

## **Rethinking the Impacts of Teacher Education Program on Building the ICT in Education Competencies of Pre-service Teachers: A Case of Teacher Education in Mainland China**

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### **Abstract**

Based on a collective case study of two teacher education programs at a normal university in South China, this paper aims to evidence pre-service teachers' learning process with the ICT integrated teacher education program and discuss the implications for the effectiveness of a teacher education program in building ICT in education competencies of pre-service teachers. The study employed the sequential mixed-method approach. Data from documentation, survey, interviews, and focus group interviews reveal that (1) the teacher education program has significant impacts on pre-service teachers' learning outcomes from curriculum structure, course objectives, content, and pedagogy perspectives, (2) sustained efforts are required to improve coherence and coordination for teacher education program, and (3) feedback and reflections from pre-service teachers' ICT learning experiences are essential to revise and refine teacher education program.

**Keywords:** ICT in education competencies, TPACK, teacher education program

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## INTRODUCTION

Pre-service teacher education has been a critical entry point to embed ICT into education system (Northcote & Lim, 2009). Over the last two decades, studies have demonstrated that pre-service teachers' education competencies in ICT have significantly impacts on tomorrow's teaching and learning. This has been an important research focus in pre-service teacher education. There have been continuous efforts to design, develop, and evaluate the existing ICT usage in education curriculum in the area of ICT integration throughout the world (Chai, Koh & Tsai, 2010; Jimoyiannis, 2010). China is no exception in the ICT development trend in teacher education. A considerable number of initiatives from both normal universities and educational policy authorities have been focusing on curriculum reform to foster pre-service teachers' positive attitudes towards ICT and to raise pre-service teachers' ICT competencies (He & Wang, 2009; Wei, 2010; Zhao & Zhang, 2013; Li & Wang, 2014). During the recent years, various instructional models have been proposed for ICT and curriculum integration by Chinese researchers (Zhao & Xu, 2010). Nevertheless, a gap still exists at the teacher education program level, between what pre-service teachers are taught and how they will apply ICT in an authentic classroom (Pope, Hare, & Howard, 2002). This paper is a comparative study of ICT application in educational curriculum structure of two teacher education programs in a Chinese normal university. This study explored their perspectives on the feedback and reflections of pre-service teachers' ICT learning experiences in order to understand how teacher education program builds up such ICT competencies of pre-service teachers. Further, the implications were suggested for future research in this field.

## LITERATURE REVIEW

### **The Factors Affecting upon the Effectiveness of Teacher Education Program**

Based on Shulman's (1986) pedagogical content knowledge (PCK), the technological, pedagogical and content knowledge (TPACK) framework developed by Mishra and Koehler (2006) has gained much attention recently. The TPACK framework is a theoretical scheme for understanding teachers' knowledge and skills involved in using ICT for teaching and learning. The knowledge construct includes PK (pedagogical knowledge), CK (content knowledge), and TK (technological knowledge); with four intersected knowledge constructs: pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPCK). As an analytical framework, TPACK proposes that effective teaching with technology needs to focus on the connections and interactions among technology, pedagogy, and subject content (Chai, Ho, Koh, & Tsai, 2012). As a practical guideline, TPACK classifies teachers' knowledge required for effective ICT integration (Mishra & Koehler, 2006) and how they might develop this knowledge. Therefore, the TPACK framework has been adopted in many teacher education programs globally to design, develop, or evaluate curriculum in the area of ICT integration (Chai, Koh & Tsai, 2010; Jimoyiannis, 2010).

According to the TPACK framework, an effective teacher education program plays a crucial role in preparing pre-service teachers with the necessary ICT and pedagogical competencies to integrate ICT in teaching and learning during their apprenticeship phase (Mins, Polly, Shepherd, & Inan, 2006). To understand how such kinds of ICT in education competencies can be effectively built up, there is a need to explore the essence of a teacher education program – curriculum. Curriculum is a planned program developed by educational professionals. Curriculum and program are interdependent and mutually excluded. Thus, they are part of the same process consisting of planning experiences and leading to the growth of students' learning (Parkay, Hass, & Anctil, 2010).

ICT in education curriculum is one of the key factors that considerably influence the development of pre-service teachers' ICT in education competencies. According to the TPACK framework, the ICT in education curriculum structure should be a systematic project, which needs to realize the effective integration from perspective of technology, pedagogy, and subject. Technical competency is essential to the effective use of instructional technologies (Becker, 2001). However, a single course approach may be insufficient to transfer pre-service teachers' ICT skills into practices during their internships (Rees, 2002). In response to the

inadequacies of a skills-oriented approach, ICT in education curriculum structure needs to stress the importance of understanding ICT in relation to its pedagogical use, and provide a pedagogical oriented unit to train pre-service teachers to integrate ICT into subject teaching (e.g. Brown, 2002; Delargey, 2002; McNair & Galanouli, 2002; Willis & de Montes, 2002; Zhu & Yan, 2002). Meanwhile, subject specific integration has been recognized as an essential component of ICT in education curriculum structure (McNair & Galanouli, 2002). Many teacher education programs include training whereby ICT have been embedded into specific subjects (Steketee, 2005).

### **Pre-service teachers' ICT in Education Competencies**

When defining teachers' competencies regarding the use of ICT, there are three points to be noted: first, personal ICT application does not easily or automatically translate into an integration of ICT into teaching and learning (Lim, Chai, & Churchill, 2010); second, easier access to computer may not be synonymous with competencies (Ellilott, 2004); third, many current pre-service teachers are still weak in information literacy and critical thinking (Oblinger & Oblinger, 2005). Therefore, pre-service teachers need to be prepared with the necessary ICT and pedagogical capabilities to integrate ICT into teaching, learning, and even administration (Mims, Polly, Shepherd, & Inan, 2006).

To specify a clear set of internationally recognized guidelines on appropriate ICT professional development for educators (UNESCO, 2008), the UNESCO created a set of competency standard modules for teachers first in 2008 and recently updated as the *UNESCO ICT Competency Framework for Teachers* in 2011 (UNESCO ICT-CFT). The framework defines teachers' competencies in three stages-----“Technology literacy, knowledge deepening and knowledge creation. These approaches are mapped across six dimensions of the education system: understanding ICT in education, curriculum and assessment, pedagogy, ICT, organization and administration, and teacher professional learning” (Lim, Chai, & Churchill, 2010, p.8). The UNESCO ICT competency framework is regarded as the international-recognized curriculum guidelines for teacher education and the core component of national ICT in Education Master Plan (UNESCO, 2011). However, the expectation of society and government agencies may not be satisfied easily. Therefore, based on the UNESCO ICT Competency Framework for Teachers (2011), most countries are still likely to formulate their own national progressive standards for teachers, according to specific social, economic, and educational development stage.

In China, the MOE issued “Educational Technology Competency Standards for Primary and Secondary Teachers (Trial)” in 2004; hereafter this document will be abbreviated as the Standards (2004). The structure of the Standards (2004) can be summarized into four domains of competencies that are - values of and attitudes to applying educational technologies, fundamental knowledge and skills of educational technology, application and innovation of educational technology, and social responsibility issues involved in adopting educational technology. The Standards (2004) represented the country's efforts to build the ICT capacities of primary and secondary teachers (He, 2006), especially in terms of constructing ICT infrastructure, developing educational resources, standardizing ICT curriculum, and training teachers to apply ICT in teaching (Zhao & Xu, 2010). Since the formulation of the Standards (2004), most of the ICT competency trainings for in-service teachers and pre-service teachers in China have been usually designed and implemented to be in coordinate with the Standards (2004).

### **Research Questions**

Although great deals of research have been conducted on ICT in teacher education, there is a constant need for more research on the effects of ICT in teacher education programs in a specific context (Zhang & Martinovic, 2008). According to the reviewed literature and the contextual background, the following two research questions guiding the current study are:

1. How does teacher education program have impacts on the development of ICT in education competencies of pre-service teachers?
2. What are the implications of pre-service teachers' ICT in education competencies for teacher education program improvement?

## Research Methodology

In this case study, mixed methods were employed, including documentation, survey, interview, and focus group interviews for the addressing research questions. The document analysis focused on administrative documents, syllabi for various technology courses, program sheets, and subordinate school websites. The collected information was to corroborate and augment evidence obtained from other sources (Yin, 2003).

The survey participants involved all the fourth cohort of 154 pre-service teachers from two sampled programs. Sampled program A involved 42 science pre-service teachers and sampled program B contained 112 liberal arts pre-service teachers. They had already completed all the required courses except for practicum. Survey research design was usually characterized by using a standard questionnaire (Muijs, 2012). This study adopted the questionnaire (English & Chinese version) developed by Chai et al. (2013) to measure the TPACK perceptions of pre-service teachers. The items of the questionnaire were originally adopted from the Survey of Pre-service Teachers' Knowledge of Teaching and Technology by Schmidt et al. (2009) and had been modified several times when contextualized in Asian educational background. Chai et al.'s (2013) study had yielded validity through exploratory factor analysis and reported internal consistency reliability. To be specific, all factors had reliability coefficients greater than 0.8. The respective coefficients are CK (0.88), PCK (0.92), PK (0.90), TPCK (0.92), TCK (0.90), TPK (0.91), and TK (0.92). All items located on their respective factor were with factor loadings greater than 0.75. More importantly, the questionnaire was translated into Chinese by Chai and his colleagues (2013) and validated among 550 Asian pre-service teachers from mainland China, Hong Kong, Singapore, and Taiwan. The seven factors of TPACK were identified. Therefore, the research instrument was valid and reliable to be adopted in this study.

The questionnaire consisted of three sections. The first section contained demographic information including gender, age, major, teaching experiences above six months, and completed educational technology courses. The second section contained 50 items focusing on the seven-factor TPACK model to examine the pre-service teachers' perception and confidence in using ICT in their learning and teaching. The final section was open-ended and asked the respondents to share their experience of using ICT for teaching and learning. The valid data gathered in this process were presented with statistical tests to provide the general information of their perception of TPACK. Further, the emerging themes from this survey would provide a research basis for collated description or comparison (Johnson, 1994), and was used to fine-tune the discussion questions in the follow-up qualitative part of the study.

To explore information about the expectations and challenges of ICT core courses, the concerned course coordinators were invited for semi-structured interviews. The interview consisted of four sections. The first section centered on the course planning; the second section focused on the implementation and development of the course; the third section was mainly about the course evaluation; and the last section consisted of open-ended questions for the course coordinators to provide suggestions and comments regarding their specific ICT core course. The 60 minutes' interviews were conducted in Chinese and audio-recorded. The interview recordings were transcribed and translated into English.

The pre-service teachers for focus group interviews were chosen after considering their gender, grade, major, and native place etc. Totally 8 pre-service teachers from two sampled teacher education programs were organized into two focus groups respectively. Semi-structured interviews were conducted within 30 minutes for each group. These interviews were tailored to understand the pre-service teachers' attitudes towards, perceptions, and learning experience of ICT.

## Research context

This study was conducted in a provincial normal university in the southern part of China. There were twenty-eight subordinate schools in the university and teacher education was of the university's strength. Like many other mid-sized normal universities in China, pre-service teachers were registered in different subject subordinate schools. Their teacher education programs were composed of four parts: general education, specialization education, teacher education, and practicum. Specifically, the ICT core courses included: (1) "Fundamentals of Computer", a three-credit and compulsory general education course on ICT

skills for all the undergraduate students; (2) “Application of Educational Technology”, a two-credit optional course for pre-service teachers; (3) “Comprehensive teaching skills of pre-service teachers”, a two-credit compulsory course involving ICT as an element that was offered by each subordinate school; and (4) an optional or compulsory course on teaching subject knowledge with ICT offered by some subordinate schools.

“Fundamentals of Computer” was an ICT core course offered by the School of Computer and Science for all undergraduate students in the University. Students’ ICT competencies varied greatly as they came from very different background across the country. Thus, starting from 2010, a pre-test on computer knowledge and skills was administered to all students to determine their ICT competency level and divided them into classes of three different levels – the low level A, the intermediate level B, and the high level C. The majority of students (about 60%) fell into the intermediate level B, with the rest divided between the low level A and high level C. Different courses were offered for each level of students. For Level A and B students, the goal of the course was to equip them with basic competency of computer. While for Level C students who had already acquired basic competency of computer, more advanced content on programming and databases would be covered. However, the course did not cover the contents on using computer for teaching and learning purposes. In addition, the course had its own computer-based assessment system, with a bank of exam topics to choose from.

## PROFILES OF TWO CASES

### Profile of Case One: Teacher Education Program A

*The course “Comprehensive Teaching Skills of Pre-service Teachers”*

“Comprehensive Teaching Skills of Pre-service Teachers” was a two-credit compulsory course. This course mainly focused on the theories and practices for pedagogical knowledge. The comprehensive teaching skills were organized into three sub-courses, namely, “Microteaching” (1 credit), “Calligraphy and Blackboard Design” (0.5 credit), and “Teaching Practice” (0.5 credit). The assessments for these sub-courses were arranged at Semester 5, Semester 6, and Semester 7 respectively from Year two to Year three. There was no classroom lecturing for these sub-courses, but the course assessment standards would be provided for the pre-service teachers in advance for preparation. Pre-service artifacts and teaching practices were adopted as the major assessment method for this course.

*The course “Application of Educational Technology”*

“Application of Educational Technology” was a two-credit ICT course optional to pre-service teachers, developed and delivered by the School of Education. The goals of this course were set against the Standards (2004), mainly focusing on two dimensions: knowledge and skills, application, and innovation. This course especially aimed to develop pre-service teachers’ awareness of applying educational technology into teaching and learning process by constantly requiring them to reflect on their learning and peer-review their works. Since this course was open to pre-service teachers from different study disciplines, it did not include specific subject knowledge. For this course, the integrated assessment was based on attendance (10%), reflections on personal blogs (20%), and assignments (70%). For the assignments, the online artifacts accounted for 30%, the PPT presentation for 50%, the website design and management for 20% respectively.

*I think it course provided us some basic knowledge of educational technology, which were necessary for our future teaching. For instance, I never used Web Quest before. Since I learned it in this course, I found it was very useful for my ICT teaching and learning. I thought Web Quest set us free from traditional learning model and led us to a more creative and personalized ICT learning environment, which was the highlight of this course. (Focus group interview with pre-service teachers from Group 2)*

## Profile of Case Two: Teacher Education Program B

### *The course “Computer-aided Teaching”*

“Computer-aided Teaching” was a three-credit compulsory course. This course especially aimed to develop pre-service teachers’ awareness of the integration of technology and pedagogy into subject knowledge. Specifically, it was based on the theory of pedagogy, integrated the Mathematics subject knowledge and supported by educational technologies. This course is opened at semester 5 (Year 3). The course coordinator especially involved many cases on secondary school Mathematics pedagogy to get pre-service teachers well-prepared for their practicum in secondary school teaching and graduation designing project in Year 4. The assessment was based on pre-service teachers’ artifacts. This course was regarded as the major ICT in education curriculum for Mathematics pre-service teachers, and the feedbacks and responses from pre-service teachers were very positive as well.

*This course provides us new thinking of teaching designs, new understanding of educational technology and new cognition of the teacher careers. As a student majored in Mathematics, the technology learned in this course (e.g. Web Quest) was very useful to illustrate the inferring process of a calculation formula or the proving process of a mathematical assumption. The technology made things easier and clearer. (Focus group interview with pre-service teachers from Group 1)*

### *The revised course “Comprehensive Teaching Skills of Pre-service Teachers”*

In teacher education program B, “Comprehensive Teaching Skills of Pre-service Teachers” consisted of three sub-courses, “Internship at Middle-School and Microteaching” (1 credit), “Standard Chinese and its Oral Expressions” (0.5 credit), and “Calligraphy and Multimedia Courseware” (0.5 credit). However, considering the limited credits for ICT core courses, the course coordinator involved ICT as an element in “the Calligraphy and Multimedia Courseware” with classroom lecturing. More importantly, the course content embodied the integration of technologies into the teaching and learning process. Therefore, this revised course was not only the pedagogical course, but it had been developed as an integrative course for technological pedagogical knowledge. The assessments for the three sub-courses were intensively organized in Semester 6 (Year 3). Pre-service teachers’ artifacts and teaching practices were the major approaches for assessment; however, technologies had been one of the key components in the assessment standards. In accordance with the course “Computer-aided Mathematics Teaching”, the course coordinator and lecturer of the two courses was the same person, who had more than five years’ teaching experience of teaching educational technology. When asked why this course had been revised, the course coordinator pointed out:

*We recognized that it was urgent to develop our current ICT curriculum to meet the requirement for teacher education development, especially to develop students’ technological competency. Based on the Standards (2004), we conducted a comprehensive instructional analysis of pre-service teachers’ ICT knowledge and skills, aptitude for learning and the requirements of curriculum reform, and we revised the course into the current form in 2010. (Interview with the course coordinator)*

## KEY FINDINGS AND DISCUSSION

### Perspectives on Pre-service Teachers’ Perceptions of TPACK

Among the collected 154 questionnaires, 121 responses were valid and the data were put into statistical analyses. Table 6.1 presented the means and standard deviations of the sampled pre-service teachers’ perception of TPACK from the two teacher education programs. The results of Independent Samples T-Test indicated that significant differences existed in the seven factors between two groups of pre-service teachers except PK. Specifically, the pre-service teachers from program B had a strikingly apparent higher self-judgment in the six factors. They had a tendency of judging their TCK ( $M=5.10$ ,  $SD=.96$ ) as the best and CK

( $M=4.66$ ,  $SD=1.22$ ) the lowest. However, the situation of pre-service teachers from program A was different, where they deemed their PK as the best ( $M = 4.60$ ,  $SD=1.01$ ) and TK ( $M=3.95$ ,  $SD=.66$ ) and TPK ( $M=3.95$ ,  $SD=.85$ ) as the lowest. In addition, no significant differences between groups were found in these pre-service teachers' perception of PK ( $t=-1.921$ ,  $p=.057$ ).

**Table 6.1**

*The T-Test results of pre-service teachers' perceptions of TPACK (N: A=39, B=82).*

	Teacher education Program A		Teacher education Program B		t	p
	Mean	SD	Mean	SD		
CK	3.99	1.06	4.66	1.22	-2.92	.004
PK	4.60	1.01	4.97	.98	-1.92	.057
PCK	4.37	1.05	4.77	.96	-2.09	.039
TK	3.95	.66	4.93	.90	-5.58	.000
TPK	3.95	.85	4.93	1.04	-5.11	.000
TCK	4.53	1.11	5.10	.96	-2.94	.004
TPCK	4.20	1.10	4.84	.97	-2.15	.024

### Perspectives on ICT in Education Curriculum

The comparison of the ICT in education curriculum from the two cases revealed that teacher education program seemed to have a positive impact on pre-service teachers' ICT in education competencies from the curriculum planning, implementing, and evaluating perspectives. The findings from data analysis were presented in the Table 6.2. It was evident that there existed differences for the ICT in education courses in terms of time arrangement, course content, pedagogy, and assessment.

**Table 6.2**

*The comparison of the ICT in education curriculum structure*

Teacher education program A			
Year of study	Course	Course content	Assessment
Year 1	"Fundamentals of Computer"	TK	Computer-based assessment system
Year 2-Year 3	"Comprehensive teaching skills of pre-service teachers"	PK	Pre-service artifacts and teaching practices
Year 3	"Application of educational technology"	TPK	Attendance, Reflections on blogs & assignments
Teacher education program B			
Year of study	Course	Course content	Assessment
Year 1	"Fundamentals of Computer"	TK	computer-based assessment system
Year 3 (S5)	"Computer-aided teaching"	TPCK	Pre-service artifacts
Year 3 (S6)	The revised "Comprehensive teaching skills of pre-service teachers"	PK → TPK	Pre-service artifacts and teaching practices

It should be noted that time arrangement for ICT core courses was an important influencing factor to the learning outcomes of ICT in education competencies. For example, the curriculum planning needed to follow up with the TPACK framework, as well as to be structured with adequate awareness of the general scheme of progression for the pre-service teachers (Lim, Chai, & Churchill, 2010). Specifically, the preparation from PK, CK, and TK course were expected to constitute the necessary knowledge foundation for ICT integration, and then the integrative course, such as TPK course, PCK course, TCK course and the TPACK course should be offered. Importantly, the TPACK course needed to be arranged closed to the practicum, and then the pre-service teachers might apply the TPACK knowledge to their teaching practices more effectively. In addition, to avoid repetition and disconnection, the ICT in education curricula should be linked with each other in a gradual progress; even the units within one curriculum should be connected with

the main tasks of each session and the assignment after its completion as well.

Regarding the course content, the data analyzed from documentation and focus group interview indicated that there was a need to improve the TK-related integrative course for pre-service teachers. In particular, they should develop their TK-related integrative competencies from the TPK course before they attend the TPCK course. The responses from interviews with course coordinators also confirmed this point. That was why the coordinator of teacher education program B revised their course “Comprehensive teaching skills of pre-service teachers” from PK to TPK course.

*Referring to my own learning experience, I recognized that the TK-related course was also very important for us. Without solid foundation of TK, it was very different for us to continue with the further study of TPK or TPCK course, especially for us liberal arts majors. (Focus group interview with pre-service teachers of Group 2)*

### **Perspectives on the Efforts for Coordination of Teacher Education Program**

The ICT core courses were offered by different subordinate schools. For example, “Fundamentals of Computer” was offered by the School of Computer and Science, “Application of Educational Technology” was organized by the School of Education; “Comprehensive teaching skills of pre-service teachers” was arranged by individual subordinate schools as well as the course on teaching subject knowledge with ICT. The supporting hardware and technical matters came under the charge of the Resource and Property Management Office of the university. The contemporary structure brought about incoherence in managing teacher education programs. Therefore, sustained efforts should focus on the coordination and communication for the coherence of teacher education program. The broken, vacuum, and overlap in the process of program planning, implementation, and evaluation should be identified for improvement and revision, such as overlapped course content, gaps or omissions between courses, lack of consistent management or supervision, and even lack of an assessment or evaluation system.

### **Perspectives on the Feedback and Reflections of Pre-service Teachers’ ICT Learning Experiences**

All interviewed pre-service teachers shared their willingness to learn more about the ICT in teaching and learning. Most participants suggested that it was imperative that each teacher education program should involve its own TPACK course, which was likely to improve the ICT in education competencies of pre-service teachers more effectively. Also, they believed that ICT incorporation into teacher education program should emphasize the integration of technology, pedagogy, and content knowledge, as well as the connection between theories and practices. Meanwhile, the course coordinators admitted that the feedback and reflections from pre-service teachers’ learning experience seemed to be the most important implications for ICT in education curriculum development. Pre-service teachers’ responses tended to be a direct assessment for the effectiveness of ICT in education curriculum; therefore, they should be adopted to revise the course or even the whole teacher education program.

## **IMPLICATIONS AND CONCLUSION**

As stated previously, this study explored how a teacher education program built up the ICT in education competencies of pre-service teachers. The findings provided useful information for various stakeholders involved in the processes of teacher education program planning, implementation, and evaluation. Such a study aimed to inform policymakers, school administrators, and lecturers about how to effectively develop teacher education programs towards building up pre-service teachers’ ICT in education competencies. From the analysis of the data set from various research instruments, the following implications should be noted.

Subordinate schools

Lecturers’ reflections, together with pre-service teachers’ feedback, should be taken into serious consideration. Pre-service teachers’ feedback ought to be carefully considered by course coordinators or vice dean of each subordinate school. Formal or informal discussions regarding possibilities for improvement in ICT teaching and learning should be based on pre-service teachers’ concerns.

Regular evaluation of ICT teaching and learning was an important strategy to ensure the effectiveness of the existing ICT in education curriculum. All the key stakeholders should be involved in the auditing and revisions. Outcomes of such evaluation should play a vital role in developing current teacher education policies and guidelines. In particular, the concerns from pre-service teachers and pre-service teachers' evaluation of teaching might also provide useful data for evaluation and suggestions for improvement.

There was a need to fully recognize the limitations in terms of credit management, class hours, students' quantity, and resources. The interviewed vice deans realized that it was essential to set up a mechanism to stipulate the evaluation standards and to supervise the adaptability and flexibility of ICT in education curriculum. More importantly, they also realized the need to assess or evaluate pre-service teachers' ICT learning outcomes to accumulate practical experience for further development.

University

The University should set a clear vision for developing pre-service teachers' ICT in education competencies. It was crucial to pull together those who had a stake in the learning outcomes of pre-service teachers' such competencies, including pre-service teachers, lecturers, vice dean of each subordinate school, and university administrators. They should be supportive to assist in the creation of the vision by contributing their knowledge and positive attitudes to build a strong acceptance, commitment, and potential for teacher education program improvement. In addition, supports from the university level were always important not only to coordinate the relationship among subordinate schools, but also to foster communication or partnerships with other private or public, national or international educational institutions.

Other normal universities

This study might be representative for most current teacher education programs in Chinese teacher education. The presented significance, challenges, and restrictions of the effects of teacher education programs on building up the ICT in education competencies of pre-service teachers might be references for the other normal universities in China or teacher education institutions in the similar educational context.

## CONCLUSION

Based on this collective case study at a normal university in South China, it is possible to provide a deeper understanding of how a teacher education program has impacts on the development of ICT in education competencies of pre-service teachers. The ICT learning experience of pre-service teachers tends to be important driving forces for teacher education program development. However, educators are still under pressure on acquiring and utilizing effective strategies for teaching and curriculum improvement. After all, development of the ICT in education competencies of pre-service teachers may not be a simple task. It requires the concentrating efforts on the processes of program planning, implementation and evaluation, and the sustained efforts on coordination and communication from different stakeholders, so as to construct the ICT in education curriculum models and approaches of ICT integration in teacher education programs based on the above understanding.

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