Previous researchers have reported Finnish student teachers' active learning experience and their perception of professional competence (Niemi et al., 2016). However, due to the reasonably flexible and accommodating characteristics of teachers' professionalisation (Sachs, 2015), the adaptability of active learning is worth studying in other countries outside Europe. These results indicate that active learning under the framework of Chinese educational policy can effectively improve the PTC of geography student teachers.

6.2.2 Practical Contribution

This study makes a practical contribution to university administrators, educators, and students, who are seeking effective approaches and strategies to promote geography student teachers' professional competence, especially in teacher training programmes in the ITE field. It has been proven that active learning can help to improve the PTC of future teachers in higher education. In terms of the teacher university administrators, the study can provide a powerful reference for building a teacher education curriculum in the context of geography education. As for educators, they

could teach their students using active learning strategies in a similar teacher education courses, and develop their students' PTC. Last but not least, the findings of this study will provide students with a better platform and opportunity to understand active learning strategies and train their PTC. It is also hoped that geography student teachers could become sufficiently competent to teach in schools as future teachers with the benefit of active learning.

6.3 Recommendations

It was proved in this study that an active learning course could greatly improve the PTC of Chinese college geography student teachers. Training student teachers' PTC and enabling them to qualify as teachers is an essential task for ITE.

National educational administrative departments, for example, the Teachers' Work Department of the Ministry of Education of China, can design corresponding macro educational policies and highlight the student-centered orientation (MOE, 2011), e.g., active learning methods, to guide Chinese student teachers' training in order to offer a basis for university administrators to implement policies (MOE, 2019) and promote teachers' professional certification (MOE, 2022).

As for university administrators, they could design and implement regulations based on national education policies to promote the construction of a student-centred active learning course, which will improve the quality of education by optimising the teaching process, careful planning, and the effective implementation of

the curriculum (Abdullah & Hui, 2014). As Misseyanni et al. (2018) observe, active learning represents a new paradigm to meet the challenges that are emerging in the development of higher education due to its high quality, collaborative and engaging nature.

However, there are some limitations that could be remedied in further studies and some recommendations that can be made for related researchers to consider. The first is that innovative educational technologies and models could be applied in teaching along with active learning to develop student teachers' PTC. Previous researchers have pointed out that active learning, integrated with the application of technologies, e.g., online learning or virtual learning, can help to improve learners' learning engagement and qualifications because they are flexible and can provide more opportunities for active learning (Astudillo et al., 2020; Khan et al., 2017). Even WeChat has become a teaching tool for active learning by facilitating immediate feedback, improving student-centered communication, and students' satisfaction with learning (Shen, 2020). As Vonderwell and Turner (2005) discovered, the "pedagogically effective convergence of active learning strategies and methods and technology tools can help faculties and students to accomplish successful teaching and learning" (p.66). A combination of active learning methods and educational technologies could be tried and practiced in future research.

Secondly, other research methods could be used to collect the data in future studies. The only instrument used to examine the outcome of this study was the

performance of the 96 participants before and after the study using a revised PTC framework by experts. In terms of the teaching content, it emphasised the acquisition of students' professional knowledge and teaching competence but failed to pay attention to the student teachers' feelings, experience, and even their perception of PTC in the learning process. Hence, a combination of a quasi-experiment and other data collection methods, including interviews and questionnaires (Shaaruddin & Mohamad, 2017; Niemi & Nevgi, 2014), could be utilised in future research in order to obtain more feedback from participants.

Additionally, the sample size of this study was small and from the same university in the same region, so that the research results had certain limitations for generalisation. Subsequent studies can test the relevant research results by expanding the sample size.

Despite the limitations mentioned above, this study has enhanced the understanding of the effect of active learning on Chinese geography student teachers' PTC. It is hoped that these results will stimulate the further exploration of this important educational field.

REFERENCES

Abdullah, A. H., Omar, M. C., Embong, R., & Bakar, N. S. A. (2015). The perception towards practicum experience among islamic education preservice teachers in University Sultan Zainalabidin (UnisZA), Terengganu, Malaysia. *Middle-East Journal of Scientific Research*, *23*(4), 695-705. http://dx.doi.org/10.5829/idosi.mejsr.2015.23.04.22158

Abdullah, Z. B., & Hui, J. (2014). The relationship between communication satisfaction and teachers` job satisfaction in the Malaysian primary school. *Asian Journal of Humanities and Social Sciences (AJHSS)*, *2*(2), 58-71. http://ajhss.org/pdfs/Vol2Issue2/7.pdf

Adkins, J. K. (2018). Active learning and formative assessment in a user-centered design course. *Information Systems Education Journal*, *16*(4), 34. http://isedj.org/2018-16/n4/ISEDJv16n4p34.pdf

Alexandra Galbin. (2014). An introduction to social constructionism. *Social Research Reports*, *26*, 82-92. https://doi.org/10.5860/choice.33-3018

Allen, D., & Tanner, K. (2005). Infusing active learning into the large-enrollment *biology* class: Seven strategies, from the simple to complex. *Cell Biology Education*, *4*(4), 262-8. https://doi.org/10.1187/CBE.05-08-0113

Allen, J. M., & S. E. Wright. (2014). Integrating theory and practice in the pre-service teacher education practicum. *Teachers and Teaching: Theory and Practice*, *20*(2),136–151. https://doi.org/10.1080/13540602.2013.848568

Anderson, L. W., Krathwohl, D. R., & Bloom, B. S. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Longman.

Anthony. (1996). Active learning in a constructivist framework. *Educational Studies in Mathematics*, *31*(4), 349-369. https://doi.org/10.1007/BF00369153

Armbruster, P., Patel, M. R., Johnson, E., & Weiss, M. R. (2009). Active learning and student-centered pedagogy improve student attitudes and performance in introductory biology. *CBE Life Sciences education*, *8*(3), 203-213. https://doi.org/10.1187/cbe.09-03-0025

Astudillo, D. M., Santos Nogueira, D. V., & Ortiz, J. A. (2020). Active methodologies of learning and educational technologies in higher education. *Global Journal of Human-Social Science Research*, *20*(10) 51-59. https://doi.org/10.34257/gjhssgvol20is10pg51

Astuty, E. (2015). Implementation analysis of lecturer's pedagogical competence on student's academic achievement. *Journal of Management and Research*, *7*(2), 152-168. https://doi.org/10.5296/JMR.V7I2.6834

Aussems, M. E., Boomsma, A., & Snijders, T. A. (2011). The use of quasi-experiments in the social sciences: A content analysis. *Quality & Quantity*, *45*(1), 21-42. https://doi.org/10.1007/S11135-009-9281-4

Bada, & Olusegun, S. (2015). Constructivism learning theory: A paradigm for teaching and learning. *Journal of Research & Method in Education*, *5*(6),66-70. https://10.9790/7388-05616670

Berkhout, J. J., Helmich, E., Teunissen, P. W., Der Vleuten, C. P., & Jaarsma, A. D. (2018). Context matters when striving to promote active and lifelong learning in medical education. *Medical Education, 52*(1), 34-44. https://doi.org/10.1111/medu.13463

Bhargava, A., & Pathy, M. (2011). Perception of student teachers about teaching competencies. *American International Journal of Contemporary Research, 1*(1), 77-81. https://asset-pdf.scinapse.io/prod/2184495376/2184495376.pdf

Biesta, G. (2017). The future of teacher education: Evidence, competence or wisdom? *Research on Steiner Education, 3*(1), 8-21. https://doi.org/10.1007/978-981-10-4075-7_29

Bijsterbosch, E., Béneker, T., Kuiper, W., & van der Schee, J. A. (2019). Teacher professional growth on assessment literacy: A case study of prevocational geography education in the Netherlands. *The Teacher Educator*, *54*(4), 420 - 445. https://doi.org/10.1080/08878730.2019.1606373

Bishara, S. (2018). Active and traditional teaching, self-image, and motivation in learning math among pupils with learning disabilities. *Cogent Education, 5,* 1436123. https://doi.org/10.1080/2331186X.2018.1436123

Blankman, M., Schee, J., Boogaard, M., & Volman, M. (2016b). Design and development of a geography module for first-year primary student teachers. *Curriculum and teaching, 31*(2), 5-25. http://dx.doi.org/10.7459/ct/31.2.02

Blankman, M., Schoonenboom, J., van der Schee, J., Boogaard, M., & Volman, M. (2016a). Learning to teach geography for primary education: Results of an experimental programme. *Journal of Geography in Higher Education, 40*(3), 425-441. https://doi.org/10.1080/03098265.2016.1144731

Bloom, B. S., *et al*. (1994). *Taxonomy of educational objectives, the classification of educational goals, handbook I: Cognitive domain.* Anderson.

Bonwell, C. C., & Eison, J. A. (1991). *Active learning: creating excitement in the classroom*. George Washington University.

Boon, J., & van der Klink, M. R. (2001). Scanning the concept of competencies: How major vagueness can be highly functional. In J. N. Streumer (Eds.), *Perspectives on learning in the workplace. Proceedings Second Conference on HRD Research and Practice Across Europe 2001* (pp. 299-307). University Twente.

Bouley, F., Wuttke, E., Schnick-Vollmer, K., Schmitz, B., Berger, S., Fritsch, S., & Niemi, H. (2012). Relationships of teachers' professional competences, active learning and research studies in teacher education in Finland. *Reflecting Education, 8*(2), 23-44. https://www.academia.edu/download/67082433/118.pdf

Bouley, F., Wuttke, E., Schnick-Vollmer, K., Schmitz, B., Berger, S., Fritsch, S., & Seifried, J. (2015). Professional competence of prospective teachers in business and economics education: evaluation of a competence model using structural equation modeling. *Peabody Journal of Education, 90*(4), 491–502. https://doi.org/10.1080/0161956X.2015.1068076

Brame, C., (2016). Vanderbilt university center for teaching. *Active learning.*

https://cft.vanderbilt.edu/active-learning/

Bransford, J. D., Brown, A. L., & Cocking, R. R. (1999). *How people learn: brain, mind, experience, and school*. National Academy Press.

Brooks, J., & Brooks, M. (1993). *In search of understanding: the case for constructivist classrooms.* Association for Supervision and Curriculum Development.

Caena, F. (2014). *Initial teacher education in Europe: An overview of policy issues*. ET2020 Working Group of Schools Policy, European Commission. http://ec.europa.eu/education/policy/strategic--framework/expertgroups/ documents/ initial- -teacher--education_en. pdf

Cai, J. (2015). Di fang yuan xiao shi fan sheng zhi ye su yang xian Zhuang diao cha ji ti sheng ce lue [A survey and countermeasures of the normal students' professional quality in local colleges and universities]. *Gao Jiao Lun Tan*, *9*, 39-41.

Callaghan-Koru, J. A., & Aqil, A. R. (2020). Theory-informed course design: Applications of Bloom's taxonomy in undergraduate public health courses. *Pedagogy in Health Promotion*, *8*, 75 - 83. https://doi.org/10.1177/2373379920979684

Campbell, E. (2008). Preparing ethical professionals as a challenge for teacher education. In Tirri, K (Eds.), *Educating moral sensibilities in urban schools* (pp. 1-18). Sense Publishers. https://doi.org/10.1163/9789087906870_002

Canaleta, X., Vernet, D., Vicent, L., & Montero, J. A. (2014). Master in teacher training: a real implementation of active learning. *Computers in Human Behavior*, *31*, 651–658. https://doi.org/10.1016/j.chb.2013.09.020

Cavanagh, M. (2011). Students' experiences of active engagement through cooperative learning activities in lectures. *Active Learning in Higher Education*, *12*(1), 23 - 33. https://doi.org/10.1177/1469787410387724

Chen, K. Y., & Wang, Z. H. (2011). *Advanced statistical analysis using SPSS and AMOS*(2nd). Wunan Publishing Company.

Chen, P. F., Chang Y. C., You, X. (2020). *Development of problem solving confidence to* Chinese *international graduate students of educational management in Thailand by using active learning*. The 2nd China-ASEAN International Conference 2020, Bangkok, Thailand. https://www.dpu.ac.th/caiconf2020/

Chen, Y. Q., & Yang, L. M. (2007). A study of strategies of teaching for self-motivated learning. *Education and Modernization*, *83*(2), 21-27.

Chen, Z. (2015). *Active Learning through combination of project-based learning with problem-based learning in engineering education*. International Conference on Social Science and Higher Education (ICSSHE 2015), Sanya, China. https://doi.org/10.2991/ICSSHE-15.2015.59

Chow, K., Chu, S. K. W., Leung, O. & Yu, S. (2011). *Teachers as researchers and the development of teacher professionalism*. CITE Research Symposium 2011, Hong Kong, China. https://www.Sam-research\QEF\Publications\Conference paper of CITERS 2011\Teachers as researchers (Ken)\Teachers as researchers and the development of teacher professionalism v6_final.doc.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences (2nd ed.)*. Routledge. https://doi.org/10.4324/9780203771587

Daouk, Z., Bahous, R., & Bacha, N. N. (2016). Perceptions on the effectiveness of active learning strategies. *Journal of Applied Research in Higher Education*, *8*(3), 360-375. https://doi.org/10.1108/JARHE-05-2015-0037

Dávila-Acedo, M. A., Sánchez-Martín, J., Airado-Rodríguez, D., & Cañada-Cañada, F. (2022). Impact of an active learning methodology on students' emotions and self-efficacy beliefs towards the learning of chemical reactions—the case of secondary education students. *Education Sciences*, *12*(5), 347. https://doi.org/10.3390/educsci12050347

Demirci, C., & Akcaalan, M. (2020). Active learning: English language teaching via write share learn strategy. *International Journal of Educational Research Review*, *5*(3), 214-220. https://doi.org/10.24331/ijere.732948

Deng, R. P., & Zhang, Y., C. (2019). Ji yu wen ti dao xiao (PBL) jiao xue fa zai hua xue fan ying gong cheng jiao xue zhong de ying yong yu shi jian [Application and practice of PBL in chemical reaction engineering teaching]. *Gao Jiao Xue Kan*, (1), 79-81.

Diković, M., & Gergorić, T. (2020). Teachers' assessment of active learning in teaching Nature and Society. *Economic Research-Ekonomska Istraživanja*, *33*(1), 1265 - 1279. https://doi.org/10.1080/1331677X.2020.1728563

Ding, G., & Li, M. (2014). Zhong guo gao deng shi fan yuan xiao shi fan sheng pei yang Zhuang kuang diao cha yu zhen ce fen xi bao gao [A national investigation report and policy analysis on cultivation status of normal university students in China]. *Jiao Yu Yan Jiu*, *35*(11), 95–106.

Drew, V., & Mackie, L. (2011). Extending the constructs of active learning: Implications for teachers' pedagogy and practice. *The Curriculum Journal*, *22*(4), 451 - 467. https://doi.org/10.1080/09585176.2011.627204

Du, X., Chaaban, Y., Sabah, S., Al-Thani, A. M., & Wang, L. (2020). Active learning engagement in teacher preparation programmes - A comparative study from Qatar, Lebanon and China. *Asia Pacific Journal of Education*, *40*(3), 283 - 298. https://doi.org/10.1080/02188791.2020.1717436

Du, Y., & Yuan, X. P. (2021). Zhu dong xue xi dao xiang de da xue wu li ke tang jiao xue gai ge yu shi jian [Reform and practice of college physics classroom teaching oriented by active learning], *Jiao Yu Jiao Xue Lun Tan*, *43*, 29-33.

Education corner. (2021). *The leaning pyramid*. https://www.educationcorner.com/the-learning-pyramid.html

Ellerton, N. (2013). Engaging pre-service middle-school teacher-education students in mathematical problem posing: Development of an active learning framework. *Educational Studies in Mathematics*, *83*(1), 87-101. https://doi.org/10.1007/S10649-012-9449-Z

Fauth, B., Decristan, J., Decker, A., Büttner, G., Hardy, I., Klieme, E., & Kunter, M. (2019). The effects of teacher competence on student outcomes in elementary

science education: The mediating role of teaching quality. *Teaching and Teacher Education, 86*, 102882. https://doi.org/10.1016/j.tate.2019.102882

FedoryshynO., P. (2018). Active learning techniques in higher education. *Young Scientist*, *55*(3),81-86. http://molodyvcheny.in.ua/files/journal/2018/3.2/19.pdf

Ferizat, M., & Kuat, B. (2021). The effectiveness of interactive teaching methods in the professional training of pre-service geography teachers. *Cypriot Journal of Educational Sciences*, *16*(4), 1976-1996. https://doi.org/10.18844/cjes.v16i4.6066

Fink. L. D. (2013). *Creating significant learning experiences: An integrated approach to designing college courses*. John Wiley & Sons.

Freeman, S., Eddy, S. L., Mcdonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences of the United States of America*, *111*(23), 8410-8415. https://doi.org/10.1073/pnas.1319030111

Furlong, J. (2008). Does the teaching professional still need universities? In D. Johnson & R. Maclean (Eds.), *Teaching: Professionalization, development and leadership* (pp. 85–97). Springer.

Furlong, J. (2013). *Education: An anatomy of the discipline*. Routledge.

General Office of Shaanxi Provincial Government. (2021, July 15). *2020 nian Shaan xi sheng jiao yu shi ye fa zhan tong ji gong bao* [2020 Statistical communique on the development of education in Shaanxi province]. People's Government of Shaanxi Province. http://www.shaanxi.gov.cn/zfxxgk/fdzdgknr/tjxx/tjgb_240/xygb/202107/t20210715_2183200.html

Goetze, D. (2015). Hybrid active learning situations: Common pools, climate change and course purposes. *Simulation & Gaming*, *46*(6), 792–816. https://doi.org/10.1177/1046878115620089

Gokalp, M. (2016). Investigating classroom teaching competencies of pre-service elementary mathematics teachers. *Eurasia Journal of Mathematics, Science and Technology Education*, *12*(3), 503-512. https://doi.org/10.12973/EURASIA.2016.1296A

Gonzalez, A., Conde, A., Diaz, P., Garcia, M., & Ricoy, C. (2017). Instructors' teaching styles: relation with competences, self-efficacy, and commitment in pre-service teachers. *Higher Education, 75*(4), 625-642. https://doi.org/10.1007/S10734-017-0160-Y

Goodwin, A. L., & Oyler, C. (2008). Teacher educators as gatekeepers: Deciding who is ready to teach. In M. Cochran-Smith, S. Feiman-Nemser, D. J. McIntyre, & K. E. Demers (Eds.), *In Handbook of research on teacher education: Enduring questions and changing contexts* (pp. 468-489). Routledge.

Guan, Q. H., Wu, X. Y., Zhao, D. (2016). Mian fei shi fan sheng jiao xue neng li pei yang ce lue you hua tan tao [Optimization of strategies for tuition-free students in relation to teaching abilities]. *He Bei Shi Fan Da Xue Xue Bao (Jiao Yu Ke Xue*

Ban), *18*(6),100-104.

Hanifah, M., Mohmadisa, H., Yazid, S., Nasir, N., & Saiyidatina Balkhis, N. (2019). Professional and pedagogical competencies of geography teachers in Malaysia. *Review of International Geographical Education Online (RIGEO)*, *9*(2), 304-318. https://doi.org/10.33403/rigeo.509836

Hargreaves, A. (2000). Four ages of professionalism and professional learning. *Teachers and Teaching*, *6*(2), 151–182. https://doi.org/10.1080/713698714

Harte, W., & Reitano, P. F. (2015). Pre-service geography teachers' confidence in geographical subject matter knowledge and teaching geographical skills. *International Research in Geographical and Environmental Education*, *24*(3), 223- 236. https://doi.org/10.1080/10382046.2015.1034458

Hartikainen, S., Rintala, H., Pylväs, L., & Nokelainen, P. (2019). The concept of active learning and the measurement of learning outcomes: A review of research in engineering higher education. *Education Sciences*, *9*(4), 276. https://doi.org/10.3390/educsci9040276

Hatlevik, I. K. R. (2017). The impact of prospective teachers' perceived competence on subsequent perceptions as schoolteachers. *Teachers and Teaching*, *23*(7), 810–828. https://doi.org/10.1080/13540602.2017.1322056

Hb, Z., Trinova, Z., & Mahmud, M. (2020). Students' pedagogic and professional competencies in teaching practice program. *Al-ta'lim Journal*, *27*(2),156-165. https://doi.org/10.15548/jt.v27i2.608

He, R., Gao, D., & Luan, Y., Y. (2018). "Active learning" teaching practice in civil engineering graphics course. *Journal of Graphics*, *39*(4), 782-785. DOI:10.11996/JG.j.2095-302X.2018040782.

Hedden, M. K., Worthy, R. W., Akins, E. E., Slinger-Friedman, V., & Paul, R. (2017). Teaching sustainability using an active learning constructivist approach: discipline-specific case studies in higher education. *Sustainability*, *9*(8), 1320. https://doi.org/10.3390/SU9081320

Herppich, S., Praetorius, A., Förster, N., Glogger-Frey, I., Karst, K., Leutner, D., Behrmann, L., Böhmer, M., Ufer, S., Klug, J., Hetmanek, A., Ohle, A., Böhmer, I., Karing, C., Kaiser, J., & Südkamp, A. (2017). Teachers' assessment competence: Integrating knowledge-, process-, and product-oriented approaches into a competence-oriented conceptual model. *Teaching and Teacher Education*, *76*, 181-193. https://doi.org/10.1016/J.TATE.2017.12.001

Herrmann, K. J. (2013). The impact of cooperative learning on student engagement: Results from an intervention. *Active Learning in Higher Education*, *14*(3), 175–187. https://doi.org/10.1177/1469787413498035

Horváthová, B., & Naďová, L. (2021). Developing critical thinking in reading comprehension of texts for specific purposes at all levels of bloom's taxonomy. *Journal of Teaching English for Specific and Academic Purposes*, *9*(1), 1-16. https://doi.org/10.22190/JTESAP2101001H

Hou, D. Q. (2016). Gao xiao zhuan xing bei jing xia shi fan sheng jiao xue ji neng ti

sheng de shi zheng yan jiu [An empirical study of improving students' teaching skill under the background of colleges and universities transformation]. *Xi Be Shi Fan Da Xue Bao (She Hui Ke Xue Ban)*, *53*(6), 109-114.

Hu, W. F., Zeng, C. (2019). An hui sheng di li shi fan sheng jiao xue ji neng da sai shi yu xia de jiao xue ji neng pei yang yan jiu [The cultivation of teaching skills inspired by Anhui provincial geography teaching skills competition among normal university students]. *Fu Yang Shi Fan Xue Yuan Xue Bao (She Hui Ke Xue Ban)*, *189(*3),152-156.

Ishii, K. (2017). Active learning and teacher training: Lesson study and professional learning communities. *Scientia in Educationa*, *8*, 101-118. https://doi.org/10.14712/18047106.734

Ismail, S. A., & Jarrah, A. M. (2019). Exploring pre-service teachers' perceptions of their pedagogical preferences, teaching competence and motivation. *International Journal of Instruction*, *12*(1), 493-510. https://doi.org/10.29333/iji.2019.12132a

Isman, A., Abanmy, F. A., Hussein, H. B., & Saadany, M. A. (2012). Using blended learning in developing student teachers teaching skills. *Turkish Online Journal of Educational Technology*, *11*(4), 336-345. https://files.eric.ed.gov/fulltext/EJ989298.pdf

Jeong, J., González-Gómez, D., Cañada-Cañada, F., Gallego-Picó, A., & Bravo, J.C. (2019). Effects of active learning methodologies on the students' emotions, self-efficacy beliefs and learning outcomes in a science distance learning course. *Journal of Technology and Science Education*, *9*(2),217-227. https://doi.org/10.3926/JOTSE.530

Kaiser, G., König, J. (2019). Competence measurement in (mathematics) teacher education and beyond: Implications for policy. *Higher Education Policy*, *32*(4), 597–615. https://doi.org/10.1057/s41307-019-00139-z

Karaca, A. (2020). Connection of architectural education with the technological world in Northern Cyprus. *International Journal of New Trends in Social Sciences*, *4*(1), 36-50. https://doi.org/10.18844/ijntss.v4i1.5138

Kember, D., Hong, C., & Ho, A. (2013). From model answers to multiple perspectives: Adapting study approaches to suit university study. *Active Learning in Higher Education*, *14*(1), 23–35. https://doi.org/10.1177/1469787412467221

Kerrigan, J., & Prendergast, L. (2021). Flipped precalculus for engineers: An active learning course transformation. *PRIMUS*.1-8 https://doi.org/10.1080/10511970.2021.1993395

Khan, A., Egbue, O., Palkie, B., & Madden, J. (2017). Active learning: Engaging students to maximize learning in an online course. *Electronic Journal of e-Learning*, *15*(2), 107-115. https://files.eric.ed.gov/fulltext/EJ1141876.pdf

Kim, B., & Kim, J. (2016). Development and validation of evaluation indicators for teaching competency in STEAM education in Korea. *Eurasia journal of mathematics, science and technology education*, *12*(7), 1909-1924. https://doi.org/10.12973/eurasia.2016.1537a

King, M. B., & Newmann, F. M. (2001). Building school capacity through professional development: Conceptual and empirical considerations. *International Journal of Educational Management*, *15*(2), 86-94. https://doi.org/10.1108/09513540110383818

König, J. A., & Rothland, M. (2012). Motivations for choosing teaching as a career: effects on general pedagogical knowledge during initial teacher education. *Asia-Pacific Journal of Teacher Education*, *40*(3), 289 - 315. https://doi.org/10.1080/1359866X.2012.700045

Körkkö, M., Kyrö-Ämmälä, O., & Turunen, T. (2016). Professional development through reflection in teacher education. *Teaching and Teacher Education, 55*, 198–206. https://doi.org/10.1016/J.TATE.2016.01.014

Kramarski, B., & Michalsky, T. (2009). Investigating preservice teachers' professional growth in self-regulated learning environments. *Journal of educational psychology*, *101*(1), 161. https://doi.org/10.1037/A0013101

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into Practice*, *41*(4), 212–218. https://doi.org/10.1207/s15430421tip4104_2

Kunter,M., Klusmann, U., Baumert, J., Richter, D., Voss, T., & Hachfeld, A. (2013). Professional competence of teachers: effects on instructional quality and student development. *Journal of Educational Psychology*, *105*(3), 805–820. https://doi.org/10.1037/A0032583

Laksana, K., Busayanon, K., & Mahamarn, Y. (2019). *Creating pre-service teachers' engagement in an active learning journey with project-based learning to become effective teachers.* Proceedings of the 8th Teaching & Education Conference, Vienna, Austria. https://doi.org/10.20472/tec.2019.008.015

Lander, N.J., Mazzoli, E., Cassar, S., Symington, N., & Salmon, J. (2020). Embedding active pedagogies within pre-service teacher education: Implementation considerations and recommendations. *Children*, *7*(11).1-24. https://doi.org/10.3390/children7110207

Lauermann, F., & König, J. (2016). Teachers' professional competence and wellbeing: Understanding the links between general pedagogical knowledge, self-efficacy and burnout. *Learning and Instruction*, *45*, 9-19. https://doi.org/10.1016/J.LEARNINSTRUC.2016.06.006

Lee, J. F. K. (2019). Enhancing preservice teachers' professional competence through experiential learning. *Journal of Education for Teaching*, *45*(3), 353–357. https://doi.org/10.1080/09589236.2019.1599507

Leong, C. S., & Clutter, L. B. (2015). Active learning improves nursing student clinical performance in an academic institution in Macao. *Chinese Nursing Research, 2*(2), 35-39. https://doi.org/10.1016/J.CNRE.2015.08.001

Li, J. Q., & Feng, S. J. (2013). Lun ji yu biao zhun de zhi qian jiao shi zhuan ye neng li xing cheng ji li [Formation mechanism of pre-service teachers' professional competence based on the professional standards for secondary school teachers]. *Jiao Shi Jiao Yu Yan Jiu*, *25*(6), 41-46.

Li, M. Q., Zhang, X. M., Wang, L. W. (2015). Research on training strategy of the geography student teachers' teaching skills based on practice oriented skills. *Journal of Xinyang College of Agriculture and Forestry*, *25*(2), 143-145. https://doi.org/10.12783/dtssehs%2Fesem2017%2F15089

Li, X. Y. (2022). Di fang gao xiao di li shi fan sheng he xin su yang diao yan fen xi---yi shaan xi li gong da xue di li ke xue zhuan ye wei li [Analysis of the core literacy of college students majoring in geography in local universities based on survey—taking the geographical science major of Shaanxi university of technology as an example]. *Jiao Yu Jiao Xue Lun Tan*, (7), 68-70.

Li, Y. F. (2021). Pu tong yuan xiao shi fan bi ye sheng cong shi jiao yu gong zuo te zheng ji bian hua fen xi---ji yu shan xi sheng pu tong yuan xiao shi fan bi ye sheng jiu ye chuang ye gen zong diao chao [Analysis on the characteristics and changes of educational work for ordinary normal graduates---based on the follow-up survey of employment and entrepreneurship of graduates in Shaanxi]. *Jiao Shi Jiao Yu Xue Bao*, *8*(06),28-38.

Li, Y., Song, Y., Moukrim, A., & Yu, S. (2020). *An ability-oriented approach for teaching programming courses.* 2020 IEEE Frontiers in Education Conference (FIE), Uppsala, Switzerland. https://doi.org/10.1109/FIE44824.2020.9274199

Liakopoulou Maria (2011). The professional competence of teachers: Which qualities, attitudes, skills and knowledge contribute to a teacher's effectiveness? *International Journal of Humanities and Social Science*, *21*(1), 66-78. https://www.academia.edu/download/48402276/8.pdf

Lo, N. K. (2009). Huai zhi xing jiao: Dui zhong guo da lu jiao shi pei yang zhong yi xie wen ti de tan suo [Teacher education—an exploration of issues in teacher preparation in the chinese mainland]. *Dong Bei Shi Da Xue Bao (Zhe Xue She Hui Ke Xue Ban)*, (2) 163–170.

Lonka, K., & Ketonen, E. E. (2012). How to make a lecture course an engaging learning experience? *Studies for the Learning Society*, *2*(3), 63-74. https://doi.org/10.2478/v10240-012-0006-1

Lukasik, J. M., Jagielska, K., Duda, A., Koperna, P., Mróz, A., & Sobieszczańska, K. (2019). *Teachers at the beginning of their professional work-assessment of the level of pedagogical competence of graduates of teaching faculties*. Proceedings of the 2nd International Conference on Social Science, Public Health and Education (SSPHE 2018), Sanya, China. https://doi.org/10.2991/ssphe-18.2019.30

MacLean, M. S., & Mohr, M. M. (1999). *Teacher-researchers at work*. National Writing Project, University of California.

Malushko, E. (2015). Methodological podcasts as a way for developing the pre-service teachers' professional competence and skills. *Theoretical & Applied Science*, *21*(1), 173-177. https://doi.org/10.15863/TAS.2015.01.21.29

McClanahan, E. B., & McClanahan, L. L. (2002). Active learning in a non-majors biology class: Lessons learned. *College Teaching*, *50*(3), 92–96. https://doi.org/10.1080/87567550209595884

McConnell, D. A., Chapman, L. Y., Czajka, C. D., Jones, J. P., Ryker, K., & Wiggen, J. (2017). Instructional utility and learning efficacy of common active learning strategies. *Journal of Geoscience Education, 65*(4), 604 - 625. https://doi.org/10.5408/17-249.1

Ministry of Education of the People's Republic of China (2011). *Jiao shi jiao yu ke cheng biao zhun (shi xing)* [Standards for teacher education curriculums (Try-out version)]. (Jiao Shi No. 2011 :6). http://www.moe.gov.cn/ewebeditor/uploadfile/2011/10/19/20111019100845630.doc

Ministry of Education of the People's Republic of China (2018). *Pu tong gao zhong di li ke cheng biao zhun (2017 ban)* [Geography Curriculum Standards for Senior High Schools (2017)] (Jiao Cai No. 2017:7). http://www.moe.gov.cn/srcsite/A26/s8001/201801/W020181025286384018871.rar

Ministry of Education of the People's Republic of China (2019, September 23). *Zhong gong zhong yang, guo wu yuan yin fa zhong guo jiao yu xian dai hua 2035* [Central Committee of the Communist Party of China, and the State Council issued *Modernization of Chinese Education 2035*]. Xinhua Net. http://www.moe.gov.cn/jyb_xwfb/s6052/moe_838/201902/t20190223_370857.html

Ministry of Education of the Peoples Republic of China (2021). *Zhong xue jiao yu zhuan ye shi fan sheng jiao shi zhi ye neng li biao zhun (shi xing)* [Standards for teachers' professional competence of secondary education students in normal universities (try-out version)] (Jiao-Shi-Ting Standard No. 2021:2). http://www.moe.gov.cn/srcsite/A10/s6991/202104/W020210426331486891275.docx

Ministry of Education of the People's Republic of China (2022, February 24). *Jiao yu bu jiao shi gong zuo si 2022 nian gong zuo yao dian* [Key points of the Department of Teachers' Work of the Ministry of Education in 2022]. http://www.moe.gov.cn/s78/A10/tongzhi/202202/t20220225_602341.html

Mirzagitova, A. L., & Akhmetov, L. G. (2015). Self-development of pedagogical competence of future teacher. *International Education Studies, 8*(3), 114-121. https://doi.org/10.5539/IES.V8N3P114

Misseyanni, A., Papadopoulou, P., Marouli, C., & Lytras, M. D. (2018). Active learning stories in higher education: Lessons learned and good practices in STEM education. In A. Misseyanni, P. Papadopoulou, C. Marouli, & M. D. Lytras (Eds.), *Active learning strategies in higher education (*pp. 75-105). Emerald Publishing Limited. https://doi.org/10.1108/978-1-78714-487-320181004

Mitchell, J. T. (2018). Pre-service teachers learn to teach geography: A suggested course model. *Journal of Geography in Higher Education, 42*(2), 238 - 260. https://doi.org/10.1080/03098265.2017.1398719

Murray, J. (2016). Trends in teacher education across Europe: An initial analysis. In F.,

Iván & O. G., Judit (Eds.), *New aspects in european teacher education* (pp. 1-8). Líceum Kiadó. https://repository.uel.ac.uk/download/a9c5888e887de1db9033b6b419f6670cae3aaab712e5d693528a47446441fc74/483242/Trends%2520in%2520European%2520teacher%2520education%25202015-1.pdf

Namli Altintas, İ., & Karaaslan, H. (2019). Peer assessment and active learning experiences of social studies teacher candidates. *Review of International Geographical Education Online (RIGEO), 9*(2), 319-345. https://doi.org/10.33403/rigeo.615716

National Development and Reform Commission, Ministry of Foreign Affairs, and Ministry of Commerce of the People's Republic of China. (2018). *Tui dong gong jian si chou zhi lu jing ji dai he 21 shi ji hai shang si chou zhi lu de yuan jing yu xing dong* [Vision and Actions on Jointly Building Silk Road Economic Belt and 21st-Century Maritime Silk Road]. Xinhua Nut. http://www.xinhuanet.com/world/2015-03/28/c_127631962.htm

Niemi, H. (2012). Relationships of teachers' professional competences, active learning and research studies in teacher education in Finland. *Reflecting Education, 8*(2), 23-44. https://www.academia.edu/download/67082433/118.pdf

Niemi, H., & Nevgi, A. (2014). Research studies and active learning promoting professional competences in Finnish teacher education. *Teaching and Teacher Education, 43*,131-142. https://doi.org/10.1016/J.TATE.2014.07.006

Niemi, H., Nevgi, A., & Aksit, F. (2016). Active learning promoting student teachers' professional competences in Finland and Turkey. *European Journal of Teacher Education, 39*(4), 471-490. https://doi.org/10.1080/02619768.2016.1212835

Niiranen, S., Ikonen, P., Rissanen, T., & Rasinen, A. (2020). Development of teacher education students' pedagogical content knowledge (PCK) through reflection and a learning-by-doing approach in craft and technology education. *Design and Technology Education, 25*(3), 35-46. https://ojs.lboro.ac.uk/DATE/article/view/2843

Nonaka, I., & Toyama, R. (2005). The theory of the knowledge-creating firm: subjectivity, objectivity and synthesis. *Industrial and Corporate Change, 14*(3), 419–436. https://doi.org/10.1093/ICC%2FDTH058

O'Grady, A., Simmie, G. M., & Kennedy, T. (2014). Why change to active learning? Pre-service and in-service science teachers' perceptions. *European Journal of Teacher Education, 37*(1), 35 - 50. https://doi.org/10.1080/02619768.2013.845163

Oliva, À., Pozo, R. M., & Franco, E. P. (2016). Teaching competences necessary for developing key competences of primary education students in Spain: teacher assessments. *Teacher Development, 20*(1), 123-145. https://doi.org/10.1080/13664530.2015.1101390

Pantić, N., & Wubbels, T. (2010). Teacher competencies as a basis for teacher education – Views of Serbian teachers and teacher educators. *Teaching and Teacher Education, 26*(3), 694-703. https://doi.org/10.1016/J.TATE.2009.10.005

Pantić, N., Wubbels, T., & Mainhard, T. (2011). Teacher competence as a basis for teacher education: comparing views of teachers and teacher educators in five western Balkan countries. *Comparative Education Review*, *55*(2), 165 - 188. https://doi.org/10.1086/657154

Pirbhai-Illich, F., & Martin, F. (2020). Fundamental British values: Geography's contribution to understanding difference. *Primary Geography, 103,* 23-25. https://www.geography.org.uk/write/MediaUploads/Training%20and%20events/Conference/Saturday_12_PG_AUT_2020_PIRBHAI_MARTIN.pdf

Pirrie, A., & Thoutenhoofd, E. D. (2013). Learning to learn in the European Reference Framework for lifelong learning. *Oxford Review of Education, 39*(5), 609–626. https://doi.org/10.1080/03054985.2013.840280

Polit, D. F., Beck, C. T., & Owen, S. V. (2007). Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Research in nursing & health, 30*(4), 459-467. https://doi.org/10.1002/NUR.20199

Preston, L., Harvie, K., & Wallace, H. (2015). Inquiry-based learning in teacher education: A primary humanities example. *Australian Journal of Teacher Education, 40*(12), 6. https://doi.org/10.14221/AJTE.2015V40N12.6

Prince, M. (2004). Does active learning work? A review of the research. *Journal of* Engineering *Education*, *93*(3), 223–231. https://doi.org/10.1002/j.2168-9830.2004.tb00809.x

Rampeng, R., Atmowardoyo, H., & Noni, N. (2021). Speaking materials based on active learning activities and revised Bloom's taxonomy: development, validation, and revision. *International Journal of Humanities and Innovation (IJHI), 4*(2),57-65. https://doi.org/10.33750/ijhi.v4i2.109

Rao, P., Chugh, K., Prasad, K., & Shekar, K. (2018). *Impact of active learning in engineering education*. 2018 IEEE 6th International Conference on MOOCs, Innovation and Technology in Education (MITE), Mlrit, India. https://doi.org/10.1109/MITE.2018.8747038

Rodriguez, B. (2019, September 6). *Active learning vs. passive learning: What's the best way to learn?* Classcraft. https://www.classcraft.com/blog/active-learning-vs-passive-learning/

Sachs, J. (2015). Teacher professionalism: Why are we still talking about it? *Teachers and Teaching*, *22*(4), 413-425. https://doi.org/10.1080/13540602.2015.1082732

Sediyani, T., Yufiarti, & Hadi, E. (2017). Integration of audio visual multimedia for special education pre-service teachers' self-reflections in developing teaching competencies. *Journal of Education and Practice, 8*(6), 106-112. https://files.eric.ed.gov/fulltext/EJ1133052.pdf

Shaaruddin, J., & Mohamad, M. (2017). Identifying the effectiveness of active learning strategies and benefits in curriculum and pedagogy course for undergraduate TESL students. *Creative Education, 89*(14), 2312-2324. https://doi.org/10.4236/ce.2017.814158

Shen, J. (2020). Introduction of social media to aid active-learning in medical

teaching. *Interactive Learning Environments*, 1-8. https://doi.org/10.1080/10494820.2020.1766508

Shen, J. L., & Wang, K. R. (2000). Lun jiao shi de jiao xue neng li [On teacher's teaching abilities]. *Bei Jing Shi Fan Da Xue Xue Bao (Ren Wen She Hui Ke Xue Ban), 157*(1),64-71.

Shi, M., Liu, C., Liu, X., Zhou, P., Chris, T., Liu, J., & Wei, R. (2016). 21 shi ji he xin su yang de kuang jia ji yao su yan jiu [Analysis of 21st century competencies and frameworks]. *Hua Dong Shi Fan Da Xue Xue Bao (Jiao Yu Ke Xue Ban), 3,* 29-37. https://doi.org/10.16382/J.CNKI.1000-5560.2016.03.004

Slack, M. K., & Draugalis, J. R. (2001). Establishing the internal and external validity of experimental studies. *American journal of health-system pharmacy, 58*(22), 2173-2181. https://doi.org/10.1093/AJHP%2F58.22.2173

Sosu, E. M., & Gray, D. S. (2012). Investigating change in epistemic beliefs: an evaluation of the impact of student teachers' beliefs on instructional preference and teaching competence. *International Journal of Educational Research, 53,* 80-92. https://doi.org/10.1016/J.IJER.2012.02.002

Stover, S., & Ziswiler, K. M. (2017). Impact of active learning environments on community of inquiry. *The International Journal of Teaching and Learning in Higher Education*, *29*(3), 458-470. https://files.eric.ed.gov/fulltext/EJ1150760.pdf

Sueblinwong, T., Panichkul, S. (2007). *The ethical guidelines for research on human subject in Thailand*. Ethical Review Committees in Thailand.

Sumanasekera, W. K., Turner, C., Ly, K., Hoang, P., Jent, T., & Sumanasekera, T. U. (2020). Evaluation of multiple active learning strategies in a pharmacology course. *Currents in pharmacy teaching & learning*, *12* (1), 88-94. https://doi.org/10.1016/j.cptl.2019.10.016

Swiderski, S. M. (2011). Transforming principles into practice: using cognitive active learning strategies in the high school classroom. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, *84*(6), 239–243. https://doi.org/10.1080/00098655.2011.590549

Tabrizi, S., & Rideout, G. W. (2017). Active learning: Using bloom's taxonomy to support critical pedagogy. *International Journal for Cross-Disciplinary Subjects in Education*, *8*(3), 3202-3209. https://doi.org/10.20533/ijcdse.2042.6364.2017.0429

Tanase, M., & Wang, J. (2010). Initial epistemological beliefs transformation in one teacher education classroom: Case study of four preservice teachers. *Teaching and Teacher Education*, *26*(6), 1238–1248. https://doi.org/10.1016/J.TATE.2010.02.009

Tang, S. Y. F., Wong, A. K. Y., & Cheng, M. M. H. (2015a). The preparation of highly motivated and professionally competent teachers in initial teacher education. *Journal of Education for Teaching*, *41*(2), 128-144. https://doi.org/10.1080/02607476.2015.1010875

Tang, S. Y. F., Wong, A. K. Y., & Cheng, M. M. H. (2015b). Examining professional learning and the preparation of professionally competent teachers in initial teacher education. *Teachers and Teaching, 22*(1), 54–69. https://doi.org/10.1080/13540602.2015.1023028

Tang, S. Y. F., Wong, A. K. Y., & Cheng, M. M. H. (2016a). Configuring the three-way relationship among student teachers' competence to work in schools, professional learning and teaching motivation in initial teacher education. *Teaching and Teacher Education, 60*, 344–354. https://doi.org/10.1016/J.TATE.2016.09.001

Tang, S. Y. F., Wong, A. K. Y., Li, D. D. Y., & Cheng, M. M. H. (2017). The contribution of non-formal learning in higher education to student teachers' professional competence. *Journal of Education for Teaching, 43*(5), 550–565. https://doi.org/10.1080/02607476.2017.1342052

Tang, S. Y., Cheng, M. M., & Wong, A. K. (2016b). The preparation of pre-service student teachers' competence to work in schools. *Journal of Education for Teaching, 42*(2), 149-162. https://doi.org/10.1080/02607476.2016.1143143

Thắng, H. V. (2021). Applying micro-teaching method to develop geography education competence for Geography pre-service teachers. *Tạp chí Khoa học, 18*(8),1415-1429. https://doi.org/10.54607/hcmue.js.18.8.3124(2021)

Tigelaar, D. E., Dolmans, D., Wolfhagen, I. H., & van der Vleuten, C. P. (2004). The development and validation of a framework for teaching competencies in higher education. *Higher Education, 48*(2), 253-268. https://doi.org/10.1023/B%3AHIGH.0000034318.74275.E4

Togimin, N., & Jaafar, H. (2020). Role play activities: An innovative approach to teaching speaking skills in an ESL classroom. *LSP International Journal, 7*(2), 19-36. https://doi.org/10.11113/lspi.v7.16310

Ubani, M. (2016). RE student teachers' professional development: results, reflections and implications. *British Journal of Religious Education, 38*(2), 189–199. https://doi.org/10.1080/01416200.2016.1139893

Virtanen, P., Niemi, H., & Nevgi, A. (2017). Active learning and self-regulation enhance student teachers' professional competences. *Australian Journal of Teacher Education, 42*(12), 1-20. https://doi.org/10.14221/AJTE.2017V42N12.1

Vogt, F., & Rogalla, M. (2009). Developing adaptive teaching competency through coaching. *Teaching and Teacher Education, 25*(8), 1051-1060. https://doi.org/10.1016/J.TATE.2009.04.002

Vonderwell, S., & Turner, S. (2005). Active learning and preservice teachers' experiences in an online course: A case study. *Journal of Technology and Teacher Education, 13*(1), 65-84. https://www.learntechlib.org/primary/p/18892/

Wal, J., Brok, P., Hooijer, J., Martens, R., & Beemt, A. (2014). Teachers' engagement in professional learning: Exploring motivational profiles. *Learning and Individual Differences, 36*, 27–36. https://doi.org/10.1016/J.LINDIF.2014.08.001

Wang, J. (2015). *Xin xi ji shu zhi chi de yin yue shi fan sheng jiao xue neng li pei yang yan jiu* [Research on training undergraduates' music-teaching ability under the

support of information technology]. [Doctoral dissertation, Hua Zhong Shi Fan Da Xue], China Doctoral Dissertations Full-text Database.

Wang, M. C. (1980). Adaptive instruction: Building on diversity. *Theory into Practice, 19*(2), 122-128. https://doi.org/10.1080/00405848009542885

Wang, Q., & Ma, X. (2009). Educating for learner-centredness in Chinese pre-service teacher education. *Innovation in Language Learning and Teaching, 3*(3), 239 - 253. https://doi.org/10.1080/17501220903404475

Wang, Y., Zhang, H. Y. (2021). Di li shi fan sheng jiao xue shi jian neng li pei yang tu jing yan jiu [Study on cultivating pathway of teaching practical ability of geography normal students]. *Hei Long Jiang Ke Xue*, *12*(5),68-69.

Wardoyo, C., Herdiani, A., & Sulikah, S. (2017). Teacher professionalism: analysis of professionalism phases. *International Education Studies*, *10*(4), 90. https://doi.org/10.5539/IES.V10N4P90

Watkins, C., E. Carnell, & C. Lodge (2007). *Effective learning in classrooms*. Sage.

Weber, B. W. (2019). Climbing Bloom's taxonomy with jupyter notebooks: Experiences in mechanical engineering. *Engineering Education, 5*, 1-14. https://doi.org/10.1115/imece2019-10615

White, P. J., Larson, I., Styles, K., Yuriev, E., Evans, D. J., Short, J., Rangachari, P., Malone, D., Davie, B., Naidu, S., & Eise, N. T. (2015). Using active learning strategies to shift student attitudes and behaviours about learning and teaching in a research intensive educational context. *Pharmacy Education, 15(1)*, 162-172. https://pharmacyeducation.fip.org/pharmacyeducation/article/view/373

Yan, C., & He, C. (2020). Chinese student teachers' reticence in teacher education courses. *ELT Journal*, *74*(3), 287–296. https://doi.org/10.1093/elt/ccaa014

Yang, N. M. (2016). *Zheng ti ti sheng shi fan sheng jiao shi zhuan ye neng li yan jiu---yi xi bei shi fan da xue wei li* [A study on the overall improvement of students' professional skills---take northwest normal university as an example]. [Doctoral dissertation, Xi Bei Shi Fan Da Xue], China Doctoral Dissertations Full-text Database.

Yang, T. T., Shan, L., Yue, L. (2021). 'Zhuo Yue Jiao Shi' bei jing xia shi fan sheng jiao xue ji neng ping jia mo xing gou jian---Yi di li ke xue zhuan ye wei li [Establishing an assessment model of teaching skills for normal students majoring in geographic science]. *Jiao Shi Jiao Yu Lun Tan*, *34*(3), 30-35.

Ye, Z. X. (2017). *Research methods in research*. Taipei: Psychological Publishing Co., Ltd.

You, Z. S. (2015). Yi pei yang shi fan sheng jiao xue neng li wei he xin de jiao xue gai ge tan xi---ji yu 'xiao xue yu wen ke cheng yu jiao xue' de si kao [Teaching reform for cultivating normal students' teaching ability: Reflections on 'primary chinese curriculum design and teaching']. *Hu Nan Di Yi Shi Fan Xue Yuan Xue Bao, 15*(4), 17-21. https://webofproceedings.org/proceedings_series/ESSP/ICESS%202019/ICESS19333.pdf

Zeng, Z. (2015). *An action research on cultivating Chinese sophomore efl student* teachers' *teaching competence during intensive English course*. Proceedings of the 2015 International Conference on Social Science, Education Management and Sports Education, Beijing, China. https://www.atlantis-press.com/proceedings/ssemse-15/25842094.

Zhang, G. H., Zhang, Q. Q. & Hu, L. M. (2015). Guan yu gao xiao di li shi fan sheng su yang de diao yan fen xi [Investigation and analysis of normal university students' literacy of geography specialty]. *Liao Ning Shi Fan Da Xue Xue Bao (Zi Ran Ke Xue Ban), 38*(3),415-420. http;//10.11679/lsxblk2015030415

Zhao, F. Y. (2010). *Ying yu shi fan sheng xue ke jiao xue neng li fa zhan yan jiu---Ji yu han dan xue yuan wai guo yu xue yuan ji neng ke shi jian* [Research on developing pre-service teachers' English pedagogical content competence---a case study of developing skills at Handan college]. [Doctoral dissertation, Shang Hai Wai Guo Yu Da Xue], China Doctoral Dissertations Full-text Database.

Zheng, H., & Zhao, Y. F. (2022). Xue ke he xin su yang shi jiao xia de shi fan sheng zhi ye ji neng pei yang mo shi yan jiu [A study on vocational skill cultivation model of normal university students from the perspective of disciplinary core literacy -- A case study of geographical science major]. *Zhong Xue Di Li Jiao Xue Can Kao,* (4),86-89.

APPENDICES

Appendix I

Evaluation Table of the Teaching Ability of Geography Student Teachers

First-level index and weight	Secondary-level indicators	Serial number	Index requirements	Weight (%)	Level					Score
					A	B	C	D	E	
Professional knowledge (30%)	Education Foundation	1-1	The student teacher can master the basic education theoretical knowledge, follow the middle-school teaching rules, combine the cognitive characteristics of middle-school students and use teaching principles and methods to solve teaching practice problems.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
	Discipline Literacy	1-2	The student teacher can master the relevant basic geographical knowledge, theories, and thinking methods, such as man-land coordination, regional cognition, etc.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
		1-3	The student teacher can analyse the value of geographical knowledge to the development of students' core qualities of geography (such as man-land, coordination, regional cognition, comprehensive thinking, and geographical practice).	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	

Evaluation Table of the Teaching Ability of Geography Student Teachers

First-level index and weight	Secondary-level indicators	Serial number	Index requirements	Weight (%)	Level					Score
					A	B	C	D	E	
	Information Literacy	1-4	The student teacher can master the common operation of information teaching equipment, software, and other new technologies.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
	Knowledge Integration	1-5	The student teacher can understand the connection between geography and other subjects and carry out effective geography teaching activities in combination with social life practice.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
		1-6	The student teacher can master geography teaching knowledge and strategies.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
design teaching competencies (25%)	Familiar with Course Standards	2-1	The student teacher is familiar with the geography curriculum standard and textbook compilation logic and system structure, can correctly handle the relationship between the geography curriculum standard and geography textbook, and be conscious of teaching according to the curriculum standard.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
	Learning	2-2	The student teacher can analyse the	5	Strongly	Relatively	Medium	Relatively	Strongly	

Evaluation Table of the Teaching Ability of Geography Student Teachers

First-level index and weight	Secondary-level indicators	Serial number	Index requirements	Weight (%)	Level					Score
					A	B	C	D	E	
	Situation Analysis		relationship between the geography teaching content and their existing knowledge and experience and predict the difficulty in learning geography based on his/her existing level of knowledge, learning experience, and interest characteristics.		Agree	Agree		disagree	Disagree	
	Design Lesson Plans	2-3	The student teacher can accurately grasp the geography teaching content, and understand the status of this course in the textbook and the relationship with other courses. They can also determine the appropriate learning objectives and learning focus according to the geography curriculum standard requirements and learning situation analysis.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
		2-4	The student teacher can design learning activities reasonably and choose appropriate learning resources and teaching methods.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	

Evaluation Table of the Teaching Ability of Geography Student Teachers

First-level index and weight	Secondary-level indicators	Serial number	Index requirements	Weight (%)	Level					Score
					A	B	C	D	E	
		2-5	The student teacher can arrange the teaching process and link reasonably, design scientific and reasonable evaluation content and ways.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
teaching implementation competence (45%)	Create Environments	3-1	The student teacher can create teaching situations, establish the connection between learning content and life experience, stimulate learning interest and guide students to actively participate in learning activities.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
	Instruction Organisation	3-2	The student teacher can master the form and strategy of teaching organisation and classroom management and can control teaching time and teaching pace.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
		3-3	The student teacher can scientifically and accurately present and express the teaching content, establish reasonable questions and discussions, guide students to actively learn, explore learning, and achieve their learning	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	

Evaluation Table of the Teaching Ability of Geography Student Teachers

First-level index and weight	Secondary-level indicators	Serial number	Index requirements	Weight (%)	Level					Score
					A	B	C	D	E	
			objectives.							
	Learning Instructions	3-4	The student teacher can guide students toward independent, cooperative and inquiry-based learning, and help them to effectively learn key and difficult learning points in relation to the characteristics of geographical subjects, the cognitive characteristics of middle-school students and individual differences.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
		3-5	The student teacher can use class ending skills to guide students to conclude and summarise the learning content and assign a reasonable amount of homework.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
	Instruction Evaluation	3-6	The student teacher can evaluate learning activities and learning outcomes in the form of homework and problem feedback in teaching practice.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
		3-7	The student teacher can analyse the problems and deficiencies that exist in	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	

Evaluation Table of the Teaching Ability of Geography Student Teachers

First-level index and weight	Secondary-level indicators	Serial number	Index requirements	Weight (%)	Level					Score
					A	B	C	D	E	
			the teaching and students' learning process and form an awareness of diagnosing and improving teaching based on students' learning situations.							
	Master Skill	3-8	The student teacher has the basic teaching skills of chalk, pen, brush writing, and Mandarin.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
		3-9	The student teacher can systematically master the basic classroom teaching skills, such as introduction, explanation, questioning, demonstration, writing on the board, finishing, assignment, and so on.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
Total										

Appendix II
Course Design of Active Learning Strategies

Course Title	Pedagogy of Geography Course
Course Description (Synopsis)	This course will expose students to the concepts, principles, and methodology of geography pedagogy, including the theoretical foundation, the design of teaching objectives, teaching content and methods, teaching process and teaching scheme, teaching evaluation, and teaching reflection. This is a compulsory course of ITE for undergraduates majoring in geography science. It is also an applied theoretical course emphasising the application of pedagogical theory in geography teaching practice in secondary schools.
Course Learning Outcomes	After completing the course, the students should be able to: 1. Explain the basic principles and knowledge of geography pedagogy. (Knowledge) 2. Design the main links of secondary school geography teaching and construct a geography teaching scheme. (Design teaching skills) 3. Apply basic teaching skills to implement teaching geography. (implement teaching skills)
Target Audience	Undergraduates majored in geographic sciences
Delivery Method	Face-to-face teaching
Duration	16 weeks

Unit	Lesson	Theme	Learning Objectives	Content	Instructional Method / Duration	Activities	Assessment
Unit 1: Introduction of Geography teaching design	Lesson 1	Introductory class	➢Knowledge • Summarise the characteristics of geography pedagogy. (U) • Explain the research object of geography pedagogy. (U) • Explain the subject nature of geography pedagogy. (U)	• Characteristics of geography pedagogy • Research object of geography pedagogy • Subjective nature of geography pedagogy	Visual-based instruction/ Think-pair-Share (100 minutes)	• Short answer question （e.g., please describe your understanding of the characteristics of geography teaching） • Concept map (e.g., showing the objects of different stages of geography teaching theory) • Discussion (e.g., the subjective nature of geography pedagogy)	Oral report /Paperwork/ quiz (choice questions)
Unit 1: Introduction of Geography teaching design	Lesson 2	Geography teaching design and its theoretical basis	➢Knowledge • Define geography instructional design. (R) • Summarise the characteristics of modern geography teaching design. (U)	• Definition of geography instructional design • Characteristics of modern geography teaching design	Visual-based instruction/ Think-pair-Share (100 minutes)	• Discussion (e.g., Based on the example in the video, what do you think are the most significant features of modern geography teaching design?) • Concept map (e.g., sorting out the effect of	Oral report /paperwork/ quiz (choice questions)

Unit	Lesson	Theme	Learning Objectives	Content	Instructional Method / Duration	Activities	Assessment
			• Explain the theoretical basis of Geography teaching design. (U)	• Theoretical basis of geography teaching design		teaching theory on geography teaching design)	
Unit 2: Design of geography teaching objective	Lesson 3	Geography teaching objective and its design requirements	➢Knowledge • Define geography teaching objective. (R) • Summarise geography teaching objectives' design requirements. (U) ➢Design teaching skill • Create a concept map of a specific teaching theme. (C)	• Definition of geography teaching objective • Requirements of geography teaching objectives design	Cooperative learning /Visual-based instruction (100 minutes)	• Short answer question (e.g., State the definition of geography teaching objectives) • Presentation (e.g., draw out and show a concept map of a specific teaching theme)	Oral report / Practice (Work in groups to complete a concept map for a given topic) /quiz (choice questions)
Unit 2: Design of geography teaching objective	Lesson 4	Compilation and presentation of geography teaching objectives	➢Knowledge • Describe the steps for developing geography teaching objectives. (U) ➢Design teaching skill	• Steps for developing geography teaching objectives.	Cooperative learning / Case study (100 minutes)	• Short answer question (e.g., What steps are included in developing geography teaching objectives?	Oral report /Paperwork/ Practice (Work in groups to develop the teaching

Unit	Lesson	Theme	Learning Objectives	Content	Instructional Method / Duration	Activities	Assessment
			• According to the requirements for developing teaching objectives, judge the effectiveness of the objectives. (E) • Construct teaching objectives. (C)	• Common mistakes in compiling geography teaching objectives		• Critiques (e.g., Point out the errors in the given cases of designed teaching objectives.) • Presentation (e.g., write and show the teaching objectives)	objectives for a given topic) /quiz (choice questions)
Unit 3	Lesson 5	Introduction and design requirements of geography teaching content	➢Knowledge • Summarise the definition and structure of the secondary school geography curriculum standards. (U) • Analyse the design requirements of geography teaching content. (An)	• Definition and structure of the secondary school geography curriculum standards • Requirements for designing geography teaching content	Think-pair-Share / Case study (100 minutes)	• Discussion (e.g., discuss the definition and structure of secondary school geography curriculum standards) • Case study (e.g., What are the requirements for designing geography teaching content?)	Oral report/quiz (choice questions)
Unit 3: Design of geography	Lesson 6	Design of geographic conceptual	➢Design teaching skill • Conduct a scheme using the design	• Design strategy for geographic	Role play/ cooperative learning/	• Presentation / Discussion (e.g., Design and show a teaching	Oral report/ Practice (Work in groups to

Unit	Lesson	Theme	Learning Objectives	Content	Instructional Method / Duration	Activities	Assessment
teaching content		knowledge and geographic process knowledge	strategy for geographic conceptual knowledge. (C) • Conduct a teaching fragment using the design strategy for geographic process knowledge. (C) ➢ Implement teaching skill • Show a scheme of geographic conceptual or process knowledge. (Ap)	conceptual knowledge • Design strategy for geographic process knowledge	Demonstration (100 minutes)	fragment in groups, using the strategies for geographic conceptual knowledge) • Presentation / Discussion (e.g., Design and show a teaching fragment in a group, using the strategies for geographic process knowledge)	present a designed teaching content for a given topic, using some learned strategies) /quiz (choice questions)
Unit 3: Design of geography teaching content	Lesson 7	Design of geographic principal knowledge and geographic regional knowledge	➢ Design teaching skill • Conduct a teaching fragment using the design strategy for geographic principal knowledge. (C) • Conduct a scheme using the design	• Design strategy for geographic principal knowledge • Design strategy for geographic regional knowledge	Role play/ cooperative learning/ Demonstration (100 minutes)	• Presentation / Discussion (e.g., Design and show a teaching fragment in groups, using the strategies for geographic principal knowledge) • Presentation / Discussion (e.g., Design	Oral report/ Practice (Work in groups to present a designed teaching content for a given topic, using some

Unit	Lesson	Theme	Learning Objectives	Content	Instructional Method / Duration	Activities	Assessment
			strategy for geographic regional knowledge. (C) ➢Implement teaching skill • Show a scheme of geographic regional knowledge. (Ap)			and show a teaching fragment in groups, using the strategies for geographic regional knowledge)	learned strategies) /quiz (choice questions)
Unit 3: Design of geography teaching content	Lesson 8	"Promotion" and "Second Creation" of geography teaching content;	➢Knowledge • Describe the main strategies for improving teaching content. (U) • Summarise the basic procedures for realising the activity of teaching content. (U)	• Main strategies for improving teaching content • Basic procedures for realising the activity of teaching content	Visual-based instruction/ Think - pair - Share (100 minutes)	• Short questions (e.g., State key strategies for improving teaching content). • Concept map (e.g., Draw out the process to realise the activity of teaching content)	Oral report/ quiz (choice questions)
Unit 4: Design of geographical teaching methods	Lesson 9	Design of geographical teaching methods--- lectures and talking	➢Knowledge • Summarise the requirements for the use of the talking method. (U) ➢Implement teaching skill	• Lecture method • Talking method	Role play/ Think - pair - Share / Cooperative learning (100 minutes)	• Presentation/ Simulation (e.g., simulate teaching a scheme using the lecture method) • Discussion (e.g., discuss the use	Oral report/ Practice (Work in groups to present a designed teaching fragment for a

Unit	Lesson	Theme	Learning Objectives	Content	Instructional Method / Duration	Activities	Assessment
			• Use lecturing method to demonstrate different types of geographical knowledge. (Ap)			requirements of the conversational method)	given topic, using some learned methods) /quiz (choice questions)
Unit 4: Design of geographical teaching methods	Lesson 10	Design of geographical teaching method--- discovery method and situational teaching method	➢Knowledge • Analyse the general steps of the discovery method. (An) • Analyse the ways of establishing a problem situation in the situational teaching method. (An)	• Discovery method • Situational teaching method	Case study /Think - pair - Share (100 minutes)	• Case study (e.g., analyse cases and summarise the general process of the discovery method) • Discussion (e.g., analyse the case, summarise the way the situation was created)	Oral report/ quiz (choice questions)
Unit 4: Design of geographical teaching methods	Lesson 11	Design of geographical teaching media---map	➢Knowledge • Analyse how to use a map in teaching. (An) ➢Design teaching skill • Design teaching method for given	• Geographic wall map method	Case study / Role play/ Cooperative learning (100 minutes)	• Case study (e.g., What are the principles of using a map to teach in the classroom?) • Presentation (e.g., Show a teaching topic	Oral report/ Practice (Work in groups to present a designed teaching

Unit	Lesson	Theme	Learning Objectives	Content	Instructional Method / Duration	Activities	Assessment
			teaching content and show it. (C) ➢Implement teaching skill • Show a scheme designed using some teaching methods. (Ap)			designed using some teaching methods)	fragment for a given topic, using some learned methods) / quiz (choice questions)
Unit 5: Design of geography teaching process	Lesson 12	Design of geography teaching process	➢Knowledge • Analyse the common forms of classroom lead-in. (An) • Analyse the common ways of classroom transition and closure. (An) • Judge the type of blackboard-writing. (Ap)	• Common forms of classroom lead-in • Common ways of classroom transition and closure	Visual-based instruction /Case study/ Role-play (100 minutes)	• Case study (e.g., analyse and summarise Common forms of classroom lead-in, transition and closure) • Short questions (e.g., state the type of blackboard-writing shown)	Oral report/ quiz (choice questions)
Unit 5 : Design of geography teaching	Lesson 13	Design of blackboard-writing	➢Design teaching skill • Design the teaching process of a specific theme. (C)	• Type of blackboard-writing • Board drawing requirements	Cooperative learning / Role play (100	• Presentation (e.g., show a teaching process including the lead-in, transition, closure and	Oral report/ Practice (Work in groups to present a

Unit	Lesson	Theme	Learning Objectives	Content	Instructional Method / Duration	Activities	Assessment
process			• Conduct the blackboard-writing of a teaching fragment, according to the requirement of blackboard-writing. (C) • Using the board drawing requirements, draw an outline of an area, e.g. China. (C) ➢Implement teaching skill • Show the teaching process and the blackboard-writing of a specific theme. (Ap)	• Drawing of a regional outline	minutes)	blackboard-writing for a scheme) • Sketch (e.g., draw the outline of China)	designed whole teaching process for a given topic) / Quiz (choice questions)
Unit 5: Design of geography teaching process	Lesson 14	Design of geography teaching plan	➢Knowledge • Analyse the components of a teaching plan. (An) • Summarise the main links and guiding	• Components of a teaching plan, • the main links and guiding ideas of different classroom models	Case study/ cooperative learning (100 minutes)	• Case study (e.g., describe the main components of the teaching plan shown) • Presentation (e.g., design a teaching plan for a topic.)	Paperwork /Practice (Work in groups to present a designed teaching plan

Unit	Lesson	Theme	Learning Objectives	Content	Instructional Method / Duration	Activities	Assessment
			ideas of different classroom models. (U) ➢Design teaching skill • Elaborate a teaching plan. (C)			• Short question answer (e.g., summarise the main links and guiding ideas of a specific teaching model)	for a given topic) /quiz (choice questions)
Unit 6: Design of geography teaching evaluation	Lesson 15	Design of geography teaching evaluation	➢Knowledge • Analyse the content of geography teaching evaluation. (An) ➢Design teaching skill • Conduct a teaching evaluation of a teaching theme. (C) ➢Implement teaching skill • Estimate the teaching design and teaching process shown by members, using the evaluation methods and requirements. (Ap)	• Content of geography teaching evaluation • Evaluation methods and criteria	Case study /Role play / cooperative learning (100 minutes)	• Case study (e.g., state the content of geography teaching evaluation, using the provided materials) • Presentation (e.g., design a teaching evaluation for a topic) • Simulation (e.g., simulate an assessment of another teaching design and process based on the relevant requirements)	Oral report /Practice (Work in groups to present a designed teaching evaluation for a given topic and provide advice on the other group's design) / Quiz (choice questions)
Unit 6: Design of	Lesson 16	Geography teaching	➢Knowledge	• Necessary qualities and	Think-pair-Share/ Role	• Discussion (e.g., what abilities must	Oral report /Practice

Unit	Lesson	Theme	Learning Objectives	Content	Instructional Method / Duration	Activities	Assessment
geography teaching evaluation		reflection and redesign	• Summarise the necessary qualities and abilities of a geography teacher. (U) ➢Implement teaching skill • Reflect their own teaching design, and write and state their teaching reflection and redesign. (Ap)	abilities of a geography teacher • Geographic teaching reflection	play/ cooperative learning (100 minutes)	geography teachers have?) • Simulation (e.g., simulate reflecting on the teaching design and redesign it.)	(Work in groups to reflect on the teaching design of your own group and try to redesign it) / Quiz (choice questions)

Note: Developed for this research