DEVELOPMENT OF A TASK-DRIVEN M-LEARNING MODEL TO ENHANCE ICT COMPETENCIES FOR UNDERGRADUATE PRE-SERVICE TEACHERS

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SULTAN IDRIS EDUCATION UNIVERSITY

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ABSTRACT

The purpose of this study was to develop a Task-driven Mobile Learning model to enhance the Information Communication Technology (ICT) competencies of the pre-service teachers. The model adopted the Design Development Research (DDR) methodology. In this study, the needs analysis phase consisted of three parts: a survey of 278 pre-service teacher students using a questionnaire, semi-structured interviews with seven university lecturers, and analysis of seven official documents and relevant course documents. The results of the data analysis in this phase showed that undergraduate pre-service teacher students lacked ICT skills, and that upgrading their information technology skills required a task-driven and mobile learning combined strategy. During the design and development phase, a literature analysis and expert survey methodology was used. The initial prototype of the model was identified by analyzing the literature, and then the final TDML model was identified after two consultative surveys with 18 experts.The evaluation phase assessed the effectiveness and usability of the module through a quasi-implementation design. The study collected data and compared the changes in the performance of the pre-service teachers who participated in the experiment, the average ICT level (mean=216.80) of the experimental group was higher than that of the control group (mean=198.36).The TDML model fully combines the advantages of mobile learning and task-driven, and is divided into three phases (before, during, and after class,) while considering the three-dimensional dimensions of teacher'behavior, mobile online platform, and student' activities, and contains a total of 37 items.And the study found that the TDML model was more effective in improving pre-service teachers' ICT competencies than the traditional model. Therefore, the TDML model designed in this study can be used as a formal learning support to address the lack of ICT competence among undergraduate pre-service teachers.

PEMBANGUNAN MODEL PEMBELAJARAN MUDAH ALIH BERASASKAN TUGAS UNTUK MENINGKATKAN KOMPETENSI ICT BAGI GURU PRA-PERKHIDMATAN SISWAZAH

ABSTRAK

Tujuan kajian ini adalah untuk membangunkan satu model Pembelajaran Mudah Alih Berasaskan Tugas (Task-driven Mobile Learning – TDML) bagi meningkatkan kompetensi Teknologi Maklumat dan Komunikasi (ICT) dalam kalangan guru pra-perkhidmatan siswazah. Model ini menggunakan metodologi Penyelidikan Pembangunan Reka Bentuk (Design Development Research – DDR). Fasa analisis keperluan dalam kajian ini melibatkan tiga komponen: soal selidik terhadap 278 pelajar guru pra-perkhidmatan, temu bual separa berstruktur bersama tujuh pensyarah universiti, dan analisis tujuh dokumen rasmi serta bahan kursus berkaitan. Hasil analisis data menunjukkan bahawa pelajar guru pra-perkhidmatan kekurangan kemahiran ICT, dan peningkatan kemahiran ini memerlukan strategi gabungan pembelajaran mudah alih dan berasaskan tugasan.Dalam fasa reka bentuk dan pembangunan, analisis literatur dan kaedah tinjauan pakar telah digunakan. Prototaip awal model dikenal pasti melalui analisis literatur, dan model akhir TDML dimuktamadkan selepas dua tinjauan perundingan bersama 18 orang pakar.Fasa penilaian menilai keberkesanan dan kebolehgunaan modul melalui reka bentuk kuasi-pelaksanaan. Data dikumpulkan untuk membandingkan perubahan prestasi pelajar guru pra-perkhidmatan yang menyertai eksperimen; kumpulan eksperimen menunjukkan purata tahap ICT (min=216.80) yang lebih tinggi berbanding kumpulan kawalan (min=198.36). Model TDML ini menggabungkan sepenuhnya kelebihan pembelajaran mudah alih dan pendekatan berasaskan tugasan, dan dibahagikan kepada tiga fasa (sebelum, semasa, dan selepas kelas) dengan mengambil kira tiga dimensi utama iaitu tingkah laku guru, platform dalam talian mudah alih, dan aktiviti pelajar. Model ini mengandungi sebanyak 37 item. Kajian mendapati bahawa model TDML lebih berkesan dalam meningkatkan kompetensi ICT pelajar guru pra-perkhidmatan berbanding model tradisional. Oleh itu, model TDML yang dibangunkan dalam kajian ini boleh digunakan sebagai sokongan pembelajaran formal untuk menangani kekurangan kompetensi ICT dalam kalangan guru pra-perkhidmatan siswazah.

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LIST OF ABBREVIATIONS

DDR	Design Development Research
ICT	Information Communication Technology
MOOC	Massive Open Online Courses
SPSS	Statistical Package for the Social Sciences
TMDL	Task-driven Mobile Learning
TPACK	Technological Pedagogical Content Knowledge

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The revolutionary impact of various new generations of information technology on education is accelerating, as a result of the rapid development and wide application of information technology in this new era. The continuous application of information technology in the field of education has provided a new context and foundation, which has deepened the integration of innovations in information technology with educational and pedagogical practices (Liu et al., 2021). The information technology is playing an increasing role in changing the teaching and learning process. Information technology does not only create an intelligent teaching and learning environment, but also changes the form of the original paper-based teaching materials, providing new ways of distributing and storing them, as well as enriching the teaching

content and resources. Furthermore, information technology effectively increases the availability and utilisation of a wide range of online and offline resources.

Under the influence of information technologies, new teaching models have placed greater emphasis on the need to focus on improving students' capacity for independent learning and allowing them to become the "masters" of the classroom. Liu Yan Dong (2012) pointed out, "There still exist some universities with outdated teaching models that are not able to adapt to the requirements of the development in the new era. At the same time, some students have limited knowledge, and their comprehensive quality and adaptability are poor. Therefore, it is necessary to accelerate teaching reform." At present, the reform of education and teaching in China's colleges and universities has made some progress. Since 2020, the implementation of mobile teaching in colleges and universities has been taken by the education administrative department under the background of the epidemic (Hu & Meng, 2021) .

This study uses the method of Design and Development Research (Richey & Klein, 2007) and develops a Task-Driven M-Learning model to improve the information ability for pre-service teachers. The M-Learning model helps teachers in higher education to carry out practical teaching tasks more effectively, and enhance pre-service teachers' information communication technology (ICT) competency and effectiveness of mobile learning.

1.2 Background

UNESCO has declared three principles within the scope of Education 2030. The first principle affirms education as an essential human right as well as an enabling right. The second reiterates education's status as a public good. Finally, the third principle prioritizes gender equality and participation in education as a long-term worldwide project (UNESCO, 2016). Unfortunately, UNESCO fails to implement the two aspects of the first principle, as well as, most of the cultural and educational institutions. Based on this framework, technology is positioned as an effective tool for eliminating disparities in education(Graham, 2016).

By 2022, the digital transformation of education has gradually become a major international trend, and many governments and international organisations have already formulated policies to actively aid and encourage the development of digital transformation in education (Informatization-100, 2022). On April 18, 2022, American Association for Higher Education (EDUCAUSE) issued the "2022 EDUCAUSE Horizon Report, Teaching and Learning Edition". This report pays more attention to the information explosion, the contribution of new generation information technology to the continued development of higher education, the impact of artificial intelligence, 5G and new generation information technology on learning, the construction of blended learning spaces, online convergent learning and other efforts to transform teaching and learning (Pelletier et al., 2022).

Since the "National Medium-Term and Long-Term Education Reform and Development Plan Outline (2021 to 2035)" was released in China in 2021, the

government has been extremely attentive to information technology in education, which has now achieved fruitful results in all aspects and at all levels of education. These results mainly involve integration of information technology with the curriculum, teaching methods in an information environment, and information-based instructional design. The Ministry of Education of China is implementing the Education Informatization 2.0 Action Plan. In this plan, it mentioned that "It is necessary to integrate the online learning space to innovate the teaching mode, learning mode, teaching and research mode and the co-construction and sharing mode of educational resources. Teachers should be encouraged to use the online learning method to prepare lessons and do activities such as teaching, home-school interaction, online training, and to guide students' learning. Students will be encouraged to use the online learning space to conduct learning activities such as preview, homework, self-assessment, extended reading, and online electives, to develop self-management, self-learning, and self-service learning activities.

Although the digital transformation of higher education began several years ago, the COVID-19 pandemic had accelerated this process and led to fundamental changes. This technological change in education involves profound changes in teaching methods, basic competencies, and assessment methods (García-morales et al., 2021). Hybrid learning combines traditional face-to-face classroom instruction with online digital learning. It is a model of programmes increasingly adopted by higher education institutions as clear examples of technological, pedagogical, and organisational innovations in universities (Castro, 2019). New pedagogical models have also been introduced to provide better access to education and to allow individual students to study independently or engage in activities online.

According to the 47th China Internet Development Statistical Report, as of June 2021, the number of mobile Internet users in China reached 1.007 billion, and 99.6% of Chinese Internet users used mobile phones to access the Internet, 25.6% would connect to television to access the Internet and depended on desktop computers. The proportions of surfing the Internet on laptops and tablets, were 34.6%, 30.8%, and 24.9% respectively. The popularization of mobile devices and the demand for college education reform make mobile learning an indispensable learning mode in the future college education model. Mobile learning, which is based on smart mobile devices and wireless network technology, supports learning styles anytime, anywhere and is more focussed on using trivial time for learning. "Fragmented" learning requires the correct guidance and efficient use of learning time (Tian & Rong, 2014). HE Ge Kang (2014) noted "We advocate combining the advantages of traditional learning methods with blended learning in an online learning environment, and it is worth pointing out that the advantages of mobile learning in particular should be actively introduced into classroom teaching strategies".

At the same time, the widespread implementation of new pedagogical models offer more flexible academic approaches, online resources and learning opportunities which has contributed significantly to the development of the profession and provided on going support for the employment of the majority of students (Agnes et al., 2022). Local colleges and universities generally serve the development of the region. In this context, it is important to establish a hybrid teaching model that combines online and offline platforms in local applied undergraduate universities to promote the future development of professional students.

With the development of online learning, there is a greater need for instant contact and communication between teachers and students in the university classroom, and a need for teachers to provide students with more interactive learning opportunities. This requires university teachers to limit the teacher-centred teaching method and give the initiative of knowledge learning to students. This change can set up independent learning courses with topics selected by students and teachers, build multiple learning models, and strengthen the training and guidance of learning strategies and methods. Moreover, it cultivates students' critical thinking and innovation ability promoting personality development (Dang, 2016). In the teaching and learning process in colleges and universities, most teachers usually use tasks to teach. Teachers design and develop new learning tasks in advance, distribute them to students, and finally evaluate students' performance based on the results of the given tasks (Schulz et al., 2016).

Therefore, to improve the information literacy of pre-service teachers and realize the cultivation of pre-service teachers who meet the requirements of the information age, the concept of mobile learning needs to be introduced. Pre-service teachers can be more active in mobile learning using information technology. Thinking about task points and completing learning tasks are in line with the characteristics of university students' learning, and this helps to cultivate college students' autonomous learning abilities. On the other hand, the combination of M-learning and actual classroom teaching has injected vitality into classroom teaching. With the support of M-learning, teachers can be more flexible in using mobile application platforms to assist teaching and learning. Through M-learning, teachers not only save teaching time, but also guide students to make use of fragmented time to

complete a variety of knowledge points, which has a significant effect on improving the ICT competency of pre-employment students (Yugang Wang et al., 2022).

1.3 Statement of the problem

The United Nations Educational, Scientific and Cultural Organization (UNESCO) has identified education as a major social priority while acknowledging that serious problems in education have not been effectively addressed, especially in developing countries (Castro, 2019). To illustrate, certain undergraduate colleges in China continue to face challenges in terms of college education reform and the improvement of training quality, including ambiguous talent training goals, imperfect curriculum systems, outdated teaching methods, and a gap between theory and practice (Xu et al., 2021). Technology is critical to these models, but special attention should be paid to how to engage students through active learning styles and forms of engagement (Agnes et al., 2022). Colleges and universities need to introduce new technologies that enable staff or students to access services or deliver services from anywhere and support blended working and learning at the same time, and many colleges and universities are looking for more flexible and viable blended learning solutions (EDUCAUSE, 2022).

In the context of the information age, the demand for training excellent digital teachers has emerged as a societal priority. Educational colleges and universities hold a fundamental position among institutions of higher learning, and improving the quality of pre-service teacher training become a primary focus for professional

personnel training in educational colleges and universities (Zhu & Wu, 2020). In October 2022, France announced the launch of the "higher education innovation space" national platform. The goal is to provide face-to-face training for teachers and promote student-centred active teaching methods (Informatization-100, 2022). Meanwhile, China's educational administrative departments and educational institutions at all levels have begun to increase investment in technology and upgrade various types of equipment and facilities in order to provide better quality environment and resources. This crucial act helps to improve the pre-service teachers' ability in applying information technology. However, certain issues still persist.

One prominent issue in recent years is the lack of alignment between current competency standards and pre-service teacher training. Most existing standards and frameworks primarily cater to in-service teachers. While some international frameworks classify teachers' developmental stages and ability levels, they do not fully align with the progression path of Chinese teachers (Yang et al., 2021). These differences are mainly in the form of separation between content and front-line basic education practice, a general monotony in teaching methods, a lack of innovation in classroom teaching, an incomplete curriculum system for pre-service teacher skills, insufficient practice and guidance for pre-service teachers, and an over-reliance on a single type of homework (Zhou et al., 2017). The absence of a curriculum system for cultivating information technology application abilities directly or indirectly hampers the effective improvement of such skills (Zhou et al., 2017). Without an effective strategy, the traditional classroom fails to meet the demands of educational informatization and the current teaching needs of pre-service teacher training.

In the traditional mode of teaching, teachers or teaching organisers tend to rely on their own experience and professional knowledge to formulate teaching plans and carry out teaching activities, which leads to unstable and uncertain teaching outcomes. The information-based education and teaching reform and the development of online education provide a new opportunity for the further application of online classrooms. However, many college and university lecturers still insist on using traditional teaching methods, even when assisted by online platforms and network resources (Liu, 2021). Zhang Jie (2015) pointed out that in the actual teaching process, classroom teaching in today's colleges and universities is still mainly teacher-centred, seldom considering the individual differences of students and carrying out targeted teaching activities. Furthermore, traditional teaching fails to fully stimulate students' enthusiasm for learning and cognitive initiative. Under this context, adopting a student-centered teaching approach and exploring open and flexible learning models in university teaching, such as "micro-classes," "MOOCs," "flipping" the classroom, and "Online Classroom," have become a consensus (Qin, 2020). However, classroom teaching is centred around students, and there are still a number of students who also show passivity in their pre-classroom preparation and offline classroom performance, which feeds back to the fact that the current teaching model also suffers from a lack of student pre-class preparation (Liu, 2021).

In the new context, the urgent need to promote the development of contemporary education is to improve the information technology application abilities of pre-service students (SUN et al., 2022). Some studies have shown that the level of pre-service teachers' response to modern pedagogical theories, new pedagogical models and information-based instructional design processes is average, and it is

interesting to note that among the factors affecting the level of response, "lack of information-based instructional design capabilities" accounted for 52.8%, and "poor learning effects of university-related courses" accounted for 34.7% (J. Liu et al., 2015). The technological literacy of pre-service teachers is low, and there are still a significant number of pre-service teachers who say that they are not well versed in the operation of traditional multimedia teaching and learning systems, especially in the use of interactive multimedia (Zhou et al., 2017). The lack of a systematic curriculum that directly or indirectly develops information technology application skills has resulted in pre-service teachers not being able to effectively experience the process of training and going through information technology application skills before employment (Zhou et al., 2017). At the same time, the ability of pre-service teachers to use information technology for independent learning and research innovation is also relatively weak (SUN et al., 2022).

Another problem is the unwillingness of pre-service teachers to optimize teaching and learning using information technology. Zhou Dong Dai's survey showed that only 36% of pre-service teachers thought that it was necessary to use information technology to optimize classroom teaching, while 40% of pre-service teachers had the idea that it did not matter, and 24% of pre-service teachers believed that it was not necessary. Pre-service teachers usually focus more on the development of basic professional and theoretical knowledge, but lack the ability to integrate information technology into their teaching and the use of information technology. For example, video production requires proficiency in a variety of technical aspects, such as using online video production tools and audio and video technology to process footage. Unfortunately, many pre-service teachers lack mastery of these skills. As a result,

there is a need to improve their information technology application skills (XU, 2016).

Rapid advances in technology provide new solutions for teachers to help students adapt to the professional needs of a changing world, one of the most significant technological advances has been the development and use of mobile devices(Wei et al., 2017). In the era of network information technology, pre-service teachers possess mobile learning devices, and mobile learning based on smart phones offers significant potential for development for new ways of learning. Research indicated that even when pre-service teachers utilize mobile devices for learning, their primary focus is on retrieval-based learning driven by specific tasks (Zhao, 2012). Although approximately 80% of pre-service teachers actively attempt to use mobile devices for learning, they do not fully embrace mobile learning as a holistic learning method (Liu et al., 2018). This reduces the application effect of mobile learning in classroom teaching. A survey showed that nearly half of the students still chose to consult their teachers or seek help from their classmates when they encountered learning difficulties, and were incompatible with the use of the Internet for independent learning (DU & Zhang, 2021). Overall, many learning resources remain underutilized by pre-service teachers.

Blended learning can compensate for the limitations of mobile learning for pre-service teachers. However, it is crucial to conduct in-depth research on the characteristics of different learning methods, considering teaching practice, the mobile learning devices available to pre-service students, and specific contexts (Zhao, 2012). The introduction of new concept-driven pedagogical models in a new technology-supported environment is now a necessity for the development of good

pre-service teachers (Yang et al., 2021). One advantage of blended learning is that managers and teachers can rely on mobile terminals to monitor the learning process of learners at any time, providing more targeted assistance and guidance to learners (Xinmin & Haijun, 2017).

On the other hand, task-driven teaching method is a student-centred teaching mode, it can be combined with other teaching methods to better improve the quality of teaching (Liu & Su, 2018). Therefore, task-driven teaching method used through M-learning platforms combines the advantages of mobile and classroom learning, and teachers can emphasise students' independent learning skills and knowledge acquisition while also guiding them to take full advantage of the benefits of decentralised and flexible m-learning (Yugang Wang et al., 2022).

Based on the above, to more effectively enhance pre-service teachers' ICT competency, this study aims to develop a standardized model that optimizes the integration of task-driven and mobile learning. Additionally, the study seeks to experimentally validate the effectiveness of this model.

1.4 Purpose of the Study

The general purpose of the study is to develop a Task-Driven M-Learning model, which focuses on how task-driven mobile learning can be incorporated into classrooms for pre-service teachers. The objective of the study is to enhance the ICT competency of pre-service teachers, contribute to the development of relevant

strategies, and provide recommendations for the effective implementation of mobile learning in the teaching process. The model employs a selection of appropriate learning activities and content, aligned with standards for the development of pre-service teachers' competencies and related theoretical frameworks.

The research focuses on the implementation of this model in the compulsory course, "Modern Educational Technology Application" for undergraduate pre-service teachers at Ping Ding Shan University, Henan Province, China. The assessment of the model also includes consultation with the lecturers involved in the experiment. The developmental process of the model follows the Design Development Research (DDR) approach (Richey & Klein, 2007) and consists of three phases: the needs analysis phase, the development phase, and the Evaluation Phase.

1.5 Objective of the study

The objective of this research is to design a Task-Driven M-Learning model that helps undergraduate pre-service teachers to strengthen their ability to use ICT. This research is divided into three phases. The goals of each phase are as follows:

1. To determine the need to develop a Task-Driven M-Learning implementation model based on undergraduate lectures' views and undergraduate pre-service teachers’ actual situations.

2. To develop the Task-Driven M-Learning model for enhancing undergraduate pre-service teachers' ICT competency based on experts' opinions and decisions.

3. To evaluate the Task-Driven M-Learning model for undergraduate pre-service teachers based on the experimental and implementation effects.

1.6 Research Questions

The research objectives are designed based on the three phases of the study. Therefore, this study aims to answer the following research questions:

A: Need Analysis Phase

1.What is the current situation of undergraduate pre-service students ' ability to use mobile learning?

2.What are the strategies employed by the lecturersto develop the information communication technology (ICT) competency of undergraduate pre-service teachers?

3.How can task-driven and mobile learning improve pre-service teachers' ICT competency ?

B: Design and Development Phase

How to develop and design the specific procedures (including specific tasks and activities) of task-driven mobile learning models?

C: Evaluation Phase

How effective is the task-driven mobile learning model in improving pre-service teachers' information communication technology (ICT)?

1.7 Operational definition

This section provides operational definitions for certain major terminology used in this investigation. It briefly defines these words in order to provide a better grasp of the key issues in this study. The following is a definition for each of these terms:

1.7.1 Task-driven

The Task-driven teaching method is a kind of teaching method that can be well applied to teaching content with strong experimental, practical, and operability. This teaching method enables learners to acquire knowledge and skills in the process of completing specific tasks. These tasks are based on interesting situations that can stimulate students' learning motivation and curiosity and tasks that are closely integrated with teaching content (Guo, 2006). The task-driven teaching method reflects the basic characteristics of taking tasks as the bright line. It cultivates students' knowledge and skills as the dark line, and becomes teacher-led and student-centered. Classroom teaching is introduced by the arrangement of a certain task, causing students to learn knowledge, and to discover and solve problems by themselves. The whole teaching is mainly based on students' operation, and the

problems that appear due to the individual differences among students in the process of task completion which are solved by the teacher's guidance (Xiangdong Chen & Zhang, 2004). In this study, Task-driven refers to the task-driven teaching methodology, which takes specific tasks as a carrier, motivates students through authentic tasks, emphasises students' independent exploration and acquisition of skills in completing the tasks, and teachers provide targeted guidance, with the core elements including the task context, students' tasks, problem-solving performance and task attainment.

1.7.2 Mobile Learning (M-Learning)

The definition of mobile learning is proposed in the research report of a project called "Telenor M-learning Wap Project" carried out in Norway in 2001. It is a new learning method using mobile terminal devices for learning due to the increase of people's geo-spatial mobility and flexible learning needs (Kristiansen, 2001). Chabra and Figueiredo (2002) combined distance education theory and made a broader definition of M-learning. They defined it as the ability to use specific equipment to learn at anytime and anywhere (Chabra & Figueiredo, 2002). It is a novel mode for learning that realizes the construction of personal and social knowledge. It includes learning resources, powerful search capabilities, rich interactivity, strong support for effective learning, and performance-based assessments that can be assessed anywhere and at any time. It is a digital learning method facilitated by information devices such as PDAs, personal digital assistants, or mobile phones (Desmond Keegan, 2004).

In this study, Mobile learning is a digital learning paradigm supported by wireless mobile communication technology, the core of which lies in the dynamic process of knowledge acquisition and construction through portable smart terminals (including smartphones, tablet PCs and dedicated learning terminals, etc.), with an emphasis on device-promoted digital learning.Among other things, the mobile support system should include resource libraries, search tools, learning support services and assessment mechanisms, with core functions including access to learning resources, information exchange and interaction.

1.7.3 Model

Russell (1974) Model generally refers to the theoretical logical framework of the object under study, an operable knowledge system between experience and theory, and a theoretical simplified structure that reproduces reality. The people who first introduced the term "model" into the field of teaching and conducted systematic research on it, such as B.Joyce and M.Weil in the United States. Although up to now, the views of domestic scholars are different from different angles, there are different sayings, but from the perspective of the attribution of teaching mode, there are no more than the following six aspects, namely: teaching theory, teaching structure, teaching design, teaching procedure, teaching paradigm, teaching strategy or method, etc. Most people think that the teaching mode is a relatively stable teaching activity structure or procedure formed under the guidance of a certain teaching theory (Zhang, 1996).The book "The Models of Teaching" systematically studies the teaching model, and puts forward the concept of teaching mode: "A teaching mode is a plan or

paradigm that composes courses, selects teaching materials, and guides teaching activities in classrooms and other links."(Bruce R. Joyce et al., 2014).

In this study, Model refers to the structured representation of complex phenomena or systems in teaching and learning. Its essence is to reveal the core mechanisms and association laws of the teaching and learning process through abstraction, simplification and symbolisation.By selecting key variables and establishing a network of relationships to form a dynamically optimisable framework for teaching and learning, it lies in revealing the guidelines and paths for the operation of the teaching and learning system specific to this study.

1.7.4 Normal universities and colleges

Generally speaking, Teachers Colleges or Education Universities, or Normal Universities are regarded as high-quality educational institutions committed to cultivating more professional and excellent educational talents for society and contributing to national construction and development. In this study, normal colleges and universities mainly refer to the institutions of higher learning that train teachers at all levels. Normal university refers to universities with an undergraduate level that aims to cultivate high-level teachers and train cultural, scientific, engineering, and teaching talents for a more comprehensive university. Normal universities are the ones closest to the essence of education.

1.7.5 Pre-service teachers

Pre-service teacher, often known as a teacher candidate, refers to student teachers who are enrolled in a teacher education program and pursuing teacher certification. They perform supervised field-based teaching experiences under the supervision and guidance of university instructors and K-12 cooperating teachers. These are students who have received training from higher education institutes to become professional instructors but have little to no classroom experience (Keengwe, 2022). Pre-service teachers are also called normal students in China. The employment objectives of undergraduate pre-service teachers are clear, which mainly engage in teaching management in primary and secondary schools or educational institutions, so the undergraduate pre-service teachers are regard as the most vital resources for China's education. The undergraduate pre-service teachers in this study mainly refer to the students who major in educational knowledge in education colleges and universities, they are trained as future teachers in primary and secondary schools.

1.7.6 Information communication technology (ICT)Competency

According to UNESCO, "ICT" is a scientific, technological and engineering discipline and management technique used in handling information, its application and association with social, economic and cultural matters. It refers to technologies that provide access to information through telecommunication. It is similar to Information Technology (IT) but focuses primarily on communication technologies (Ratheeswari, 2018).In China, Professor Yan Han Bing regarded "ICT competency"

as the information technology application abilities (YAN， Hanbing et al., 2018), which pre-service teachers should have. The abilities refers to the ability to apply information technology to optimize classroom teaching and the ability to apply information technology to transform learning methods (Education, 2014).

In this study, ICT competencies refers to a comprehensive literacy system that is rooted in pedagogical principles and is based on the systematic integration of digital tools, intelligent platforms and data analytics to accomplish the core pedagogical behaviours of technological integration dimension, pedagogical application dimension and ethical practice dimension. Pre-service teachers' ICT Competency refers to the ability to use information and communication technology to design and complete teaching activities, and it includes the ability to use information technology to support students to carry out learning activities such as self learning, cooperation, and inquiry under the online learning environment or corresponding equipment, or in teaching activities such as explanation, inspiration, demonstration, guidance, and evaluation.

1.7.7 Instructional design

Instructional design is a systematic process of using a systematic approach to transform the principles of learning theory and teaching theory into specific plans for teaching objectives (or teaching purposes), teaching conditions, teaching methods, teaching evaluation, and other teaching environments design (He, 2016). In a broad sense, instructional design refers to the system design (Instructional Systems Design) including the overall design plan of the course and the design of specific courses. At

this time, we can call it instructional system design. In a narrow sense, instructional design refers to the design of the certain course or a certain course or a certain training (An & Qiao, 1998). Whether it is a broad or narrow teaching design, it includes the components such as goals, content, structure, class hours, places, personnel, and testing (An & Qiao, 1998).

In this study, the In this study, instructional design is a framework for constructing a closed-loop educational intervention based on a new paradigm through systematic planning and dynamic adaptation using learning sciences as the theoretical foundation.The observable implementation procedures for knowledge construction and competence development in specific teaching scenarios are achieved through technology-supported cognitive strategies.

1.7.8 Modern Educational Technology course

Modern educational technology courses refer to the teaching of theories and timely ways for students to use technology to improve teaching through learning the use of intelligent tools, innovative teaching methods, data analysis applications, etc.In the study, the " Modern Educational Technology " course is a pre-service training course for pre-service teachers' informatization teaching ability. The teaching content includes the influence of information technology on teaching, the application of information technology in teaching, and the relevant knowledge of teaching based on information technology. The course is task-driven, goal-oriented, combining theory and practice, highlighting experience sharing, supported by rich platform functions

and diverse learning modes, emphasizing the integration of information technology and subject expertise.

1.8 Theoretical framework

This study is to develop a new blended teaching and learning model by adopting a DDR research methodology that divides the whole study into three phases, and utilising teaching and learning theories that are purposefully appropriate to guide the whole research.

The new classroom teaching structure also needs more theory to guide. Constructivism advocates learner-centred learning under the guidance of teachers. It emphasises the cognitive role of learners without ignoring the guiding role of teachers. Constructivism sees the teacher as an assistant and facilitator in the construction of meaning, rather than an imitator of knowledge (Qiu, 2019). Teachers who adhere to constructivism believe that students who are actively engaged in learning are one of the top priorities of education in science, and that teachers should guide students' learning in a constructivist environment rather than merely transferring knowledge to them (Feyzioğlu, 2012).

With the advent of Web 2.0 technology and the increasing share of space that students occupy in virtual learning environments, they advocate for the reinterpretation of constructivism as a new learning theory for learners in the 21st century. It can be said that mobile learning has all the potential for social interaction

through conversations on social networking sites, mailing functions, collaboration tools, etc, which can be a harbinger or revival of constructivism in education (Mittal et al., 2019).

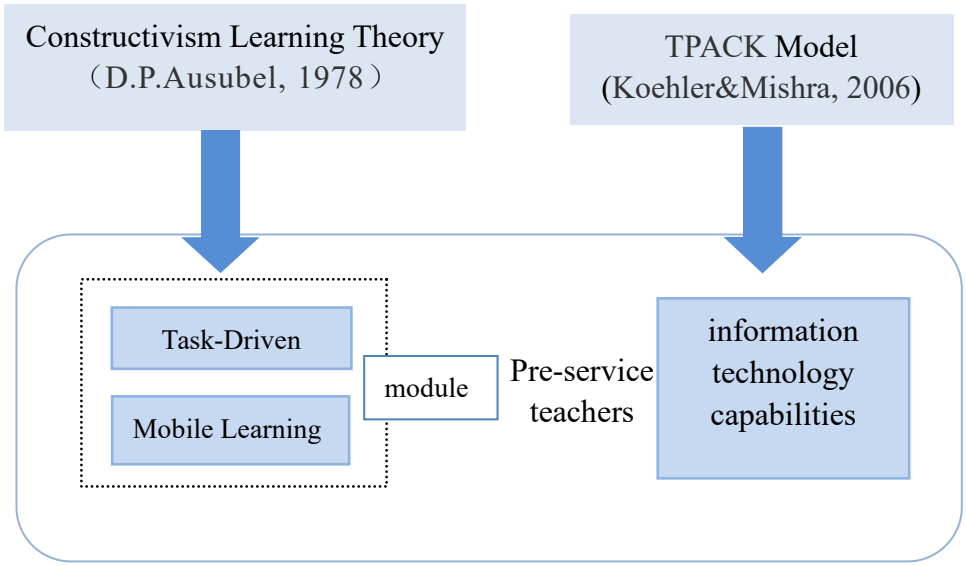
The theoretical basis of task-driven teaching is constructivism, and the main features of task-driven teaching are the main task line, student oriented and teacher-led. Students' learning activities are based on specific tasks or problems, and driven by the problems or task. Students actively use various learning resources to explore independently and interact with each other so as to acquire knowledge and skills. The task-driven teaching strategy enhances students' willingness to learn and promotes the development of their core literacy (Yuanyuan Liu & Wu, 2022).

In 2006, a frame-work was proposed that combined three important aspects of teacher knowledge: Pedagogical Knowledge, Content Knowledge, and Technology Knowledge (Koehler & Mishra, 2008; Mishra & Koehler, 2006). This new framework was called Technological Pedagogical Content Knowledge (TPCK or TPACK) (Thompson & Mishra, 2007) and built upon Lee Shulman's widely cited Pedagogical Content Knowledge (PCK) framework (Shulman, 1986a, 1986b, 1987). The TPACK framework proposes seven distinct categories of teacher knowledge. TPACK, which is at the center of the model, represents the use of technology to support content-specific pedagogical strategies. Teachers' TPACK ability is a necessary ability for future teachers (Tang & Jiang, 2020). The researchers agreed that the study of Technology Pedagogical Content Knowledge (TPACK) will help to improve teachers' ability to master and use information technology. Thus, TPACK theory can be used as one of the theoretical foundations of this study.

Exploring application of a constructivist approach in the context of teacher education is of great importance when pre-service teachers are seen as learners and technology-integrated subject teaching (TPACK) is the theme (NIE, 2017). Based on this, constructivism learning theory as the theoretical basis of task-driven and mobile learning, supports the student-centered teaching concept of the design model. Meanwhile, TPACK model can be used not only as a reference index to improve the information technology ability of students and teachers, but also as a standard to evaluate the students' information technology ability. Therefore, this study uses TPACK model and constructivism learning theory to guide the construction, evaluation and implementation of teaching models, as shown in Figure 1.1, the relevant content is elaborated in chapter 2.

Figure 1.1

Theoretical framework of this study



1.9 Significance of Research

The findings of this study are beneficial for educators, educational objects, and educational implications. They do not only determine the feasibility of a Task-Driven M-Learning model but also provide guidelines and considerations required for a mobile learning environment.

The research concept is based on the needs of teaching reform of undergraduate pre-service teachers in China. The results of the study provide ideas for policy makers, to evaluate whether the models can be used for teaching and learning as found and reflected on the feasibility of implementing the models in general educational colleges and universities. This study develops a course model that can also be applied by instructional designers to design and develop models that can be used in teaching practice. Instructional designers can choose a favoured research methodology to develop task-driven based M-Learning models or instructional models for courses in other disciplines after obtaining a centralised expert opinion.

By selecting courses and survey samples, combined with the developed model, the study selects appropriate teaching strategies to conduct teaching experiments by allowing pre-service teachers to carry out mobile learning under a new teaching method to verify the feasibility of this model. The whole process is a teaching practice for teachers to provide guidance and a reference for the selection of teaching models and curriculum reform in normal colleges and universities. This study will also help University lecturers to supply students with useful information such as the types of content suitable for study, assessment, and feedback.

This research will take pre-service teachers who are going to become educators as the research object and come out with training strategies for undergraduate pre-service teachers. The teaching strategies and developmental processes of pre-service teachers in this study can complement the theories and methods of information technology competency development for undergraduate pre-service teachers.

The study selected the "Modern Educational Technology" course to implement the model. As a compulsory public course for pre-service teachers in higher education, the core purpose of the course is to develop the pre-service teachers' information literacy and information-based teaching skills. Therefore, it is necessary to re-examine its curriculum content and teaching mode. The introduction of the mobile learning model based on the task driven, on the other hand, is more conducive in updating the information literacy and ability of pre-service teachers. It helps to improve pre-service teachers' awareness and emphasize information technology literacy. Consequently, it provides more possibilities of nurturing pre-service teachers to become an excellent digital teacher in the context of educational informatization. The study is supposed to offer advice and create some new form for the reconstruction of the content system and teaching model of the "Modern Educational Technology Application" course.

This study verifies the impact of the combination of mobile learning and task driven model on the actual classroom. In the process of model implementation and data collection, the flexible use of various mobile applications in assisting teaching do not only save teaching time but also mobilize students' enthusiasm for learning, which

has a significant effect in improving the comprehensive ability of students. The availability of learning resources at any time and in any location will facilitate more active interaction and communication among students, who will benefit from a meaningful and relevant mobile learning environment. Pre-service teachers will also master the planned and purposeful methods and have greater clarity on how to utilize online learning resources to help their before and after class learning.

1.10 Rationale of the Study

In the information age, an important feature of educational development is a lifelong learning and universal education accompanied by personalized learning and high-quality education. As teachers in the future, the information technology competence of pre-service teachers largely determines the general trend of information technology in education in the future. At the same time, the personalised, ubiquitous and flexible features of mobile learning can complement the traditional classroom teaching mode. Therefore, mobile learning and the training process of pre-service teachers can form a sustainable trend of development. Classroom teaching combined with mobile learning develops into a comprehensive process that runs through all stages of the training of pre-service college teachers' information-based teaching ability (SUN, 2014).

Institutions of higher learning must reform education and teaching methods and explore new teaching modes. It is imperative to innovate the talent training model for pre-service teachers. Through the in-depth integration of online classrooms and

the "task-driven" teaching method, we strive to achieve innovation in the teaching model and cultivate high-quality skilled talents(J. WU & LIU, 2015). To realize the effective integration of traditional classroom teaching and online mobile learning, the mode based on mobile learning and task-driven can be applied in teaching. This teaching model is widely welcomed by students, but this model should also be distinguished and refined in practice and further improved in future teaching practice (Yugang Wang et al., 2022).

Therefore, this study is necessary since the mobile learning platform and the task-driven teaching method do not only provide fragmented and flexible mobile learning opportunities but also emphasize students' ability to learn independently and acquire knowledge, complementing the advantages of mobile learning and classroom learning.

Aiming at the problems existing in the information-based teaching ability training of pre-service teachers, the training strategies are constantly innovated and improved, can effectively improve the informatization teaching ability of pre-service teachers in colleges and universities, to meet the requirements of the development of basic education informatization (SUN, 2014). Therefore, it is crucial to make adjustment to the ICT competency training courses of pre-service teachers. By innovating and improving the teaching mode, the information teaching ability of pre-service teachers can be expanded.

1.11 Limitation of the Study

The Developmental research approach focuses on the developmental process starting from the analysis phase and proceeded to the design phase. It finally ended with the evaluation phase. As a result, this research focuses on the development of a product, a Task-Driven M-Learning model.

This study has limited student participation. The results of the developmental research are only related to the participants in the context of this study with limited backgrounds, learning experiences, and economic levels of the participants. The results of the research are beneficial to the universities of the same category as Ping Ding Shan Normal University. The findings may not have the tendency to generalize different situations, but they serve as a reference for further research in similar contexts and similar situations.

Another limitation is the uniqueness of the study sample. In the analysis stage, the researcher only surveyed pre-service teachers and students in selected education colleges and universities. Ping Ding Shan Normal University is a general application-oriented university and most of the pre-service students are from Henan Province, China. In the third phase, only 50 students, who have the access to mobile phones and computers, are selected to participate in the implementation of the models. In this study, mobile phones, computers, and notebooks can support all learning functions, not only the Online learning platform (named Chao Xing Study Application) but also Ding Talk. However, the fact that most university students have mobile phones and not necessarily other form of devices, has indicated the different learning

styles exercised by the students when using mobile devices. Different levels of information technology skills, learning styles, preferences and learning abilities, may have impacted the findings.

The experts chosen for this study were teachers specialising in teaching, including university teachers and teachers at other educational levels. Most of them have certain educational technology skills, but differ in teaching experiences due to their different work backgrounds, and these experiences affect their views on the model designed.

1.13 Summary

This chapter begins with a brief introduction to the study, followed by an overview of the research background of the study. Then, it goes on to discuss in detail the rationality of using mobile learning and task-driven teaching model and deeply discusses the importance of this mode to improve the ICT competency of undergraduate pre-service teachers in colleges and universities. Then there is the part of research objectives and research questions. By listing the objectives and questions of the three stages of this research, it systematically shows the focus and problems to be solved in the development of this teaching model.

The theoretical framework of this study demonstrates the main theoretical basis of this study, and it will illustrate reference models, research methods, and techniques in detail through a flow chart in Chapter 2. The basic principle and

significance of this study further expound the rationality of the development of the teaching mode. In addition, the limitations of this study are also discussed in this chapter to illustrate the scope of this study. Finally, definitions of terms designed in the study are outlined in Operational Definitions for a better understanding of the relevant concepts of this study.