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Applying Active Learning Strategies to Develop the Professional Teaching Competency of Chinese College Student Teachers in the Context of Geography Education

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Abstract. Developing the professional teaching competence of college student teachers is a vital task in initial teacher education institutions. The aim of this research, based on a quasi-experimental design, was to apply active learning strategies to develop the professional teaching competence of Chinese college geography student teachers. In total, 96 geography student teachers in China participated in this research; 50 of them were placed in the experimental group, and the remaining 46 were placed in the control group. The intervention on active learning strategies was based on Bloom's taxonomy and the Standards for The Professional Competence of Teachers majoring in Secondary Education for Student Teachers. The experimental group received the experimental intervention for 16 lessons, while the control group was exposed to the traditional teaching in the same teaching schedule. The results of the one-way ANCOVA undertaken show that the intervention consisting of active learning strategies significantly improved the professional competence of the Chinese college student geography teachers in the experimental group. This study contributes empirically to the universities, educators, and researchers involved in initial teacher education programmes in the geography field.

Keywords: professional teaching competency, active learning strategies, student teacher, geography education, Bloom's taxonomy

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1. Introduction

The development of the professional competency of teachers is an essential component of their professionalisation (Ubani, 2016) which has been found to predict teacher burnout (Lauermann & König, 2016) and have a positive impact on student academic outcomes and the quality of instructions given (Fauth et al., 2019). The teaching competence is the most crucial out of the many competencies required by professional teachers, as well as being the concentrated embodiment of their professionalism (Guan et al., 2016). Initial teacher education (ITE) is deemed to be the foundation of the development of a teacher's professional teaching competence (Wardoyo et al., 2017). It is where student teachers are equipped with professional teaching competence by learning various pedagogical courses and participating in pre-service training (Allen & Wright, 2014). The student teachers' teaching competence and their participation in ITE have been proven to be positively related (Goodwin & Oyler, 2008), playing a vital role in their effective professional teaching performance (Gokalp, 2016). Hence, training and developing the student teachers' professional teaching competence is a crucial task for ITE institutions.

However, many challenges affect the development of the student teachers' professional teaching competence. Firstly, the professional competence in China is generally comparable to the requirements of a reformed middle school geography curriculum (Zhang et al., 2015). This is manifested by an unstable professional attitude, unfamiliarity with teaching knowledge, and low teaching competence (Wang & Zhang, 2021; Hu & Zeng, 2019). Secondly, the related curriculum for teacher education mainly focuses on theory and ignores the need for student teachers to have practical experience (Ding & Li, 2014). Thirdly, student teachers are usually silent in teacher-driven education classes because the educational environment is based on teacher-centred pedagogies and related ways of operation (Yan & He, 2020). Hence, reforming ITE has been deemed a policy lever to transform the teachers' professional development. Therefore, restructuring the Chinese geography teachers' initial education has become a critical issue in the context of reforming the educational environment, mode of teaching, and teacher education courses to improve their professional teaching competence.

Many factors and learning strategies can affect and promote the student teachers' professional competency (Lee, 2019). According to the central tenet of constructivism, learning is a process of constructing knowledge actively (Bada & Olusegun, 2015; Brooks & Brooks, 1993) in which the learners are encouraged to participate in their studying actively and to connect it to their previous experiences positively (Bonwell & Eison, 1991). Active learning has been proven to increase the engagement of student teachers, enhance the effect of the learning itself (Preston et al., 2015) and assist them in acquiring and understanding their professional competence deeply (Kramarski & Michalsky, 2009; Tang et al., 2016). A positive relationship has been reported to exist between active learning and the student teachers' professional competence (Niemi, 2012; Virtanen et al., 2017).

Based on the existing literature, only a few empirical researchers have studied the teaching competence of Chinese college geography student teachers (Yang et al., 2021). Although the existing research into the 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 the Chinese student teachers to use to develop their professional teaching competence (Zeng, 2015; Hou, 2016). Additionally, active learning is relatively new to the field of teacher education. Although the relationship between active learning and the professional competence of Finnish student teachers has been explored in teacher education programmes (Niemi et al., 2016; Lonka & Ketonen, 2012), there have been only a few in-depth analyses of the development of the teaching competence of student teachers through active learning. Therefore, the research aimed to fill in this gap by applying active learning strategies in a course to develop the college student teachers' professional teaching competence in the context of geography education. The results of this research are expected to become a reference for ITE administrators and educators to develop the professional teaching competence of college geography student teachers.

2. Literature Review

2.1 Professional teaching competence in geography education

As the core of teachers' professional competence, professional teaching competence constitutes a combination of the knowledge and abilities necessary for teachers to effectively undertake their teaching activities in various situations (Tigelaar et al., 2004). Since it is context-specific and necessary for resolving problems in the teaching practice (Herppich et al., 2017), it seems to be a means to manage the teaching process itself (Hb et al., 2020; Lukasik et al., 2019). A competent teacher should be equipped with all kinds of knowledge and competencies to manage the teaching and learning process effectively, e.g., subject knowledge, general teaching knowledge, pedagogical content knowledge, pedagogical technology knowledge, and the ability to plan and implement instructions (Kim & Kim, 2016; Oliva et al., 2016; Astuty, 2015; Hanifah et al., 2019). This includes designing the course, implementing the teaching and learning process, evaluating the outcomes, etc. (Lukasik et al., 2019; Hb et al., 2020). More specifically, geography teachers need to possess varied knowledge of the natural sciences (e.g., geomorphology, water resources, biology, and the climate) and social sciences (e.g., nation, history, archaeology), be able to explain the relationships between social phenomena, natural events, and geographical space, and teach geographical knowledge (Karaca, 2020; Pirbhai-Illich & Martin, 2020). Therefore, the college geography student teachers' professional teaching competence is defined in this study as a synthesis of the specific teaching competence and knowledge required to ensure that the professional geography teaching activities and processes are undertaken effectively.

Developing a teaching education course with an innovative classroom teaching model in the ITE stage is an essential measure to improve the student teachers' teaching competence (Pantić & Wubbels, 2010; Lander et al., 2020). According to

the professional competence framework used for the student teachers majoring in Secondary Education (Trial) issued by the Ministry of Education of China (MOE), the Chinese student teachers' professional teaching competence has been summarised and categorised into three dimensions: professional knowledge, teaching design competence, and teaching implementation competence (MOE, 2021). This framework was applied to this research to measure the Chinese college geography student teachers' teaching competence.

2.2 Active Learning

Active learning was developed based on Piaget's constructivist learning theory which is focused on the individual nature of the learning process in which the learners' knowledge is reconstructed into new information by connecting and modifying their existing knowledge and experience (Bransford et al., 1999). Hence, when using active learning methods, the learners are often explicitly required to link their new knowledge to their old thinking patterns. The teachers provide them with effective learning activities to help them to overcome the conflict between the old and new knowledge and to reconstruct their way of thinking (Brame, 2016). Meanwhile, according to Vygotsky's social constructionism theory, an individual's learning is built by communicating with others in a group (Alexandra, 2014). Active learners tend to generate and apply knowledge collaboratively in discussions or through cooperative problem-solving (Nonaka et al., 2005). Active learning strategies, including demonstrations, discussions, practising doing, and teaching others, are highlighted due to their high information retention rate, which is helpful in stimulating the students' desire to increase their comprehension of the knowledge by discussing it with their peers (Rodriguez, 2018).

Active learning is regarded as any activity that inspires the students to become involved in classroom learning, as well as encourages them to think critically about extracurricular activities (Adkins, 2018). Active learning is contrary to traditional passive learning (Stover & Ziswiler, 2017). It is characterised by being student-centred, experiential, and involving cooperative learning to help the learners obtain new abilities in a more positive way (Diković & Gergorić, 2020). Their abilities are supported by common active learning strategies, including visual-based instructions, case studies, cooperative learning, role-playing and simulations, think-pair-share, visual aids, and so on (Daouk et al., 2016; McConnell et al., 2017).

Researchers have found that active learning can effectively stimulate the students' interest, improve their learning engagement and performance, and significantly develop their competence (Cavanagh, 2011; Togimin & Jaafar, 2020; Chen et al., 2020). As a key achievement, the student teachers' professional teaching competency is influenced by active learning strategies, such as autonomous group work, cooperative learning, and problem-solving (Niemi et al., 2016; Virtanen et al., 2017). There exists a strong relationship between the student teachers' professional competence and active learning based on them being highly engaged in the learning tasks undertaken in a collaborative learning culture (Niemi, 2012). Other researchers have provided case studies to prove that active learning strategies such as role-play, cooperative learning,

visual-based instructions, and practice-by-doing can enhance the college geography student teachers' professional competence (Ferizat & Kuat, 2021), e.g., their professional assessment ability (Bijsterbosch et al., 2019), ability to acquire knowledge of geographical subjects, and knowledge of the pedagogical content (Harte & Reitano, 2015; Niiranen et al., 2020).

2.3 Bloom's taxonomy

Active learning provides learners with valuable strategies to achieve their learning objectives. Bloom's taxonomy is considered a key tool for organising educational knowledge (Bloom et al.,1956). It is based on six steps arranged in a hierarchical structure, namely Remember, Understand, Apply, Analyse, Evaluate, and Create (Krathwohl, 2002). Some researchers have reported that Bloom's higher-order cognitive goals and skills, such as analysis, evaluation, and creation, can be developed through the use of active learning strategies such as cooperative learning, role-playing, case studies, discussions, problem-based learning, and so on (Bonwell & Eison, 1991; Brame, 2016; Weber, 2019). Additionally, Bloom's taxonomy could also be utilised to guide teachers in the use of active learning in the classroom based on designing questions (Tabrizi & Rideout, 2017), developing the teaching materials (Rampeng et al., 2021), inspiring and motivating the students to learn, and enhancing their ability to practice (Li et al., 2020). Therefore, active learning was chosen as a possible teaching method to develop the student teachers' teaching competence in this study. Bloom's taxonomy was used as a tool for organising educational knowledge and describing the teaching objectives of every lesson in the active learning course.

Therefore, in this study, active learning strategies, such as visual-based instruction, cooperative learning, case studies, role-playing, and discussion, were applied in a teaching educational course based on Bloom's taxonomy to examine its effectiveness in improving the Chinese college geography student teachers' professional teaching competence.

3. Methodology

In this study, a quasi-experimental design with a non-equivalent control group was used, aiming to apply active learning strategies to train and develop the sampled college geography student teachers' professional teaching competence. The participants were 96 geography student teachers from a public university in China, who were placed in the experimental group (EG) or control group (CG). The independent variable was active learning strategies, and a pre-test and post-test were used as the dependent variables to evaluate the college geography student teachers' professional teaching competence.

3.1 Procedures

This study was implemented in two stages. Stage 1 consisted of developing the course using active learning strategies to promote the Chinese student geography teachers' teaching competence based on analysing the related literature. Five experts were asked to review the course to obtain expert validity, and the active learning course was then modified based on the five experts'

suggestions. The purpose of Stage 2 was to examine the effectiveness of the revised active learning course to develop the student teachers' teaching competence. The CG was subjected to traditional teaching, while the EG received the active learning intervention. The student teachers' teaching competence was scored and compared using a t-test, ANCOVA, pre-test, and post-test.

3.2 Participants

The study was conducted in a public teacher university in northwest China. There were 96 college geography student teachers selected to partake in this research. Fifty were randomly placed in the EG, and the remaining 46 in the CG. The intervention consisting of active learning strategies was used to teach the EG for 16 lessons over 16 weeks, while the CG was exposed to traditional teacher-centred lectures over the same period.

3.3 Research intervention

The designed active learning strategies, such as visual-based instruction, cooperative learning, case studies, role-playing, and discussion, were utilised as the intervention to instruct the EG, while the CG received the regular lecture-based teaching. The researcher was the teacher in the experiment. All the participants utilised the same textbook containing 6 units and the same teaching environment and schedule.

The course chosen for this study was Geography Teaching Theory, a compulsory course in ITE for undergraduates majoring in geography education. The learning objectives of the course were designed based on Bloom's taxonomy (Bloom et al., 1956) and the Standards for The Professional Competence of Teachers majoring in Secondary Education for Student Teachers (Trial) issued by the MOE (MOE, 2021). As for the learning objectives, at the end of the course, the students should be capable of explaining the basic principles and knowledge of geography pedagogy, designing the main links of secondary school geography teaching, constructing a geography teaching scheme, and applying basic teaching skills to implement geography teaching. The points correspond to the three dimensions of the Chinese student teachers' professional teaching competence, namely professional knowledge, teaching design competence, and teaching implementation competence. As shown in Table 1, the three dimensions of the Chinese student teachers' professional teaching competence served as the learning objectives for every unit. The course was followed by teaching the student teachers professional knowledge from week 1 to week 2, designing teaching competence from week 3 to week 16, and implementing teaching competence from week 5 to week 16. Understand (U), Apply (Ap), Evaluate (E), and Create (C) represent the different levels of the sub-goals based on Bloom's taxonomy and unit themes. The EG was designed with active learning strategies in mind, such as visual-based instructions, cooperative learning, case studies, role-playing, discussions, etc. Two or three active learning strategies were chosen and displayed in the lecture classroom. On the contrary, the CG was exposed to lecture-based and teacher-centred methods, alongside fewer activities. The course was comprised of 16 lessons, with one lesson per week lasting for 100 minutes.

Table 1: Theme design for each unit intervention in the form of the active learning strategies used by the EG

Theme	**Period**	**Learning objectives (U: *Understand*; C: *Create*; E: *Evaluate*; Ap: *Apply*)**	**Introduction methods**
Unit 1: Introduction to the geography teaching design	2 periods (2 classes for 100 minutes each class)	➢ Professional knowledge • Summarise the characteristics of geography pedagogy. (U) • Summarise the characteristics of modern geography teaching design. (U) • Explain the theoretical basis of the geography teaching design. (U)	Visual-based instruction/ Think-pair-Share
Unit 2: Design of the geography teaching objective	2 periods (2 classes for 100 minutes each class)	➢ Teaching design competence • Construct the teaching objectives. (C) • Judge the effectiveness of the requirements for developing the teaching objectives. (E)	Case study/ Visual-based instruction/ Cooperative learning
Unit 3: Design of the geography teaching content	4 periods (2 classes for 100 minutes each class)	➢ Teaching design competence • Construct a scheme for the different geographical knowledge using the design strategy. (C) ➢ Teaching implementation competence • Demonstrate the designed scheme. (Ap)	Cooperative learning / Case study/ Think-pair-Share / Role-play/ Demonstration
Unit 4: Design of the geographical teaching methods	3 periods (2 classes for 100 minutes each class)	➢ Teaching design competence • Design and demonstrate a teaching method for the given teaching content. (C) ➢ Teaching implementation competence Demonstrate the designed scheme using a selection of teaching methods. (Ap)	Role-play/ Think - pair – Share/ Demonstration /Role-play
Unit 5: Design of the geography teaching process	3 periods (2 classes for 100 minutes each class)	➢ Teaching design competence • Elaborate a teaching plan. (C) • Design the teaching process of a specific theme and write it on the blackboard. (C) ➢ Teaching implementation competence • Demonstrate the teaching process of a specific theme and write it on the blackboard. (Ap)	Visual-based instruction/ Role-play/ Demonstration /Case study/ Cooperative learning
Unit 6: Design of a geography teaching evaluation	2 periods (2 classes for 100 minutes each class)	➢ Teaching design competence • Evaluate a teaching theme. (C) ➢ Teaching implementation competence • Estimate the teaching design and teaching process that the members show using the evaluation methods and requirements. (Ap) • Reflect on your teaching design, and write and state your teaching reflection and redesign. (Ap)	Case study /Role-play /Cooperative learning

3.4 Pre-test and Post-test

The rubric for the Chinese college geography student teachers' teaching competence was used in this study to determine if the teaching competence of the geography Chinese student teachers had effectively improved after the active learning intervention. The rubric used for evaluating the teaching undertaken refers to the Standards for the Professional Competence of Teachers majoring in Secondary Education for Student teachers (Trial) (MOE, 2021). Five experts were invited to review the rubric for the Chinese college geography student teachers' teaching competence for the revised national standard (Ye, 2017) so then it could receive expert validation. According to Polit et al. (2007), the CVI should be at least 0.78 or higher for three or more experts. Since the content validity index (CVI) of every item in this study was ranged from 0.8 to 1, the rubric for the Chinese college geography student teachers' teaching competence was considered to have good content validity.

The rubric used three dimensions to assess the teaching competence of the student teachers, namely professional knowledge, teaching design competence, and teaching implementation competence, consisting of 20 items and a 5-point Likert scale, as shown in Appendix *I*. The score was 100 points in total, with 30 points for professional knowledge, 25 points for the teaching design competence, and 45 points for teaching implementation competence.

The student teachers in both the EG and the CG were required to deliver a 10-minute instructional demonstration during the pre-test and post-test. The pre-test was implemented before the research intervention, and the post-test was taken after it. The instructional performance of the college geography student teachers in the two tests was scored based on the rubric determined by six experts with rich experience in geography education who were placed into two groups randomly. Before the official grading, all of the experts were invited to work together to mark the test materials of three students to understand the specific test procedures and assessment items, as well as unifying the test requirements. Then, an independent sample t-test, paired sample t-test, and ANCOVA were used to compare the scores of the student teachers' teaching competence.

4. Results

As mentioned above, the 96 student teachers across the EG and the CG were conducted to a pre-test and a post-test. There were 50 test-takers in the EG and 46 in the CG.

4.1 Results for professional teaching competence

The results of the descriptive analysis for teaching competence in the pre- and post-tests are shown in Table 2, in which it is indicated that the mean of the pre-test for the two groups was close, but the mean of the post-test for the EG (M=80.687) was greater than that of the CG (M= 67.638).

Table 2: Descriptive Analysis of Professional competence in Pre- and Post-tests

Group	*n*	Pre-test Mean	*SD*	Post-test 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 of Independent Sample t-test

An independent sample t-test was applied to analyse the pre-test results to examine if there were any significant differences between the EG and the CG in terms of the starting level of professional teaching competence. As shown in Table 3, there existed no significant difference between the two groups overall (t=-.621, p>.05, Cohen's d=.126) as well as in 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 indicates there was no significant difference and a small effect found regarding the professional teaching competence of both groups before the experimental intervention, which met the homogeneity requirement of the pre-test.

Table 3: Independent Sample t-test showing the pre-test results for professional teaching competence

Factors	Groups	*n*	Mean	*SD*	*t*	*p*	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	0.536	.126
	CG	46	57.797	6.834			

4.3 Paired sample t-test

A paired sample t-test was utilised to analyse the teaching performance of the sampled Chinese college geography student teachers to examine whether there existed a difference between the professional teaching competence of the EG and CG before and after the intervention. These results are shown in Table 4, where it can be found that both groups had significantly progressed (p<.001) and that there was a large effect (Cohen's d>0.8) in the three dimensions as well as the overall score. This indicates that the student teachers' pre- and post-test results were significantly different, with the post-test results being better than the pre-test ones.

Table 4: Summary of the paired sample t-test results for professional teaching competence across the 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 examine whether there existed a significant difference between the EG and CG in the post-test when the pre-test was controlled for.

Based on the ANCOVA assumption, the initial test of the homogeneity of the groups' regression coefficients displayed that there was no significant difference between the two groups overall (F=2.901, p=.092>.05.), as well as in relation to the three dimensions of 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 the further covariate analysis, the results of the variation homogeneity test also indicated the two groups had the same variation with the same quality overall (F=1.683, p=.198>.05), as well as in the three dimensions of 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 from the final analysis of the covariables are displayed in Tables 5 and 6. The mean and standard deviation of the two groups in the three dimensions and overall are shown in Table 5 after re-estimating the mean of the pre-test. According to Table 6, there was a significant effect found in the two groups in the post-test overall [F (1,93) =130.690, p<.05], as well as in the three dimensions of 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]. This indicates that the score of the EG's teaching competence in the post-test, both in different dimensions and overall, was significantly higher than that of the CG. After the research intervention, the teaching competence of the EG in the post-test was therefore found to be better than that of the CG after controlling the pre-test.

Table 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 6: Summary of the one-way ANCOVA for professional teaching competence

Factors	Source	*SS*	*df*	*MS*	*F*	*p*
Professional Knowledge	Pre-test	183.180	1	183.180	40.147	.000
	Groups	189.795	1	189.795	41.597	.000
	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
	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
	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
	Error	3152.283	93	33.896		
	Total	541050.111	96			

5. Discussion

Adopting and practicing active learning strategies in the course training as a part of teacher education has become crucial (Shaaruddin & Mohamad, 2017) due to the fact that many young graduates are not well-equipped for teaching (Wang & Zhang, 2021; Hu & Zeng, 2019). This research aimed to examine the effectiveness of a teacher education course based on active learning strategies to develop the professional teaching competence of Chinese college geography student teachers.

Firstly, the designed course called *Geography Teaching Theory* was a compulsory course that all college geography student teachers at a public university in

northwest China had to attend and complete within 16 weeks. The course aim was that student teachers could acquire the relevant professional knowledge of teaching geography and develop the competence to design and implement the teaching. The course was designed based on Bloom's taxonomy (Bloom et al., 1956) and the Chinese framework for the Professional Competence of Student Teachers (MOE, 2021). It included 6 units, namely an introduction to geography teaching design, the design of geography teaching objectives, teaching content, teaching methods, teaching process, teaching evaluation, and reflection. Active learning was incorporated into the course activities and assignments (Anderson et al., 2001) to practice the higher order skills in Bloom's taxonomy. This included strategies of visual-based instruction, think-pair-share, a case study, cooperative learning, role-play, and demonstrations, all of which should be designed according to the principle of active learning. In terms of the teaching content of the course used in this study, it was consistent with that of other researchers who all emphasise the conceptualisation of various types of geographical knowledge and the modeling of geography teaching methods (Mitchell, 2018; Schee et al., 2016). As for the teaching methods, this course responded to the suggestion that active learning strategies should be utilised to design the training programmes for college geography student teachers (Schoonenboom et al., 2016). Although previous researchers have also attempted to integrate active learning strategies into a pedagogy course with undergraduate TESL students as subjects (Shaaruddin & Mohamad, 2017), this study is different in that the research involved other active learning strategies, including micro-teaching, peer-reflections, feedback, and self-reflections in the designed course under the policy framework of higher education in Malaysia.

Secondly, the effectiveness of applying active learning strategies to develop the Chinese college geography student teachers' teaching competence was proved. First of all, the professional teaching competence of both groups had progressed overall after the intervention. However, the teaching competence of the Chinese college geography student teachers subjected to the active learning strategy training was significantly improved compared to those who underwent regular teaching. This result corresponds to the earlier review that demonstrated that active learning could positively enhance students' learning performance (Khan et al., 2017). Other researchers also reported there to be a significant relationship between active learning strategies and the student teachers' professional teaching competence (Niemi et al., 2016; Virtanen et al., 2017; Niemi, 2012). This finding also supports for the previous researchers who found that the students in active learning classrooms achieved more than those subjected to traditional teaching (Bishara, 2018; Diković & Gergorić, 2020). More specifically, all three dimensions of the professional teaching competence, including professional knowledge, designing teaching competence, and implementing teaching competence, had progressed after the intervention. This result corresponds to that of previous research that active learning was beneficial for student teachers as it helped them to understand and develop their professional knowledge (Niiranen et al., 2020; Demirci & Akcaalan, 2020; Ishii, 2017) and improve their teaching competence (Togimin & Jaafar, 2020; Niemi et al., 2016), e.g.,

developing their teaching materials (Laksana et al., 2019) and implementing and practicing the theories they have learned (Namli AltKaraaslan, 2019).

6. Conclusion

This study aimed to develop the Chinese college geography student teachers' professional teaching competence through an intervention of active learning strategies. A quasi-experimental design was implemented involving 96 participants (50 for EG and 46 for CG). The goal of developing the student teachers' professional teaching competence was achieved, and their level of competence was evaluated by experts both before and after the intervention according to the Chinese Standards for the Professional Competence of Teachers majoring in Secondary Education for Student Teachers. The experimental results were then analysed statistically and proven to be effective. Based on the analysis, the professional teaching competence of the Chinese college geography student teachers in the two groups improved between the pre-test and post-test. However, the professional teaching competence of the students in the EG improved much more than that of the students in the CG. In summary, it can be concluded that active learning strategies (e.g., visual-based instruction, think-pair-share, case study, cooperative learning, role-play, and demonstrations) can effectively improve the Chinese college geography student teachers' professional teaching competence, including their professional knowledge, teaching design competence, and teaching implementation competence.

7. Recommendations

Based on the findings, this study could be considered one of the few empirical studies that have explored how to improve the professional teaching competence of college geography student teachers in China. This study conducted an in-depth analysis of an intervention consisting of active learning strategies to develop the student teachers' teaching competence as the core ability of professional student teachers. It contributes empirically to the universities, educators, and researchers involved in ITE programmes in the geography field. Furthermore, it provides a new validated framework for integrating active learning strategies into teacher education courses. However, in further research, innovative educational techniques should be recommended, e.g., flipped classrooms, blended learning, or virtual learning. These techniques are flexible and can provide more opportunities for active learning (Fuchs, 2021; Astudillo et al., 2020). Additionally, other kinds of assessment strategies, including interviews and questionnaires (Shaaruddin & Mohamad, 2017; Niemi & Nevgi, 2014), could be utilised to get feedback on the students' experiences. It is suggested that future researchers in this field should apply these models within active learning further to develop the student teachers' professional teaching competence.

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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 required, follow the middle school teaching rules, combine the cognitive characteristics of the middle school students, and use teaching principles and methods to solve any teaching practice problems that arise.	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	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	
			coordination, regional cognition, etc.							
		1-3	The student teacher can analyse the value of geography knowledge in relation to the development of the students' core qualities regarding geography (such as man-land, coordination, regional cognition, comprehensive thinking, and geographical practice).	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
	Information literacy	1-4	The student teacher can master the common operation of information teaching equipment,	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	
			software, and other new technologies.							
	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 practices.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
		1-6	The student teacher can master the geography teaching knowledge and strategies.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
Teaching design	Familiar with course standards	2-1	The student teacher is familiar with the geography curriculum standard and textbook compilation logic	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	
competencies（25%）			and system structure, can correctly handle the relationship between the geography curriculum standard and geography textbook, and is conscious of teaching according to the curriculum standard.							
	Learning situation analysis	2-2	The student teacher can analyse the relationship between the geography teaching content and his/her existing knowledge and experience, and predict any difficulties when learning geography based on his/her existing level of knowledge, 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	
			experience, and interest characteristics.							
	Design lesson plans	2-3	The student teacher can accurately grasp the geography teaching content, understand the status of this course in the textbook, and its relationship with other courses. He/she can also determine the appropriate learning objectives and learning focus according to the geography curriculum standard requirements and their learning situation analysis.	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	
		2-4	The student teacher can design the learning activities reasonably and choose appropriate learning resources and teaching methods.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
		2-5	The student teacher can arrange the teaching process and link, as well as design scientific and reasonable evaluation content and methods.	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 the learning content and life experience, stimulate learning interest, and guide the students to	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	
			actively participate in the learning activities.							
	Instruction organisation	3-2	The student teacher can master the form and strategy of the teaching organisation and classroom management and can control both the 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 the students in active learning, explore learning, and help	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	
			them to achieve the learning objectives.							
	Learning instructions	3-4	The student teacher can guide the students towards independent, cooperative, and inquiry-based learning, and help them to effectively learn the key and difficult learning points in relation to the characteristics of the geography subjects, the cognitive characteristics of the middle school students, and their individual differences.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
		3-5	The student teacher can use class ending skills to guide the students to conclude and summarise the 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	
			content and assign a reasonable amount of homework.							
	Instruction evaluation	3-6	The student teacher can evaluate the learning activities and learning outcomes in the form of homework and problem feedback in relation to their 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 the learning process of both teachers and students, and they can form an awareness to diagnose and improve	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	
			their teaching based on the students' learning situation.							
	Master skill	3-8	The student teacher has the basic teaching skills of using chalk, pen, brush writing, and Mandarin.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
		3-9	The student teacher can systematically master basic classroom teaching skills such as the introduction, explanation, questioning, demonstration, writing on the board, finishing, assignments, and so on.	5	Strongly Agree	Relatively Agree	Medium	Relatively disagree	Strongly Disagree	
Total										