Developing Early Childhood Pre-Service Teacher Instructional Model Based on Meaningful Learning Theory to Improve Lesson Design Ability

Ting Zhao

A Thesis Submitted in Partial Fulfillment of Requirements for

degree of Doctor of Philosophy in Curriculum and Instruction

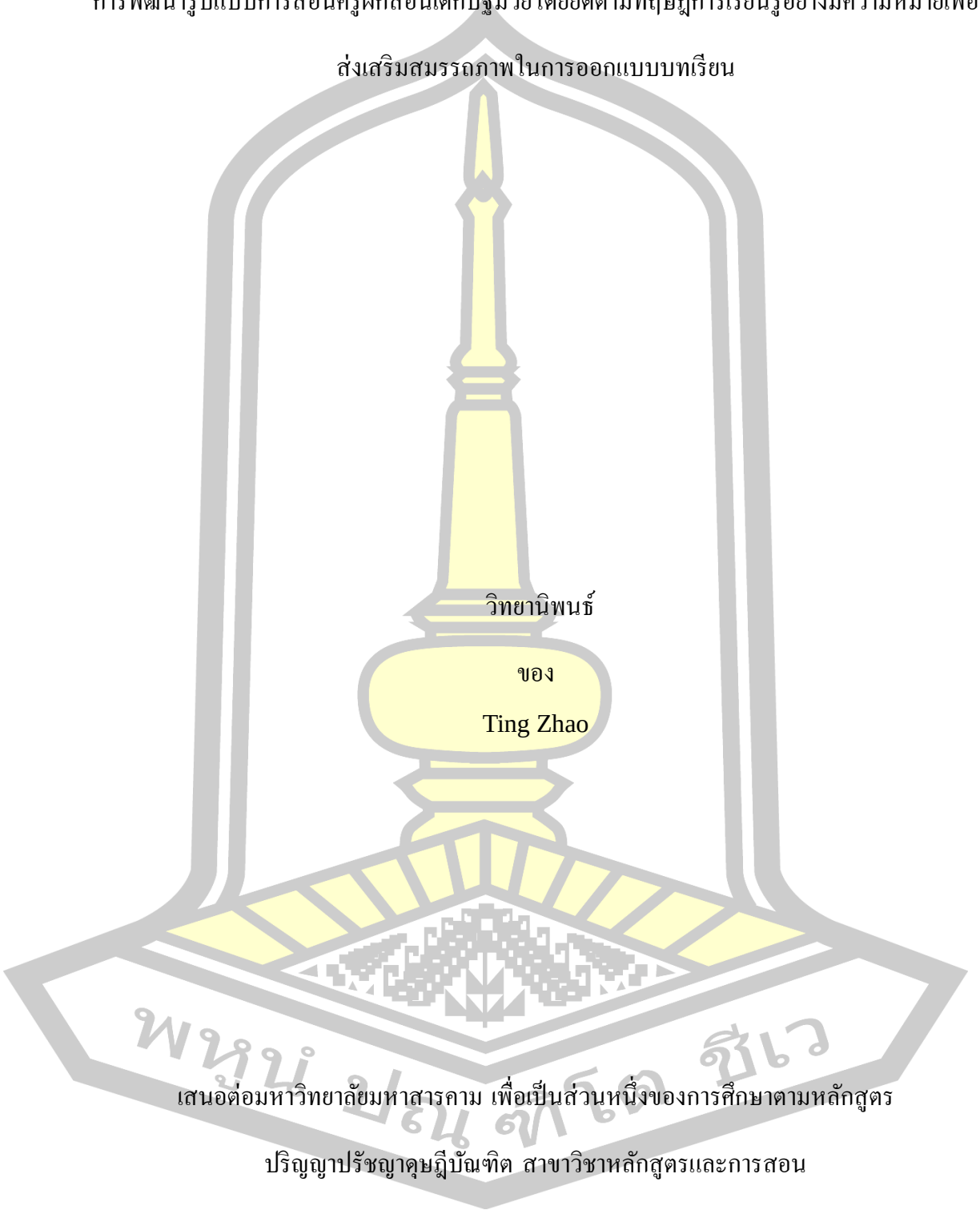
May 2025

การพัฒนารูปแบบการสอนครูฝึกสอนเด็กปฐมวัยโดยยึดตามทฤษฎีการเรียนรู้อย่างมีความหมายเพื่อส่งเสริมสมรรถภาพในการออกแบบบทเรียน

วิทยานิพนธ์

ของ

Ting Zhao



เสนอต่อมหาวิทยาลัยมหาสารคาม เพื่อเป็นส่วนหนึ่งของการศึกษาตามหลักสูตร

ปริญญาปรัชญาดุษฎีบัณฑิต สาขาวิชาหลักสูตรและการสอน

พฤษภาคม 2568

พหุน ปณฺ ฑิโต ชีเว

Developing Early Childhood Pre-Service Teacher Instructional Model Based on Meaningful Learning Theory to Improve Lesson Design Ability

Ting Zhao

A Thesis Submitted in Partial Fulfillment of Requirements

for Doctor of Philosophy (Curriculum and Instruction)

May 2025

พหุน ปณฺ ฑิโต ชีเว

The examining committee has unanimously approved this Thesis, submitted by Ms. Ting Zhao , as a partial fulfillment of the requirements for the Doctor of Philosophy Curriculum and Instruction at Mahasarakham University

Examining Committee

..... Chairman
(Asst. Prof. Denchai Prabjandee , Ed.D.)

..... Advisor
(Assoc. Prof. Chowwalit Chookhampaeng , Ph.D.)

..... Co-advisor
(Asst. Prof. Jiraporn Chano , Ph.D.)

..... Committee
(Hemmin Thanapatmeemamee , Ph.D.)

..... Committee
(Apiradee Jansaeng , Ph.D.)

..... Committee
(Asst. Prof. Araya Piyakun , Ph.D.)

Mahasarakham University has granted approval to accept this Thesis as a partial fulfillment of the requirements for the Doctor of Philosophy Curriculum and Instruction

..... (Assoc. Prof. Chowwalit Chookhampaeng , Ph.D.)
Dean of The Faculty of Education

..... (Asst. Prof. Pondej Chaowarat , Ph.D.)
Dean of Graduate School

พหุน ปณฺ ฑิโต ชีเว

TITLE Developing Early Childhood Pre-Service Teacher Instructional Model Based on Meaningful Learning Theory to Improve Lesson Design Ability

AUTHOR Ting Zhao

ADVISORS Associate Professor Chowwalit Chookhampaeng , Ph.D.
Assistant Professor Jiraporn Chano , Ph.D.

DEGREE Doctor of Philosophy **MAJOR** Curriculum and Instruction

UNIVERSITY Mahasarakham University **YEAR** 2025

ABSTRACT

This research is based on Rogers' Theory of Meaningful Learning and aims to improve the lesson design ability of early childhood pre-service teachers. The research objectives are: 1) To study the basic information of developing an instructional model based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers; 2) To develop an instructional model based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers; 3) To examine the results of implementing the developed instructional model based on meaningful learning theory in improving the lesson design ability of early childhood pre-service teachers in a normal college.

The study is divided into three phases:

Phase I: Contextual Study

In this phase, a literature review and survey research were conducted to collect basic information on lesson design ability, meaningful learning theory, and related instructional models, identifying the current status and needs of pre-service teachers in lesson design. This phase laid the theoretical foundation for the subsequent development of the instructional model. The findings highlighted two core dimensions—Pedagogical Content Knowledge (PCK) and lesson design skills—yet existing courses are overly theoretical and lack practical, reflective guidance. Both

students and instructors expressed a strong need for experiential, case-based, and reflection-oriented instructional support.

Phase II: Developing the Instructional Model

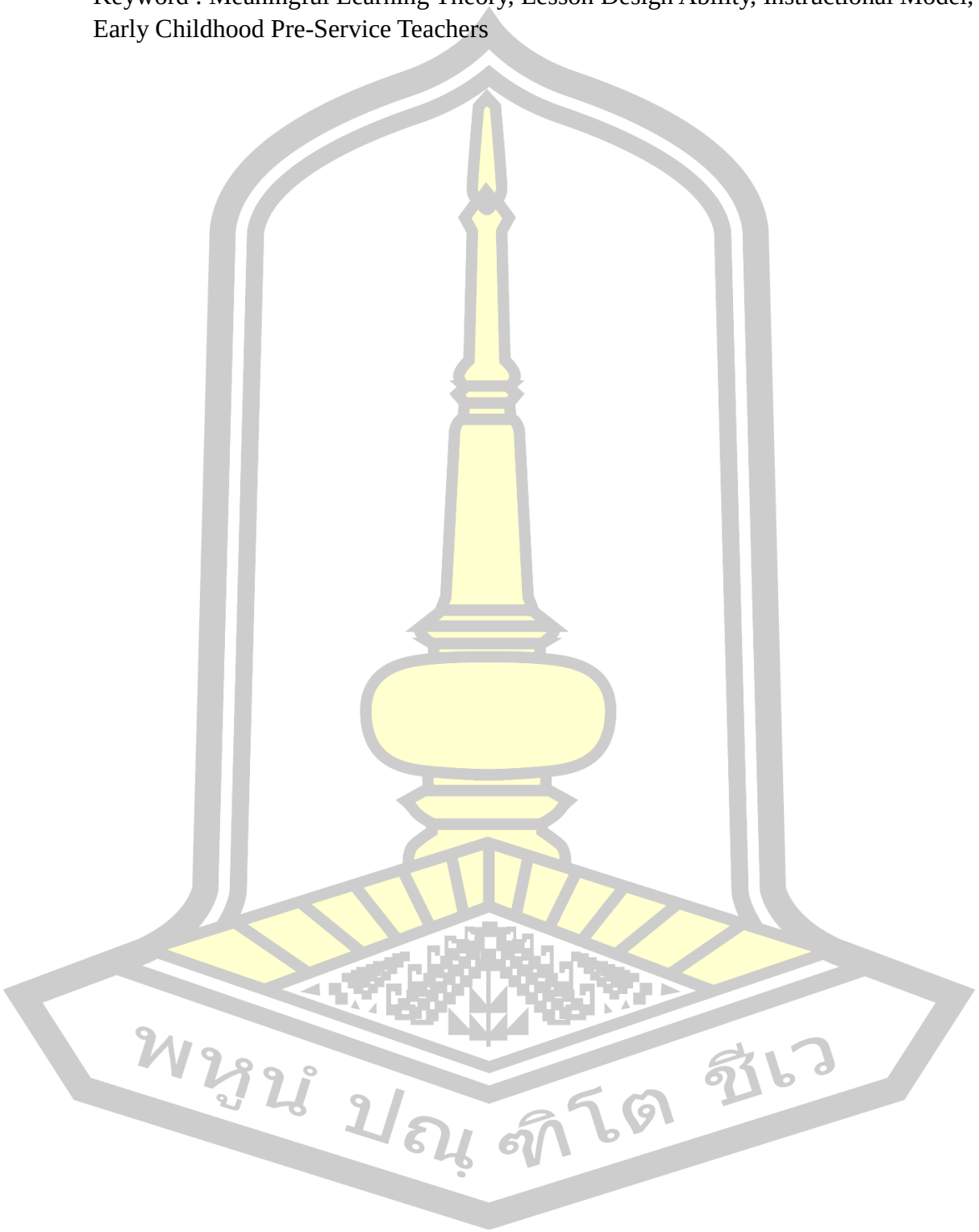
Based on the research results from Phase I, this phase designed and drafted an instructional model based on meaningful learning theory (the CAPE Model), which includes the following components: 1) principles of the model, 2) objectives of the model, 3) syntax, 4) social system, 5) principle of reaction, and 6) support system. The expert evaluation of the preliminary model showed high ratings in several areas, with an overall score of 4.47 (SD = 0.54), indicating a high level of usability. Specifically, the sections on syntax, principle of reaction, and support system all received scores of 4.4, indicating that the structure and functionality of the model meet expectations and can effectively support the enhancement of lesson design abilities. Based on expert feedback, necessary adjustments were made to the model, resulting in the final version of the CAPE model.

Phase III: Implementation

This phase assessed the effectiveness of the CAPE Model in improving the lesson design abilities of early childhood pre-service teachers.Experts evaluated the teaching syllabus based on the CAPE model. The overall mean score was 4.59, indicating strong approval and showing that the syllabus is well-structured, aligns with early childhood education standards, and meets the needs of pre-service teachers.In the quasi-experimental study, the experimental group (Class 2201, 30 students) was taught under the new model, while the control group (Class 2202, 30 students) was taught using the traditional model. After 36 hours of study, Independent samples t-test analysis showed that the experimental group's lesson design ability (LDA) increased from 51.43 in the pre-test to 89.13 in the post-test, PCK increased from 48.57 to 75.40, and LDS improved from 51.43 to 89.13, with all indicators showing statistically significant changes ($P<0.05$). A comparison of the post-test results between the experimental and control groups revealed that the experimental group outperformed the control group in all measured areas. The post-test scores for LDA, PCK, and LDS were significantly higher in the experimental group, with P-values of less than 0.05, indicating that the CAPE model was more effective in improving lesson design abilities compared to traditional teaching methods.

This study demonstrates that the CAPE model is an effective instructional approach. Compared to traditional teaching methods, the CAPE model significantly improves early childhood pre-service teachers' lesson design abilities, particularly in pedagogical content knowledge and lesson design skills, providing strong support for future teacher training in early childhood education.

Keyword : Meaningful Learning Theory, Lesson Design Ability, Instructional Model, Early Childhood Pre-Service Teachers



ACKNOWLEDGEMENTS

First and foremost, I would like to express my deepest gratitude to my advisor, Asst. Prof. Chowwalit Chookhampaeng, for his invaluable guidance, unwavering support, and continuous encouragement throughout my doctoral research. His profound insights and rigorous academic attitude have provided me with valuable direction, constantly pushing me to reflect and improve during my research process. I am truly fortunate to have had the opportunity to work under his guidance. His professional knowledge and concern for my progress have been a vital source of motivation in overcoming challenges and advancing forward.

At the same time, I would like to extend my heartfelt thanks to my co-advisor, Asst. Prof. Jiraporn Chano, for her meticulous guidance and assistance throughout the study. Her detailed feedback and careful instruction have greatly enriched my dissertation, and I have made significant progress in my research methods, thinking processes, and academic writing thanks to her invaluable support. I deeply appreciate her dedication to my development.

I would also like to express my sincere gratitude to the members of my dissertation committee. Their valuable time, insightful suggestions, and thorough reviews have been crucial in refining this dissertation. I appreciate their commitment to my work and their constructive feedback, which has greatly contributed to the overall quality of this research.

To my family, I owe the deepest appreciation. My parents have been my pillars of strength, offering unconditional love, encouragement, and understanding throughout the highs and lows of my academic journey. Without their unwavering belief in me and their constant support, this journey would not have been possible. I also want to thank my relatives and friends for always being there for me and for their endless encouragement.

Their companionship has been a constant source of warmth and strength throughout my research journey.

Lastly, I want to express my gratitude to everyone who has contributed, directly or indirectly, to the completion of this dissertation. Your support and belief in me have meant the world, and I will forever cherish your kindness and contributions to this achievement.

Ting Zhao

TABLE OF CONTENTS

Page

LIST OF TABLE

Page

LIST OF FIGURES

Page

CHAPTER I

INTRODUCTION

1.1 Research background

Teachers are the key to the cultivation of national talents. The Outline of the National Medium- and Long-term Education Reform and Development Plan (2010-2020) (Ministry of Education of China, 2010) states that "teachers are the foundation of education. Only with good teachers can we have good education." John Hattie and his research team concluded based on more than 900 meta-analyses that "teachers are one of the biggest factors affecting learning" (John Hattie, 2015). The teaching level of teachers directly affects students' learning outcomes.

As the primary factor of teachers' teaching ability, lesson design ability is a necessary prerequisite for teachers to have teaching qualifications and professional qualities (Guo Siyong, 2019). In the teacher qualification examination, lesson design ability is the core evaluation indicator. Lesson design ability is an important manifestation of teachers' professionalization and an essential skill that teachers need to focus on developing (Qiao Xinhong, 2019).

According to the stage theory of the development of the teacher's career cycle, the pre-service teacher education stage is an important period for teachers to learn teaching professional skills and teaching content (Betty E. Steffy, 2012). From the national level to normal schools, great importance is attached to the cultivation of lesson design ability of early childhood pre-service teachers.

The Professional Standards for Kindergarten Teachers (Trial) (Ministry of Education of China, 2012) promulgated by the Ministry of Education of my country set "planning and implementation of educational activities" as the professional ability of kindergarten teachers and put forward clear requirements. In the talent training program for early childhood education majors, "the ability to design and implement kindergarten educational activities" ranks first in professional ability. The cultivation of lesson design ability of early childhood education normal students is conducive to helping them internalize teaching theories, improve lesson design ability, and promote professional growth (Guo Siyong, 2019).

At present, the lesson design ability of students majoring in early childhood education is cultivated through “Early Childhood Lesson Design” Course Series includes five courses, but the courses has the following problems:

In the teaching process, researchers found that: first, the course lacks a theory-based instructional model. Second, students are not motivated to learn. Third, there is a lack of staged guidance and evaluation mechanism for the development of lesson design abilities. Existing studies have also proposed that students have a weak sense of

autonomous development, insufficient teaching experience, deviations in the understanding of teaching methods, insufficient school teaching staff, and insufficient off-campus practical teaching conditions (Guo Siyong, 2019). The collective teaching activities of early childhood education students are inefficient in terms of goal expression and process design. The main reasons are affected by factors such as students' academic level, solid professional knowledge, and knowledge transfer ability (Li Xiaofang, 2020).

Based on the above problems, researchers realized that it is urgent to build an instructional model that can deeply integrate theory and practice, is student-centered, and focuses on experience construction and reflection, which can not only provide structural support for teachers' teaching, but also create a real and open learning environment for students' ability development.

Rogers' meaningful learning theory emphasizes the "learner-centered" and advocates combining learning with learners' interests, experiences, and emotions to enhance the depth and sustainability of learning. By incorporating meaningful learning theory into curriculum design, teachers can not only better understand students' needs, but also design more attractive teaching activities based on students' interests, thereby effectively improving students' learning motivation and participation (Li Hua, 2016). Paying attention to students' emotional needs and learning interests often leads to more meaningful teaching results (Chen Hui, 2018). In addition, the teaching model based on meaningful learning theory can help teachers better select and organize course content, thereby improving the effectiveness of teaching activities and improving classroom design capabilities (Wang Xiaolong, 2020).

Rogers' meaningful learning theory provides a theoretical basis and practical path for reconstructing lesson design courses. Therefore, constructing an instructional model based on this theory to systematically improve the lesson design ability of early childhood pre-service teachers not only has theoretical innovation value, but also responds to the current reality of curriculum reform and teacher training.

1.2 Research Questions

1) What is the basic information of developing an instructional model based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers?

2) What are the components of the instructional model developed based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers?

3) What are the results implementing the developed instructional model that based on meaningful learning theory to improve the early childhood pre-service teachers’ lesson design ability in a normal college?

1.3 Research objectives

1) To study the basic information of developing an instructional model based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers.

2) To develop an instructional model based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers.

3) To examine the results of implementing the developed instructional model based on meaningful learning theory in improving the lesson design ability of early childhood pre-service teachers in a normal college.

1.4 Scope of Research

This study is research and development and its implementation (R&D)
The stages are as follows:

1.4.1 Phase I Contextual Study (R1)

The first stage is the background study. The main purpose of this stage is: 1) To study the basic information of developing instructional model based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers; 2) To investigate the current situation and needs of early childhood pre-service teachers' lesson design ability and the needs of their teachers. Based on these two research purposes, the following two steps of research are carried out:

Step 1: Literature research. By searching Chinese databases and foreign databases such as CNKI, Google Scholar, ERIC, and relevant websites of the Ministry of Education, find literature related to lesson design ability, early childhood pre-service teachers' ability training, instructional models, etc., read and analyze relevant literature.

Step 2: Investigation and research. Investigate and research the current situation and needs of early childhood pre-service teachers' lesson design ability and the needs of their teachers regarding the instructional model. Sample Size: Approximately 300 students majoring in early childhood education and 5 teacher educators. Sampling Method: A normal college with an early childhood education major was selected. For students, simple random sampling was used to select 300 participants from a population of 1,635 students. For teacher educators, purposive sampling was employed to select 5 teachers who have more than five years of teaching experience and are responsible for teaching lesson design courses.

1.4.2 Phase II Develop instructional model (D1)

Based on the research results of the first stage, this stage develop an instructional model based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers. Including drafting instructional model and evaluating the quality of instructional model. The steps are as follows:

Step 1: Draft an instructional model based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers，with input from a focus group discussion involving five teachers and the researcher. Purposive sampling was employed to select 5 teachers who have more than five years of teaching experience and are responsible for teaching lesson design courses.

Step 2: Evaluation the instructional model based on 5 expert feedback. Purposive sampling was used to select experts who met the following criteria: There are associate professors or above in academic rank, including one expert in educational psychology, three early childhood education experts with over 10 years of experience in teaching lesson design, and one expert in education.

1.4.3 Phase III Implementation (R2)

The third phase is to examine the results of implementing the new instructional model based on meaningful learning theory in improving the lesson design ability of early childhood pre-service teachers in a normal college.

Step 1: Implementing the new instructional model in a norml college of early childhood education major.

This phase adopts a quasi-experimental design with cluster sampling. One normal college with an early childhood education major—Xichang Minzu Preschool Normal College—is purposively selected as the research site. From this college, two intact classes of second-year early childhood education students (a total of 60 students) are selected using intact group sampling (a type of cluster sampling) as they already form natural class groupings. Experimental group: 30 students receive instruction using the new instructional model based on Meaningful Learning Theory. Control group: 30 students receive traditional instruction. All participants meet the following criteria:

They are at the same academic level and have not previously been exposed to any similar instructional model. They voluntarily agree to participate in the study and complete all required evaluations and feedback. The instructional model is implemented over one semester in the course related to lesson design.

Step 2: Examine the results of implementing the developed instructional model by comparing the lesson design ability. To evaluate effectiveness, a pre-test and post-test on lesson design ability is administered to both groups. A validated assessment tool is used, and statistical methods are applied to analyze the differences in learning outcomes between the two groups.

1.5 Definition

This study develop an instructional model for early childhood pre-service teachers to promote the improvement of their lesson design ability.

1.5.1 Early childhood pre-service teachers

1.1) Early childhood pre-service teachers refer to students who are studying early childhood education at normal college. These individuals are being professionally prepared to become kindergarten teachers and are in the stage of acquiring foundational knowledge, skills, and attitudes related to early childhood education.

1.2) According to relevant professional standards (e.g., Professional Standards for Kindergarten Teachers), early childhood pre-service teachers are expected to develop a range of competencies. These include:

Creating and utilizing supportive learning environments
Organizing and managing daily routines
Supporting and guiding play-based learning
Designing and implementing educational activities (i.e., lesson design)
Motivating and assessing young learners
Collaborating and communicating effectively
Reflecting on practice and engaging in continuous development

Among these competencies, lesson design ability plays a central role in connecting theoretical learning with practical classroom application. While not the sole indicator of professional competence, it is a key focus of this study, as it reflects the teacher’s ability to plan and execute effective instruction that supports children's holistic development.

Therefore, this study targets early childhood pre-service teachers as its primary participants and aims to enhance their lesson design ability through a purposefully developed instructional model.

1.5.2 Instructional model

2.1) The instructional model is a relatively stable, systematic and theoretical teaching paradigm formed by selecting appropriate theories or principles based on the characteristics of the educated and the teaching content. Teachers can complete the teaching design efficiently according to this paradigm.

2.2) The instructional model is a bridge connecting educational theory and teaching practice, providing teachers with a clear framework to help them organize and plan teaching activities. It plays an important role in improving teaching quality, promoting learner development and achieving educational goals. The structure of the instructional model includes six elements: 1) The principles of the instructional model; 2) The objectives of the model; 3) Syntax; 4) Social system: teacher role, learner role; 5) Reaction principle; 6) Support system: media, equipment and learning resources, etc.

1) Principles: This study takes Rogers' meaningful learning theory as the

basic theory, and the teaching principles include: learner-centered, practical learning, and autonomous learning as teaching principles;

2) Objective: To enhance lesson design ability for early childhood pre-service teachers, including two aspects: 1.1) To enhance pedagogical content knowledge for early childhood pre-service teachers; 1.2) To enhance lesson design skills for early childhood pre-service teachers.

3) Syntax: 1.1) Case analysis. through the teacher's explanation and guidance, so that students know what to do ; 1.2) Autonomous learning. teachers provide students with the necessary learning materials, students according to their own learning interests and needs to choose different learning materials to learn; 1.3) Practice, students design and implement teaching activities based on the knowledge learned; 1.4)Evaluation, through the teacher and students jointly evaluate the effect of practice to find problems and guide students to further study.

4) Social system: teachers are learning guides, providing students with guidance on learning materials and learning methods. They are also learning evaluators and participate in the evaluation of students' learning outcomes. Students are learners and the main body of teaching; they are collaborators, completing tasks with classmates; they are evaluators, participating in the evaluation of teaching design skills; they are reflectors, reflecting on their own learning process and results.

5) Reaction principle: The response principle refers to the teacher's feedback and adjustment strategies on students' learning behavior during the teaching process. The response principles adopted in this instructional model are the participatory response principle and the specific response principle. Participatory response principle: encourage students to participate in the feedback process; specific response principle: the teacher's feedback is specific and clear, pointing out the students' specific problems and directions for improvement, rather than general evaluation.

6) Support system: The support system refers to those internal and external conditions that can provide help and convenience for teaching activities, including support in technology, resources, personnel, etc. The support systems under this instructional model include: teaching resource library, classrooms for collective teaching with internet-connected all-in-one machines, micro-classrooms, and online mobile learning applications.

2.3）In this study, the instructional model is developed specifically for early childhood pre-service teachers, with the goal of enhancing their lesson design ability. Based on Rogers' theory of meaningful learning, the model incorporates learner-centered, practical, and autonomous learning principles. It aims to address the common gap between theoretical knowledge and practical application in early childhood teacher education, particularly in the area of lesson planning and implementation.

This instructional model is applied in the context of normal colleges that offer early childhood education major. It is implemented in the course where students learn about lesson design. The model provides a structured pathway for pre-service teachers to analyze case studies, engage in autonomous learning, practice lesson design, and

receive feedback and evaluation.

The purpose of the model is to systematically guide students through the development of both pedagogical content knowledge (PCK) and lesson design skills, thereby improving their overall teaching competence and readiness for real teaching environments in kindergartens.

1.5.3 Lesson Design Ability

3.1) Lesson Design Ability is the ability of teachers to plan, organize, and implement instruction by integrating Pedagogical Content Knowledge (PCK) and Lesson Design Skills based on teaching objectives and learners' characteristics to optimize learning outcomes. In the context of pre-service early childhood teacher education, lesson design ability is an essential component of teachers' professional competence. It not only reflects mastery of professional knowledge but also includes the ability to flexibly respond to childhood's developmental needs, systematically design and implement educational activities, and promote childhood's holistic development, ensuring the effectiveness of teaching practices.

3.2) Lesson design ability encompasses two main aspects:

① Pedagogical Content Knowledge (PCK): PCK is the integration of subject matter knowledge and pedagogical knowledge, enabling teachers to effectively convey knowledge in a way that is accessible to students. It involves understanding students' learning processes, including potential difficulties and misconceptions, and requires teachers to select appropriate teaching strategies to facilitate meaningful learning.nThe PKC-test includes three dimensions: teaching content knowledge, teaching object knowledge, and teaching method knowledge, and three types of questions: multiple-choice questions, short-answer questions, and case analysis questions.

② Lesson Design Skills: This refers to the practical ability of teachers to plan, organize, and implement instructional activities. It includes learner analysis, setting clear learning objectives, selecting appropriate teaching methods and materials, designing engaging learning experiences, and evaluating and reflecting on teaching effectiveness to continuously optimize instructional practices.The LDS-test asks students to design lessons and analyzes students' lesson design skills according to the standards, including six dimensions:nalyze learning situations skill, set activity objectives skill, activity preparation skill, select activity content skill, activity implementation planning skill, evaluation and reflection skill.

The Lesson Design Ability Test and scoring criteria are shown in the attachment. The Lesson Design Ability Test (including the PCK-Test and LDS-Test) developed in this study serves as both a diagnostic and evaluative tool to monitor the improvement of pre-service teachers' lesson design competence throughout the instructional intervention.

1.5.4 Meaningful Learning Theory

The Meaningful Learning Theory, proposed by Carl Rogers, emphasizes that genuine learning arises from learners' active engagement, internal identification, and emotional involvement. Unlike traditional teacher-centered knowledge transmission models, meaningful learning advocates a learner-centered approach, focusing on individual learners' interests, experiences, and developmental needs, and highlights learners' autonomy and positive emotional experiences throughout the learning process.

In the field of pre-service teacher education, there are common challenges such as insufficient integration of theory and practice and a lack of learner autonomy. Traditional teaching models often overlook individual differences and emotional support, thus limiting the development of teaching design abilities. To address these issues, this study introduces the Meaningful Learning Theory, aiming to create an autonomous and emotionally supportive learning environment that fosters the improvement of early childhood pre-service teachers' instructional design competencies.

The application of the Meaningful Learning Theory in this study mainly focuses on three core concepts: (1) Learner-centered learning, which emphasizes designing instructional activities based on students' interests and developmental levels; (2) Self-directed learning, which encourages students to set learning goals and manage their own learning processes; and (3) Emotional support, which focuses on learners' emotional experiences and aims to create a respectful and understanding learning atmosphere.

Correspondingly, the fundamental principles include the principle of learner autonomy, the principle of emotional environmental support, and the principle of individualized learning. These concepts and principles provide theoretical guidance for the design of the instructional model in this study, aiming to help pre-service teachers flexibly apply pedagogical knowledge and skills in real teaching contexts and enhance the relevance and effectiveness of their lesson designs.

1.5.5 Fundamental Information

In the phase frist of this study, a comprehensive literature review is conducted to synthesize the Fundamental Information, which encompasses the following four key dimensions:

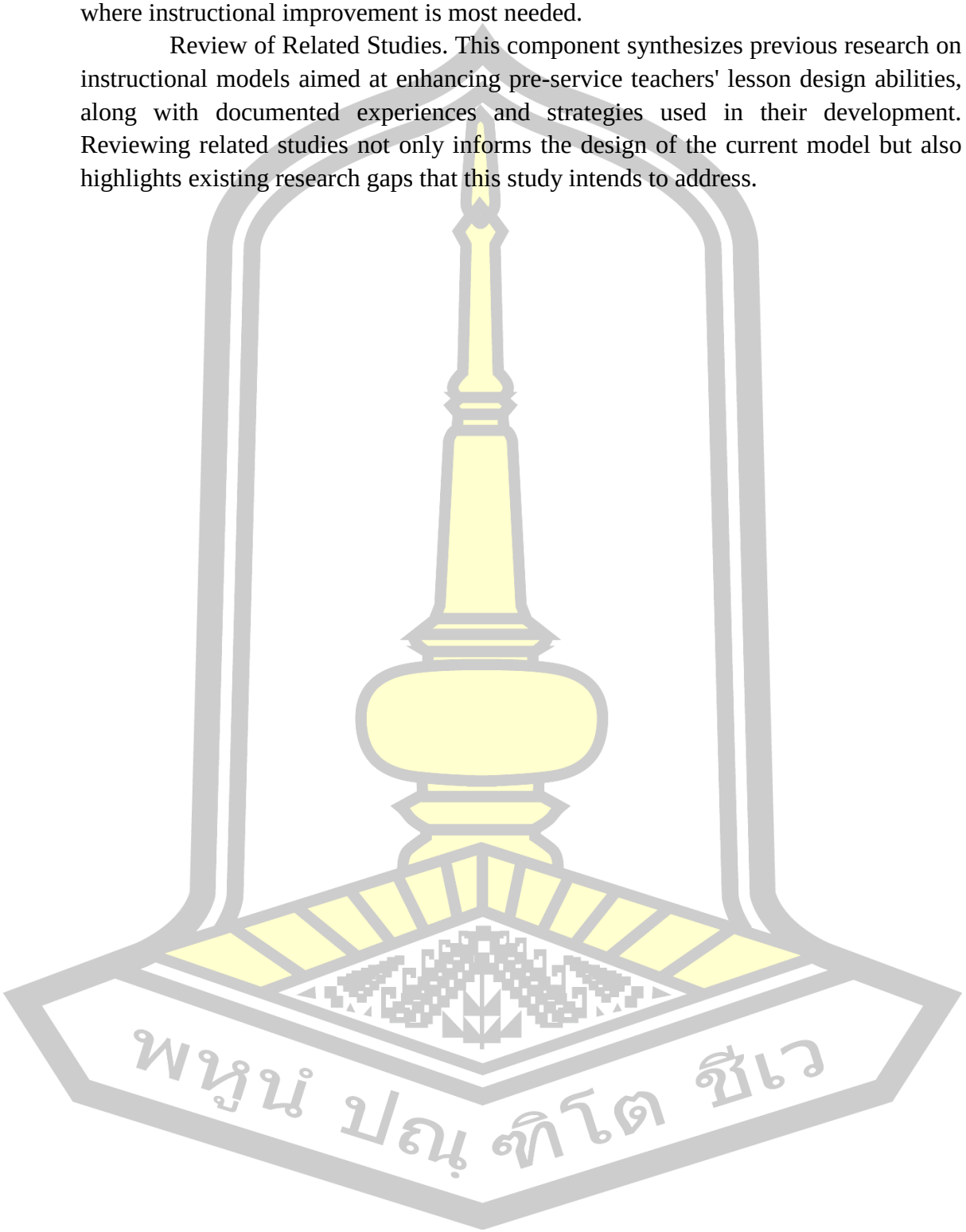
Theoretical Foundations. This component includes Rogers' theory of meaningful learning, and analyses of curriculum standards. Together, these theoretical and policy frameworks establish the conceptual basis for the development of the instructional model proposed in this research.

Characteristics of Research Subjects. This dimension examines the current composition of their lesson design abilities, and the assessment methods employed to evaluate these competencies.

Current Teaching Practices. This section analyzes prevailing instructional models and existing strategies for cultivating lesson design abilities. By identifying the

strengths and shortcomings of current practices, it provides critical insights into areas where instructional improvement is most needed.

Review of Related Studies. This component synthesizes previous research on instructional models aimed at enhancing pre-service teachers' lesson design abilities, along with documented experiences and strategies used in their development. Reviewing related studies not only informs the design of the current model but also highlights existing research gaps that this study intends to address.



Chapter II

Literature Review and Conceptual Framework

This study belongs to the category of teacher education. It aims to develop an instructional model based on the theory of Meaningful Learning to improve the lesson design ability of early childhood pre-service teachers. This study adopts the research and development (R&D) method. The literature analysis will be carried out from 7 aspects as follows:

1. Early Childhood Pre-service Teacher
    1.1 The importance of lesson design for early childhood pre-service teachers
    1.2 What should early childhood pre-service teachers learn ?
    1.3 Learning content and standards for Early Childhood Pre-service Teacher' lesson design
    1.4 Early childhood pre-service teachers quality
    1.5 Learning standard indicators of early childhood pre-service teachers' lesson design
    1.6 History and current situation of early childhood pre-service teachers
2. Lesson design ability
    2.1 Meaning of lesson design ability
    2.2 Components of lesson design ability
    2.3 How to improve lesson design ability
    2.4 Factors affecting lesson design ability
    2.5 The importance of lesson design ability
    2.6 Evaluation of lesson design ability
3. Instructional Model
    3.1 Meaning of instructional model
    3.2 Composition of the instructional model
    3.3 Steps in developing an instructional model
    3.4 Importance of instructional model
4. Meaningful Learning Theory
5. Related theories
    5.1 Self-Determination Theory
    5.2 Self-efficacy theory
    5.3 Experiential Learning Theory
6. Related Research
7. CONCEPTUAL FRAMEWORK

2.1 Early Childhood Pre-service Teacher

Early childhood pre-service teachers refer to students who are studying early childhood education in normal schools, that is, normal school students majoring in early childhood education. They must prepare to be kindergarten teachers.

The professional abilities that early childhood pre-service teachers need to possess include the creation and use of the environment, the organization and care of daily life, the support and guidance of game activities, the design and implementation of lesson, motivation and evaluation, communication and cooperation, reflection and development. Therefore, lesson design ability is a teacher's professional ability, but it is not all of a teacher's professional ability.

2.1.1 The importance of lesson design for early childhood pre-service teachers

Early childhood pre-service teachers are in the preparation stage for early childhood teachers. In China, early childhood teachers are trained in early childhood normal colleges and their major is early childhood education. lesson design is one of the core skills required for students majoring in early childhood education. It involves multiple aspects such as lesson planning, activity organization, and teaching method selection, and is an important part of professional ability. By learning lesson design, students can better understand the needs of childhood at different stages of development and design lesson that are more in line with the laws of childhood's physical and mental development. Good lesson design can improve the effectiveness and fun of teaching activities, thereby improving the quality of education and promoting the all-round development of childhood. By learning lesson design, students can better apply theoretical knowledge in actual teaching, enhance practical ability, and lay a solid foundation for their future careers. Through the study of lesson design, students can better understand the purpose and value of education and enhance their professional quality and sense of educational responsibility. The study of lesson design not only involves professional knowledge, but also includes the cultivation of soft skills such as communication, cooperation, and critical thinking, which is conducive to students' personal growth and all-round development.

2.1.2 What should early childhood pre-service teachers learn

The Early Childhood lesson Design course aims to cultivate students' professional skills and knowledge in the field of early childhood education to ensure that they can design and implement effective teaching activities to meet the learning and development needs of preschool childhood. The following are some specific course objectives:

2.1.2.1 Attitude towards early childhood education, including correct understanding of early childhood and its education and teaching, cultivating students' correct views on childhood and education, loving the cause of early childhood

education, and actively using the theoretical knowledge learned to design and implement early childhood education.

2.1.2.2 Relevant knowledge of early childhood lesson design, including understanding early childhood development, understanding the physical and mental development characteristics of childhood at different ages, including cognitive, language, social emotional and physical development. Familiar with the theoretical basis of lesson design, including learning theory, subject theory, development appropriateness principle (DAP) and multiple intelligence theory.

2.1.2.3 Skills in early childhood lesson design, that is, cultivating students to be able to choose appropriate teaching methods and strategies according to childhood's development level and learning needs, effectively use and innovate teaching resources to support teaching activities, and design lesson plans that meet educational goals and standards. Including five areas: language, society, science, health and art.

2.1.2.4 The ability to implement early childhood teaching, that is, the ability to effectively transform teaching plans into actual teaching activities according to curriculum design. Including resource utilization, communication and cooperation, practical ability, self-reflection, etc.

2.1.3 Learning content and standards for Early Childhood Pre-service Teacher' lesson design

Content 1: Health field

Standard 1: Correctly understand early childhood health education, understand the definition of early childhood health, including physical, psychological and social adaptation, and how these aspects affect the development of early childhood.

Standard 2: Master the pedagogical content knowledge of early childhood health education, including teaching content knowledge, teaching object knowledge and teaching strategy knowledge.

Standard 3: Be able to design early childhood health field education lesson. Including providing nutrition guidance for early childhood and guiding early childhood in physical activities and sports skills. Understand and support the mental health and social-emotional development of preschool childhood.

Standard 4: Be able to implement educational activities based on the teaching design of early childhood health field, and reflect on and optimize teaching activities.

Content 2: Language field

Standard 1: Correctly understand early childhood language education, understand the importance and basic concepts of early childhood language education.

Standard 2: Master the pedagogical content knowledge of early childhood language education, including teaching content knowledge, teaching object knowledge and teaching strategy knowledge.

Standard 3: Be able to design and implement educational activities that

promote the language development of early childhood. Such as storytelling, role-playing and language games. Use books, songs and poems to promote childhood's language learning.

Standard 4: Be able to implement language education activities in simulated or actual teaching environments, and reflect on and optimize these activities.

Content 3: Social field

Standard 1: A positive attitude towards early childhood social education, including respect, understanding and care for childhood, and appreciation of multicultural and social diversity.

Standard 2: Master the pedagogical content knowledge of early childhood social education, including teaching content knowledge, teaching object knowledge and teaching strategy knowledge.

Standard 3: Design educational activities and courses that promote early childhood's social learning and emotional development. Include activities for social skills training, cultural cognition and social responsibility cultivation.

Standard 4: Be able to effectively implement social education activities in simulated or real teaching environments, and be able to evaluate and reflect on the activities.

Content 4: Science Field

Standard 1: Correctly understand early childhood science education and understand the role and importance of science education in early childhood development.

Standard 2: Master the pedagogical content knowledge of early childhood science education, including teaching content knowledge, teaching object knowledge and teaching strategy knowledge.

Standard 3: Design educational activities in the field of science for early childhood, including scientific experiments, observations, production, and mathematical activities.

Standard 4: Be able to implement scientific education activities in simulated or actual teaching environments, and reflect on and optimize these activities.

Content 5: Art Field

Standard 1: Correctly understand the importance of art education in early childhood development, including the role of art in promoting childhood's creativity, aesthetics and cultural understanding.

Standard 2: Master the pedagogical content knowledge of early childhood art education, including teaching content knowledge, teaching object knowledge and teaching strategy knowledge.

Standard 3: Design educational activities and courses that promote early childhood art exploration and creative expression. Including painting, handicrafts, music games and simple dance suitable for early childhood childhood of different ages.

Standard 4: Be able to effectively implement arts education activities in simulated or actual teaching environments, and be able to evaluate and reflect on the

activities and provide constructive feedback.

2.1.4 Early childhood pre-service teachers quality

Early childhood pre-service teachers:

2.1.4.1 Master the relevant theoretical knowledge of early childhood education, including pedagogy, psychology theory, and relevant theories of subject teaching in the five major fields of health, language, society, science, and art.

2.1.4.2 Understand the learning characteristics of young childhood and be able to correctly analyze the basic level of young childhood. Including health status, language foundation, social skills, scientific exploration, artistic expression, and the basic principles of early childhood education, including child-centered, game-oriented, developmental suitability, and comprehensiveness.

2.1.4.3 Formulate appropriate teaching goals based on the basic level of young childhood and early childhood teaching theory to promote the development of early childhood childhood. Including curriculum goals in the five major fields of health, language, society, science, and art.

2.1.4.4 Be able to choose appropriate teaching content according to teaching goals and the development level of young childhood, and choose teaching content that can stimulate childhood's interest and meet their development stage.

2.1.4.5 Be able to flexibly use different teaching strategies according to the teaching content and the characteristics of young childhood, including direct teaching, inquiry learning, and gamification learning. Design teaching activities that meet the development needs of young childhood, including collective activities, group activities, and individual guidance. Ensure that teaching activities are interactive, interesting, and educational, and can stimulate childhood's participation and exploration.

2.1.4.6 Be able to create a safe, healthy and inspiring learning environment, be able to adjust the environment layout according to teaching needs, and be able to prepare teaching materials and resources that stimulate childhood's interest and are in line with their development stage.

2.1.4.7 Be able to master the methods of evaluating childhood's learning progress and teaching effectiveness. Be able to reflect on your own teaching practice, identify your strengths and areas for improvement. Improve your own teaching skills through further learning and practice.

2.1.5 Learning standard indicators of early childhood pre-service teachers' lesson design

Content 4: Science Field

Standard 1: Correctly understand early childhood science education and the role and importance of science education in early childhood development. The basic information is shown in Table 1.

Table 1 Science field standards 1

Indicator	What Learners Learn	What Learners Can Do
1. Definition of Early Childhood Science Education	The definition of early childhood science education	State the definition of early childhood science education
2. Role of Early Childhood Science Education	The role of early childhood science education	State the role of early childhood science education
3. Significance of Early Childhood Science Education	The significance of early childhood science education	State the significance of early childhood science education

Source : Zhao Ting (2025)

Standard 2: Master the pedagogical content knowledge of early childhood science education, including teaching content knowledge, teaching object knowledge and teaching strategy knowledge. The basic information is shown in Table 2.

Table 2 Science field standards 2

Indicator	**What Learners Learn**	**What Learners Can Do**
Content Knowledge of Early Childhood Science Education	Teaching content of early childhood science education	Understand the content of early childhood science education
Knowledge of Teaching Objects in Early Childhood Science Education	Teaching objects of early childhood science education	Master the characteristics and developmental rules of teaching objects in early childhood science education
Knowledge of Teaching Strategies in Early Childhood Science Education	Teaching strategies of early childhood science education	Understand the teaching methods of early childhood science education

Source : Zhao Ting (2025)

Standard 3: Design lesson in the field of science for early childhood, including scientific experiments, observations, productions, and mathematical activities. The basic information is shown in Table 3.

Table 3 Science field standards 3

Indicator	What Learners Learn	What Learners Can Do
1. Design Early Childhood Observation-Based Science Education Courses	Goals, content, and methods of early childhood observation-based science education courses	Design early childhood observation-based science education courses
2. Design Early Childhood Experiment-Based Science Education Courses	Goals, content, and methods of early childhood experiment-based science education courses	Design early childhood experiment-based science education courses
3. Design Early Childhood Creation-Based Science Education Courses	Goals, content, and methods of early childhood creation-based science education courses	Design early childhood creation-based science education courses
4. Design Early Childhood Mathematics-Based Science Education Courses	Goals, content, and methods of early childhood mathematics-based science education courses	Design early childhood mathematics-based science education courses

Source : Zhao Ting (2025)

Standard 4: Ability to implement science education activities in simulated or actual teaching environments and reflect on and optimize these activities. The basic information is shown in Table 4.

Table 4 Science field standards 4

Indicator	What Learners Learn	What Learners Can Do
1. Implement Early Childhood Science Education in Simulated or Real Situations	Implementation of early childhood science education	Implement early childhood science education in simulated or real situations
2. Evaluate and Optimize Early Childhood Science Education	Evaluation and optimization of early childhood science education	1. Evaluate early childhood science education courses2. Reflect on and optimize early childhood science education courses

Source : Zhao Ting (2025)

2.1.6 History and current situation of early childhood pre-service teachers

Early childhood pre-service teachers refer to individuals who are receiving education and training to become kindergarten teachers. They need to go through a series of learning and practice processes before becoming qualified kindergarten teachers. According to the latest regulations, this learning and practice is completed in colleges and universities at the junior college level and above, and is currently mainly in kindergarten teacher training colleges, and its major is called early childhood education. There are currently 94 early childhood teacher training colleges in the country, accounting for 76%. In terms of enrollment, the enrollment of kindergarten teacher training colleges nationwide accounts for 96%. Since 2020, the number of students majoring in early childhood education has been expanded nationwide, reflecting the country's emphasis on early childhood education.

Table 5 Number of schools nationwide enrolling students majoring in early childhood education

Year	Higher Vocational Colleges of Early Childhood Education	Comprehensive Universities	Normal Universities	Proportion (%)
2019	51	13	40	49%
2020	51	19	36	48%
2021	94	18	23	70%
2022	94	10	19	76%
2023	94	10	20	76%

Source : Zhao Ting (2025)

Table 6 Number of Students Enrolled in Early Childhood Education Nationwide

Year	Total Number of Students	Higher Vocational Colleges of Early Childhood Education	Proportion (%)
2019	28,680	25,500	89%
2020	43,386	40,086	92%
2021	50,400	47,940	95%
2022	44,980	43,240	96%
2023	45,098	43,298	96%

Source : Zhao Ting (2025)

Table 7 Number of Kindergartens, childhood Receiving Early Childhood Education, and Teachers Nationwide

Year	Number of Kindergartens	childhood Receiving Early Childhood Education	Number of Teachers	Teacher-Child Ratio
2019	281,200	47,138,800	2,763,100	1:18
2020	291,700	48,182,600	2,913,400	1:17
2021	295,000	48,052,100	3,500,000	1:14
2022	289,200	46,275,500	3,244,200	1:14
2023	274,400	40,929,800	3,073,700	1:13

Source : Zhao Ting (2025)

Table 8 Student-Teacher Ratio in Early Childhood Education Colleges Nationwide

Year	Number of Early Childhood Education Students	Number of Teachers	Student-Teacher Ratio
2019	25,500	51	1:22
2020	40,086	51	1:31
2021	47,940	94	1:30
2022	43,240	94	1:25
2023	43,298	94	1:24

Source : Zhao Ting (2025)

According to educational information, the Early Childhood Education Teaching and Research Section analyzed the current early childhood education and found that:

2.1.6.1 From the perspective of market demand, the demand for early childhood teachers nationwide is far from enough. According to the relevant provisions of the "Standards for the Staffing of Kindergarten Teachers (Trial)" promulgated by our country, the ratio of full-time kindergarten teachers to early childhood teachers reaches the standard of 1:7 to 1:9. According to the data from 2019 to 2023, although the teacher-student ratio in kindergartens is constantly improving, it is still far from the standard. It can be seen that there are far from enough early childhood teachers nationwide.

2.1.6.2 From the perspective of national policies, the country needs high-quality early childhood teachers. The "14th Five-Year Plan for the Development and Promotion of Preschool Education" issued by the Ministry of Education and other nine departments proposed the goal of improving the level of universal accessibility of preschool education, as well as measures such as strengthening the staffing and supplementation of kindergarten teachers and the salary and benefits guarantee system. As well as a series of documents promulgated by the state, such as the "Standards for the Certification of Preschool Education Majors" and the "Standards for the Professional Competence of Teachers of Normal Students in Preschool Education Majors (Trial)", they all show the country's determination to develop pre-service training for early childhood teachers.

2.1.6.3 In terms of finance, the state allocates funds to promote the training of pre-service teachers for early childhood. The state allocates 12,000 yuan per student each year, which is used for technical facilities construction and teaching quality improvement. These investments help improve teachers' professional capabilities and promote the sustainable development of inclusive preschool education. In addition, the state has also issued the "Special Management Measures for Central Budget Investment in Education Power Infrastructure Construction Project (Public Training Base Direction)", which further clarified the financial support for the construction of

educational infrastructure, including the construction of public training bases, to enhance the basic capabilities of vocational skills training.

2.1.6.4 In terms of technology, the state is also promoting the digitalization of education. Through the "Action Plan for Deepening the Reform of Basic Education Curriculum Teaching", it emphasizes the construction of a new teaching and learning model in a digital context to improve teaching efficiency and quality. However, the information literacy of teachers in normal colleges needs to be improved.

2.1.6.5 From the perspective of school type, early childhood normal colleges dominate. In 2021, my country promulgated the latest version of the Vocational Education Catalog, canceling the preschool education major in the field of secondary vocational education and replacing it with a childcare major. That is to say, starting from 2022, the training level of preschool teachers in my country will be upgraded to college and above, and the training of preschool teachers at the technical secondary school level will become history (Liu Qu, Li Guoqiang, Yang Jie, Xu Shanshan, Cai Fei, 2023). Therefore, in terms of quantity, the number of early childhood normal colleges in my country will increase to 94 in 2021. As a national public college, it is guaranteed in terms of structural stability, infrastructure, enrollment, and fund preparation. However, since most colleges have just been upgraded, their school philosophy, institutional management, teaching quality, and teacher quality still need to be improved.

2.1.6.6 In terms of production and service. Early childhood normal colleges train early childhood pre-service teachers for the society. However, according to research, the practical ability of early childhood pre-service teachers who graduated from early childhood normal colleges is still insufficient.

2.1.6.7 From the management perspective, managers lack experience. Administrative managers do not understand most education and teaching well, and lack experience in managing schools, because most managers are transferred from government departments.

2.1.6.8 From the perspective of teachers, there is a shortage of teachers and their teaching level is limited. According to the data, the teacher-student ratio of early childhood education majors in 2023 is 1:24. According to the national requirements for normal education, the teacher-student ratio must be below 1:17 so that teachers can have enough time to complete their teaching tasks. Teachers spend less time in kindergartens and lack teaching experience. There are not many professional teachers, and many teachers are not majoring in early childhood education and do not have enough time to study. This is because teachers have heavy teaching tasks and many other tasks besides teaching.

2.1.6.9 From the perspective of resources, although most schools are equipped with better equipment, sufficient books and network resources, their utilization rate is very low. This is because students do not know how to use these resources to improve their own abilities.

From the above teaching environment, factors such as teacher level, resource

utilization, and school management have affected higher normal colleges, thereby affecting the training of early childhood pre-service teachers. The specific problems are:

(1) Management problems. Since many early childhood normal colleges have just expanded their scale and improved their quality, school managers are inexperienced and do not understand teaching well, resulting in unreasonable work arrangements. Secondly, there are a large number of students in each class, and there is insufficient attention to students in teaching management, and teachers do not have enough time to guide students in practice.

(2) Teachers. There are not enough teachers, the ratio of teachers to students does not meet the requirements, and teachers have too much extra work. Secondly, the teaching level of teachers is not enough. Many teachers are not majoring in early childhood education, have little time to go to kindergarten, do not understand early childhood education enough, and lack practical experience.

(3) Resource utilization issues. The school has sufficient resources, but the utilization rate is not high. Such as teaching equipment, network resources, etc. Many schools have hardware equipment such as training rooms and micro classrooms, but because students have limited skills in using these equipment and teachers do not have enough time to guide students, the utilization rate of these classrooms is not enough. In terms of network resources, the school has resource libraries, case libraries and online teaching guidance software resources, but because students and teachers have limited information technology, the utilization rate of these resources in teaching is not enough.

Early childhood pre-service teachers are trained in early childhood normal colleges, and their major is early childhood education. At present, there are 94 early childhood normal colleges in China, and there are 4 early childhood normal colleges in Sichuan Province. A total of 10,205 students were enrolled in five years, accounting for 96.3% of early childhood education students in Sichuan Province, and it is the main institution for the training of early childhood pre-service teachers in the province. Table 9 shows the number of students in the four schools over a five-year period.

Table 9 Enrollment in Early Childhood Education Programs at 4 Early Childhood Normal Colleges in Sichuan Province (2019–2023)

School	2019	2020	2021	2022	2023	Total
Southern Sichuan Vocational College of Early Childhood Education	913	535	433	410	360	2,651
Northern Sichuan Vocational College of Early Childhood Education	522	599	550	414	403	2,488
Sichuan Vocational College of Early Childhood Education	368	426	385	492	345	2,016
Xichang National Vocational College of Early Childhood Education Childhood Education	601	814	668	402	565	3,050
Total	2,404	2,374	2,036	1,718	1,673	10,205

Source : Zhao Ting (2025)

Table 10 Graduates and Kindergarten Teacher Qualification Exam Pass Rates at 4 Early Childhood Normal Colleges in Sichuan Province (2021–2023)

Year	**Metric**	**Southern Sichuan College**	**Northern Sichuan College**	**Sichuan College**	**Xichang National College**	**National Average Pass Rate**
2021	Graduates	650	760	320	451	71.13%
	Qualified Kindergarten Teachers	201	281	106	153	
	Pass Rate (%)	31%	37%	33%	34%	
2022	Graduates	907	520	361	601	74.54%
	Qualified Kindergarten Teachers	302	198	115	222	
	Pass Rate (%)	33%	38%	32%	37%	
2023	Graduates	528	587	410	799	76.56%
	Qualified Kindergarten Teachers	191	246	147	304	
	Pass Rate (%)	36%	42%	36%	38%	

Source : Zhao Ting (2025)

It can be seen from the table that the passing rates of the teacher qualification certificates of the four schools were very low within three years, lower than the national average.

Table 11 Facilities in 4 Early Childhood Normal Colleges in Sichuan Province (2023)

School	Classrooms (Multimedia)	Training Rooms	Microteaching Rooms	Affiliated Kindergartens	Practice Bases
Southern Sichuan Vocational College	127	24	11	1	200
Northern Sichuan Vocational College	200	32	18	3	179
Sichuan Vocational College	172	20	27	2	121
Xichang National Vocational College	186	43	32	1	147

Source : Zhao Ting (2025)

As shown in Table 11, the four schools all have a certain number of classrooms (equipped with multimedia equipment), training rooms, micro classrooms, affiliated kindergartens and training bases, which can meet normal teaching and practice needs.

Table 12 Student and Faculty Numbers in 4 Early Childhood Normal Colleges in Sichuan Province (2023)

School	Total Students	Students Learning Curriculum Design	Faculty (Total / Professors & Associate Professors)	Faculty Teaching Curriculum Design (Total / Professors & Associate Professors)
Southern Sichuan Vocational College	1,203	843	140 / 40	7 / 2
Northern Sichuan Vocational College	1,367	964	127 / 47	6 / 1
Sichuan Vocational College	1,222	877	105 / 32	6 / 1
Xichang National Vocational College	1,635	1,070	147 / 52	7 / 1

Source : Zhao Ting (2025)

As can be seen from Table 12, the number of teachers in the four schools is

insufficient and the quality is not high. In particular, there are very few teachers teaching early childhood curriculum design, which shows that the teachers have a heavy teaching workload and their professional level needs to be improved.

To summarize the above conclusions:

Low pass rate: The pass rate of kindergarten teacher qualification examination in these colleges is still lower than the national average, indicating the need to strengthen teacher training programs.

Adequate facilities: All four colleges have adequate facilities, including multimedia classrooms, training rooms and internship bases, to support education and training needs.

Faculty challenges: The number of teachers teaching early childhood curriculum design is limited, and the ratio of professors to associate professors is low, which affects the teaching quality.

2.2 Lesson Design Ability

2.2.1 Meaning of Lesson Design Ability

The definition of lesson design ability varies internationally:

Pedagogical Design Capacity (PDC):This refers to teachers' ability to use and manipulate curriculum materials to complete specific classroom tasks (Brown, 2009). PDC emphasizes teachers' capacity to identify and utilize available resources to create learning environments for students, including internal and external resources. Internal resources primarily refer to teachers' personal resources, such as teaching beliefs, subject knowledge, and pedagogical knowledge. External resources mainly refer to teaching materials. PDC enables teachers to engage in lesson design activities through two key actions: perceiving and mobilizing existing resources (personal and curricular) to create instructional segments (Pea, 1993; Ball & Cohen, 1999; Brown, 2002; Brown & Edelson, 2003; Brown, 2009). PDC is described as "the productive ability to mobilize curriculum resources… to perceive the affordances of curriculum materials and make decisions about how to use them to create instructional segments to achieve... objectives" (Brown, 2009). PDC views teaching as a design activity and considers how teachers use resources to develop classroom instruction and learning experiences that support students (Knight-Bardsley & McNeill, 2016). In summary, PDC corresponds to lesson design ability as the capability of perceiving and mobilizing existing resources to create instructional environments to achieve teaching objectives.

Instructional Design Expertise: This refers to the professional skills of instructional designers, characterized not only by content knowledge but also by the flexible application of principles for instructional delivery, communication, and content representation (Hardré, 2003). Instructional expertise also includes understanding students, recognizing their learning difficulties, addressing misconceptions, and employing effective strategies to help students achieve academic success (Hatano, 1990). The essence of instructional design expertise lies in developing flexible adaptive

skills, enabling designers to identify core problem features and apply appropriate design principles to create unique, need-driven solutions for new instructional tasks. This aligns with the concept of "adaptive expertise," which is critical for successful teaching and learning. Adaptive expertise also involves metacognition, which is the ability to monitor one's methods for problem-solving.

Instructional Design Competency: From the perspective of competency theory, instructional design competency is defined as the stable and lasting series of individual performance behaviors exhibited during the completion of teaching tasks, closely related to professional knowledge, skills, and attitudes. In 2001, the International Board of Standards for Training, Performance, and Instruction (IBSTPI) published the third edition of Instructional Design Competency Standards, categorizing design competency into four dimensions: foundational planning and analysis, design and development, implementation, and management (Richey, Fields, & Foxon, 2001). IBSTPI revised these standards in 2013, defining instructional design competency as the ability to demonstrate professional knowledge, skills, and emotional attitudes necessary for fulfilling teaching tasks. Instructional design competency extends beyond course or product development and encompasses problem-solving skills and processes. It applies to formal education, workplace training, and continuing education. IBSTPI divides instructional design competency into five domains—professional foundations, planning and analysis, design and development, evaluation and implementation, and management. These five domains include 22 competency standards, classified into basic, advanced, and managerial levels, comprising 105 specific indicators.

In China, lesson design ability has been defined in four main ways:

As the ability to analyze and solve teaching problems using resources:

Scholars such as Liu Zhiping, Liu Meifeng, and L üJinjiao (2009) define lesson design ability as the capacity to use systematic methods to analyze teaching problems, design solutions, evaluate their effectiveness, and make modifications. Others, like Chen Wei (2013), view lesson design ability as the practical ability to analyze and solve teaching problems. Ma Yongshuang defines it as the ability to identify and organize resources for inquiry-based teaching and create learning environments for students. This perspective emphasizes the use of resources and problem-solving in teaching.

As the ability to plan and refine teaching plans:Luo Xiaoduan (2012) defines lesson design ability as the ability to propose specific teaching plans for a lesson or issue. He Hongyan (2023) describes it as the ability of pre-service teachers to analyze, design, and refine teaching plans using acquired knowledge, skills, and values. Others, like Yue Zengcheng (2019), consider it the comprehensive use of knowledge, skills, and beliefs to plan teaching objectives, content, strategies, and methods to develop teaching plans.

As the ability to plan and arrange the entire teaching system: Ye Hong (2021) defines lesson design ability as the capacity to systematically plan and arrange the teaching process to achieve specific teaching goals, including background analysis, goal setting, media selection, process design, and evaluation. This approach focuses on

the entire teaching process.

As a reflection of personal qualities: Liu Xinyang (2016) views lesson design ability as a complex structure composed of declarative teaching knowledge, practical teaching knowledge, and broad teaching beliefs, reflecting high individuality, tacit knowledge, and context dependence. It encompasses professional knowledge, teaching skills, and psychological qualities.

Both the IBSTPI concept of instructional design competency and the Chinese perspective of lesson design ability (teacher's instructional design competency) share similarities. Both regard lesson design ability as a professional capacity involving knowledge, skills, beliefs, and psychological attributes, reflecting both teaching practices and internal cognition.

In research on early childhood teachers' lesson design ability, two interpretations emerge:

Practical Perspective: Scholars such as Li Jimei and Xiao Xiangning (1997) define early childhood lesson design ability as teachers' ability to plan and implement teaching activities in alignment with teaching objectives and principles. Others, such as Zhu Jiaxiong (2003), describe it as structured teaching activities organized by teachers for young childhood.

Competency Perspective: The Professional Standards for Kindergarten Teachers (2012) outline professional abilities, including lesson design as a critical component. It emphasizes understanding childhood's developmental needs, selecting appropriate content and methods, and planning educational activities to support childhood's growth effectively.

Based on Brown's (2009) Pedagogical Design Capacity (PDC), which emphasizes teachers' ability to utilize and adapt curriculum resources, Hardré's (2003) concept of Instructional Design Expertise, which highlights adaptability and flexibility in teaching, and IBSTPI's (2013) definition of Instructional Design Competency, which conceptualizes instructional design as a comprehensive professional ability, along with Liu Zhiping et al.'s (2009) definition of lesson design ability as the capacity to utilize teaching resources and solve instructional problems, the researcher defines:

Lesson Design Ability is the ability of teachers to plan plan, organize, and implement instruction by integrating Pedagogical Content Knowledge (PCK) and Lesson Design Skills based on teaching objectives and learners' characteristics to optimize learning outcomes. In the context of pre-service early childhood teacher education, lesson design ability requires not only professional knowledge but also the capacity to flexibly respond to childhood's developmental needs, systematically plan and implement educational activities, and facilitate childhood's holistic development. Therefore, this ability is not only a crucial component of teachers' professional competence but also a key factor in ensuring effective teaching practices.

2.2.2 Composition of Lesson Design Ability

Based on its definition, lesson design ability encompasses two main aspects: Pedagogical Content Knowledge and lesson design skills. These two dimensions form the structure of lesson design ability and will be analyzed below.

2.2.2.1 Pedagogical Content Knowledge (PCK)

Pedagogical content knowledge serves as the foundation for early childhood educators' lesson design ability. There is extensive domestic and international research on teacher knowledge. In 1986, Shulman, considering the state of educational research in the United States at the time, first proposed the concept of Pedagogical Content Knowledge (PCK). Shulman defined PCK as a form of knowledge embedded within subject matter knowledge and inherently related to teaching. It is a type of subject knowledge that is most "teachable" and represents a unique integration of a teacher's personal teaching experiences, subject content, and pedagogy (Shulman, 1986).

PCK includes common educational topics within a subject, the best methods for teachers to convey ideas, and the most effective representations to aid student understanding, such as analogies, diagrams, demonstrations, examples, and explanations. It also includes teachers' understanding of the challenges students face with specific topics, their misconceptions, and strategies to address these misunderstandings. Teachers are expected to guide the organization, presentation, and adaptation of specific topics, questions, and arguments to suit students with different interests, abilities, and backgrounds, helping them comprehend content in personally meaningful ways (Shulman, 1987). Thus, PCK represents the knowledge necessary for effectively teaching a subject, rather than the subject knowledge itself.

Magnusson (2002) and Park (2008) summarized PCK using the "PCK Pentagonal Model," which includes five core components: scientific teaching orientation, knowledge of scientific curricula, knowledge of students, knowledge of teaching strategies, and knowledge of scientific assessment. The National Council for Accreditation of Teacher Education (NCATE, 2009) defined teachers' pedagogical knowledge as the knowledge formed through the interaction between subject content knowledge and effective teaching strategies. This knowledge enables teachers to promote effective student learning, requiring a thorough understanding of the subject content, students' cultural backgrounds, prior knowledge, and experiences, and the ability to utilize diverse teaching methods (Diane, 2009).

Many Chinese scholars have applied the PCK framework to study teachers' professional knowledge. Yue Dingquan (2009) defined teachers' pedagogical knowledge as a comprehensive knowledge system oriented towards teaching practice. It involves effectively representing, organizing, and presenting specific teaching topics based on subject knowledge, general teaching methodologies, and broader knowledge bases to facilitate students' learning. Ma Min (2011) described PCK as a specialized pedagogical understanding that helps students learn subject-specific content knowledge.

This understanding bridges the gap between childhood and subject knowledge, emphasizing the generative and open nature of students' learning experiences. Ma stressed the concepts of "curriculum" and "childhood," asserting that PCK is not just a pedagogical practice but a form of curriculum practice.

Research on the role of PCK in kindergarten teachers' professional knowledge has also been abundant. Tang Jieying (2013) explored PCK in early childhood education by examining subject-specific teaching knowledge in language, mathematics, and arts. Tang categorized this knowledge into three parts: knowledge of teaching content, knowledge of learners, and knowledge of teaching methods. Ouyang Yanni (2017) used this framework to classify subject-specific teaching knowledge in kindergarten science education into four dimensions: teaching goals, teaching content, teaching methods, and teaching assessment. Hu Jiuhua (2022) applied this model to analyze the knowledge structure within chemistry teaching design for pre-service teachers, categorizing it into five dimensions: principles, teaching content, student learning, teaching strategies, and teaching assessment.

This study adopts Ouyang Yanni's PCK framework to divide instructional design knowledge into three dimensions: knowledge of teaching content, knowledge of learners, and knowledge of teaching methods. Veal and Makinster proposed the "Inverted Tree Hierarchical Model," dividing PCK into three levels: General PCK, Domain-Specific PCK, and Topic-Specific PCK. Following this approach and focusing on the practical curriculum of Early Childhood Science Education, this study narrows its scope to instructional design knowledge in the kindergarten science domain.

In China, early childhood education lacks standardized textbooks and curricula. Teachers refer to guiding documents such as the Guidelines for the Learning and Development of childhood Aged 3-6 and the Kindergarten Education Guidelines. Therefore, this study interprets instructional design knowledge by referencing Ouyang Yanni's understanding of PCK dimensions and combining insights from the aforementioned guiding documents for early childhood education.

(1) Knowledge of Teaching Content

The knowledge of teaching content focuses on "what to teach." This encompasses the specific facts, perspectives, principles, and issues within a subject, as well as how to address them. In terms of teaching content, educators should possess general teaching content knowledge, subject-specific teaching content knowledge, and teaching content knowledge related to specific topics or themes in the field of early childhood science education (Ouyang Yanni, 2022).

a. General Teaching Content Knowledge

General teaching content knowledge refers to the understanding of teaching content derived from curriculum and pedagogy. Teachers should recognize that selecting teaching content involves aligning educational values and curriculum goals, selecting curriculum elements from subject knowledge, contemporary societal experiences, or learners' experiences. This includes knowledge of pedagogy, curriculum theory, an overview of knowledge systems, teaching objectives, beliefs,

social and cultural knowledge, and specific contextual knowledge.

In the context of early childhood science education, general teaching content knowledge includes knowledge of preschool education theories, kindergarten curriculum knowledge, the knowledge system of early childhood education, and the teaching objectives of kindergartens.

b. Subject-Specific Teaching Content Knowledge

Subject-specific teaching content knowledge pertains to understanding the subject itself, including its components, structure, and nature. Early childhood educators must recognize that the teaching content in early childhood science education is rooted in young childhood's age-specific characteristics and daily life experiences. Unlike advanced scientific concepts, it focuses on holistic perceptions and understanding of the living world, material world, Earth and space sciences, and science and technology. Based on the interpretation of the Guidelines for the Learning and Development of childhood Aged 3-6 and the Kindergarten Education Guidelines, the content of early childhood science education can be categorized as follows:Life Sciences: This includes topics on common animals, plants, and human biology. Material Sciences: This covers everyday materials, physical phenomena, and chemical phenomena. Earth and Space Sciences: Topics include weather, seasons, the sun, moon, stars, soil, rocks, wind, clouds, rain, snow, fog, and other natural phenomena observed in the environment. Science and Technology: This involves exploring technological products encountered in daily life and engaging in simple, safe science experiments or creations. Mathematics: This covers numbers and quantities, shapes and space, classification and sorting, time, and measurement.

c. Knowledge of Specific Topics or Themes

This level focuses on specific knowledge points within a subject, including concepts, principles, and facts. The teaching content in early childhood science education revolves around designing activities on themes like life sciences, material sciences, Earth and space sciences, science and technology, and mathematics. Each specific educational activity addresses a unique topic or theme. Therefore, beyond general teaching content knowledge and subject-specific teaching content knowledge, educators must have a precise understanding of scientific phenomena and principles related to a specific theme or topic. For instance: In life sciences, teachers should understand the characteristics, structure, diet, reproduction, and habitats of animals. They should know how animals grow, move, and change over time, and be familiar with plants, including roots, stems, leaves, flowers, fruits, and seeds. They should understand the conditions necessary for plant growth and their uses, the structure of the human body (e.g., bones, muscles), and concepts like environmental pollution and human-nature interactions. In material sciences, teachers should understand that water is a transparent, colorless, and odorless liquid existing in solid, liquid, and gas forms. They should know its solubility properties, ability to float objects, and importance as a resource. Teachers must also introduce concepts like air (its necessity for life, flow, and how it forms wind), soil properties, the utility of land for plant growth, and phenomena

like motion, light and shadow, temperature, sound, electricity, and magnetism. For example, they should explain the transmission of sound, the dangers of noise, the sources and uses of electricity, and the properties of magnets. In Earth and space sciences, teachers should discuss topics like weather, seasons, celestial bodies (sun, moon, stars), and phenomena related to Earth. For example, they should teach childhood the names of the four seasons, their cycles, and the effects of the sun. In science and technology, teachers should introduce technological products in daily life and guide childhood in creating simple and safe scientific projects. In mathematics, teachers should develop childhood's understanding of basic mathematical concepts and cultivate their interest in and initial mathematical thinking skills. This includes recognizing numbers up to 10, understanding their relationships with quantities, comparing sizes and quantities, and recognizing common shapes (e.g., circles, squares, triangles) and spatial relationships (e.g., up/down, front/back, left/right). childhood should also learn the sequence of a day (morning, noon, night) and seasonal changes, understand ordering and sorting by attributes like size or weight, and practice simple arithmetic operations (e.g., 1+1=2) through hands-on activities. Teachers can also encourage childhood to observe patterns, measure using non-standard units, and explore concepts of money through basic transactions.

By mastering knowledge at all three levels-general, subject-specific, and topic-specific-teachers can effectively design and implement science education activities for young childhood, ensuring their engagement and comprehensive understanding of the world around them.

(2) Knowledge of the Learners

In teaching practice, knowledge of the learners focuses on "whom to teach." Teachers need to understand the characteristics of their students, the challenges they may face in understanding certain subjects, their prior learning experiences, and how to evaluate their progress. Addressing these issues requires a comprehensive understanding of learners, including their understanding and misconceptions of specific subjects, prior knowledge, learning experiences, and evaluation methods. Based on the hierarchical framework, this knowledge encompasses: Knowledge of learners' general characteristics, Knowledge of learners' age-specific characteristics, and Knowledge of unique individuals or groups, such as a particular class or an individual student.

a. Knowledge of Learners' General Characteristics

Learners in early childhood education are young childhood. Teachers need to understand their general age-related developmental characteristics, including physical and psychological growth, as well as general principles of cognition and learning. This requires foundational knowledge in psychology, such as general psychology, developmental psychology, and cognitive psychology.

b. Knowledge of Learners' Age-Specific Characteristics

Human development occurs in stages, with each stage having distinct age-related traits. Once teachers identify the developmental stage of their learners, they should make an effort to study the characteristics of learners at that stage. Early

childhood is a critical period for human development, during which physical and intellectual growth occurs rapidly. childhood exhibit physiological developmental characteristics, such as changes in height, weight, skeletal development, and muscle system growth. They also show psychological developmental traits related to their senses, memory, emotions, attention, will, and thinking. When conducting science education activities, teachers must be well-acquainted with these age-specific physical and mental developmental characteristics. This allows them to adopt appropriate teaching methods and strategies to enhance the effectiveness of educational activities.

c. Knowledge of Unique Individuals or Groups

Science education activities for young childhood are conducted within specific classes and among individual childhood. Teachers must understand the dynamics of their class, including class characteristics, atmosphere, and attitudes toward learning. For individual learners, teachers need to accurately assess their prior knowledge, learning styles, and potential difficulties. Understanding these characteristics allows teachers to provide tailored instruction that suits the needs of the class or individual. For example, a teacher should consider the atmosphere of a specific class and the unique traits of certain students within it. Each student has their own personality, and each age group has its distinct characteristics. Moreover, every class or group has its own unique traits. A teacher should study their class's learning atmosphere and thinking habits in depth. Before teaching, they should predict which topics the class is likely to grasp easily, which topics may present challenges, and which students are stronger or weaker in certain areas. This preparation helps teachers design, implement, and adjust their teaching strategies effectively. Outstanding teachers take this a step further by respecting the individuality of each student and inspiring their potential, ensuring that every learner is supported and encouraged to thrive.

(3) Knowledge of Teaching Methods

Knowledge of teaching methods refers to the "how to teach" aspect of teaching. It can be categorized into three levels: Knowledge of general teaching strategies, Knowledge of teaching strategies specific to a particular subject, Knowledge of teaching strategies suited to specific knowledge points.

a. Knowledge of General Teaching Strategies

Preschool teachers need to possess knowledge of general teaching strategies. These strategies are experiential, derived from both the general principles of educational psychology and teachers' personal accumulation of practical experience. Effective teaching strategies help achieve maximum learning outcomes with minimal time, energy, and resources, making them a crucial factor in determining educational success. Teachers should be familiar with a wide variety of teaching methods, including: Language-based methods: Lecture, discussion, questioning, and guided reading. Visual methods: Demonstration and observation. Practice-based methods: Hands-on exercises and experiments. Emotion-focused methods: Appreciation-based teaching and situational teaching. Inquiry-based methods: Discovery learning.

In addition, teachers should have basic knowledge of teaching

environments and technology. They need to understand the types of physical and psychological environments conducive to learning. For example, in early childhood education, a suitable psychological and physical environment is essential. A safe psychological environment encourages childhood to explore autonomously and deeply, while a rich, engaging physical environment facilitates effective learning. Teachers must be skilled in creating such environments by providing meaningful materials, as childhood's understanding of the world depends on their interactions with it.

b. Knowledge of Subject-Specific Teaching Strategies

For specific subjects, teachers should study, accumulate, and summarize teaching strategies suitable for that subject. Teachers in early childhood science education need to consider factors such as the characteristics and functions of teaching methods, as well as the role of teaching media. Teaching strategies should align with teaching objectives, the characteristics of learners, and the nature of the subject matter. Teachers should combine comprehensiveness, flexibility, and creativity in their use of teaching methods.

According to research by Ouyang Yanni, common teaching methods in early childhood science education include discovery learning, play-based learning, hands-on activities, explanation and demonstration, discussion, and comparison.

c. Knowledge of Teaching Strategies for Specific Knowledge Points

Within a subject, certain knowledge points are better learned through specific teaching strategies. Teachers must be aware of these strategies and how to represent the knowledge effectively.

For instance, when teaching young childhood about geometric shapes, it is more effective to provide concrete objects for them to manipulate and explore. This hands-on approach enables childhood to develop an understanding of geometric shapes through direct experience. In contrast, abstract descriptions, such as “A triangle is a closed figure formed by three connected line segments, with three vertices and three interior angles summing up to 180 degrees,” are not suitable for young learners.

In summary, the pedagogical content knowledge (PCK) in this study, in terms of content, is divided into knowledge of teaching content, knowledge of learners, and knowledge of teaching methods. In terms of levels, it is divided into general knowledge, subject knowledge, and specific subject knowledge. Therefore, the pedagogical content knowledge (PCK) in this study includes:

1) Knowledge of Teaching Content:1.1) General knowledge of teaching content: This includes knowledge of preschool education, kindergarten curricula, the kindergarten knowledge system, and kindergarten teaching objectives. 1.2) Subject-specific teaching knowledge: This refers to teaching knowledge in early childhood science education, including life sciences, physical sciences, Earth and space sciences, technology, and mathematics.1.3) Knowledge of specific themes or content: For instance, within the mathematics theme of early childhood science education, this includes knowledge of number recognition, geometric shapes, understanding spatial relationships, learning about time, mastering sorting and classification, and

measurement.2) Knowledge of Learners:2.1) Knowledge of the general characteristics of learners: For example, understanding the characteristics of childhood aged 3–6 years.2.2) Knowledge of the age-specific characteristics of learners: For instance, understanding the developmental characteristics of childhood aged 3–4 years, 4–5 years, and 5–6 years.2.3) Knowledge of individual learners: This includes recognizing the unique characteristics of different individuals, such as their interests, abilities, and potential.3) Knowledge of Teaching Methods:3.1) General teaching strategies: This includes common methods such as lecture-based teaching, discussion, questioning, and guided reading (language-focused); demonstration and observation (visual-focused); hands-on activities and experiments (practice-focused); appreciation-based and situational teaching (emotion-focused); and discovery learning (inquiry-focused).3.2) Subject-specific teaching strategies: For example, common teaching methods in early childhood science education include discovery learning, play-based learning, hands-on activities, explanation and demonstration, discussion, and comparison.3.3) Teaching strategies for specific knowledge points: Teachers need to understand which teaching strategies are most suitable for specific knowledge points. For instance, when teaching childhood about geometric shapes, it is more effective to provide concrete objects for hands-on manipulation and perception than to describe a triangle abstractly as “a closed shape made up of three connected line segments, with three vertices, three edges, and three internal angles, whose sum is always 180 degrees.”

2.2.2.2 Lesson design skills

Different scholars have made different structural divisions of indicator systems.

In 2000, the American Association for Educational and Communication Technology (AECT) divided instructional design capabilities into the following five dimensions: design, development, application, management, and evaluation. In 2013, IBSTPI divided instructional design capabilities into five major areas: professional foundation, planning and analysis, design and development, evaluation and implementation, and management. There are 22 capability standards and 105 specific indicators in the five areas.

Brown (2002) believes that Curriculum design includes five types of design activity: interpretation, selection, reconciliation, accommodation and modification (Brown, 2002, 2009). Curriculum development is a more encompassing term, including analysis, design, development, implementation and evaluation (Huizinga, Handelzalts, Nieveen & Voogt, 2014).

The five stages of ADDIE proposed by Branch & Kopcha (2014) include a complete system of analysis, design, development, implementation and evaluation.

In 2011, Professor Du Ping of Chongqing Normal University referred to the regulations and rules of the teacher qualification examination system in many regions of China, and proposed seven major types of teaching abilities including lesson

design ability, and proposed six project contents of lesson design ability, including the ability to understand and analyze students, the ability to formulate teaching objectives, the ability to reorganize teaching content, the ability to design teaching processes, the ability to select teaching strategies, and the ability to design flexibly. A total of 19 ability observation points.

Zhang Sipei (2015) summarized the evaluation indicators and methods of the design technology ability of chemistry teachers at home and abroad, and developed a set of dimensional indicators to measure the teaching design technology ability of middle school chemistry teachers, analyzing the mastery of students' knowledge, grasp of curriculum standards, compilation of teaching objectives, reorganization of teaching content, design of teaching process, selection of teaching methods, and flexible technical design quality. Zhang Yuhang (2017) summarized the lesson design ability into seven dimensions, namely, learning situation analysis, teaching goal design, learning environment and resource selection, learning situation creation, teaching content reorganization, and learning activity analysis and evaluation.

Wang Xiao (2019) divided the chemistry lesson design ability into teaching material analysis and processing ability, learning situation analysis ability, teaching goal design ability, teaching process design ability, and teaching strategy selection ability in "Research on the Composition and Current Status of lesson design ability of Middle School Chemistry Teachers", and refined the first-level indicators and proposed 13 second-level indicators.

Zhang Haizhu, Sun Zhongjun, and Yin Miao (2019) used a top-down literature coding method and a bottom-up behavioral event interview text coding method to construct a rural teacher lesson design ability verification model, and divided the lesson design ability into six dimensions: teaching background analysis ability, teaching goal design ability, teaching method design ability, teaching media design ability, teaching process design ability, and teaching design results evaluation ability.

Liu Guixia (2020) based on the coding of existing research. At the same time, combined with years of work experience and online interviews and questionnaires with some famous middle school teachers, proposed that the components of teachers' lesson design ability mainly include five categories: teaching background analysis ability, teaching goal design ability, effective teaching information transmission ability, blackboard design ability, and teaching evaluation ability.

Liao Zhihua (2022) under the guidance of system theory and Bloom's educational goal taxonomy theory, based on the development law of normal students' lesson design ability, combined with the existing lesson design ability indicator system, formulated a lesson design ability evaluation index system for normal students in colleges and universities, including memory, understanding ability, application, analysis ability, reflection, evaluation ability, and innovation (creativity) ability.

From the perspective of lesson plan design, Cang Xiran and Wang Dandan (2018) analyzed the ability to design kindergarten teaching activities from four dimensions: the design of activity goals, the selection of activity content, the use of

activity environment and materials, and the design of activity process. Zheng Longxiang (2020) identified the dimensions of lesson design ability from the perspective of STEM education, including the ability to analyze teaching objects, the ability to select teaching content, the ability to formulate teaching goals, the ability to design teaching processes, the ability to select and utilize teaching methods, the ability to select and utilize resource media, and the ability to evaluate teaching.

Professor Huang Jin (2014) pointed out that the structural elements of teachers' lesson design ability include the prior setting of activity goals, the creation of activity situations, the planning and adjustment of activity processes, the analysis of childhood and their learning needs, the development and utilization of educational resources, and the prediction and evaluation of childhood's behavior.

Professor Gao Jing's analysis of the elements that kindergarten teaching design plans need to have shows that a complete collective teaching activity design plan should include activity names, activity goals, activity preparations, activity organization and implementation processes, and activity extensions.

Kong Fengxia (2021) divides kindergarten lesson design skill into six dimensions: learning situation analysis skill, activity goal setting skill, activity content selection skill, activity preparation skill, activity implementation planning skill, and evaluation and reflection skill.

(1) Learning situation analysis skill refers to the ability of kindergarten teachers to analyze factors that affect childhood's meaningful learning through their own experience and value judgment or through external methods and means in kindergarten teaching design. Its connotation analysis mainly includes two aspects-on the one hand, it is the ability to analyze the basic situation of the childhood themselves, and on the other hand, it is the ability to analyze the degree of conformity between kindergarten teaching activities and childhood's development.

(2) Activity goal setting skill is the ability to analyze and integrate the basis for goal setting and specific operations. Its connotation mainly includes scientific analysis of the basis for setting activity goals and standardized expression of activity goal statements.

(3) Activity content selection skill refers to the ability to plan and select the scope of activity content based on certain selection principles. Its connotation includes content selection principles and activity content scope. Overall, the content selection of kindergarten education is very extensive, including all aspects of childhood's lives, which makes it challenging for teachers to choose appropriate content.

(4) Activity preparation skill refers to the pre-planning ability of kindergarten teachers to develop and select materials, conditions, etc. of experience and materials. It is reflected in the design of evoking and retrieving experience and creating, selecting and utilizing material materials.

(5) The implementation planning skill of teaching activity design refers to the ability of kindergarten teachers to provide strategies, methods, and other aspects for the various parts of the activity process with the purpose of ensuring the natural and

smooth progress of the teaching process and achieving the teaching objectives.

(6) The skill to evaluate and reflect on teaching activities is divided into two parts. The ability to evaluate teaching activity design refers to the ability of kindergarten teachers to make value judgments on the entire process of teaching activity design. Teaching activity reflection is the analysis of the effectiveness of kindergarten teachers' own teaching activity design and implementation and the effectiveness of childhood's learning.

It can be seen that both domestic and foreign countries divide the dimensions according to the design process and the steps of teaching implementation. And both domestic and foreign countries recognize the complete system of analysis, design, development, implementation, and evaluation. But the difference is that the subjects of lesson design at home and abroad are different. Foreign countries target teaching designers. Therefore, the focus is also different.

Based on the Professional Standards for Kindergarten Teachers and the content and standards of the curriculum, this study divides lesson design skills into two dimensions: teaching design knowledge and lesson design skills. Based on the division of the lesson design process structure by many scholars, six secondary dimensions are identified: learning situation analysis skills, teaching goal design skills, teaching content selection skills, teaching preparation skill, planning lesson implementation skills, and lesson evaluation and reflection skill.

This study, based on the Professional Standards for Kindergarten Teachers as well as the content and standards of the curriculum, categorizes lesson design ability into two dimensions: pedagogical content knowledge and lesson design skills. Furthermore, drawing from various scholars' classifications of lesson design processes, six sub-dimensions are identified: learner analysis skill, lesson goal-setting skill, lesson preparation skill, lesson content selection skill, lesson implementation planning skill, and lesson evaluation and reflection skill.

Learner analysis skills refer to a teacher's ability to analyze factors that influence childhood's learning. This includes analyzing childhood's basic conditions and assessing the relationship between learning materials and child development.

Lesson goal-setting skill involve the ability to design lesson objectives that align with childhood's development. The criteria for these goals include comprehensiveness, specificity, feasibility, and age appropriateness. This skill primarily entails the scientific analysis of goal-setting foundations and the standardized expression of curriculum objectives.

Lesson preparation skill refer to a teacher's ability to plan and select both experiential and material resources in advance. This is reflected in the activation and retrieval of prior knowledge, as well as the design, selection, and utilization of physical learning materials.

Lesson content selection skills involve selecting appropriate teaching content for childhood based on lesson objectives. This includes determining content selection principles and defining the scope of learning activities.

Lesson implementation planning skill refer to a kindergarten teacher's ability to ensure a smooth and effective teaching process that meets instructional goals. This involves planning suitable strategies, methods, and guiding language for different parts of the lesson.

Lesson evaluation and reflection skill consist of two aspects: evaluation and reflection. Lesson evaluation skill involve making value judgments about the entire curriculum process, while; esson reflection skill refer to a teacher's ability to assess the effectiveness of lesson design and implementation, as well as the impact on childhood's learning, in order to propose improvements.

2.2.3 How to Improve Lesson Design Ability

In 2005, Hardré, a scholar in the field of instructional design in the United States, proposed the IDE model of instructional design capability development. Hardré argued that the expertise of instructional design professionals involves three dimensions: expert thinking, design practice, and design products. She primarily studied the differences between novice instructional designers and experts across these three dimensions and constructed a model for instructional design capability development. This model describes the progression from novice to expert in instructional design in terms of thinking, practice, and product development, influenced by knowledge, skills, and metacognitive reflection. This means that growth is driven not only by increased knowledge and skills in instructional design but also by designers' deep reflection on their design ideas, practices, and products. Such reflection effectively promotes the development of expertise in instructional design, advancing novices toward becoming experts.

Luo Xiaoduan (2012) suggested enhancing instructional design skills through microteaching training, lesson presentation exercises, and teaching observation.

Microteaching Training: Conducted in specialized microteaching classrooms, this involves pre-service teachers delivering short (5–20 minutes) simulated lessons. The sessions are recorded, and with guidance from instructors, the teachers review the recordings to analyze their strengths and weaknesses. This approach is instrumental in refining teaching language, board work, explanation techniques, demonstrations, questioning skills, and other classroom teaching skills. It also hones the ability to control teaching processes, such as introducing topics, reinforcing content, organizing activities, trial and error, and concluding lessons.

Lesson Presentation Exercises: This involves pre-service teachers articulating their teaching design to others, including their teaching objectives, key points, teaching strategies, and reasons for their decisions. By presenting in front of instructors and peers, they receive feedback and engage in discussions to enhance their skills.

Teaching Observation: According to the Teacher Education Curriculum Standards (Trial), pre-service teachers must spend at least one semester in educational practice at schools or kindergartens. Through direct observation and interaction, they

can experience how teachers communicate with students, prepare lessons, and deliver instruction, fostering the development of instructional design skills.

Xu Jinxia (2009) emphasized the role of microteaching in improving pre-service teachers' instructional design abilities. Microteaching creates an environment and conditions not easily achieved in traditional teaching settings. Instructional design ability, in this context, is defined as the capacity to analyze teaching problems systematically, design solutions, evaluate their effectiveness, and make necessary adjustments. The fundamental goal of instructional design is to improve the efficiency of teaching systems through problem-solving.

Xiao Jun (2021) advocated for case analysis as a method to enhance instructional design skills. In this approach, teachers provide students with real-life, typical teaching cases (presented via videos or text), guiding them to apply educational theories to analyze and address issues related to teaching goals, curriculum content, strategies, and evaluations. This method helps pre-service teachers articulate implicit knowledge, fostering high-order thinking and bridging the gap between theory and practice.

Xie Xiaoying and Wu Siyong (2019) suggested various methods to improve instructional design skills, including task-driven teaching, case analysis, discussion and practice, and simulation teaching.

Task-Driven Teaching: This involves operational tasks (e.g., analyzing lesson plans, writing activity designs, or simulating teaching). Pre-service teachers explore solutions independently under guidance, then share, reflect, and revise their work.

Case Analysis: Students analyze the strengths and weaknesses of lesson plans or teaching videos to cultivate analytical skills.

Discussion and Practice: Group discussions and collaborative writing of activity designs strengthen design skills.

Simulation Teaching: Pre-service teachers apply their lesson designs in simulated or real teaching scenarios, reflecting on and refining their work to improve their skills.

Fu Rong (2013) proposed a broader range of methods, including microteaching, task-driven strategies, scaffolded instruction, discussion, network-based exploratory learning, collaboration, role-playing, case teaching, and opportunities for internships.

In summary, commonly used methods to enhance lesson design skills include microteaching, case analysis, and simulation teaching.

Microteaching: Conducted in a specialized environment, pre-service teachers simulate short lessons, analyze recordings, and refine their designs.

Case Analysis: Students analyze real or typical teaching cases to gain insights into effective instructional design.

Simulation Teaching: Teachers guide students to apply their designs in practical settings, reflect on their experiences, and improve further.

2.2.4 Factors Influencing Lesson Design Ability

Xie Xiaoying and Wu Siyong (2019) proposed that the autonomous development awareness of preschool education majors significantly impacts the cultivation of instructional design ability. Currently, many preschool education students lack such awareness and undervalue courses like teaching methodology.

On one hand, they exhibit a passive, last-minute approach to theoretical learning, resulting in weak foundational knowledge. This hinders the transfer of theoretical knowledge to practical application, often leading to various issues in instructional design.

On the other hand, they approach practice exercises perfunctorily, relying on online lesson plans to complete assignments without critical thinking, which makes it difficult to create excellent activity plans.

Yang Shu analyzed the factors influencing the development of kindergarten teaching activity design abilities:

Student-level Factors: Low professional identity and learning motivation; weak autonomous learning ability and unclear goals; limited understanding of educational subjects, leading to a disconnect between theory and practice.

Teacher-level Factors: Monotonous teaching methods and dull content; insufficient kindergarten experience, making practical guidance challenging; lack of targeted training, leading to slow skill improvement.

Curriculum-related Factors: Inaccurate course positioning, prioritizing theory over practice; insufficient course hours, resulting in poor teaching outcomes; incomplete internship and practicum mechanisms, restricting students' practical skill development.

Pan Chenjun (2021), in a master's thesis, analyzed learners in instructional design improvement courses through classroom observation and surveys. The study identified that learners' abilities, habits, autonomy, and foundational knowledge all influence their instructional design skills.

Chen Xiuzhen (2007), based on literature research and work analysis, examined how pre-service education internships, self-learning, peer learning, classroom observation, and participation in research activities impact instructional design abilities. These factors interact in diverse and complex ways.

Hu Xuting (2019), summarizing Chinese and foreign literature, analyzed factors influencing teaching activity design from three dimensions: learners, learning resources, and classrooms.

Learners: Self-efficacy, willpower, and learning strategies.

Learning Resources: Resource management and adaptability.

Classroom: Learning environment and classroom interactivity.

Survey results further revealed a strong relationship between learners and instructional design.

Zheng Longxiang (2020), through interviews with kindergarten teachers,

identified factors influencing STEM instructional design abilities, including teacher-related factors, pre-service education training, teacher development programs, and kindergarten management. Teacher-related factors include insufficient understanding of education, vague concepts of instructional design, and poor autonomy.

Zhu Xiao (2023) analyzed problems in preschool education courses related to kindergarten activity design, highlighting issues with textbooks, teaching methods, equipment, faculty, evaluation methods, and educational philosophies, all of which affect students' instructional design skills.

Xie Xiaoying and Wu Siyong (2019) also attributed the challenges faced by preschool education students in instructional design to:

Weak awareness of autonomous development and undervaluation of courses like teaching methodology.

Lack of teaching experience, leading to low-quality activity designs.

Misconceptions in teaching methodology courses.

Inadequate on-campus faculty qualifications.

Poorly supported off-campus practical teaching conditions.

Summary, lesson design ability in pre-service teachers is influenced by factors such as learner autonomy, practical experience, learning resources, and teaching methods.

Learner Autonomy: Refers to students' ability to manage their own learning. In school settings, learner autonomy is conditional rather than absolute. For instance, students may have limited freedom in choosing learning resources, materials, or environments. To cultivate autonomy, educators can focus on areas where students can exercise control, such as encouraging active engagement in available learning opportunities.

Practical Experience: Refers to pre-service teachers' internships or fieldwork in kindergartens or early education institutions. Through observing childhood and teaching practices, they can develop their teaching skills and improve their instructional design abilities.

Learning Resources: Includes resources from various channels, such as online platforms, teachers, schools, and materials like early childhood storybooks, games, and teaching cases related to pedagogy, psychology, and kindergarten education.

Teaching Methods: Refers to the instructional strategies used in delivering content to students. Diverse teaching methods can enhance student interest and engagement, thereby improving learning outcomes.

2.2.5 The Importance of Lesson Design Ability

Instructional design ability is a vital component of teachers' core competencies and reflects their professional level. It represents the professional qualities demonstrated by teachers during instructional design processes, directly influencing the effectiveness of classroom teaching and impacting students' holistic development

(Guan Min & Huang Youchu, 2021).

The Professional Standards for Kindergarten Teachers (Trial) issued by China's Ministry of Education in 2012 identifies "planning and implementing educational activities" as a professional competency for kindergarten teachers and outlines explicit requirements. Similarly, the Standards for Primary and Kindergarten Teacher Qualification Exams (Trial) released in 2011 stipulate that kindergarten teachers should "select educational content, determine activity objectives, and design activity plans based on educational goals, childhood's interests, needs, and age characteristics." Instructional design is also a key component in assessing kindergarten teachers. The ability to design and write collective teaching activity plans is an essential professional core skill for every kindergarten teacher and serves as the foundation and guarantee for effective educational activities in kindergartens (Li Xiaofang, 2020).

Instructional design ability is one of the critical skills that pre-service early childhood teachers must learn. According to the stage theory of teacher career development, the pre-service teacher education phase is a crucial period for acquiring professional teaching skills and subject knowledge (Betty E. Steffy, 2012). As a fundamental part of pre-service teacher education, students majoring in early childhood education form the backbone of the future teaching workforce. The quality of education these students receive directly influences the development of the teaching profession.

In 2021, China’s Ministry of Education released the Professional Competency Standards for Pre-service Teachers in Early Childhood Education (Trial), a guiding document specifically for the pre-service training of early childhood teachers. It emphasizes that early childhood education majors should possess the ability to design instructional plans: "They should be able to select educational content, determine activity objectives, and design activity plans based on the requirements of the Kindergarten Education Guidelines (Trial), the Guidelines for Learning and Development for childhood Aged 3–6, as well as the interests, needs, and age characteristics of childhood" (Ministry of Education, 2021).

Instructional design ability is central to the professional skills of pre-service early childhood teachers. It plays a decisive role in improving teaching quality, promoting childhood's holistic development, and achieving educational goals. In the new era, higher standards for instructional design ability are being set for pre-service early childhood teachers. For instance, in 2021, China’s Ministry of Education introduced the Vocational Education Program Catalogue (2021), which replaced the early childhood education major in secondary vocational education with the childcare major. This change signifies a higher standard for early childhood education training.

In higher vocational education, cultivating instructional design ability in early childhood education majors is considered a primary professional competency. Courses such as "Design and Implementation of Kindergarten Educational Activities" are positioned as core professional courses. In the curriculum for early childhood education majors, the ability to "design and implement kindergarten educational activities" ranks as the top professional skill. Cultivating pre-service early childhood teachers'

instructional design ability helps them internalize teaching theories, improve their instructional design skills, and promote their professional growth (Guo Siyong, 2019).

The Professional Standards for Kindergarten Teachers serves as a critical guideline for the professional development of kindergarten teachers, specifying the professional competencies and skills required in educational practice. Instructional design ability is one of the key factors influencing childhood's learning outcomes and fostering their holistic development. The Professional Standards for Kindergarten Teachers (Trial) (2012) specifies four basic requirements under the dimension of professional competency for planning and implementing educational activities:

Develop phased educational activity plans and specific activity schemes.

Observe childhood during educational activities and adjust the activities based on their performance and needs, providing appropriate guidance.

Reflect interest, integration, and relevance to life in the design and implementation of educational activities, flexibly using various organizational forms and appropriate educational methods.

Provide opportunities for hands-on exploration, cooperative interaction, and creative expression to support and promote active learning among childhood.

These comprehensive and detailed requirements emphasize the need for teachers to continually learn, practice, and reflect to improve their instructional design ability. This ensures they can contribute to the healthy growth and holistic development of childhood.

In summary, instructional design ability is a core professional skill for teachers and the central competency for pre-service early childhood educators. It reflects their professional competence and significantly impacts their effectiveness in fostering childhood's growth and development.

2.2.6 Measurement of Lesson Design Ability

Lesson Design Ability is one of the key indicators for evaluating teachers' professional competence. In recent years, researchers have gradually deconstructed lesson design ability into two core dimensions: Pedagogical Content Knowledge (PCK) and Lesson Design Skills (LDS). PCK primarily focuses on how teachers transform subject matter knowledge into teaching strategies that are understandable for students, whereas Lesson Design Skills emphasize teachers' comprehensive application of learning objectives, instructional materials, teaching methods, and assessment strategies in the lesson design process.

To better measure teachers' lesson design ability, researchers worldwide have developed various measurement tools and methods.

2.2.6.1 Measurement of PCK

As an essential component of teachers' professional knowledge, PCK has been measured through multiple approaches in recent years, including PCK tests,

classroom observations, interviews, and teaching case analysis.

PCK Tests：Researchers design subject-specific PCK test questions to assess teachers' level of subject knowledge. For example: COACTIV Study (Baumert et al., 2010) developed a Mathematics PCK test to evaluate teachers' ability to transform mathematical concepts into teaching content. Li Ming (2018) designed a PCK assessment tool for early childhood science education, covering dimensions such as teaching strategy selection, childhood's cognitive understanding, and misconception diagnosis. Zhang Wei (2020) developed a PCK evaluation scale for early childhood mathematics teaching and found that PCK levels were related to teachers' pre-service training experiences. This structured evaluation method is easy to implement on a large scale.

Classroom Observations：Researchers analyze early childhood teachers' actual teaching practices through classroom recordings or live observations, assessing their PCK levels.

RTOP (Reformed Teaching Observation Protocol), developed by Sawada et al. (2002), evaluates the extent to which teachers implement reformed teaching practices in the classroom. PCK Mapping by Loughran et al. (2004) tracks teachers' PCK development through case analysis. Zhao Hong (2019) used CLASS (Classroom Assessment Scoring System) to observe early childhood teachers' interaction quality and found a strong correlation between PCK and classroom supportiveness. Sun Li (2021) observed early childhood mathematics instruction and found that teachers' questioning strategies influenced childhood's mathematical understanding. Although this method provides direct insights into teachers' PCK application in the classroom, the observer effect may influence teachers' behavior, potentially affecting the accuracy of the assessment.

Interviews & Self-Reports：Researchers analyze teachers' PCK levels through interviews, open-ended questionnaires, or reflective teaching logs. Wang Fang (2020) used semi-structured interviews to explore how early childhood teachers apply PCK in storytelling instruction. Liu Na (2022) found that experienced teachers focused more on childhood's cognitive development in their teaching reflections, while novice teachers were more concerned with lesson organization. This qualitative research method provides in-depth insights into teachers' thinking but is susceptible to subjective bias, making quantification challenging.

Based on the scope of this study, the researcher employs PCK tests to assess participants' PCK, with the design process detailed in Chapter 3.

2.2.6.2 Measurement of Lesson Design Skills (LDS)

Methods for measuring Lesson Design Skills (LDS) include lesson design tasks, case analysis, classroom observations, and surveys.

Lesson Design Tasks：Teachers are required to design lessons within specific contexts, and their lesson plans are scored accordingly. Example: IBSTPI (2013)

proposed a lesson design competency evaluation framework.

Case Analysis & Lesson Plan Evaluation：Researchers collect teachers' lesson plans and evaluate them using standardized assessment rubrics. Example: Timmermans et al. (2019) developed a lesson design competency evaluation model.

Teaching Performance Assessment：Teachers' implementation of lesson designs is assessed through classroom observations, video analysis, or microteaching. Example: CLASS (Classroom Assessment Scoring System) is frequently used for evaluating teaching performance.

Questionnaires & Self-Assessment：Teachers complete self-assessment questionnaires on lesson design ability. Example: AECT (2000) developed a lesson design competency assessment tool.

Chinese scholars have adapted these methods based on research needs: Zheng Longxiang (2020) developed the STEM Lesson Design Content Analysis Scale for early childhood teachers, covering 7 dimensions and 16 indicators, including learning objectives, instructional strategies, resources, and assessment. Kong Fengxia (2021) created a Kindergarten Lesson Design Ability Questionnaire, measuring six key competencies, including situation analysis, lesson preparation, objective setting, content selection, implementation planning, and reflection. Li Xiaofang (2020) assessed teachers' lesson plan design ability using nine dimensions, such as lesson objectives, instructional methods, and learning extension. Chen Hua & Wang Ailing (2024) developed a "6-24 Lesson Design Competency Model" for pre-service teachers using literature analysis, behavioral event interviews, Delphi method, and surveys. Ye Hong (2021) employed lesson plan text analysis to evaluate student teachers' lesson design competencies.

This study adopts Li Xiaofang’s evaluation method, establishing scoring criteria based on lesson design dimensions to measure participants' lesson design skills.

2.2.6.3 Measurement of Lesson Design Ability

In recent years, researchers have increasingly adopted mixed methods to measure lesson design ability. Examples include:

PCK + Lesson Design Task: Combining PCK tests and lesson design assessments to evaluate teachers’ overall lesson design ability (Krauss et al., 2008).

Observation + Interviews: Classroom observations combined with teacher interviews to provide a comprehensive assessment.

Data Mining & Learning Analytics: Using AI and big data to analyze teachers' lesson design behaviors, improving the objectivity of assessments (Seufert et al., 2021).

Despite advances in measuring PCK and Lesson Design Skills, several challenges remain:

Standardization of Measurement Tools: Different studies employ diverse assessment tools, lacking a unified standard.

Assessment Objectivity: Some methods (e.g., interviews, self-reports) are subject to personal biases and require objective measurement tools.

Technology Integration: AI and big data analytics could enhance assessment accuracy and efficiency.

Research suggests that mixed-method assessments will become the future trend, enabling a more holistic and objective evaluation of teachers' lesson design abilities.

Combining the above research, the researchers combined the PCK test and the lesson design skill test to create a lesson design ability measurement test to measure the lesson design ability of the subjects. The test dimensions and examples are shown in Table 13:

Table 13 Lesson design ability test case

First-Level Dimension	Second-Level Dimension	Question Type	Case Study
PCK	Knowledge of Teaching Content (29 points)	Multiple Choice (3 questions, 3 points each, total: 9 points)	*The main goals of early childhood science education do NOT include (C.)* A. Developing childhood's observation and inquiry skills B. Cultivating childhood's interest in science C. Helping childhood master scientific laws D. Promoting childhood's social interaction skills
		Essay Question (1 question, 10 points each)	*Based on the goals of science education, analyze the characteristics of science teaching content in kindergarten and give examples of how these characteristics can be reflected in teaching.*
		Case Analysis (1 question, 10 points each)	*In the "Mystery of Magnets" teaching activity, the teacher directly told the childhood that magnets can attract iron but did not provide any materials for hands-on exploration. As a result, the childhood showed little interest, and some did not understand the properties of magnets.* Question: (1) What are the problems in this teacher's lesson design?
	Knowledge of Learners (29 points)	Multiple Choice (3 questions, 3 points each, total: 9 points)	*The cognitive characteristics of young childhood in scientific exploration activities mainly include ( ).* A. Thinking based on intuition, enjoying hands-on activities B. Ability to engage in abstract reasoning C. Having a complete scientific concept system D. Independently conducting scientific experiments

First-Level Dimension	Second-Level Dimension	Question Type	Case Study
		Essay Question (1 question, 10 points each)	*Analyze the cognitive characteristics of 5-6-year-old childhood in scientific inquiry and provide an example of how to design a science activity based on these characteristics.*
		Case Analysis (1 question, 10 points each)	*In the "Mystery of Magnets" teaching activity, the teacher directly told the childhood that magnets can attract iron but did not provide any materials for hands-on exploration. As a result, the childhood showed little interest, and some did not understand the properties of magnets.* Question: (2) Based on the cognitive characteristics of older kindergarten childhood, propose a more effective teaching method and explain your reasoning.
	Knowledge of Teaching Methods (42 points)	Multiple Choice (4 questions, 3 points each, total: 12 points)	*How should teachers guide childhood in scientific exploration activities? ( )* A. Directly tell childhood the conclusions B. Have childhood read textbooks on their own C. Guide childhood to discover rules through experiments and observations D. Rely mainly on parents' guidance
		Essay Question (1 question, 10 points each)	*Discuss the value of the "experimental inquiry method" in early childhood science education and provide an example of how to effectively organize a science experiment for young childhood.*
		Case Analysis (1 question, 10 points each)	Case 2 (Teaching Methods Knowledge, 20 points) *In a "Seed Germination" experiment, a teacher only allowed childhood to observe seed changes and fill in a recording sheet. However, the childhood showed little interest in the experiment.* Questions: (1) What are the shortcomings of this teaching method? (10 points) (2) How would you adjust the teaching method to enhance childhood's active exploration and participation? (10 points)
Lesson Design Skills	Analyze Learning Situations (15 points)	Lesson Design Task (1 question,	*The goal of early childhood science education is to stimulate childhood's curiosity and interest in exploration while cultivating their observation,*

First-Level Dimension	Second-Level Dimension	Question Type	Case Study
	Set Activity Objectives (20 points)	120 points total)	*thinking, and hands-on abilities. Based on the characteristics of older kindergarten childhood, design a science inquiry activity with a self-selected theme (e.g., floating and sinking, magnetic properties, plant growth, etc.).* Scoring criteria for each dimension are provided in the attachment.
	Prepare for Activities (10 points)		
	Select Activity Content (20 points)		
	Plan Activity Implementation (35 points)		
	Evaluate and Reflect (20 points)		

Source : Zhao Ting (2025)

The process of determining the Lesson Design Ability Test is elaborated in detail in Chapter Three.

2.3 Instructional Model

2.3.1 Meaning of instructional model

Regarding the meaning of instructional model, researchers have different understandings:

East and Weir (1972) explained the instructional model in the book " instructional models": "An attempt to systematically explore the interaction between educational goals, teaching strategies, curriculum design and teaching materials, as well as social and psychological theories, in order to examine a range of alternative types that can model teacher behavior."

Li Bingde (1991) believes that the instructional model is "a relatively stable, systematic and theoretical teaching paradigm formed around a certain theme in teaching activities under the guidance of certain teaching ideas."

Professor Cao Yiming (1993) pointed out: "instructional model refers to the formation of a stable and concise teaching structure, theoretical framework and its specific and operational practical activities under the guidance of certain educational ideas and on the basis of a large number of teaching experiments in order to achieve specific teaching goals and content."

Based on the characteristics of higher vocational education, scholars such as Zhang Xuxiang (2010) believe that "instructional model refers to a certain standard structural style and operating method formed by systematically designing the training

process according to the training objectives under the premise of determining the educational ideas and professional direction."

Feng Wenwen (2010) defined the curriculum model of technical undergraduate education as a reference style for curriculum development in terms of curriculum objectives, categories and structure, content and organization, under the guidance of a certain curriculum concept and based on the characteristics of technical talents in their professional activities and ability structure.

Men Yanli (2013) believes that the instructional model of higher vocational education is a relatively stable teaching structure framework and implementation strategy designed and constructed under the guidance of certain teaching ideas and teaching theories to form students' professional abilities.

Bi Yuren (2016) believes that the instructional model is the sublimation of teaching experience under the guidance of education and teaching theory. A notable feature of the instructional model is that it has a clear theoretical structure and is definite in operability and repeatability (Bi Yuren, 2016) .

Generally speaking, there are two categories of instructional model in China, the teaching structure category and the teaching process category. The teaching structure category believes that the instructional model is a stable classroom structure and activity program established under the guidance of certain teaching ideas or teaching theories. The teaching process category believes that the instructional model is a strategy system or teaching style related to the teaching procedure. However, no matter which category it is, there are two common points. First, the formation of the instructional model must be based on a certain theoretical basis. With the continuous changes in life, people's understanding of education is also constantly changing, so the formation of the instructional model is also constantly updated with this understanding. This is why the instructional model in modern society shows a trend of diversified development. Second, the instructional model can guide specific teaching practice, foresee possible teaching effects, and make the entire teaching an efficient system, thereby gradually improving and improving the teaching process, methods and results.

To sum up, the instructional model is a relatively stable, systematic and theoretical teaching paradigm formed by selecting appropriate theories or principles based on the characteristics of the educated and the teaching content. Teachers can complete the teaching design efficiently based on this paradigm.

2.3.2 Elements of the instructional model

Kibler (1970) pointed out that the instructional model has four components:

Teaching objectives. Covers cognitive-behavioral, psychological and practical aspects.

Basic Behavior Measurement This is a readiness check. Basic knowledge and basic skills of students before actual instruction.

Organizing the teaching and learning process It is the activities organized to

develop student behavior, starting with basic behavior and continuing to the final behavior.

Overall evaluation It is an evaluation to check whether teaching and learning are achieved. What is the purpose? Is the teaching method appropriate?

Dick, W. and Carey (1985) pointed out that there are four elements of instructional model:

Setting teaching objectives. This can be done by studying the needs of learners so that teaching can be modified to suit the learners' level.

Student behavior and skills analysis does not require analytical practice, but analyzes learners' knowledge and skills rather than specifying standards.

Organize the teaching process and organize activities to cultivate students' behavior, such as formulating teaching strategies and developing teaching materials.

Evaluation Formative evaluation is done at each step, whereas summative evaluation is done after the pilot project and for improvements before release.

Eggen, PD, Kauchak (2006) pointed out that the instructional model includes the following:

The instructional model is designed to enable learners to learn effectively according to the specific objectives of that instructional model.

The instructional model consists of prescribed teaching steps to help learners achieve the learning objectives of the instructional model.

The instructional model is based on learning theory.

Teaching styles are supported by motivation theory.

Professor Cao Yiming (1993) proposed that the structure of the instructional model includes five elements: guiding philosophy, teaching objectives , teaching steps, evaluation criteria and practical conditions.

(1) Guiding philosophy refers to the teaching theory and teaching ideas on which the instructional model is based. It is a component that can be independent of the structure and yet connected with other structures. It is the direction guide for the instructional model. When constructing a certain instructional model, it is necessary to first point out the guiding philosophy on which it is based to ensure the directionality of the structure.

(2) Teaching objectives are the direction indicator in the instructional model. The construction of the instructional model is to achieve teaching objectives and complete teaching activities. In teaching activities, teaching objectives are the learning performance and behavioral changes that teachers expect from students. They are the starting point and destination of teaching design, and the main basis for testing teaching results. They determine the methods and strategies adopted by teachers and students, and play a restrictive role on other factors.

(3) Teaching steps refer to the arrangement of teaching content in chronological order and the design of activity steps for teachers and learners to complete tasks. Before the teaching activities , teachers design a detailed and standardized teaching process based on the course content, which can have a

preliminary conception of the real teacher-student activities, but if they encounter unexpected answers in class, they can also flexibly change and face them calmly.

(4) Evaluation criteria are the methods and standards for judging the entire teaching process and results after completing the teaching activities. Since the teaching objectives and content of each course are different , the evaluation methods and standards must also change according to the specific situation of teaching, but under each instructional model, the final learning situation should have an evaluation method and standard.

(5) Practical conditions are the feasibility conditions for transitioning the instructional model from theory to practice. In order to make the instructional model play a deeper value, many factors must be considered, including teachers, students, teaching content, hardware, software, teaching resources, environment, etc. Teachers should use various favorable conditions according to the design of teaching objectives and teaching process to ensure the effective implementation of teaching.

The components of the instructional model of Joyce and Weil's thought (2004) consist of the following important components:

(1) Principles, concepts and basic theories of instructional model. For example, organizing learning psychology and various teaching theories into instructional model.

(2) Teaching objectives, the purpose or goal of the instructional model .

(3) Syntax or teaching process that help teaching and learning achieve the desired goals. This is a step-by-step arrangement of activities, with different numbers of teaching steps in each form.

(4) Social system. It explains the role of teachers and students in teaching activities, the role of learners, the role of teachers and students in teaching activities

(5) The response principle tells you how to communicate and interact. The teacher responds to the learner's behavior. Create a labeling atmosphere without judging right or wrong.

(6) Support systems, media, equipment and learning resources have direct and indirect effects on students, which indicates the conditions or necessity for using the teaching mode.

The structure of the instructional model in this study includes six elements: 1) basic theories, principles and concepts of the instructional model; 2) objectives of the instructional model; 3) sytnax; 4) social system: teacher role, learner role; 5) opposition principle; 6) support system : media, equipment and learning resources, etc.

2.3.3 Steps in developing a instructional model

Walter Dick and Lou Carey (2004) proposed the Instructional System Design (ISD) model, which includes analysis, design, development, implementation and evaluation. These stages are interrelated, and each link is nested within these five links, reflecting the "parts have the characteristics of the whole" in system science. The ADDIE model includes five elements: analysis, design, development, implementation

and evaluation.

(1) Analysis: This phase involves a comprehensive analysis of learners, course content, training tools, and the training environment to determine learning needs and objectives.

(2) Design: In the design phase, based on the results of the analysis phase, the course outline, curriculum system planning and training objectives are developed.

(3) Develop: This stage focuses on selecting appropriate teaching materials, producing and developing various auxiliary learning resources, and generating specific teaching unit content.

(4) Implementation: The implementation phase conducts teaching and seminar activities through teaching media to achieve talent development goals. This may include training instructors and students, as well as ensuring that all technical tools work properly.

(5) Evaluate: The evaluation stage is the step that best reflects the value of training in the entire process, including formative evaluation and summative evaluation to ensure that the training effect achieves the expected goals.

The characteristics of the ADDIE model are its systematicity and pertinence. Through comprehensive consideration of these five steps, the one-sidedness and blindness of training are avoided, and training programs are designed and developed according to training needs, thereby improving training efficiency.

The ASSURE model was proposed by Robert Heinich, Michael Molenda, Russell, and Smaldino in 1989. It is a systematic instructional design model. The model systematically and step-by-step designs the teaching process through six links. Each letter represents an instructional design step, including:

(1) Analyze Learners: Understand the general characteristics of learners, their starting points, their learning styles, etc.

(2) State Objectives: Clearly state the behavioral performance that learners are expected to achieve through teaching activities.

(3) Select Methods, Media, and Materials: Choose appropriate teaching methods, media, and technologies based on learner characteristics and learning objectives.

(4) Utilize Materials: Apply the selected teaching resources to teaching.

(5) Require Learners' Performance: Encourage learners to actively participate in teaching activities to achieve learning objectives.

(6) Evaluate and Revise: Evaluate teaching activities and make necessary revisions based on feedback to optimize teaching outcomes.

The ASSURE model is widely used in classroom teaching, online learning and organizational training. It emphasizes the integration of technology and resources, highlights learners' participation in activities, promotes learners to actively use resources and media for learning, and encourages multi-dimensional interactions with teachers, peers and the learning environment.

It can be seen that the construction of a instructional model must go through

five processes: analysis, design, development, implementation and evaluation. This study developed a instructional model based on the ADDIE model to promote the lesson design ability of early childhood pre-service teachers, which is divided into five steps: Step 1: Analyze, Step 2: Design, Step 3: Develop, Step 4: Implement, Step 5: Evaluate.

2.3.4 Importance of instructional model

Instructional models are a bridge between educational theory and teaching practice, and play an important role in improving teaching quality, promoting learner development and achieving educational goals. instructional model provide teachers with a clear framework to help them organize and plan teaching activities. instructional model can express a teaching idea or teaching theory in a simplified form, making it easier for people to master and apply (Tang Wenzhong, 1990)

The instructional model is not only a summary and processing of a certain type of specific teaching activities in teaching practice, but also has directionality and exploratory nature. The framework it proposes can be further systematized and standardized in theory through continuous practice and experimentation, and continuously provide various materials for the research of teaching theory. From the functionality of the instructional model, first of all , it can well guide teaching practice , and facilitate teachers to find a suitable teaching method in the teaching process and better organize teaching . Secondly , it is a "bridge" and "mediator" to communicate teaching practice and teaching theory. It is not a simple summary of a certain teaching method, nor is it a simple "practicalization" of a certain theoretical basis or guiding ideology. Therefore, the instructional model has at least two functions in theory and practice (Hu Jinping, 2013). From a theoretical point of view, the instructional model can "connect" the originally "high and elusive" theoretical basis or guiding ideology with actual teaching, which is convenient for teachers to use and improve. At the same time, the "exploratory" and "directional" nature of the instructional model can summarize specific teaching practices, and rely on the continuous refinement of teaching practice to further standardize and systematize the theory. From a practical perspective, instructional model can guide specific teaching practices, foresee possible teaching effects, and make the entire teaching process an efficient system, thereby gradually improving and improving the teaching process, methods and results (Hu Jinping, 2013).

American sociologist Deutsch pointed out that models generally have four functions : construction function , which can indicate the order and relationship between various systems and parts , and enable us to have a holistic and clear understanding and grasp of things ; explanation function , which can explain the complex phenomena we observe in a concise and clear way ; inspiration function , which can reveal various relationships to show a certain arrangement order ; inference function , which can infer the expected results based on the law . instructional model also have the above four functions . Construction function , instructional model combine teaching methods ,

teaching means, etc. to clarify the relationship between various elements in the teaching process . Explanation function , instructional model make clear explanations for a series of arrangements in the teaching process . Inspiration function, instructional model can inspire people to think and improve teaching based on certain theoretical foundations or procedures . Inference function , instructional model can enable teachers to predict the results of teaching behavior . Overall , the instructional model fundamentally solves the gap between teaching theory and teaching practice , making teaching a theoretically based and scientific activity .

Instructional models is a bridge between educational theory and teaching practice, providing teachers with a clear framework to help them organize and plan teaching activities. They play an important role in improving teaching quality, promoting learner development and achieving educational goals.

2.4 Meaningful Learning Theory

Carl Rogers was a great psychologist and an important representative of humanistic psychology. During his research in psychotherapy, he considered issues related to education. He proposed the theory of meaningful learning, also known as learner-centered theory, based on client-centered therapy. He believed that the only learning that meaningfully influences behavior is self-discovery and self-directed learning (Rogers, CR, 1961). In 1961, Rogers published a collection of academic papers titled The Formation of the Individual, in which he proposed the concept of meaningful learning in Chapter 14, "Psychotherapy and Education" (Rogers, CR, 1983). In this article, he distinguished between experiential learning and cognitive learning. Cognitive learning, which occurs above the neck, is considered mechanical and meaningless, while experiential learning integrates the student's growth process with learning experiences, organically connecting learning with the student's interests, desires, and needs, thereby stimulating self-motivated learning.

Therefore, it is a valuable and meaningful learning process (Rogers, CR, 1983). In Freedom to Learn for the 80's 2nd Edition, Rogers pointed out that his educational philosophy aimed to cultivate a person who integrates body, mind, emotions, spirit, and mental strength, thus forming a complete individual (Rogers, CR, 1983). Rogers believed that in a positive learning environment, students are able to learn autonomously. He placed great importance on the emotional factors of the entire learning process, asserting that the teacher's role is to share emotions, not control the students (Zeng Yu, 2022). Students need freedom, but not neglect (Rogers, CR, 1983). A student remarked, "I think our freedom refers more to the freedom of expression, rather than being lawless or lacking self-control. Our goal is clear—to be able to express ourselves freely." This is the kind of teaching Rogers aimed to create, one that promotes meaningful learning for students. His educational theory emphasizes individual experience, emotional factors, and self-actualization. Rogers' Meaningful Learning Theory is a crucial part of his humanistic educational philosophy. The theory posits that

learning should be learner-centered, focusing on the learner's experiences and emotions, and encouraging active exploration and self-directed learning for personal growth (Rogers, 1969). This research uses Rogers' Meaningful Learning Theory as the main guiding principle, aiming to create a free and relaxed learning environment in teaching while guiding students to learn autonomously and find joy in learning.

In the article, Rogers mentions that learning in psychotherapy centers involves the following conditions: First, there is the confrontation of a problem. The client is facing a difficult problem and finds that no matter how hard they try, they end up failing, which creates a strong desire to learn (Rogers, CR, 1983). The second condition is genuineness and transparency (congruence). This refers to the therapist being genuinely transparent within the therapeutic relationship. They are honest and authentic, both in their inner self and outward expression.

When their emotions and reactions change, their awareness of these changes aligns with their actual experiences. The third condition is unconditional positive regard. This means not only accepting the good and positive but also accepting the negative, painful, and fearful aspects. The fourth condition is empathy. "The therapist must experience an accurate empathetic understanding of the client's world, as if seeing the world from the client's perspective." The fifth condition is that the client must experience or feel the therapist's genuineness, transparency, acceptance, and empathetic understanding. Based on these conditions in therapy, Carl Rogers proposed some of his understandings of education. First, the engagement with problems. He believes that meaningful learning is more likely to occur in situations where there is a recognized problem. "When college students see courses as experiences that solve their relevant problems, the ease and motivation are remarkable." Students must be allowed to confront significant issues in their lives and realize the problems and focal points they want to solve. The teacher's role is to create a classroom atmosphere that promotes meaningful learning. This overall concept can be broken down into several smaller aspects: teacher authenticity.

If teachers are authentic and transparent, learning seems to be facilitated. Acceptance and understanding. If teachers accept students for who they truly are and understand their inherent emotions, meaningful learning is more likely to occur. Providing resources. Teachers should provide all available resources, including themselves, that may help the students. Basic motivation. The primary driving force teachers rely on is the student's tendency for self-actualization. If students can confront problems, they will be willing to learn, grow, seek discovery, strive for mastery, and desire to create. In this framework, Carl Rogers also notes that this excludes forced lectures, talks, and explanations imposed on students, as well as evaluations of students. However, these two aspects are also central to modern education, and must be considered in the development of teaching methods.

The core concepts of Meaningful Learning Theory include learner-centered learning, experiential learning, the role of emotional factors in learning, self-directed learning, and self-actualization.

Rogers' central idea in Meaningful Learning Theory is that "the learner is the subject of learning, and the teacher's primary task is to create an appropriate learning environment that stimulates the learner's intrinsic motivation." Compared to traditional teacher-led classrooms, Rogers advocates for non-directive teaching, allowing students to autonomously choose learning content, learning methods, and construct knowledge based on personal experience.

Rogers believes that true learning is not simply the reception of information but is based on individual experience (Experiential Learning). When learning content connects with the learner's personal experiences, learning becomes more meaningful (Kolb, 1984). For example, in project-based learning (PBL) or case studies, students deepen their understanding through practice and exploration, rather than solely relying on teacher explanations.

Rogers emphasizes that learning is not just a cognitive process but also involves emotional experience. A learner's sense of safety, self-esteem, and belongingness all affect learning outcomes. A supportive and inclusive learning environment can reduce anxiety and increase confidence, thereby promoting deep learning (Rogers, 1983). Therefore, teachers need to build a trusting relationship in the classroom, encouraging students to express their viewpoints, question problems, and grow through interaction.

Rogers believes that meaningful learning is a form of self-directed learning, where the learner proactively acquires and organizes knowledge through intrinsic motivation, rather than passively receiving the teacher's instruction. Knowles' (1975) theory of adult learning (Andragogy) aligns closely with Rogers' view, as it states that effective learning should be learner-driven and related to the individual's interests and goals.

Rogers' educational goal is not just mastery of knowledge but the promotion of individual self-actualization. He believes the ultimate purpose of learning is to help individuals grow into independent, confident, and creative people who can apply their knowledge flexibly in the real world (Maslow, 1970).

Based on these core concepts, Rogers' Meaningful Learning Theory has the following characteristics:

Learning Must Be Related to Experience: Learning content must have practical significance for the individual, or the learner will struggle to understand or retain it. For instance, in teacher training courses, having future teachers design real lesson plans is more effective in fostering knowledge internalization than merely learning teaching theories.

Emotional Support & Safe Learning Environment: A supportive environment reduces anxiety and resistance, increasing learning motivation. Open discussions, encouraging feedback, and the teacher’s empathy are crucial for meaningful learning.

Promoting Learner Autonomy: The teacher’s role is that of a "guide" rather than an "authority on knowledge." Their responsibility is to provide resources, offer guidance, and help learners develop their own understanding. Inquiry-based learning

(IBL) in higher education is an example of a teaching method based on Rogers' ideas.

Reflection & Self-Assessment: Learners need to continuously self-evaluate and reflect on their learning process to adjust their learning strategies. Tools such as learning journals, peer assessments, and case studies are effective in promoting reflective learning.

The comparison of Meaningful Learning Theory with other learning theories is shown in the following table 14.

Table 14 The comparison of Meaningful Learning Theory with other learning theories

Learning Theory	Key Figures	Main Ideas	Similarities and Differences
Behaviorist Learning Theory	B.F. Skinner	Learning is a response to stimuli, emphasizing external rewards and punishments.	Behaviorism focuses on external control, whereas Rogers emphasizes intrinsic motivation and self-driven learning.
Cognitive Learning Theory	Jean Piaget	Learning is an active process of constructing knowledge and involves cognitive development.	Cognitive learning theory emphasizes changes in cognitive structures, whereas Rogers focuses more on emotional experiences and individual growth.
Constructivist Learning Theory	Lev Vygotsky	Social interaction plays a key role in learning, highlighting the Zone of Proximal Development (ZPD).	Constructivism and Rogers' theory both emphasize learner autonomy, but constructivism places more emphasis on socio-cultural influences.
Humanistic Learning Theory	Abraham Maslow	Learning is a process of self-actualization and requires meeting basic psychological needs.	Rogers' Meaningful Learning Theory can be considered a core idea within humanistic education.

Source : Zhao Ting (2025)

From table 14, it can be seen that compared to behaviorism and cognitivism, humanistic learning theory places greater emphasis on human emotions, needs, self-actualization, and inner personal growth. Simply put, humanism highlights the learner's subjective experience, intrinsic motivation, and the development of personal potential, rather than merely focusing on external behavior changes (behaviorism) or cognitive processing of information (cognitivism).

Rogers' meaningful learning theory further emphasizes the emotional connection in learning, autonomy, and individual growth. Rogers focuses on how

learners internalize knowledge as meaningful personal experience, stresses a “learner-centered” approach, values “real experience” and “reflective growth,” and highlights the applicability and operability of educational practice.

In the field of educational psychology in the 20th century, David Ausubel and Carl Rogers respectively constructed theoretical systems of meaningful learning from cognitive and humanistic perspectives. David Ausubel's theory of meaningful learning emphasizes that learners can consciously link new knowledge with their existing cognitive structures, thereby achieving deep understanding and long-term memory（Ausubel, 1963). He pointed out that meaningful learning depends on the association between learning materials and learners' prior experiences, enabling knowledge to be systematically and organically organized within the cognitive structure, in sharp contrast to rote memorization. Ausubel's theory focuses on the construction of knowledge structures at the cognitive level, emphasizing the role of advance organizers and the logical arrangement of instructional content(Ausubel, Novak & Hanesian, 1978).

Carl Rogers, on the other hand, proposed a humanistic theory of meaningful learning that places greater emphasis on emotional experience, autonomy, and personal growth during the learning process(Rogers, C. R,1969). According to Rogers, true meaningful learning is not only about cognitive connections of knowledge but also a process in which learners internalize knowledge as meaningful personal experiences driven by intrinsic motivation. Rogers emphasized learner-centered teaching, highlighting the importance of emotional needs and the subjectivity of learners. He believed that only in a supportive and secure environment can learners achieve deep reflection and self-actualization (Rogers, C. R, 1983).

In Ausubel's model, teachers are seen more as transmitters and organizers of knowledge who need to plan systematic instructional steps and build cognitive bridges for students. In contrast, Rogers’ model positions teachers as facilitators and environment creators, whose main task is to stimulate students' intrinsic motivation and provide emotional support and personalized guidance. This role transformation shifts the classroom from a one-way knowledge transmission mode to an interactive field where teachers and students co-construct knowledge(Rogers, C. R, 1969, 1983).

While Ausubel’s theory highlights cognitive structuring, it gives relatively less attention to students’ emotional states. In contrast, Rogers explicitly emphasized that learning cannot be separated from emotional experience and the need for self-realization, making emotional support a key factor in promoting learning(Rogers, C. R, 1983).

With the advent of the post-industrial society, contemporary learners demonstrate significant generational shifts. In the context where material needs are largely met, learning motivation has gradually shifted from external instrumental rationality to internal aspirations for personal growth. According to the Global Education Monitoring Report (2023), 78% of Generation Z students identified “the possibility for self-actualization” as their top criterion in choosing educational

programs(UNESCO,2023). Consequently, scholars argue that learning is not only a cognitive process but also a journey of emotion and self-fulfillment (Darling-Hammond, 2005, Twenge, 2017). Only by stimulating learners' intrinsic motivation and fostering positive emotional experiences can deep, meaningful learning and sustainable development be achieved.

Researcher believes that learning is not only a cognitive process but also a process involving emotions and self-actualization; only by stimulating learners' intrinsic motivation and positive emotional experiences can deep and sustained meaningful learning be achieved.

Rogers' Meaningful Learning Theory emphasizes learner autonomy, experience, emotions, and self-actualization, profoundly influencing modern education. This theory has been widely applied in primary education, higher education, and adult education. Although challenges exist in practice, such as the transformation of teachers' roles and differences in students' self-directed learning abilities, the rise of personalized and adaptive learning, facilitated by advancements in information technology, presents new opportunities for meaningful learning.

Application in Early Childhood Pre-Service Teacher Training, Lesson design ability is one of the core competencies for future early childhood educators. Traditional instructional model primarily focus on knowledge transmission, offering students limited opportunities to engage in the complete process of instructional design. This may result in a lack of autonomy, creativity, and practical experience in their future teaching careers. Integrating Carl Rogers' Meaningful Learning Theory into teacher training and developing a new instructional model based on this theory can effectively enhance the instructional design abilities of early childhood education students.

Core Ideas of Meaningful Learning Theory and Their Application, Learning should be constructed through active exploration and real experience rather than passive reception. Traditional teaching methods often involve teacher-centered instruction, where students passively receive knowledge of instructional design without deep understanding or opportunities for autonomous exploration. By adopting Rogers' Meaningful Learning Theory, instructional models can allow students to construct curriculum plans in authentic teaching situations, enhancing their comprehension and mastery of instructional design. Approaches such as Project-Based Learning (PBL), case studies, and micro-lesson development can be introduced to encourage students to research independently, analyze problems, and design lessons, thereby improving their self-directed learning abilities.

Learning must be closely connected to real-life experiences to transform knowledge into practical skills. Traditional education primarily emphasizes theoretical learning, leaving students with little hands-on experience in curriculum design. Consequently, they may struggle to create developmentally appropriate lesson plans when they start working in kindergartens. Contextual learning can help students complete instructional design in real or simulated early childhood teaching environments. Collaborations with kindergartens can be established, allowing students

to develop practical lesson plans based on childhood's interests and developmental needs, followed by teaching trials and iterative refinements.

Learning is a personalized process, and every student has unique learning paths and needs. Future early childhood educators must be capable of designing personalized curricula tailored to different childhood's needs. However, traditional standardized curriculum design training may not adequately develop this ability. A personalized learning model can be established, enabling students to choose teaching topics and methods aligned with their interests for in-depth research and curriculum design. Methods such as open-topic selection, personalized assignments, and mentorship programs can encourage students to explore instructional design based on their interests.

A safe, respectful, and supportive learning environment fosters growth and creativity. Traditional assessment methods often cause students to focus excessively on grades, neglecting deep reflection on instructional design, which may stifle creativity and intrinsic motivation. Based on Rogers' Meaningful Learning Theory, a collaborative learning environment can be established where students refine their lesson plans through peer collaboration, teacher support, and feedback mechanisms. A peer review + teacher feedback + iterative optimization model can be implemented, allowing students to continuously revise and improve their instructional design in a supportive, open atmosphere, fostering creativity.

Deep learning requires self-reflection and continuous adjustments for true knowledge internalization. In the instructional design process, students should engage in a cycle of teaching trials, feedback, revisions, and further optimizations to improve the feasibility and effectiveness of their plans. Teaching reflection journals, learning portfolios, and case discussions can be integrated into the instructional model to help students assess their curriculum design approaches and make timely improvements. Lesson design presentations can be arranged, where students present their plans to classmates, instructors, and experienced kindergarten teachers for feedback, which they then use to refine their designs.

By constructing an instructional model based on Carl Rogers' Meaningful Learning Theory, students can progressively develop strong instructional design abilities through autonomous exploration, real-world practice, personalized learning, supportive environments, and reflective optimization. This approach lays a solid foundation for their future careers in early childhood education.

Therefore, this study chooses Rogers' meaningful learning theory as its theoretical foundation, aiming to promote the teaching design abilities of preschool education students by paying attention to individual differences and emotional needs, thereby fostering their professional growth and teaching innovation in future educational practices.

2.5 Related theories

2.5.1 Self-Determination Theory

Self-Determination Theory (SDT), proposed by Deci and Ryan in 1985, is a psychological theory that focuses on human motivation and the factors that influence it. According to this theory, individuals exhibit the highest intrinsic motivation when their basic psychological needs—autonomy, competence, and relatedness—are satisfied. In recent years, SDT has increasingly been applied in the field of education, particularly in enhancing students' intrinsic motivation, increasing engagement, and improving academic performance. This review will examine recent studies on SDT and explore its applications in education, especially in relation to promoting students' motivation, classroom performance, and academic success.

The fundamental assumption of SDT is that individuals' intrinsic motivation can be triggered and positive behaviors promoted when their three basic psychological needs are met: autonomy, competence, and relatedness. Autonomy refers to the need for individuals to feel free in their choices and in controlling their actions. Competence refers to the need to feel capable and effective in their activities. Relatedness refers to the need to feel emotionally connected with others and to receive social support. The satisfaction of these needs is considered key to fostering intrinsic motivation and contributing to higher engagement and better learning outcomes (Ryan & Deci, 2000). Research indicates that when students feel autonomous, competent, and connected with others during their learning, they exhibit higher motivation, greater effort, and better academic performance (Deci & Ryan, 1985).

In the educational field, the core principles of SDT have been widely applied to understand students' learning motivation and their impact on academic achievement. Studies have shown that when teachers provide more autonomy support, students' intrinsic motivation increases significantly. For example, offering choices, reducing external control, and encouraging active participation all help to enhance students' autonomy, thereby boosting their motivation and academic performance (Reeve, 2006). In addition to autonomy, competence support is equally critical. Research shows that providing positive feedback and offering challenging yet achievable tasks can effectively enhance students' perceived competence, which in turn strengthens motivation and academic success (Vallerand, 1997). In the classroom, teachers can foster students' sense of competence through appropriate task design and timely feedback, thereby enhancing their interest in learning. Relatedness is also a significant factor influencing learning motivation. Students who feel they have good social support and positive relationships with teachers tend to display higher motivation. Studies show that when students feel a strong connection with others, such as their peers and teachers, they are more willing to engage in learning activities and maintain long-term interest (Jang, Reeve, & Deci, 2010).

In practical teaching, educators can design learning environments that promote students' motivation by satisfying their needs for autonomy, competence, and

relatedness. For example, teachers can enhance students' intrinsic motivation by encouraging them to choose their learning tasks, setting appropriately challenging tasks, and promoting teacher-student interaction. SDT has been applied in various instructional models, such as active learning, student-centered learning, and cooperative learning, all of which emphasize satisfying students' psychological needs to increase their learning engagement and academic performance (Deci & Ryan, 2008). In recent years, the application of SDT has extended beyond traditional classroom settings to online learning, blended learning, and the use of digital educational tools. For instance, studies indicate that providing autonomy support, interactive feedback, and collaborative tools in online learning platforms can effectively enhance students' motivation, especially in environments lacking face-to-face interaction (Lynch, 2014). Moreover, SDT has been used in teacher training, with research showing that training teachers to support students' autonomy and relatedness can improve classroom environments and boost students' motivation (Cheon et al., 2018). SDT provides an important theoretical framework for understanding and enhancing educational motivation. By satisfying students' needs for autonomy, competence, and relatedness, SDT offers guidance for educational practices, helping teachers create environments that foster intrinsic motivation and deep learning. In recent years, the application of SDT has been continually expanding, particularly in online education and teacher training, demonstrating its broad applicability and significance. As educational environments continue to evolve, the principles of SDT will remain an essential theoretical foundation for promoting effective student learning and improving academic performance.

2.5.2 Self-Efficacy Theory

Self-efficacy refers to an individual's belief in their capability to accomplish a specific task, a belief that can stimulate the willingness to act and sustain effort (Bandura, 1997). Individuals with high self-efficacy tend to engage more actively in learning, seek out challenges, and persist in the face of difficulties (Zimmerman & Schunk, 2011). Self-efficacy enhances intrinsic motivation, encouraging deeper engagement with learning activities and fostering exploratory behavior (Ryan & Deci, 2000). Research has shown that learners with strong self-efficacy are more likely to employ effective learning strategies and adapt flexibly when facing obstacles (Pintrich & De Groot, 1990).

According to Bandura's theory, self-efficacy develops through four primary sources: (1) mastery experiences—the sense of accomplishment gained from successful personal task performance; (2) vicarious experiences—observing others succeed at a task, which builds confidence; (3) verbal persuasion—positive feedback and encouragement from teachers, peers, or parents; and (4) physiological and emotional states—the individual’s physical and emotional responses during task engagement (Bandura, 1997, 2001). Teachers can foster students' self-efficacy by offering

successful learning experiences, modeling teaching behaviors, providing positive feedback, and supporting emotional regulation (Usher & Pajares, 2008; Schunk, 1991).

In instructional settings, strategies such as cooperative learning, reflection and self-assessment, and simulated teaching have been shown to enhance learners' self-efficacy. Cooperative learning provides social support and collaborative opportunities; reflection and self-evaluation promote awareness of learning progress; simulated teaching or role-playing offers a safe environment for practice and experimentation, thereby building confidence (Boud, 1985; Johnson et al., 2000; Bandura, 1997). Additionally, training students in metacognitive strategies can strengthen their capacity to plan, monitor, and regulate their own learning processes, thereby further promoting self-efficacy development (Zimmerman & Schunk, 2011).

In the field of teacher education, self-efficacy is widely used to explain teachers' performance in curriculum planning, instructional behavior, and professional development. Studies have shown that self-efficacy significantly influences teachers' lesson design abilities. Tschannen-Moran and Hoy (2001) argue that teachers' instructional self-efficacy derives from their analysis of teaching tasks and personal teaching beliefs, which together determine whether they will attempt new strategies or persist through instructional challenges. Teachers with high self-efficacy are more responsive to children's diverse needs, more flexible in adjusting their instructional plans, and more likely to improve teaching quality.

In pre-service teacher research, a meta-analysis by Klassen and Tze (2014) found that self-efficacy was positively correlated with classroom management, use of instructional strategies, and student engagement. Within the context of early childhood education in China, scholars such as Wang (2018) and Li (2020) emphasized the critical roles of practical experience, collaborative learning, and feedback in cultivating pre-service teachers' self-efficacy. Given the distinct developmental characteristics of young children, high self-efficacy is especially vital for pre-service teachers to design and implement instruction with flexibility and confidence.

This study, in constructing an instructional model based on the theory of meaningful learning, emphasizes the deliberate integration of activities that support the four sources of self-efficacy. For example, authentic teaching tasks and classroom simulations provide mastery experiences; model lessons offer vicarious learning opportunities; peer discussions and teacher feedback serve as verbal persuasion; and reflective writing combined with emotional support mechanisms helps regulate emotional states. These integrated strategies aim to enhance pre-service teachers' learning engagement, confidence, and development of lesson design competence.

2.5.3 Experiential Learning

Experiential learning refers to the process of acquiring knowledge, skills, and transforming thinking patterns through direct experience or reflective practice. The core of experiential learning lies in "learning by doing," rather than simply relying on

traditional theoretical study. The theory of experiential learning was proposed by David A. Kolb in 1984 and has since become an important learning theory in the field of education. Kolb's experiential learning model emphasizes that learning is a cyclical process consisting of four stages: Concrete Experience, Reflective Observation, Abstract Conceptualization, and Active Experimentation.

Concrete Experience (CE): The initial stage of learning, where individuals directly encounter or experience a situation.

Reflective Observation (RO): At this stage, learners observe and reflect on the experiences they have undergone.

Abstract Conceptualization (AC): Learners transform their observations and reflections into theories or concepts for understanding and analysis.

Active Experimentation (AE): Learners apply abstract theories or concepts to real-world situations through testing and experimentation.

Experiential learning emphasizes enhancing learners' understanding and application abilities through direct practice and reflection (Kolb, 1984). In recent years, experiential learning has gained widespread attention and application in teacher education, particularly in promoting the development of professional competencies.

Experiential learning theory is broadly applied across various educational models, especially in vocational and adult education. For instance, many higher education and vocational training programs use experiential learning theory to design practice-oriented courses such as simulations, case studies, role-playing, and project-based learning. These courses allow students to deepen their comprehension and mastery of relevant theoretical knowledge and skills through hands-on experiences and reflection.

Experiential learning provides theoretical support for cultivating teachers' instructional design abilities. Effective instructional design requires not only theoretical knowledge but also practice and reflection in specific teaching contexts to develop valid teaching plans (Loughran, 2010). By enabling teachers to personally experience the process of instructional design through real or simulated teaching, experiential learning fosters the integration of theory and practice and deepens understanding of teaching goals and strategies (Darling-Hammond & Bransford, 2005). For example, activities such as microteaching, case analysis, collaborative teaching, and project practice offer valuable "learning by doing" opportunities that strengthen teachers' abilities to generate and refine instructional designs (Gibbs, 2013).

Furthermore, reflective practice, as a vital component of experiential learning, is critical to teachers' professional development (Schön, 1983). Through systematic reflection, teachers can identify the strengths and weaknesses of their instructional design, gradually improving the rigor and creativity of their teaching decisions (Hatton & Smith, 1995). This is especially important in early childhood education, where teachers must flexibly respond to children's developmental characteristics and diverse needs. Experiential learning provides an effective means for dynamically adjusting instructional design (Korthagen, 2010).

By engaging in experiential learning, students enhance their motivation through firsthand application of learned content. Reflective practice helps learners move beyond mere memorization to understand and apply knowledge in new contexts, facilitating deep learning. Experiential learning also improves problem-solving skills, cultivates critical thinking and innovation, and enables learners to better address complex real-world problems.

Experiential learning offers a student-centered teaching approach that emphasizes learning through actual experience and reflection. It has been widely applied, notably in fostering students' practical skills and problem-solving abilities. Although implementing experiential learning can face challenges such as substantial resource and time requirements, its importance in future educational practices will continue to grow as educational technologies evolve and diverse teaching methods are integrated.

In summary, experiential learning provides strong theoretical support and practical pathways for promoting teacher professional development and enhancing instructional design competencies. Future research should further explore how to deeply integrate the concepts of experiential learning with meaningful learning theory to design more targeted and effective instructional models, thereby advancing the quality of early childhood teacher education.

2.6 Related Research

Peng Yingjuan (2015) studied the training model of teaching ability. Based on cognitive learning theory, humanistic learning theory, constructivist learning theory and modern educational thought, she developed a practical instructional model for normal students under the guidance of the Teacher Education Standards (Trial) and based on the main and auxiliary lines of the learning community, which organically combines qualitative and quantitative evaluation. The research is divided into four stages. In the first stage, relevant literature is studied, and the new curriculum standards for information technology in primary and secondary schools are interpreted, and the problems and requirements for the development of current teaching ability are analyzed. In the second stage, the training model is developed.

The construction of the teaching skills training model for normal students under the guidance of the teacher education standards and the construction of the evaluation scale of quantitative methods under the interpretation of the new curriculum standards for information technology in primary and secondary schools combined with the characteristics of information technology courses are constructed. The third stage is the practice mode, which allows the normal students in the experimental group to conduct practical training on the teaching content of the three modules (the training subjects are the 2011 undergraduate normal education graduates of the School of Information Science and Technology of Yunnan Normal University. 40 students who participated in the training were selected and divided into an experimental group and a

control group, with 20 students in each group. The experimental group and the control group were each divided into 4 training groups. The teaching skills training process lasted 15 working weeks, and each class type was trained for 5 working weeks. The first stage of each class type took 1.5 weeks; the second stage took 2.5 weeks; the third stage took 1 week, and the data collection time was 5 working weeks. The ST and FIAS quantitative methods were introduced into the teaching skills analysis of normal students, and evaluation was used to promote practice. Through quantitative evaluation of students' deficiencies in teaching design and teaching, training strategies were given). The fourth stage is the result analysis. The ST and FIAS methods were used to analyze the student training videos, and the analysis data of the experimental group and the control group were compared. The results showed that the teaching skills level of the experimental group improved rapidly, while the teaching skills level of the control group improved slowly. This shows that this model can effectively promote teaching ability.

Li Ying (2014) studied the teaching mode of information-based lesson design ability of normal students. The research content includes: 1. Investigate and study the current status of information-based lesson design ability of normal students, and propose corresponding strategies and principles based on the results; 2. Construct a theoretical model of the development platform of information-based lesson design ability of normal students; 3. Design the specific content of information-based lesson design ability training for normal students; 4. Build a virtual learning community and analyze the effect. The research is divided into four stages: the first stage, investigation and research. A questionnaire survey was conducted on normal students of a certain university to understand the current status, attitude and needs of the training of normal students' lesson design ability. On this basis, a virtual learning social platform was built to enable normal students to conduct independent learning, collaborative learning and peer communication. The second stage is the theoretical research stage. Through literature analysis, the design principles and strategies for constructing the information-based lesson design ability training platform for normal students were proposed, and the specific content of the training was designed. The third stage is the technical research stage. Combined with the needs and training platform, the website was designed using software and tested. The design scheme enables the experimental subjects to participate in the learning of the information-based lesson design ability training platform for normal students. The whole training experience is: self-learning to find problems - discussion and exchange - observation of works - evaluation - improvement, five processes. The fourth stage is the effect analysis stage. The effect of the virtual learning community is analyzed through questionnaire surveys. The research results show that learners can learn effectively and improve their teaching ability through the platform.

Zhang Xiaodie (2022) studied the interdisciplinary lesson design ability training model for biology major normal students. The research is divided into three stages. The first stage is basic research. It includes reading literature to understand

relevant concepts and theoretical foundations. Questionnaire survey to understand the lesson design ability of normal students. The researcher conducted a questionnaire survey on the lesson design ability of third-year normal students in college through four indicators: textbook analysis, student situation analysis, teaching strategy and core literacy . In the second stage, the interdisciplinary lesson design ability training program was designed, implemented and tested. The 2017 students were selected as the control group and the 2018 students were selected as the experimental group. The interdisciplinary lesson design ability training in a segmented training mode was carried out for 49 students in the 2018 class. The self-efficacy front side was conducted on the 2017 students, and the self-efficacy front side and back side were conducted on the 2018 students. The results show that before the training, the self-efficacy of the 2017 and 2018 normal school students in interdisciplinary teaching was at a medium level, and the self-efficacy of the 2017 normal school students was slightly higher than that of the 2018 normal school students. The paired sample t-test was used to analyze the pre- and post-tests of self-efficacy of the 2018 normal school students. The results showed that the self-efficacy of the 2018 normal school students in interdisciplinary lesson design ability improved more significantly, with an improvement value of 0.02, indicating that the interdisciplinary lesson design ability training designed and implemented in the research has certain results and has a positive effect on the trained normal school students. In the third stage, a segmented training model is proposed. According to the training courses and their effects designed and carried out in the first and second stages, it is proposed to adopt a segmented training model to improve the interdisciplinary lesson design ability of normal school students.

Qian Zihui (2020) studied the training model of middle school teachers' lesson design ability based on the OBE teaching concept. The purpose of this study is to improve the lesson design ability of middle school teachers and enhance the quality of middle school teacher training. The study is divided into the following stages. The first stage is basic investigation. By distributing the online questionnaire link of Questionnaire Star to middle school teachers in schools in various regions of H Province, a total of 143 valid questionnaires were collected, and the collected questionnaire data were statistically analyzed using SPSS software; secondly, by conducting a qualitative analysis of the lesson plans written by some middle school teachers, the common characteristics and typical problems in the teaching design of the lesson plans were sorted out and summarized. The second stage is to construct a training model. Based on the problems found in the previous investigation, under the guidance of the OBE concept, the study started from the four levels of "defining learning outputs-realizing learning outputs-evaluating learning outputs-using learning outputs" to construct a training model for middle school teachers' lesson design ability. The third stage is the implementation of the model and effect evaluation. The study carried out practical research in the teacher training project of S Middle School, implemented the training model for the topic of "design of classroom teaching structure" by using MOOC-based hybrid training, and evaluated the application effect of the training model

with the help of the score data in the evaluation scale, questionnaires and interview surveys. The verification showed that the teacher training carried out by applying this model can help trainees clearly understand the training results, improve the professional ability of teaching design under the core literacy, enhance the "sense of gain" of middle school teachers participating in the training, and the training has achieved satisfactory results.

Meng Xianghong and Wang Xiaoli (2023) used deep learning theory as a link to build a "double-chain cycle" training model from the learners' "learning experience chain" and the educators' "teaching design chain" to improve the lesson design ability of STEM teachers. The research results show that through the "double-chain cycle" training model of the learners' "learning experience chain" and the educators' "teaching design chain", teachers who can adapt to the needs of STEM teaching can be better trained.

Jin Ping (2011) created a task-based instructional model to improve the English autonomous learning ability of preschool education normal students. The results showed that the task-based instructional model can effectively cultivate students' English autonomous learning ability and enhance students' learning motivation. Students can consciously use some learning strategies to help them learn, and their cognitive level has also been improved. At the same time, task-based teaching improves the effectiveness of teachers' teaching.

Li Wenxiu (2021) studied the instructional model that promotes the autonomous learning ability of high school students in maker education. The goal of this study is to construct a instructional model that promotes the autonomous learning ability of high school students in maker education, in order to better cultivate students' autonomous learning ability and innovative practice ability. The study is divided into four stages. In the first stage, we understand the relevant research and theories such as constructivism, "learning by doing" and situational learning to provide a theoretical basis for the research; in the second stage, we analyze the concept of instructional model, construct a instructional model that promotes the improvement of high school students' autonomous learning ability in initial maker education, and improve the autonomous learning model system. Based on the integration of the three characteristics of autonomous learning and maker education, this stage designs the teaching process into seven teaching links: creating situations, autonomous innovation, autonomous design, autonomous practice, autonomous expansion, autonomous sharing and teaching evaluation.

And guide students to conduct self-evaluation. In the third stage, the practical instructional model, a maker club of a high school in Wuhan was selected to set up an experimental class and a control class with 30 people each. A new instructional model was adopted in the experimental class, and a traditional task-driven instructional model was adopted in the control class. A three-month teaching experiment was conducted. In the fourth stage, after the teaching experiment, the teaching effect was analyzed based on the pre- and post-test data of the autonomous learning ability table, the classroom

satisfaction questionnaire, and the interview records of teachers and students to verify the effectiveness of the model. The results showed that the autonomous learning ability level of the experimental class students was more significantly improved, and was higher than the autonomous learning ability level of the control class students, indicating that the autonomous learning model has a more obvious teaching effect. And the results of the student satisfaction survey showed that 70% of the students were very satisfied with the teaching methods of the lecturers, 30% of the students were relatively satisfied, and no students were dissatisfied.

Wang Yunan and Liang Shan (2022) applied the BOPPPS model to the course "Social Education for Preschool childhood", dividing the course into three stages: before class (introduction, goals, front side) - during class (participatory learning, post-test) - after class (summary). The research results show that the application of the BOPPPS model in the hybrid teaching of "Social Education for Preschool childhood" has better solved the contradictions such as students' high pressure of theoretical learning but weak practical application ability, and empty talk of theory but unable to integrate the actual job requirements of preschool teachers into the course. This model is student-centered, based on course content, combined with the real work situation of kindergartens, and completes the learning process through the progressive work tasks, achieving the integration of industry and education while achieving teaching goals (Wang Yunan, Liang Shan, 2022).

Shi Jie (2022) designed a classroom observation record form for student activities, and analyzed the problems in the course through classroom observation and course final examination results. Based on this, a project-based instructional model was constructed through three stages of planning and design, project implementation, and evaluation and reflection to improve the information-based teaching ability of normal students. The course "Modern Educational Technology Application" of a university in Hubei Province was selected, and the classroom instructional model of project-based teaching was implemented for 73 students in the experimental group, and the traditional classroom instructional model was adopted for 70 students in the control class. Before the experiment, an initial survey was conducted on each dimension of the questionnaire of the experimental class and the control class, and the obtained data was subjected to an independent sample t- test.

There was no significant difference, and the experiment could be conducted as a parallel class. The experiment lasted for a total of 9 weeks. After the practical experiment, the information-based teaching ability of students in the experimental class and the control class was tested again, and the students in the experimental class were interviewed. Combined with the post-test data results and interview results, students' classroom performance and test scores, it was judged whether the classroom instructional model based on project-based teaching could improve the information-based teaching ability of normal students. The results showed that the experimental class was significantly higher than the control class in all three dimensions, which brought a relatively positive impact to the students and helped them better participate

in classroom teaching. (Shi Jie, 2022)

Qiao Xinhong (2019) used the KI framework as a theoretical guide to develop a series of courses aimed at improving the teaching design capabilities of pre-service science teachers. He conducted two rounds of teaching experimental research with pre-service science (biology) teachers as participants, trying to explore whether the application of knowledge integration courses can promote the development of pre-service science teachers' teaching design capabilities. The study adopted a mixed research method and qualitative research method. The study found that the four knowledge integration steps of extraction, addition, differentiation and reflection of pre- service science teachers in the KI course can effectively promote their lesson design ability development. The spiral model shows the dynamic process of the KI course promoting the development of personal fields, practice fields and results fields. It has a good explanatory power for the development process of teaching design capabilities examined from these three dimensions, and adds a micro-model of teacher learning to the field of science teacher education. (Qiao Xinhong, 2019)

Chen Wei (2013) built a collaborative lesson preparation platform based on Wiki and conducted a three-month teaching experiment on 48 pre-service English teachers. The study adopted a mixed research method combining questionnaire survey and interview. The lesson design ability scale in the questionnaire was compiled based on the lesson design ability structure of professional foundation, planning and analysis, design and development, evaluation and implementation, and management in the "Teaching Design Competency Standards" published by IBSPTI. Through the comparison of the pre- and post-test data of the scale and the qualitative analysis of the student interview data, the results of analyzing these data show that using Wiki collaborative lesson preparation can help pre-service English teachers improve their lesson preparation efficiency and promote the development of teachers' lesson design ability. (Chen Wei, 2013)

Lee, Ahhyun; Griffin, Cynthia C.(2021)Exploring Online Learning Modules for Teaching Universal Design for Learning (UDL): Preservice Teachers' Lesson Plan Development and Implementation. In this study, three interactive, online modules on Universal Design for Learning (UDL) were delivered over four weeks with teacher candidates to improve their skills and knowledge for developing and implementing lesson plans based on UDL principles. Eight teacher candidates who were in a dual certification degree program (ie general and special education) and enrolled in a graduate -level course participated in the study. After completion of the modules, the candidates significantly enhanced their ability to design lesson plans based on UDL principles and reliably implement the lessons during their student teaching placements in both high- and low- technology settings. described the discussion forums shared with their peers as the most useful aspect of the modules for promoting their learning. Additionally, teachers revealed a strong willingness to apply the principles of UDL in their future teaching. Limitations and implications are discussed.

Elwood, Kristin ; Jordan, Michelle E.(2022)Development of the Design

Thinking and Instructional creative Lessons (DTAIL) Model: A Creative Approach for Teachers. The educational landscape continues to become increasingly complex, which suggests a need for a teacher-driven approach to developing instructional lessons. This article introduces the Design Thinking and Instructional Lessons (DTAIL) model and describes its three-phase development.

In Phase I, the Design Thinking literature and the first draft of the model are described. In Phase II and III, two design studies conducted with STEM K-12 public school and community college in-service teachers participating in summer research experience for teachers (RET) programs in the United States are described. In addition, during the second design study, ten teacher-participants were observed as they implemented their lessons and were interviewed concerning how and to what extent they perceived the DTAIL model to resonate with their approach to developing instructional lessons. Revisions to the model were made based on data analysis from those three design phases. Findings suggest that Design Thinking models that facilitate teacher-driven design of instructional lessons might usefully include design stages with an explicit depiction of rotation and recursiveness. In addition, Design Thinking models should also depict (1) iteration, reflection, and revision; (2) a chaotic fluctuating problem-solution space , and (3) circling backward to eventually narrow the problem space toward a satisficed solution. Furthermore, the majority of teacher-participants found the DTAIL model to resonate with their approach to developing instructional lessons.

Diana; Sunardi ; Gunarhadi ; Yusuf, Munawir (2020)The Development of I-Teach Model to Improve Early Childhood Teachers Professionalism. The study aims to find out the effectiveness of I-Teach model to improve teachers' professionalism in handling special-needs childhood in inclusive classes. This is the final part of a research and development project with the modification of its development stage by Sukmadinata (2017) to be a model testing stage. It explained the effectiveness of the I-Teach model through a true experimental design by classifying the control and experimental group. The subjects of the study were purposively selected, with a total of 24 inclusive teachers involved. The study signified the effectiveness of the I-Teach model in facilitating the improvement of teachers' professionalism in managing inclusive classes. effectiveness of the model has been confirmed through an Independent Sample T-Test between the control and experimental group, as sig = 0.000 < 0.05 and tcalc = -7.85 < -ttab = -2.074. The result of analysis confirmed the significance of the teachers' professionalism at the experimental group compared to the control group. The study recommended the provision of trainings for all teachers to equip them with sufficient comprehension of inclusive education and special- needs childhood management, as part of the sustainable improvement of their professionalism.

Fazilla, Sarah; Bukit, Nurdin; Sriadhi (2023). Professional Competence of Prospective Elementary School Teachers in Designing Lesson Plans Integrating Project-Based Learning Models and TPACK . This study employs a qualitative approach with a case study research design by involving 10 prospective elementary

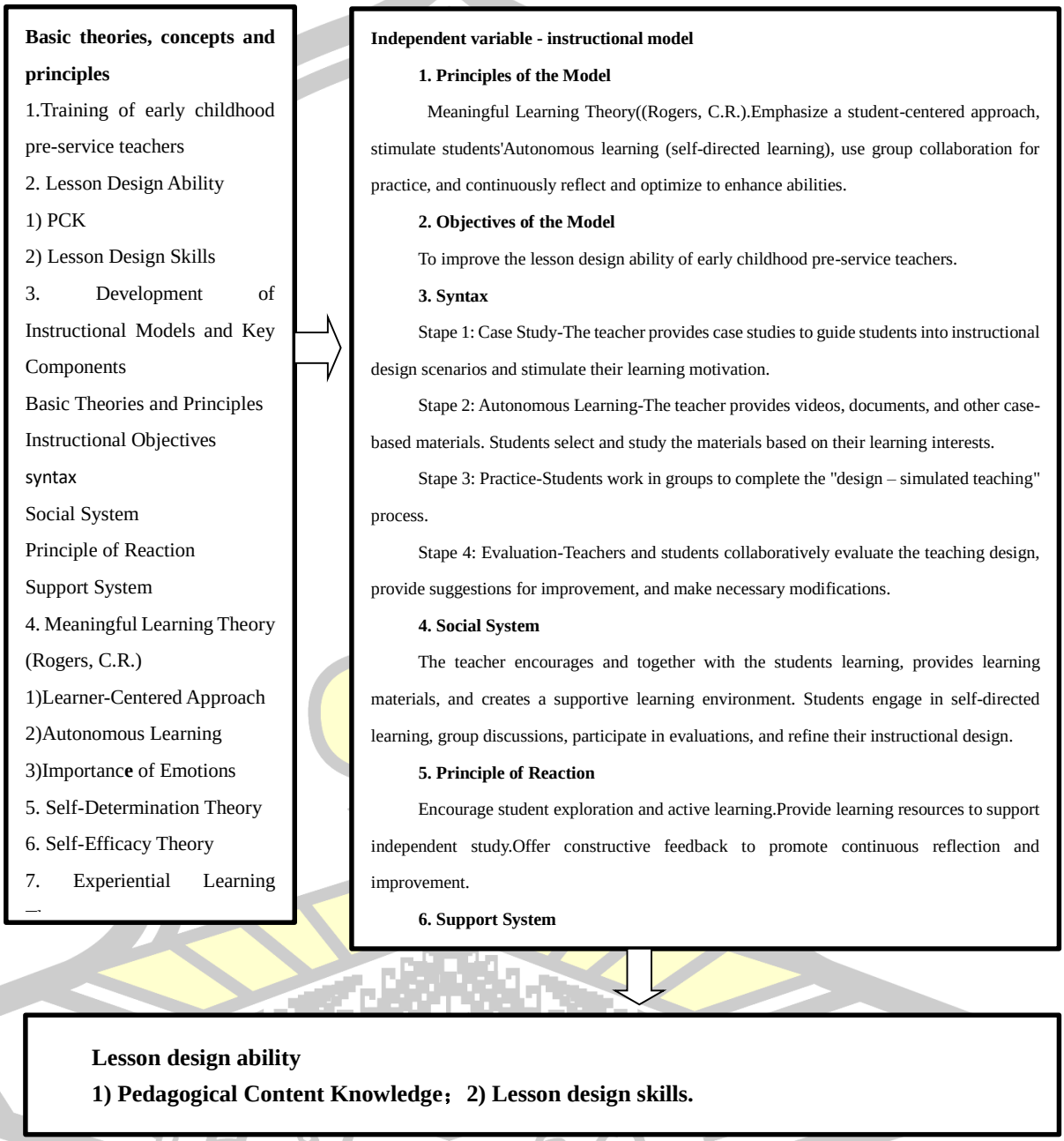
school teachers enrolled in sixth semester. Data collection was carried out through interviews, observation, and documentation, while data analysis was carried out qualitatively, comprising data reduction, verification, and conclusions.

The findings obtained revealed that the professional competence of prospective elementary school teachers was adequate but could be improved. According to the interviews, they were able to develop a scientific mindset in preparing lesson plans with subject mastery based on basic competencies and learning objectives. In fact, four participants were able to develop lesson plans using project-based learning models. In the analysis process, it was also found that these prospective elementary school teachers were able to integrate TPACK, meaning they knew how to link material with the use of technology and were able to teach it in simulation activities carried out in class. However, some of them still struggled to make project-based learning plans, especially in designing projects relevant to teaching materials. Overall, it can be concluded that the professional competence of prospective teacher students was adequate but could be improved, particularly in their capacity to design projects relevant to the material and learning objectives in elementary schools.

Hardré(2005) designed and developed an instructional design training course based on the ADDIE model and conducted training for university teaching assistants. In the research process, interviews, text analysis and questionnaire surveys were used. A psychological scale was used to measure the changes in the teaching assistants' self-perception before and after the training. A qualitative analysis of the interview data, design works and reflective papers was also conducted. These evidences show that after the intervention, not only the teaching assistants' instructional design knowledge was measured, but also the teaching assistants' lesson design skill was improved(Harré, 2005) .

2.7 Conceptual framework

The framework of this study is shown in the figure :



Figures 1 Conceptual framework for developing instructional model based on meaningful learning theory to promote the lesson design ability of early childhood pre-service teachers

Source : Zhao Ting (2025)

CHAPTER III

RESEARCH METHODS

Developing instructional model to promote the lesson design ability of early childhood pre-service teachers uses Research and Development (R & D) as the research method . Its process and methods are divided into the following three phase, As shown in Table 2.

Phase I Contextual Study (R1)

The first phase is contextual research. The main purpose of this phase is: 1) To study the basic information of developing instructional model based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers; 2) To investigate the current situation and needs in the current teaching of early childhood pre-service teachers' lesson design ability. Based on these two research purposes, the following three steps of research are carried out:

Step 1: Literature research. By searching Chinese databases and foreign databases such as CNKI, Google Scholar, ERIC, and relevant websites of the Ministry of Education, find literature related to lesson design ability, early childhood pre-service teachers' ability training, instructional model, etc. read and analyze relevant literature.

Step 2: Investigation and research. Investigate and research the current situation and needs of early childhood pre-service teachers' lesson design ability and the needs of their teachers regarding the instructional model.

Phase II Developing instructional model(D 1)

Based on the research results of the first phase, this phase will develop an instructional model based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers. Including drafting instructional model and evaluating the quality of the instructional model. The steps are as follows:

Step 1: Draft an instructional model based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers.

Step 2: Evaluation the instructional model based on expert feedback.

Phase III Implementation(R2)

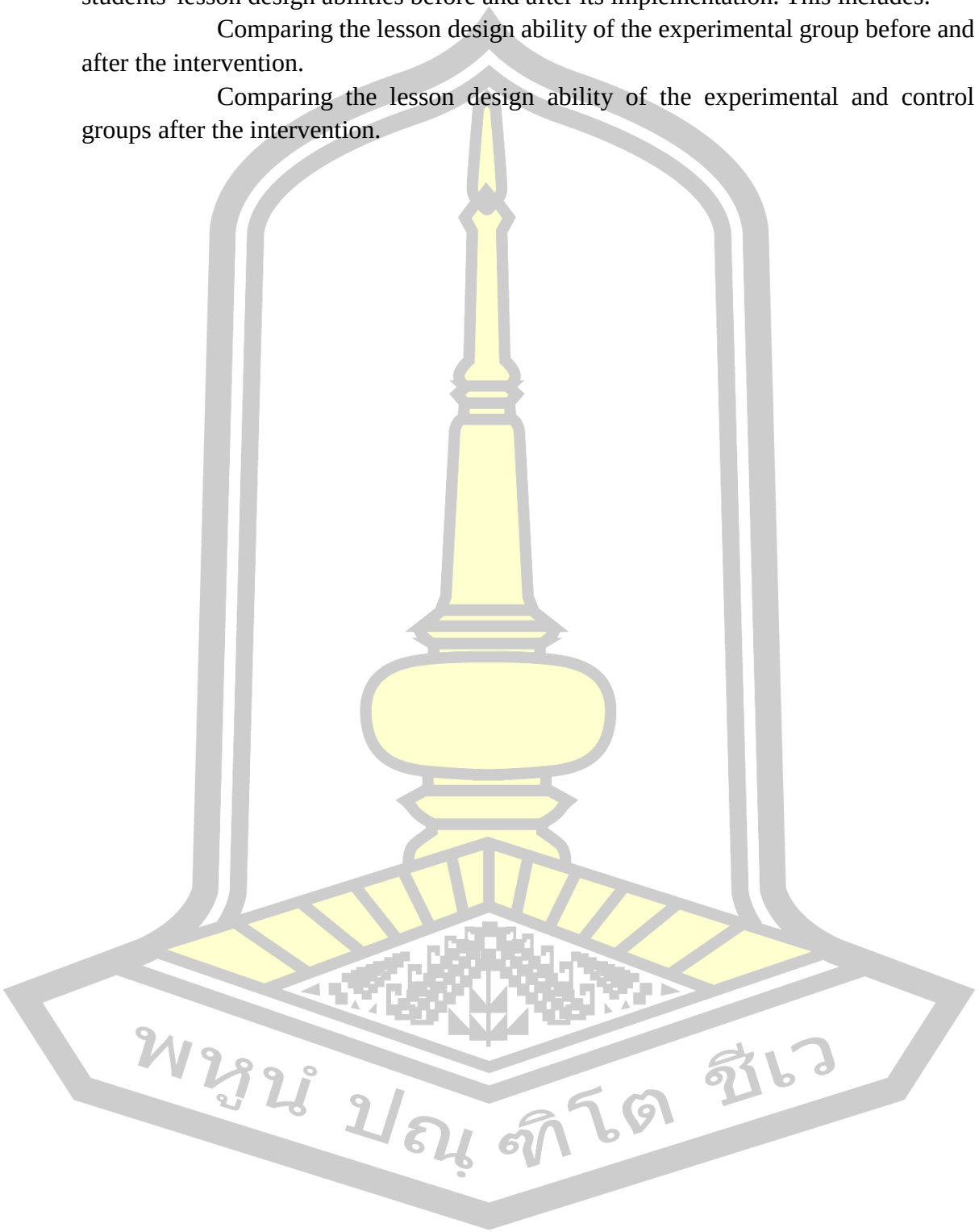
Based on the instructional model developed in Phase II, The third phase is to examine the results of implementing the new instructional model based on meaningful learning theory in improving the lesson design ability of early childhood pre-service teachers in a normal college. The implementation consists of two steps:

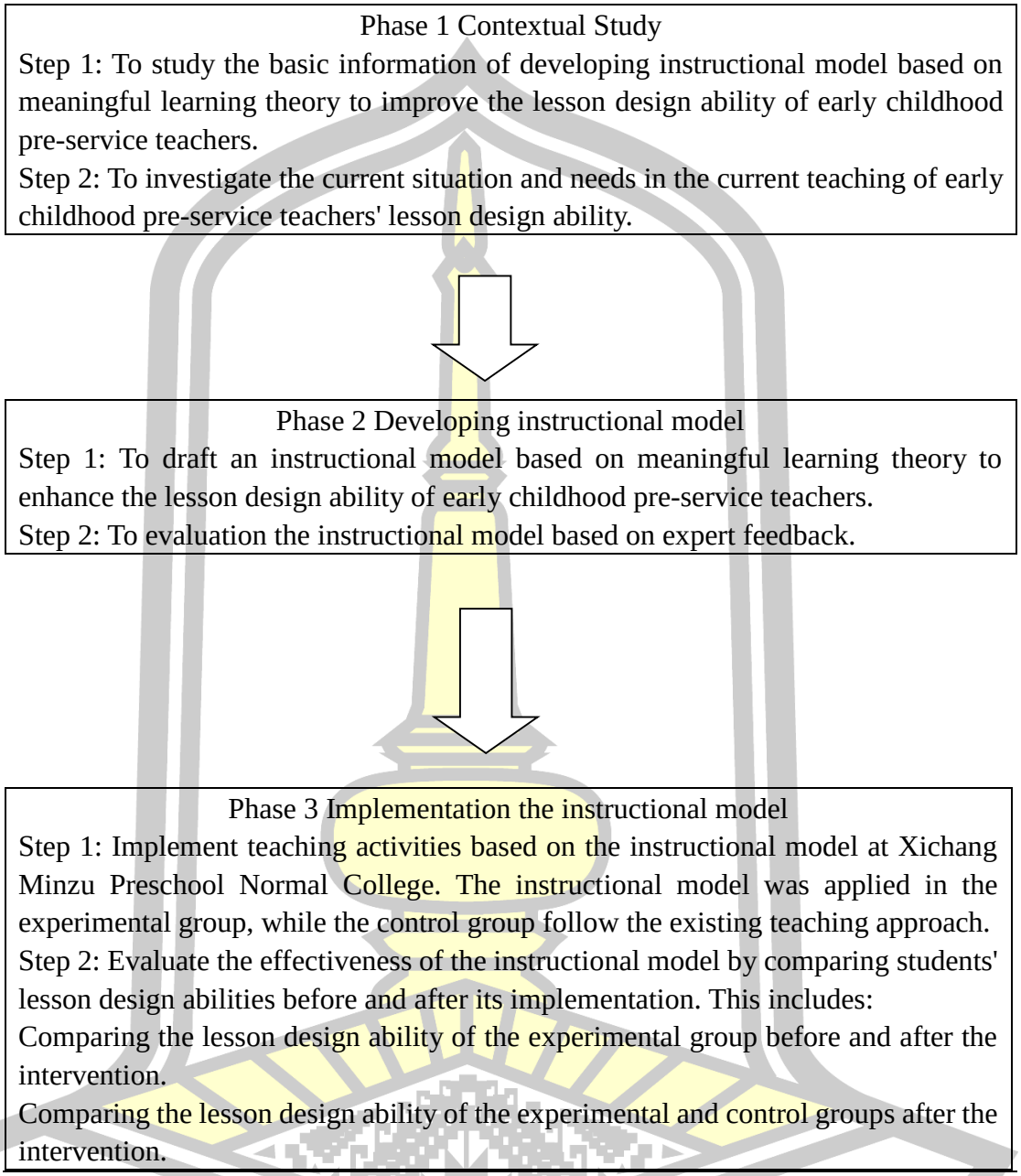
Step 1: Implement teaching activities based on the instructional model at Xichang Minzu Preschool Normal College. The instructional model was applied in the experimental group, while the control group follow the existing teaching approach.

Step 2: Evaluate the effectiveness of the instructional model by comparing students' lesson design abilities before and after its implementation. This includes:

Comparing the lesson design ability of the experimental group before and after the intervention.

Comparing the lesson design ability of the experimental and control groups after the intervention.





Figures 2 Research phase for developing instructional model based on meaningful learning theory to promote the lesson design ability of early childhood pre-service teachers

Source : Zhao Ting (2025)

The table 15 summarizes the research methodology :

Table 15 Research methods for developing instructional model

Phase	Research Objectives	Research Methods	Data Sources	Analysis	Results
Phase 1: Contextual Study	To study the theories, concepts, and principles related to instructional models and lesson design ability	Literature Review	Relevant textbooks, documents, and research papers	Content Analysis	Theoretical framework
	To investigate the current status and needs of students	Questionnaire Survey	300 students from early childhood education programs in teacher training colleges	Mean, Standard Deviation, Percentage, Content Analysis	Current status and needs of students' lesson design ability
	To investigate the needs of teachers	Interviews	5 teachers responsible for the courses	Content Analysis	Teachers' needs for the instructional model
Phase 2: Developing the Model	To develop an instructional model to enhance the lesson design ability of early childhood pre-service teachers based on the findings from Phase 1	Focus Group Discussion	Findings from Phase 1	Content Analysis	Preliminary instructional model
	Experts evaluate and guide the quality of the instructional model	Expert Review	5 experts in curriculum and instruction	Mean and Standard Deviation	Refined instructional model
Phase 3: Implementation	To compare the lesson design ability of experimental before and after the intervention, in order to evaluate the effectiveness of the instructional model.	Quasi-Experimental Research	experimental group (30 students)	Mean and Standard Deviation	Improvement in lesson design ability of the experimental group after the intervention.

Phase	Research Objectives	Research Methods	Data Sources	Analysis	Results
	To compare the lesson design ability between the experimental group and the control group after the intervention, in order to evaluate the effectiveness of the instructional model.	Quasi-Experimental Research	1 experimental group (30 students), 1 control group (30 students)	Mean and Standard Deviation	The difference in lesson design ability between the experimental and control groups.

Source : Zhao Ting (2025)

3.1 Phase I: Contextual Study

The primary objective of this phase is to:

Study the fundamental information on developing an instructional model based on meaningful learning theory to enhance the lesson design ability of early childhood pre-service teachers.

Study the current situation and needs of early childhood pre-service teachers' lesson design ability and the needs of their teachers.

Based on these two research objectives, the study consists of the following two steps:

Step 1: Studying Fundamental Information

A comprehensive literature review will be conducted by searching CNKI, Google Scholar, ERIC, and other Chinese and international academic databases, as well as relevant websites of the Ministry of Education. The focus will be on literature related to lesson design ability, early childhood pre-service teacher training, and instructional model development. The collected literature will be reviewed and analyzed. The content includes: theoretical foundation,Characteristics of the research subjects, current teaching practices, and related studies.

Step 2: Investigative Research

This step involves studying the current status, and needs of early childhood pre-service teachers regarding lesson design, and surveying teachers' needs.

3.1.1 Step 1: Studying Fundamental Information

Study about relevant concepts, theories, literature, and related research. Used to develop instructional model based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers. This includes the training of early childhood pre-service teachers, instructional model development, lesson design ability, and meaningful learning theory-related content. Analyze and integrate basic information as a research basis for developing instructional model based on meaningful

learning theory to promote the lesson design ability of early childhood pre-service teachers.

3.1.1.1 Purpose

(1) To study the related concepts, theories, texts, and research. Instructional model based on meaningful learning theory improve the lesson design ability of early childhood pre-service teachers, and strategies for organizing teaching based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers.

(2) To determine the conceptual framework for developing instructional model based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers.

3.1.1.2 Data Sources

Related literature, textbooks, articles, research, books, and online media on teaching and learning based on meaningful learning theory to promote lesson design ability. Teaching and learning activities based on meaningful learning theory, strategies for improving lesson design ability, etc.

Xichang Minzu Preschool Normal College "Early Childhood lesson Design" Course Group.

3.1.1.3 Tools

Content analysis of relevant literature, including research papers, books, and policy documents related to instructional model development and lesson design ability improvement.

3.1.1.4 Tool Development and Quality

The content analysis framework was developed based on relevant literature and research. The accuracy and relevance of the identified key themes and questions were reviewed by the thesis supervisor. Revisions and refinements were made according to the feedback to ensure validity and reliability.

3.1.1.5 Data Collection Methods

Relevant literature, theories, and research related to instructional model development and lesson design ability were reviewed and synthesized.

3.1.1.6 Data Analysis Methods

Content analysis was employed to examine the key themes and theoretical foundations of instructional model development and lesson design ability enhancement.

3.1.2 Step 2: Investigative Research

This step studying the current status, and needs of students regarding lesson design, and teachers' needs.

3.1.2.1 Population and Sampling

The total number of students enrolled in the Early Childhood Education program at Xichang Minzu Preschool Normal College are 1,635. A non-probability sample of 300 students was selected.

There are 7 instructors teaching lesson design courses, from which 5 instructors were sampled.

3.1.2.2 Sampling Design

A non-probability sampling method was used to select 300 students for the questionnaire survey. A total of 300 questionnaires were distributed.

The 5 instructors sampled were selected for convenience. All have at least five years of teaching experience in lesson design at Xichang Minzu Preschool Teachers College.

3.1.2.3 Content

Questionnaire for 300 Early Childhood Education Students:Current situation and needs, The questionnaire aims to analyze students' current situation and needs.

Interviews with 5 Instructors:The interviews will focus on the teachers' suggestions and feedback on the current instructional model, teachers' needs for improvements in the instructional model.

3.1.2.4 Tools

The tools for collecting these data are student questionnaires and teacher interview outlines.

3.1.2.4.1 Construction and Quality of tool

3.1.2.4.1.1 Tool Structure

The development of the tools followed a systematic process to ensure reliability and validity. The steps are as follows:

Literature Review: Analyzed existing research on lesson design ability, meaningful learning theory, and instructional model evaluation.

Identified key dimensions and indicators relevant to early childhood pre-service teachers' lesson design ability.

Initial Tool Development: Designed the student questionnaire and teacher interview outline based on the identified indicators.

Ensured alignment with the research objectives and theoretical framework.

Expert Validation: Sought feedback from experts in early childhood education and instructional design.

The five experts are three experts in education and two experts in educational management, all of whom have the title of associate professor or above. The five experts are as follows:

1) Professor Liu Xiaowei, from Dali University, an expert in Education;

2) Professor Yan Chaoyun, from Sichuan Normal University, an expert in Early Childhood Education;

3) Associate Professor Yu Chenghong, from Xichang National Preschool Education College, an expert in Statistics;

4) Professor Chu Yuanhui, from Baoshan College, an expert in Education;

5) Associate Professor Sun Yajuan, from Dali University, an expert in Early Childhood Education.

Modified and refined the tools based on expert suggestions to enhance clarity, relevance, and comprehensiveness.

Pilot Testing: Conducted a small-scale pilot study to test the questionnaire and interview outline. Collected preliminary data to assess clarity, reliability, and feasibility.

Final Refinement: Adjusted wording, structure, and content based on pilot test results. Finalized the tools for data collection in the main study.

This structured development process ensures that the tools effectively capture students' lesson design ability and teachers' perceptions of the instructional model.

3.1.2.4.1.2 Tool Quality

"Self-Assessment and Needs Survey on Early Childhood Pre-Service Teachers' Lesson Design Ability". The questionnaire was reviewed by three experts: A PhD in Curriculum and Instruction, A PhD in Early Childhood Education, A teacher with over five years of experience in early childhood lesson design. After revisions based on their feedback, the final version included 14 questions. A pilot survey was conducted with a small group of participants before the formal study. The final questionnaire was evaluated by five experts to ensure comprehensive coverage of the research topic and alignment with the research objectives.

Interview Guide on the Needs for Lesson Design Ability Training. The interview questions were reviewed by five experts to ensure that the topics comprehensively covered the research objectives and were closely aligned with the study's purpose.

3.1.2.4.1.2.1) Validity

Content Validity: The questionnaire items were reviewed by five experts to ensure that all 14 questions comprehensively covered the research topic and were closely aligned with the research objectives. The expert review results were analyzed using the Index of Item-Objective Congruence (IOC).

Index of Item-Objective Congruence (IOC) is an evaluation tool used to

analyze the consistency between individual items (questions) in a questionnaire or test and the overall test objectives or constructs. The IOC value is calculated based on the correlation between items, typically ranging from 0 to 1, where a higher value indicates better item consistency.

The IOC calculation formula is as follows:

$$IOC = \frac{\sum R}{N}$$

The interpretation of IOC values generally follows these standards:

Close to 1: Indicates a high level of consistency between items, suggesting strong relevance and a well-structured questionnaire or test.

Close to 0: Indicates poor consistency between items, implying that the questionnaire design may need to be re-evaluated.

In practical applications, IOC values help researchers assess whether the questionnaire or test is properly constructed and whether certain items need to be revised or removed to improve overall consistency. Additionally, IOC is an important consideration before conducting factor analysis, as it provides insight into whether the items are suitable for factor analysis. If the IOC value is low, it may indicate that the data is not suitable for factor analysis or that the questionnaire needs to be redesigned to enhance item consistency.

The IOC results of the Self-Assessment and Needs Survey on Early Childhood Pre-Service Teachers' Lesson Design Ability are shown in the table 16.

Table 16 The Experts' evaluation of the Self-Assessment and Needs Survey on Early Childhood Pre-Service Teachers' Lesson Design Ability

Item	Opinion of experts					Subtotal	Index of Coincidence (IOC)	Interpret
	1	2	3	4	5			
1	+1	+1	+1	+1	+1	5	1.0	available
2	+1	+1	+1	+1	+1	5	1.0	available
3	+1	+1	+1	+1	+1	5	1.0	available
4	+1	+1	+1	+1	+1	5	1.0	available
5	+1	+1	+1	+1	+1	5	1.0	available
6	+1	+1	+1	+1	+1	5	1.0	available
7	+1	+1	+1	+1	+1	5	1.0	available
8	+1	+1	+1	+1	+1	5	1.0	available
9	+1	+1	+1	+1	+1	5	1.0	available

10	+1	+1	+1	+1	+1	5	1.0	available
11	+1	+1	+1	+1	+1	5	1.0	available
12	+1	+1	+1	+1	+1	5	1.0	available
13	+1	+1	+1	+1	+1	5	1.0	available
14	+1	+1	+1	+1	+1	5	1.0	available

Source : Zhao Ting (2025)

The five experts are as follows:

1) Professor Liu Xiaowei, from Dali University, an expert in Education;

2) Professor Yan Chaoyun, from Sichuan Normal University, an expert in Early Childhood Education;

3) Associate Professor Yu Chenghong, from Xichang National Preschool Education College, an expert in Statistics;

4) Professor Chu Yuanhui, from Baoshan College, an expert in Education;

5) Associate Professor Sun Yajuan, from Dali University, an expert in Early Childhood Education.

Through the evaluation of the five experts, the questionnaire was found to adequately cover the survey dimensions and be closely aligned with the research objectives. The questionnaire is valid and can provide important reference for subsequent research.

The IOC results of the Lesson Design Ability Development Needs Interview Outline are shown in the table 17.

Table 17 The Experts' evaluation of the Interview Outline on Teachers' Needs for Instructional Models

Item	**Opinion of experts**					**Subtotal**	**Index of Coincidence (IOC)**	**Interpret**
	1	**2**	**3**	**4**	**5**			
1	+1	+1	+1	+1	+1	5	1.0	available
2	+1	+1	+1	+1	+1	5	1.0	available
3	+1	+1	+1	+1	+1	5	1.0	available
4	+1	+1	+1	+1	+1	5	1.0	available
5	+1	+1	+1	+1	+1	5	1.0	available
6	+1	+1	+1	+1	+1	5	1.0	available
7	+1	+1	+1	+1	+1	5	1.0	available

8	+1	+1	+1	+1	+1	5	1.0	available
9	+1	+1	+1	+1	+1	5	1.0	available
10	+1	+1	+1	+1	+1	5	1.0	available

Source : Zhao Ting (2025)

The five experts are as follows:

1) Professor Liu Xiaowei, from Dali University, an expert in Education;

2) Professor Yan Chaoyun, from Sichuan Normal University, an expert in Early Childhood Education;

3) Associate Professor Yu Chenghong, from Xichang National Preschool Education College, an expert in Statistics;

4) Professor Chu Yuanhui, from Baoshan College, an expert in Education;

5) Associate Professor Sun Yajuan, from Dali University, an expert in Early Childhood Education.

Through the evaluation of the five experts, the questionnaire was found to adequately cover the survey dimensions and be closely aligned with the research objectives. The questionnaire is valid and can provide important reference for subsequent research.

3.1.2.4.1.2.2) Reliability

Cronbach's Alpha coefficient, usually referred to as Alpha coefficient or Cronbach's Alpha, is a statistical indicator for measuring the internal consistency reliability of a scale, proposed by psychologist Lee Cronbach in 1951. It is used to evaluate the consistency of a set of scales or test questions, that is, whether all questions are measuring the same concept or construct.

The higher the Alpha coefficient value, the better the internal consistency of the scale. Generally speaking, the interpretation criteria of the Alpha coefficient are as follows:

Below 0.5: The reliability of the scale is insufficient and the questions need to be redesigned or combined.

0.5 to 0.6: The reliability of the scale is low and may need further improvement.

0.6 to 0.7: The reliability of the scale is acceptable, but there is still room for improvement.

0.7 to 0.8: The reliability of the scale is good and suitable for most studies.

0.8 to 0.9: The reliability of the scale is excellent and suitable for rigorous research.

Above 0.9: The reliability of the scale is very high.

This study employed Cronbach's Alpha coefficient to examine the

internal consistency reliability of the questionnaire. Before the formal survey, a pilot test was conducted using the Self-Assessment and Needs Survey on Early Childhood Pre-Service Teachers' Lesson Design Ability, with a sample size of 50. The calculated Cronbach's Alpha coefficient was 0.875.the Cronbach's Alpha coefficient of 0.875 demonstrates a high level of internal consistency. This means that the items in the questionnaire exhibit strong coherence when measuring the same concept or dimension, effectively assessing the target variable.

Therefore, we can conclude that this questionnaire has good reliability, ensuring consistent and dependable measurement of the research variables. It provides a solid and reliable data foundation for subsequent research. The questionnaire can continue to be used for data collection and analysis to further explore the characteristics and phenomena related to the research subjects.

3.1.2.5 Measurement and Data Collection

The Self-Assessment and Needs Survey on Early Childhood Pre-Service Teachers' Lesson Design Ability was distributed to the target group via Wenjuanxing (a Chinese survey platform) and the completed questionnaires were collected. The target group consisted of students from the early childhood Education Department of Xichang Minzu Preschool College in Liangshan Prefecture, Sichuan Province. A total of 300 questionnaires were distributed.

The Interview Outline on Teachers' Needs for Instructional Models targeted the teachers who taught the course Early Childhood Lesson Design at Xichang Minzu Preschool College. Interviews were conducted with five teachers, and voice recorders were used to capture the discussions, preparing the data for subsequent analysis. The five interviewed teachers are:

1) Professor Huang Ping – Teaches the course Early Childhood Language Lesson Design with 20 years of experience.

2) Lecturer Lin Qiang – Teaches the course Early Childhood Arts Lesson Design with 6 years of experience.

3) Lecturer Li Xiaoyan – Teaches the course Early Childhood Health Lesson Design with 5 years of experience.

4) Assistant Lecturer Wang Quanbin – Teaches the course Early Childhood Social Lesson Design with 6 years of experience.

5) Assistant Lecturer Zhu Shunfen – Teaches the course Early Childhood Science Lesson Design with 5 years of experience.

3.1.2.6 Data Analysis

The analysis method for the Self-Assessment and Needs Survey on Early Childhood Pre-Service Teachers' Lesson Design Ability is as follows:

First, an analysis of the current situation was conducted. Students' self-evaluation of their lesson design ability was divided into five levels:

5: Indicates that the current or expected situation is at the highest level.
4: Indicates that the current or expected situation is relatively high.
3: Indicates that the current or expected situation is at a medium level.
2: Indicates that the current or expected situation is at a low level.
1: Indicates that the current or expected situation is at the lowest level.

Based on the statistical results, the mean value was calculated for analysis:

A mean value between 4.50-5.00 indicates the highest level.
A mean value between 3.50-4.49 indicates a relatively high level.
A mean value between 2.50-3.49 indicates a medium level.
A mean value between 1.50-2.49 indicates a relatively low level.
A mean value between 1.00-1.49 indicates the lowest level.

Second, students' demand for the course was calculated using percentages, and the results were ranked based on the percentage distribution.

Third, open-ended questions were analyzed using text analysis, summarizing the difficulties students encountered, reason, and suggestions. Text analysis was also employed to examine students' needs and current situation, as well as teachers' needs.

The analysis of the Interview Outline on Teachers' Needs for Instructional Models was conducted using text analysis, summarizing the teachers' responses.

3.1.2.7 Statistics for Data Analysis

Analysis will be conducted using the collected data, including:

1) Calculating the mean ($\bar{X}$)
2) Calculating the standard deviation (S.D.)
3) Calculating percentages (%)

The analysis will focus on the average values of students' lesson design abilities, which will be sorted from low to high based on the mean.

Text analysis will also be used to analyze students' needs and current situation, as well as teachers' needs.

Finally, the analysis of the "Early Childhood Pre-service Teacher Lesson Design Ability Self-Assessment and Needs Survey" and the "Interview Outlin on Teachers' Needs for Instructional Models" , the current situation and needs are studied as the basis for the second phase of research.

3.2 Phase II: Developing instructional model

Based on the research results of the first phase, this phase will develop an instructional model based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers. It includes drafting an instructional model and evaluating the quality of the instructional model. The steps are as follows:

Step 1: Draft an instructional model based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers.

Step 2: Evaluation the instructional model based on expert feedback.

3.2.1 Target group

1.1) 5 teachers participated in the focus group discussion with the researcher to discuss the draft instructional model. The focus group teachers are as follows:

1. Professor Huang Ping, 20 years of experience in teaching "Early Childhood Language Lesson Design"

2. Lecturer Lin Qiang, 5 years of experience in teaching "Early Childhood Art Lesson Design"

3. Lecturer Li Xiaoyan, 5 years of experience in teaching "Early Childhood Health Lesson Design"

4. Assistant Lecturer Wang Quanbin, 6 years of experience in teaching "Early Childhood Social Lesson Design"

5. Assistant Lecturer Zhu Shunfen, 5 years of experience in teaching "Early Childhood Science Lesson Design"

1.2) Five experts provide opinions and suggestions on the instructional model and evaluate the quality of the instructional model. The five experts are shown in the following table:

1. Associate Professor She Yanjun, Director of the Preschool Education Teaching and Research Section of Xichang Minzu Normal College, an expert in educational psychology.

2. Professor Yan Chaoyun, an expert in education from Sichuan Normal University, has more than 20 years of experience in teaching lesson design.

3. Associate Professor Huang Ping, from Xichang Minzu Normal College, has more than 20 years of experience in teaching lesson design.

4. Professor Liu Xiaowei, an expert in curriculum and instruction from Dali University.

5. Professor Sun Yajuan, from Dali University, has more than 10 years of experience in teaching lesson design, an expert in preschool education.

3.3.2 Research Tool

The tools for collecting experts' evaluations and suggestions on the instructional model are the Expert Evaluation Scale and the Expert Suggestion Form.

To ensure the scientific validity and effectiveness of the expert evaluation and advice tool, a systematic development process was followed, including the following steps:

1. Literature Review

Reviewed domestic and international research on instructional model evaluation, meaningful learning theory, and lesson design ability.

Identified key evaluation criteria for experts to assess the instructional

model, such as instructional objectives, teaching strategies, student engagement, and assessment methods.

2. Preliminary Tool Design

Developed the initial framework of the tool based on the literature review, including three parts: Basic Information, Evaluation of the Instructional Model, and Suggestions for the Instructional Model.

Designed specific evaluation criteria and used Likert scales (e.g., 1-5 rating) or open-ended questions to collect expert feedback.

3. Expert Consultation and Revision

Invited experts in early childhood education, instructional , to review the tool's content, structure, and clarity.

Experts is:

Professor Yan Chaoyun, an expert in education from Sichuan Normal University, has more than 20 years of experience in teaching lesson design.

Professor Liu Xiaowei, an expert in curriculum and instruction from Dali University.

Refined the evaluation criteria based on expert feedback to ensure clarity, scientific rigor, and applicability.

This systematic development process ensures the tool's scientific validity and reliability, enabling an effective assessment of the instructional model's quality and providing guidance for its improvement.

3.2.3 Data Collection

Bring the new instructional model and Experts' Evaluate and Advices of the Instructional Model to 5 education experts and ask them to evaluate the instructional model. The basic information of the 5 experts is as table 18.

Table 18 Expert information for evaluating instructional model

No.	Name	Gender	Positional title	Research field	University
1	She Yanjun	female	Associate Professor	Educational Psychology	Xichang Minzu Normal College
2	Yan Chaoyun	male	Professor	Preschool Education	Sichuan Normal University
3	Huang Ping	female	Associate Professor	Preschool Education	Xichang Minzu Normal College
4	Liu Xiaowei	male	Professor	Curriculum and Instruction	Dali University
5	Sun Yajuan	female	Professor	Preschool Education	Dali University

Source : Zhao Ting (2025)

3.2.4 Data Statistics

1 = Seriously does not meet the requirements; cannot be used, needs to be redesigned from scratch.

2 = Major problems; cannot be effectively implemented, requires significant modification.

3 = Basically meets the requirements; has some flaws, can be partially implemented.

4 = Well-designed; effectively supports the objectives, can be implemented smoothly.

5 = Perfectly designed; fully meets the requirements, outstanding effectiveness, can be implemented efficiently.

5. Data Analysis

The mean and standard deviation of the expert ratings are calculated using the following formula:

$$\bar{X} = \frac{\sum X_i}{n}$$

Xi is the score given by each expert

n is the total number of experts (5)

$$SD = \sqrt{\frac{\sum_{i=1}^{n}(X_i - \mu)^2}{n}}$$

Where:

- X_i represents the rating from each expert.
- μ is the mean of the ratings.
- n is the number of ratings (i.e., the number of experts).

Mean Score Evaluation Standards:

1.0 - 2.0 (Not Usable)

The instructional model has serious issues and cannot be effectively implemented. It needs to be redesigned or significantly modified.

2.1 - 3.0 (Partially Usable)

The instructional model meets basic requirements but has some flaws and limitations. It can be partially implemented, but its effectiveness is limited and requires further improvement.

3.1 - 4.0 (Usable)

The instructional model is well-designed and can effectively support the objectives. It can be implemented smoothly and achieve a certain level of teaching effectiveness.

4.1 - 5.0 (Highly Usable)

The instructional model is scientifically designed, fully meets the

requirements, and can be implemented efficiently. It has outstanding effectiveness and will have a long-term positive impact on pre-service teachers' lesson design abilities.

3.3 Phase III: Implementation

Based on the instructional model developed in Phase II, this phase aims to implement and evaluate its effectiveness in improving the lesson design ability of pre-service early childhood teachers. The implementation consists of two steps:

Step 1: Implement teaching activities based on the instructional model at Xichang Minzu Preschool Normal College. The instructional model was applied in the experimental group, while the control group follow the existing teaching approach.

Step 2: Evaluate the effectiveness of the instructional model by comparing the lesson design ability. This includes:

Comparing the lesson design ability of the experimental group before and after the intervention.

Comparing the lesson design ability of the experimental and control groups after the intervention.

1) Population and Sampling

This study adopts a quasi-experimental design and selects two classes of pre-service teachers majoring in early childhood education as research participants. One class serves as the experimental group, which receives instruction based on the new instructional model grounded in Meaningful Learning Theory. The other class serves as the control group, following the traditional instructional model.

The study participants are second-year students majoring in early childhood education at Xichang Minzu Preschool Normal College, with a total of 60 students, divided as follows:

Experimental group: 30 students, receiving instruction based on the Meaningful Learning Theory instructional model.

Control group: 30 students, receiving traditional instruction.

Participants met the following criteria:

They were at the same educational level and had not previously received training under a similar teaching model.

They voluntarily participated in the study and agreed to complete all evaluations and feedback processes.

2) Sampling Design

This study adopts cluster random sampling, selecting two classes from the early childhood education program at a college. Since classroom-based instruction is the core of the study, cluster sampling helps maintain consistency in the teaching environment and minimizes individual variations.

To ensure equivalence in learning foundations and cognitive levels, a pre-test was conducted before the experiment to confirm that there are no significant differences ($p > 0.05$) between the two groups' baseline levels, thereby enhancing the

internal validity of the study.

The researchers gave the Lesson Ddesign Aability-Test(LDA-T) to the experimental group and the control group for pre-testing. And calculate the P value of the two groups' pre-test scores.

If $p > 0.05$, no significant difference exists between the two groups, confirming a similar baseline level.

If $p < 0.05$, significant differences exist, requiring further control of variables.

3) Study Content

1. Implementation

Experimental group (30 students): Receives instruction based on the Meaningful Learning Theory teaching model.

Control group (30 students): Receives instruction through traditional teaching methods.

2. Measurement Outcomes

The lesson design abilities of the two groups will be assessed before and after the instructional intervention.

4) Research Tools

1) Teaching Syllabus Based on the New Model

2) Lesson Design Ability Test

4.1) Structure of the Tools

Teaching syllabus based on the new model, developed according to the requirements of Xichang Minzu Preschool Normal College, including:Course Information,Course Objectives,Course Content and Teaching Schedule,Assessment Methods, Resources.

Lesson Design Ability Test(LDA-T), including:Basic Information; PCK Test (Pedagogical Content Knowledge); LDS Test (Lesson Design Skills).

4.2) Quality of the Tools

4.2.1) The Teaching syllabus was evaluated by 5 experts.

4.2.2) The Lesson Design Ability Test(LDA-T) was evaluated by 5 experts. The five experts are as follows:

1. Associate Professor She Yanjun, Director of the Preschool Education Teaching and Research Section of Xichang Minzu Normal College, an expert in educational psychology.

2. Professor Yan Chaoyun, an expert in education from Sichuan Normal University, has more than 20 years of experience in teaching lesson design.

3. Associate Professor Huang Ping, from Xichang Minzu Normal College, has more than 20 years of experience in teaching lesson design.

4. Professor Liu Xiaowei, an expert in curriculum and instruction from Dali University.

5. Professor Sun Yajuan, from Dali University, has more than 10 years of experience in teaching lesson design, an expert in preschool education.

The researchers brought the Lesson Ddesign Aability-Test(LDA-T) to experts for evaluation.

In order to ensure the consistency between the test questions and the objectives, IOC evaluation is usually conducted by experts, who score the relevance of each test question to the objectives and finally calculate the IOC value.

use a three-point rating scale:

1 = Agree

0 = Neutral

-1 = Disagree

Determine whether the LDA-Test is qualified based on the IOC value,The IOC calculation formula is as follows:

$$IOC = \frac{\sum R}{N}$$

IOC: Consistency between test and learning objectives

R:Synthesis of expert opinion scores

N: Total number of experts

IOC ≥ 0.80: These items are highly aligned with the objective and should be retained as core items for evaluating the objective.

0.60 ≤ IOC< 0.80: These items are somewhat aligned with the objective but need further optimization. Consider revising the item to make it a better fit.

IOC< 0.60: These items are poorly aligned with the objective and need to be redesigned or replaced to ensure they effectively measure the objective.

The expert evaluation results showed the table 19.

Table 19 Expert Evaluation Form for Lesson Ddesign Aability-Test(LDA-T)

Item	Opinion of experts					Subtotal	Index of Coincidence (IOC)	Interpret
	1	2	3	4	5			
1	+1	0	+1	+1	+1	4	0.80	Available
2	+1	+1	+1	+1	+1	5	1.00	Available
3	+1	+1	+1	0	+1	4	0.80	Available
4	+1	+1	+1	+1	+1	5	1.00	Available
5	+1	+1	+1	+1	+1	5	1.00	Available
6	+1	+1	+1	+1	+1	5	1.00	Available

7	0	+1	+1	+1	+1	4	0.80	Available
8	+1	+1	+1	+1	+1	5	1.00	Available
9	+1	+1	+1	+1	0	4	0.80	Available
10	+1	+1	+1	+1	+1	5	1.00	Available
11	+1	+1	+1	+1	+1	5	1.00	Available
12	+1	+1	+1	+1	+1	5	1.00	Available
13	+1	+1	+1	0	+1	4	0.80	Available
14	+1	+1	+1	+1	+1	5	1.00	Available
15	0	+1	+1	+1	+1	4	0.80	Available
16	+1	+1	+1	+1	+1	5	1.00	Available
17	+1	+1	+1	0	+1	4	0.80	Available
18	+1	+1	+1	+1	+1	5	1.00	Available

Source : Zhao Ting (2025)

From the table, it can be seen that the experts believe that every question of Lesson Ddesign Aability-Test(LDA-T) is usable.

5) Measurement and Data Collection

1) Expert Evaluation of the Teaching Syllabus

Five educational experts will evaluate each section of the syllabus using the following scoring criteria:

1=Completely unacceptable

2=Partially unacceptable (major issues)

3=Acceptable with room for improvement

4=Mostly reasonable with minor adjustments needed

5=Fully reasonable, no modifications needed

The five expert evaluators are:

Professor She Yanjun, Associate Professor, Director of the Early Childhood Education Teaching and Research Office, Xichang Minzu Preschool Teachers College, Educational Psychology Expert.

Professor Yan Chaoyun, Professor at Sichuan Normal University, expert in teaching activity design with 20+ years of experience in early childhood education.

Professor Chu Yuanhui, Professor at Baoshan University, expert in education studies.

Professor Liu Xiaowei, Professor at Dali University, expert in curriculum and instruction.

Professor Sun Yajuan, Professor at Dali University, expert in early childhood education with 10+ years of teaching experience.

2) Pre-Test and Post-Test for Students

A pre-test and post-test will be administered to the 60 students (30 in the experimental group and 30 in the control group) using the Lesson Design Ability Test. Test items and scoring criteria are provided in the attachment.

6) Statistical Analysis

1) Calculation of Expert Scores' Mean and Standard Deviation

The following formulas will be used to compute the mean and standard deviation of expert scores:

$$\bar{X} = \frac{\sum X_i}{n}$$

Xi is the score given by each expert
n is the total number of experts (5)

$$SD = \sqrt{\frac{\sum (X_i - \bar{X})^2}{n}}$$

2) Calculation of Lesson Design Ability Test Scores

Each student's total score will be computed, and the Mean and SD for each dimension and the total score will be calculated using:

$$\bar{X} = \frac{\sum X_i}{n}$$

Xi is the score for each student
n is the total number of students.

$$SD = \sqrt{\frac{\sum (X_i - \bar{X})^2}{n}}$$

An independent samples t-test will be conducted to compare the experimental and control groups before and after the intervention.

The formula for the Independent Samples t-Test is as follows:

$$t = \frac{\overline{X_1} - \overline{X_2}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Where:

- $\overline{X_1}$, $\overline{X_2}$ are the **sample means** of the experimental group and control group, respectively;
- s_1^2, s_2^2 are the **sample variances** of the two groups;
- n_1, n_2 are the **sample sizes** of the two groups.

Degrees of Freedom (df) Calculation:

$$df = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{(\frac{s_1^2}{n_1})^2}{n_1 - 1} + \frac{(\frac{s_2^2}{n_2})^2}{n_2 - 1}}$$

(Note: If assuming equal variances between the two groups, the simplified formula can be used: $df = n_1 + n_2 - 2.$)

7) Statistical Data Analysis

1) Interpretation of Expert Evaluations

$\bar{X}$	
4.5 - 5.0	Excellent, highly approved by experts, usable
4.0 - 4.4	Good quality, minor improvements needed, usable
3.5 - 3.9	Average, some deficiencies, not usable
3.0 - 3.4	Poor, major revisions needed, not usable
<3.0	Unacceptable, experts do not approve, not usable
SD ≤ 0.50	High agreement among experts
0.51 ≤ SD ≤ 0.80	Some disagreement among experts
SD > 0.80	Significant disagreement among experts

2) Analysis of Lesson Design Ability Test Results

If $p < 0.05$, the experiment has a significant impact on students' lesson design ability.

If $p > 0.05$, the effect of the experiment is not significant.

CHAPTER IV

DATA ANALYSIS RESULTS

This study aims to develop an instructional model based on meaningful learning theory to enhance the lesson design ability of early childhood pre-service teachers. The research presents data analysis results based on the following themes:

1. Phase I: Results of Research on Information Related to Developing an Instructional Model Based on Meaningful Learning Theory to Improve Early Childhood Pre-Service Teachers' Lesson Design Ability

2. Phase II: Results of Developing an Instructional Model Based on Meaningful Learning Theory to Enhance Early Childhood Pre-Service Teachers' Lesson Design Ability

3.Phase III: Results of Implement the CAPE Model in the "Early Childhood Science Lesson Design" of the instructional model.

4.1 Phase I: Contextual Study

Research Results on Information Related to Developing an Instructional Model Based on Meaningful Learning Theory

The research results related to developing an instructional model based on meaningful learning theory are divided into two subparts:

1.1 Fundamental information.

1.2 The current status, and needs of early childhood pre-service teachers, and teachers' needs.

4.1.1 Fundamental Information

This study collected a total of 112 relevant references, covering journal articles, academic theses, conference papers, policy documents, and curriculum standards. These references address the lesson design abilities of early childhood pre-service teachers, Rogers' theory of meaningful learning, instructional model development, and related educational policies and standards. Specifically, 68 journal articles focus on fields such as early childhood education, teacher education, instructional design, and educational psychology, providing theoretical support and empirical research to help us understand how to design instructional models based on meaningful learning theory. There are 20 academic theses, including doctoral and master's dissertations, which explore the lesson design abilities of early childhood pre-service teachers and their development pathways, with a particular focus on practical applications. Additionally, 12 conference papers and research reports focus on the construction and application of instructional models based on meaningful learning theory, offering the latest research

findings and case studies. Furthermore, 14 policy documents and curriculum standards, including key education ministry documents such as the "National Accreditation Standards for Preschool Education Programs" and "National Standards for Kindergarten Teachers," provide policy support and frameworks for developing teaching design capabilities, ensuring that the instructional model developed in this study aligns with national educational requirements.

The research results can be divided into the following four aspects：

4.1.1.1 Theoretical Foundations

1) Roger’s Meaningful Learning Theory

Carl Rogers, a prominent figure in humanistic psychology, proposed the "Meaningful Learning Theory," also known as the "Learner-Centered Theory." Rogers believed that learning that stems from self-discovery and self-directed activities could truly influence behavior. His theory was derived from client-centered therapy, emphasizing that learning should focus on students' interests, needs, and emotions.

1.1) Concepts

Learner-Centered Learning: Rogers believed that education should center on the learner, not the teacher or the textbook. The student is the main agent of learning, while the teacher acts as a guide and facilitator, rather than a mere knowledge transmitter. Teaching should focus on the interests, needs, and emotions of the students to foster active learning (Rogers, 1969).

Self-Directed Learning: In this approach, the motivation and direction of learning are determined by the students themselves. Students should choose their learning content based on their interests and needs, engaging in exploration and practice to construct knowledge. The teacher provides learning resources and support to help students set their learning goals (Knowles, 1975). This concept is especially important in pre-service teacher education, where research has shown that self-directed learning helps teachers better understand subject content and design appropriate learning activities for childhood (Boud, Keogh & Walker, 1985).

Emotional Support: Learning is not only a cognitive process but also involves emotional factors. Rogers emphasized that emotional support plays a crucial role in learning. In an emotionally supportive environment, students are more likely to overcome anxiety and gain confidence, which leads to better deep learning. Teachers' roles include providing a safe, open, and inclusive learning space, respecting students' emotional needs (Rogers, 1969). In pre-service teacher education, studies have shown that emotional support can reduce teacher burnout and improve teaching effectiveness (Johnson, 2009).

Empathy and Unconditional Positive Regard: Teachers should fully understand students' emotional needs through empathy and respond to them in a non-judgmental manner, accepting students' emotions and thoughts. Unconditional positive regard means that teachers should respect students unconditionally, regardless of their

academic performance. This attitude helps students feel valued, boosting their motivation to learn (Rogers, 1969). Research has shown that teachers who demonstrate empathy and positive regard can enhance students' psychological well-being and learning motivation (Schmidt & Hunter, 2004).

Problem-Centered Learning: Rogers argued that learning should revolve around real-world problems. Teachers can design meaningful and challenging problem situations, encouraging students to learn by solving problems, thus making learning more relevant and valuable (Rogers, 1983). Problem-centered learning is widely used in teacher education to help students apply learned theories to real-world teaching problems, fostering critical thinking and problem-solving skills (Dewey, 1938).

Experiential Learning and Individualization: Learning should be closely connected with students' personal experiences. The learning process should be individualized to meet the unique needs of each student. Through experiential learning and reflection, students not only grasp theoretical knowledge but also undergo personal growth (Kolb, 1984). Studies have shown that experiential learning allows teachers to better understand students' needs and provide tailored teaching support (Boud, 2001).

1.2) Principles

Principle of Learner Autonomy: Education should respect the autonomy of learners, allowing them to choose the content and methods of their learning. Teachers act as supporters and guides, rather than controllers of the learning process. By providing freedom and choice, students can take control of their own learning, enhancing their motivation (Knowles, 1975).

Principle of Emotional Environment Support: Learning should occur in a supportive emotional environment. Teachers must create a positive, inclusive, and non-judgmental atmosphere where students feel safe and accepted. Emotional security helps students overcome anxiety and engage more fully in the learning process (Rogers, 1969).

Principle of Experiential Learning: Learning should be based on students' personal experiences, with learning content closely linked to their lives and interests. Through actual experience and reflection, students can internalize knowledge, resulting in deep learning (Kolb, 1984).

Principle of Individualized Learning: Every student is unique, and education should be tailored to their individual interests, needs, and developmental requirements. Individualized learning emphasizes student autonomy in the learning process, empowering students to make choices based on their goals (Rogers, 1969).

Principle of Empathy and Positive Support: Teachers should demonstrate empathy to understand students' needs and offer unconditional positive regard. This respect and acceptance foster students' self-confidence and help them overcome challenges, enhancing their learning motivation and self-development (Rogers, 1969).

Principle of Problem-Centered Learning: Learning should be driven by real-world problems. Teachers must design problem situations that challenge students and encourage them to solve these problems, thereby making learning meaningful and

engaging (Dewey, 1938).

1.3) Meaningful Learning Theory in Teacher Education

Rogers' meaningful learning theory has been widely applied in teacher education, especially in the training of pre-service early childhood teachers. A growing body of research indicates the effectiveness of this theory in improving teachers' teaching design capabilities (Peng, 2015; Li, 2014). the instructional model based on Rogers' theory not only enhances pre-service teachers' instructional design abilities but also helps them focus more on students' emotional needs and individualized development during teaching.

Enhancing Teaching Design Ability: By applying Rogers' meaningful learning theory, pre-service teachers can improve their teaching design abilities through practice and reflection, particularly in designing teaching activities that meet students' needs and interests (Meng & Wang, 2023).

Enhancing Self-Reflection and Self-Evaluation Skills: Many educational studies have shown that courses based on Rogers' theory can foster self-reflection and self-evaluation abilities in teachers, helping them adjust teaching strategies to better meet students' needs (Chen, 2013).

Emotional Support and Teacher Growth: By providing emotional support and empathy, teachers can establish stronger relationships with students, reducing teacher burnout and improving creativity and empathy in instructional design (Li, 2021).

2) Curriculum standards

In this study, researcher conducted an in-depth analysis of the curriculum standards related to lesson design for early childhood pre-service teachers. The standards cover five key domains: health, language, social, science, and art. Each domain includes four progressively structured standards addressing the understanding of educational concepts, mastery of pedagogical content knowledge (PCK), instructional design, and the implementation and reflection of teaching activities. The structure of these standards is highly consistent, demonstrating systematic, practical, and developmental characteristics, and aligns closely with the nine indicators of lesson design ability proposed in this study.

Firstly, regarding learner analysis skills, the first standard in each domain emphasizes the pre-service teacher's accurate understanding of the nature of early childhood education, developmental characteristics of young children, and the goals of education in each field. For example, the health domain emphasizes physical, psychological, and social adaptation; the language domain highlights the importance of language development; the social domain stresses respect and multicultural understanding; and the science and art domains focus on cognitive inquiry and creativity. These components support pre-service teachers in analyzing children’s developmental needs and forming a solid foundation for instructional design from a child-centered perspective.

In terms of pedagogical content knowledge (PCK), the second standard in all five domains explicitly requires mastery of content knowledge, knowledge of

learners, and knowledge of teaching strategies. This three-dimensional focus helps teachers grasp the logical relationship between teaching goals and content, and adapt their instructional approaches to suit children's age and developmental stages. These standards effectively support the transformation of knowledge into comprehensive teaching competence.

Regarding the six dimensions of lesson design skills, the third and fourth standards in each domain provide detailed reflections of these competencies. The third standard typically emphasizes setting instructional goals, preparing materials and strategies, selecting appropriate content, and designing the steps for activity implementation. For instance, the language domain involves storytelling, role-play, and language games to promote development; the science domain includes experiments, observation, production, and mathematical activities; the art domain incorporates painting, musical games, and dance activities appropriate for different ages. These requirements demonstrate a comprehensive application of goal-setting, preparation, and content selection skills.

The fourth standard reflects both lesson implementation planning skills and evaluation and reflection skills. The curriculum standards clearly state that pre-service teachers should be able to conduct educational activities in simulated or real classroom settings and carry out evaluations and reflections during the implementation process. For example, in the art and social domains, teachers are expected not only to deliver instruction effectively but also to provide constructive feedback and optimize their teaching. This emphasis on the dynamic and reflective nature of teaching aligns with current educational research on professional teacher development, and with Rogers' theory of "meaningful learning," particularly the core ideas of self-renewal and integration of experience.

In summary, the curriculum standards of these five domains show a high level of alignment with the framework of teaching design competence established in this study. They promote systematic teacher development and offer a clear path for pre-service teachers to follow. These standards incorporate not only cognitive dimensions of knowledge but also skill-based aspects of practice and reflection, fully embodying the process of lesson design from cognition to implementation. This well-structured, content-rich, and conceptually sound standard system provides strong support and theoretical grounding for the cultivation of early childhood pre-service teachers' instructional competencies and serves as a practical foundation for the instructional design enhancement model developed in this study.

4.1.1.2 Characteristics of Research Subjects

1) Lesson Design Ability of Pre-Service Early Childhood Teachers

In the training of pre-service early childhood teachers, lesson design ability is considered to be a critical competency. This not only involves teachers' mastery of subject content but also their ability to design effective teaching activities based on

students' needs and characteristics.

1.1) Lesson Design Ability

Darling-Hammond and Bransford (2005) proposed that lesson design ability in teachers includes not only Pedagogical Content Knowledge(PCK) but also the skill to effectively translate subject knowledge into teaching practice, is lesson design skills.

Pedagogical Content Knowledge (PCK) is one of the core dimensions of teachers' lesson design ability. PCK involves teachers' deep understanding of subject content and how to effectively teach it to students. In early childhood education, PCK includes understanding the developmental characteristics of young childhood and how to select, design, and implement age-appropriate teaching content (Shulman, 1986).

Lesson design skills are crucial for teachers to effectively implement teaching content. Darling-Hammond and Bransford (2005) proposed that lesson design ability not only includes subject knowledge but also the skill to transform this knowledge into teaching practices. These skills involve aspects such as setting classroom goals, analyzing student learning needs, selecting teaching methods, and designing activities. Effective lesson design skills can adjust teaching strategies according to students' needs and characteristics, ensuring that teaching goals are achieved.

1.2) Lesson Design Ability of Pre-Service Early Childhood Teachers

According to the Ministry of Education (2017) "National Standards for Teacher Education Accreditation" and "Professional Standards for Kindergarten Teachers", lesson design ability is considered one of the core competencies in preschool education programs. The standards explicitly state that pre-service teachers should possess solid subject knowledge and be able to flexibly apply the basic theories and methods of lesson design. They should be familiar with the processes and methods of lesson design, including analyzing student learning needs, setting goals, selecting content, choosing teaching methods, and engaging in assessment and reflection.

Based on relevant literature and research on early childhood curriculum design courses, researchers have identified learning indicators for the lesson design ability of pre-service early childhood teachers. These indicators highlight the core elements necessary for effective lesson design, particularly pedagogical content knowledge (PCK) and lesson design skills. The following table (Table 20) lists the key learning indicators for the lesson design ability of pre-service early childhood teachers.

Table 20 learning indicators for early childhood pre-service teachers' lesson design abilities

Lesson Design Ability	Learning Indicators
Pedagogical Content Knowledge (PCK):	1. Teaching content konwledge: Guide the content of early childhood science education.
Master the knowledge of	2. Knowledge of learner: Understand the developmental

early childhood subject teaching, including content, target audience, and teaching methods.	trends of young childhood in the process of science learning.
	3. Knowledge of teaching methods: Master the basic methods for childhood to learn science knowledge.
Lesson Design Skill :Design appropriate lesson activity plans based on young childhood's characteristics.	4.Learner analysis skill: Analyze the consistency between lesson activities and childhood's developmental conditions.
	5.Lesson goal-setting skill: Formulate and articulate activity objectives scientifically and clearly.
	6.Lesson preparation skill: Plan and prepare the materials and conditions required for teaching.
	7.Lesson content selection skill: Select appropriate teaching content to achieve lesson objectives.
	8.Lesson implementation planning skill: Provide strategies and methods for each part of the lesson activity process.
	9.Lesson evaluation and reflection skill: Conduct value judgments on the entire lesson design process.

Source : Zhao Ting (2025)

From the table 20, lesson design ability includes two indicators:

Mastery of Pedagogical Content Knowledge, including three sub-dimensions: content knowledge, knowledge of learner, and knowledge of teaching methods.

Lesson design skills, which include six sub-dimensions: Learner analysis skill, Lesson goal-setting skill, Lesson preparation skill, Lesson content selection skill, Lesson implementation planning skill, Lesson evaluation and reflection skill.

2) Measuring Lesson Design Ability

Measuring lesson design ability is crucial for evaluating pre-service teachers' lesson design competencies and guiding their development. Different measurement tools can help us objectively understand pre-service teachers' ability levels in various dimensions of lesson design. Common measurement tools include questionnaires, lesson activity design analysis, classroom observation records, and expert evaluations.

Questionnaires and Self-Assessment: Questionnaires and self-assessment tools can help teachers evaluate their performance in various aspects of lesson design, particularly in terms of pedagogical content knowledge (PCK) and lesson design skills. Through regular self-assessments, pre-service teachers can identify their strengths and weaknesses, leading to improvements in their lesson design strategies (Harris & Jones, 2011).

Lesson Activity Design Analysis: Analyzing the lesson activity plans

designed by pre-service teachers is another important way to assess their lesson design ability. By examining the content, goals, methods, and assessment mechanisms of teachers' activity designs, researchers can effectively evaluate their lesson design skills. Studies have found that pre-service teachers' ability to analyze student learning needs and set appropriate goals directly influences the effectiveness of their classroom teaching (Van de Walle, 2006).

Classroom Observation and Expert Evaluation: Classroom observation and expert evaluation assess pre-service teachers' ability to apply their lesson design skills during actual teaching. Experts score pre-service teachers based on the accuracy of the teaching content, the appropriateness of the teaching methods, the effectiveness of classroom management, and other factors. This method provides a more direct and specific evaluation of their lesson design abilities.

4.1.1.3 Current Teaching Practices

1) Current Instructional Model

At present, the development of lesson design ability among early childhood pre-service teachers (i.e., students majoring in early childhood education) lacks a systematic, scientific, and widely recognized instructional model. The teaching content of relevant courses is mostly based on policy documents such as the Professional Standards for Kindergarten Teachers and the Guidelines for Kindergarten Education, which emphasize the importance of lesson design ability. However, in practice, most universities have not established clear, standardized processes or operational frameworks for teaching this competency.

Most courses rely heavily on theoretical instruction, with limited practical components. Teaching is often conducted through PowerPoint presentations, textbook analyses, and summary lectures focused on basic concepts such as setting objectives and designing activities. This knowledge-centered, practice-deficient model tends to overlook the importance of student engagement in the actual design process, thereby limiting the development of comprehensive lesson design skills.

Moreover, instructional activities are generally teacher-centered, with low student participation. Even when practical components are included, they are often in the form of course assignments or final presentations, lacking continuity and systematization. As a result, students often design lesson plans in theory without opportunities for real implementation, feedback, or revision, which greatly reduces the effectiveness of the training.

More critically, current models lack structured support for the lesson design process, such as task-oriented activities, individualized feedback, repeated simulations, and guided reflection. Although course content covers core components like instructional objectives, content selection, and methods, these are mostly presented in a static, decontextualized manner that fails to develop students' dynamic lesson design thinking.

In summary, the current teaching model for developing lesson design ability in early childhood pre-service teachers commonly suffers from the following limitations:

A lack of systematic training pathways;

Heavy reliance on theoretical instruction, with minimal practical engagement;

Static presentation of content, limiting the development of dynamic instructional thinking;

Low student involvement, with underdeveloped reflection and feedback mechanisms.

Therefore, there is an urgent need to construct a student-centered instructional model that integrates theory with practice and emphasizes reflection and transfer, in order to more effectively foster the lesson design abilities of early childhood pre-service teachers.

2) Strategies for Developing Lesson Design Ability

This study identifies effective strategies for enhancing early childhood pre-service teachers' lesson design ability, drawing on both theoretical models and practical training methods.

Firstly, Hardré's IDE Model (2005) highlights three core dimensions in developing instructional design expertise: expert thinking, design practice, and design products. The model emphasizes that growth from novice to expert is driven not only by increased knowledge and skill but also by metacognitive reflection—that is, reflecting deeply on one's thinking processes, design decisions, and teaching outcomes. This reflection fosters professional awareness and accelerates expertise development.

In practical teacher education contexts, multiple instructional strategies have proven effective:

Microteaching. Microteaching provides pre-service teachers with opportunities to deliver short, focused lessons in a controlled setting. Through video recordings and guided feedback, students analyze their teaching language, questioning techniques, classroom control, and use of instructional materials. This method cultivates real-time responsiveness and iterative improvement of lesson planning and delivery.

Lesson Presentation and Peer Feedback. Pre-service teachers articulate their lesson designs—objectives, strategies, key points, and justifications—to instructors and peers. This process enhances their ability to explain and reflect on their pedagogical choices, supported by constructive feedback and discussion.

Teaching Observation. Through school-based observation experiences, students witness how experienced teachers manage classrooms, implement teaching strategies, and interact with children. Such immersive learning connects theoretical understanding with authentic practice and encourages reflection on effective instructional design.

Case Analysis. Real-world or simulated teaching cases (via video or

written text) allow pre-service teachers to apply educational theories to analyze challenges in teaching objectives, methods, curriculum content, and evaluation. This strategy bridges theory and practice, develops high-order thinking, and helps students articulate implicit professional knowledge.

Task-Driven Instruction. By engaging in concrete tasks such as writing lesson plans, designing activities, or conducting teaching simulations, students develop their instructional skills through inquiry, reflection, and revision. This method also supports collaborative learning through peer sharing and co-construction of teaching ideas.

Simulation Teaching.Applying their lesson designs in simulated or real classroom settings allows students to test, refine, and reflect on their instructional decisions. Through practice, feedback, and iterative improvement, they gradually enhance their planning and implementation abilities.

Integrated and Scaffolded Training Models. Scholars such as Fu Rong (2013) and Xie Xiaoying & Wu Siyong (2019) recommend comprehensive training programs that include microteaching, case analysis, task-based learning, discussion, collaboration, and role-playing. These models offer varied entry points for building lesson design competence and cater to different learning styles.

In conclusion, effective strategies for developing pre-service teachers' lesson design ability include a combination of microteaching, case analysis, and simulation teaching, often supported by peer discussion, task-based learning, and reflection. These approaches not only strengthen practical skills but also promote the internalization of professional thinking and design awareness, laying a solid foundation for becoming expert instructional designers.

4.1.1.4 Related Research

A review of related studies reveals diverse approaches to cultivating teaching design ability among both pre-service and in-service teachers, informed by various theoretical frameworks and pedagogical models.

Peng Yingjuan (2015) developed a comprehensive training model for teaching ability grounded in cognitive, humanistic, and constructivist learning theories, as well as contemporary educational thought. Guided by the Teacher Education Standards (Trial), the model integrates qualitative and quantitative evaluation and follows a four-stage structure: literature review and needs analysis, training model development, practical application, and result analysis. The inclusion of ST and FIAS analysis methods to evaluate teaching practices demonstrated that the model significantly improved teaching skills in the experimental group, confirming its effectiveness in enhancing lesson design competency.

Li Ying (2014) focused on building information-based lesson design ability through a four-stage research design, which included needs analysis, theoretical framework construction, technical development, and impact evaluation. Her study

introduced a virtual learning community for self-directed and collaborative learning, emphasizing a cyclical process of problem identification, discussion, product observation, evaluation, and improvement. Results indicated that normal students significantly improved their lesson design competencies through the platform, underscoring the value of technology-mediated learning environments.

Zhang Xiaodie (2022) examined the development of interdisciplinary lesson design ability in biology education majors. By utilizing a segmented training model and comparing control and experimental groups across cohorts, Zhang's study found that the targeted training program significantly improved students' self-efficacy in interdisciplinary lesson planning. The study highlights the importance of addressing specific domains (e.g., textbook analysis, student understanding, teaching strategy, and core literacy) and supports phased, context-specific interventions for professional growth.

Qian Zihui (2020) applied the Outcome-Based Education (OBE) framework to develop and evaluate a lesson design training model for middle school teachers. Through empirical data collection and MOOC-based hybrid training, the study showed that defining, realizing, evaluating, and applying learning outcomes improved teachers' professional competencies. Teachers reported stronger clarity on training objectives, enhanced design abilities aligned with core literacy, and a higher sense of achievement, indicating the model's positive effect.

Meng Xianghong and Wang Xiaoli (2023) proposed a "double-chain cycle" model based on deep learning theory, linking learners' "learning experience chain" and educators' "teaching design chain." The model successfully enhanced STEM teachers' lesson design skills, suggesting a synergistic relationship between learner experience and instructional planning in fostering effective STEM pedagogy.

Jin Ping (2011) developed a task-based instructional model aimed at improving the English autonomous learning ability of preschool education majors. The model proved effective in enhancing students' self-regulation, learning motivation, and cognitive engagement. It also promoted greater instructional effectiveness among educators, reflecting the potential of task-based approaches for skill development in language education.

Li Wenxiu (2021) constructed an instructional model to enhance high school students' autonomous learning within the context of maker education. Drawing on constructivism and experiential learning theories, the model emphasized a seven-step instructional process involving autonomous innovation, design, practice, sharing, and evaluation. A comparative experiment between traditional and model-driven instruction confirmed the effectiveness of the new approach in promoting students' autonomous and innovative capabilities.

These studies collectively illustrate the evolving landscape of lesson design training in teacher education. They reveal the significance of theoretical grounding (e.g., constructivism, OBE, deep learning), the importance of technological and social learning environments, and the value of both segmented and cyclical training

structures. Together, they provide a rich foundation for the development of new instructional models aimed at improving teaching design capabilities, particularly in the context of early childhood pre-service teacher education.

4.1.2 The current status, and needs of early childhood pre-service teachers, and their teachers' needs

1) The current status, and needs of early childhood pre-service teachers

The researchers distributed the "Early Childhood Pre-service Teacher Lesson Design Ability Self-Assessment and Needs Survey" through the questionnaire star. The target group was students from the Department of Early Childhood Education of Xichang Nationalities Preschool College in Liangshan Prefecture, Sichuan Province. A total of 300 forms were distributed, 300 points were collected, and the response rate was 100%. After eliminating the questionnaires with the same answer to each question and the completion time of no more than 90 seconds, 279 valid questionnaires were retained for analysis.

1.1) The current status of early childhood pre-service teachers

The researchers analyzed the 279 questionnaires collected. The part two of the questionnaire, Lesson Design Ability Self-Evaluation, showed the current status of early childhood pre-service teachers. The results are shown in Table 21:

Table 21 results of early childhood pre-service teachers' lesson design ability self-evaluation

Lesson Design Ability Self-Evaluation	$\bar{X}$	S.D.	level
1. I can design lesson activities considering childhood's developmental needs.	3.12	0.86	medium
2. I can determine lesson objectives considering holistic child development.	3.24	0.94	medium
3. I can creatively plan and organize lesson processes.	3.20	0.96	medium
4. I can design suitable activities, games, and interactions for childhood.	3.26	0.99	medium
5. I can evaluate and reflect on lesson effectiveness and make necessary adjustments.	3.22	0.98	medium
6. I can prepare teaching aids, multimedia, and other resources to support teaching.	3.48	1.02	medium
view	3.25		medium

Source : Zhao Ting (2025)

From the table 21, the mean of lesson design ability is 3.25, which is at a medium level. The average scores of the six dimensions are 3.12, 3.24, 3.20, 3.26, 3.22, 3.48, all at a medium level. The results are in the following order from low to high: classroom implementation planning ability, learner analysis ability, classroom evaluation and reflection ability, classroom goal setting ability, classroom content selection ability, and classroom preparation ability.

The results indicate that early childhood pre-service teachers' lesson design abilities are generally at a "medium" level. The average score is 3.25, meaning most respondents believe they have a certain level of ability in lesson design but still have room for improvement. The average scores of the six dimensions are also at a "medium" level, suggesting that respondents generally have a moderate view of their lesson design abilities.

Lowest Score: Classroom Implementation Planning Ability (Score: 3.12): This dimension received the lowest score, indicating that pre-service teachers may have significant uncertainty or inadequacy in classroom implementation planning. Specifically, they may feel less confident or inexperienced in organizing the sequence of classroom activities, time management, and designing the detailed steps of the lesson.

Next: Learner Analysis Ability (Score: 3.20): This score is also relatively low, suggesting that pre-service teachers may still need improvement in analyzing children's developmental needs and how to design teaching activities based on these needs.

Medium Scores: Classroom Goal Setting Ability (3.24), Classroom Evaluation and Reflection Ability (3.22), Classroom Content Selection Ability (3.26):

These dimensions received slightly higher scores but still fall within the medium

range, indicating that the pre-service teachers' ability to set teaching objectives, select appropriate teaching content, and evaluate and reflect on classroom activities has not reached an excellent level. Teachers may recognize that they need more support and training in these areas.

Highest Score: Teaching Preparation Ability (Score: 3.48): This dimension received the highest score, suggesting that pre-service teachers feel more confident in preparing teaching resources, teaching aids, and multimedia tools. They are likely more proficient in classroom preparation and can effectively utilize tools and resources to support teaching.

Overall, the evaluation of lesson design abilities is at a medium level. Although pre-service teachers perform well in lesson preparation, their skills in classroom implementation planning and learner analysis are weaker. These results suggest that teachers still need further development in key areas such as learner analysis, classroom goal setting, activity design, and evaluation and reflection.

These findings can inform future teacher training and lesson design courses, particularly in strengthening teachers' abilities in classroom design and learner analysis, helping them improve the overall effectiveness of their lesson planning.

1.2) The needs of early childhood pre-service teachers

Based on students' responses, their needs can be summarized as follows:

Question 10: Which aspects of lesson design do you feel need the most improvement? (Multiple choice), Students' responses are shown in the table 22.

Table 22 Students' need in lesson design skill

No.	Skill	Number of Students	Percentage
1	Student Analysis Skill	206	73.8%
2	Goal Setting Skill	208	74.4%
3	Activity Preparation Skill	215	77%
4	Teaching Content Selection Skill	230	82.4%
5	Activity Implementation Planning Skill	238	85.3%
6	Teaching Evaluation & Reflection Skill	222	79.5%
7	Others	4	1.6%

Source : Zhao Ting (2025)

From the table 22, we can see that students consider Activity Implementation Planning as the most critical skill to improve, with a high percentage of 85.3%. This indicates that students have significant needs in organizing and executing actual teaching activities.

Other key skills that require improvement include Teaching Content Selection (82.4%) and Teaching Evaluation & Reflection (79.5%), ranking second and third, respectively. This suggests that students also need substantial support in selecting

appropriate teaching content and conducting evaluations and reflections after teaching.

While Activity Preparation Ability (77%), Goal Setting Ability (74.4%), and Student Analysis Ability (73.8%) have slightly lower percentages, they still represent high demand. This means these skills also require attention and improvement.

Overall, the data indicates that students have a generally high demand for enhancing their teaching design abilities, with all skill areas exceeding 73%. This highlights that preschool education students need systematic training and development in all aspects of teaching design.

Additionally, four students provided individual responses, mentioning language organization, activity implementation, learner autonomy, and stimulating student interest as areas they wish to improve.

Students generally perceive their lesson design abilities as insufficient and express a strong need for systematic training, especially in the areas of lesson implementation planning, content selection, and evaluation & reflection.

It is recommended that pre-service teacher training programs strengthen practical training in lesson design, including:

Providing situational simulations and hands-on classroom practice;

Increasing case analysis and peer evaluation to promote reflective thinking;

Offering training on goal-setting and content alignment based on child development;

Enhancing comprehensive, full-process lesson design training, covering learner analysis, goal setting, preparation, implementation, and evaluation in a complete cycle.

Teacher education courses should emphasize the integration of implementation and reflection, helping students improve their comprehensive ability to design and manage lessons effectively.

Question 11: In which areas do you wish to receive more guidance or resources? (Multiple choice) The survey results for Question 11 have been compiled into the following table 23.

Table 23 Students' need in crouse

No.	Option	Number of Students	Percentage
1	Child Psychology & Educational Theory Learning	213	76.5%
2	Teaching Design & Planning	218	78.1%
3	Teaching Design or Activity Case Studies	220	78.9%
4	Simulated Teaching	214	76.8%
5	Microteaching	163	58.4%
6	Group Discussion	162	58.1%
7	Independent Learning	158	56.8%
8	Teaching Evaluation & Reflection	175	62.7%
9	Access to Teaching Resources & Materials	174	62.4%
10	Other (please specify): _____	3	

Source : Zhao Ting (2025)

From the table 23, it is evident that the most desired guidance or resources among students are teaching design or activity case studies (78.9%), teaching design and planning (78.1%), and simulated teaching (76.8%). These results indicate that students highly value practical examples and structured planning in developing their teaching design abilities. Child psychology and educational theory learning (76.5%) also received significant attention, showing a strong demand for in-depth theoretical knowledge. Moderate-demand guidance or resources include teaching evaluation and reflection (62.7%) and access to teaching resources and materials (62.4%), suggesting that students seek support in assessing their teaching effectiveness and acquiring necessary materials. Lower-demand guidance or resources include microteaching (58.4%), group discussion (58.1%), and independent learning (56.8%). Although these categories have slightly lower demand, a considerable number of students still seek support in these areas. Additionally, three students selected the "Other" category, specifying needs such as internship opportunities in kindergartens, access to resource channels, and more direct teacher guidance, which align closely with the provided options.

This set of data overall reflects that students have high expectations for teaching support formats that integrate theory with practice, are driven by case studies, and involve realistic simulated teaching environments. Teacher education programs should pay close attention to this trend when designing courses, enhancing the practicality, relevance, and resource support of lesson design training.

Question 12: What challenges have you encountered in the process of learning instructional design?

Students face various challenges in course design, including a lack of

practical experience, limited individual guidance from teachers, insufficient understanding of young childhood, and difficulty in finding high-quality case studies. Table 24 is a summary of the top 10 keywords and their specific descriptions:

Table 24 Statistics of challenges faced by students in lesson design

Rank	Keyword	Frequency	Specific Description
1	Lack of High-Quality Case Studies	77	There are few cases available during the course, often requiring students to figure things out on their own. Existing cases are overly theoretical and lack real classroom-based exemplary instructional designs. Excellent instructional designs often lack detailed breakdowns, such as the rationale behind the design and comparisons between different approaches.
2	Limited Practical Opportunities	48	Limited opportunities for practice in class, making it difficult to test instructional designs. Few internship opportunities, leading to limited experience in applying instructional design in real kindergarten settings. Lack of a complete training process from design to practice, followed by revision and optimization.
3	Lack of Teacher Guidance	45	Limited feedback from teachers; often, students complete their designs without receiving many suggestions for improvement. Students hope for more case explanations and detailed analyses of instructional designs. Teacher guidance is often general rather than offering specific improvements for individual designs.
4	Goal Setting	42	Difficulty in setting appropriate goals that align with both child development levels and teaching requirements. Challenges in matching goals with activity content, sometimes setting goals that are too high or too low. Uncertainty about how to break down activity goals into smaller, measurable objectives.
5	Evaluation and Reflection	34	Unclear on how to assess whether their instructional design is reasonable after completing an activity. Difficulty in evaluating childhood's learning outcomes and determining whether they have truly understood and grasped the content. Lack of systematic guidance on reflection, making it hard to improve instructional designs.
6	Effectiveness of Collaboration	28	Few opportunities for teamwork, leading to a lack of innovative ideas. Differences in ideas and styles among team members sometimes cause disagreements.

Rank	Keyword	Frequency	Specific Description
			Over-reliance on certain members in collaborative design, limiting personal growth in instructional design.
7	Insufficient Understanding of Early childhood	25	Limited direct interaction with young childhood, making it difficult to understand their interests and developmental levels. Insufficient knowledge of cognitive characteristics and learning styles across different age groups, leading to less precise activity designs. childhood's responses sometimes differ from expectations, making it challenging to adjust teaching plans accordingly.
8	Access to and Utilization of Resources	23	Lack of suitable teaching aids, picture books, and game materials, restricting activity design. Limited proficiency in using modern teaching tools, such as PowerPoint, multimedia resources, and interactive whiteboards. Time and cost constraints in preparing handmade materials and game props for activities.
9	Selection of Content and Methods	22	Difficulty in choosing appropriate activity content, sometimes worrying that it is too simple or too complex. Limited teaching methods, often relying on direct explanation or demonstration, resulting in a lack of interactivity. Uncertainty about selecting suitable methods based on different teaching goals, such as when to use games versus inquiry-based learning.
10	Integration of Theory and Practice	21	Difficulty in applying theoretical knowledge to actual instructional design. Theoretical case studies from textbooks are useful, but students often struggle to generate ideas when designing their own lessons. Discrepancies between what is learned in class and actual teaching procedures in kindergartens.

Source : Zhao Ting (2025)

In the process of learning instructional design, students encounter challenges such as a lack of case studies, limited practical opportunities, insufficient teacher guidance, restricted access to teaching resources, difficulties integrating theory with practice, and complexities in designing course objectives, content, and methods.

These findings highlight that students need more practical, guided, and resource-supported training in instructional design. Addressing these challenges will require not only increasing opportunities for real and simulated teaching practice, but also providing targeted teacher feedback, diverse teaching cases, access to quality

materials, and systematic training in connecting theory with practical lesson planning. This insight should inform the improvement of teacher education curricula.

Question 13: What do you think are the reasons that affect the development of your lesson design ability?

The students' responses are summarized in the table 25:

Table 25 Statistics of reason affecting students' lesson design ability

Category	Count	Specific Reasons
Personal Factors	72	Incomplete knowledge, insufficient knowledge, lack of experience, too little practice, insufficient learning ability, weak theoretical knowledge, lack of interest and motivation, psychological and emotional issues, insufficient reflection, unclear goals, lack of innovation, introverted personality, limited thinking, insufficient self-learning ability, physical and psychological factors, lack of creativity
Teaching-Related Factors	56	Insufficient understanding of childhood, unclear teaching objectives, teaching activities, difficulty in lesson plan design, childhood's age characteristics, childhood's physical and mental development, classroom emergencies, insufficient teaching strategies, inadequate teaching evaluation, childhood's interests and hobbies, childhood's feedback, childhood's emotional management, unclear teaching content design, unfamiliarity with childhood's development guidelines, unclear activity objectives
Environmental Factors	33	Learning environment, kindergarten environment, insufficient group collaboration, lack of team spirit, school atmosphere, peer relationships, family influence, social influence, internet influence, shortage of educational resources, insufficient kindergarten facilities, mismatch of technical resources
External Support and Resources	21	Insufficient guidance from instructors, lack of reference materials, insufficient teaching materials, low teaching level of teachers, teacher attitude issues, insufficient learning resources, inadequate teaching ability of instructors, harsh guidance and criticism

Source : Zhao Ting (2025)

As can be seen from the table21, students identified personal factors as the most significant influence on their instructional design abilities, particularly incomplete knowledge and lack of experience. Teaching-related factors, such as insufficient understanding of childhood and unclear teaching objectives, were also highlighted.

Additionally, environmental factors (e.g., learning environment, group collaboration) and external support and resources (e.g., insufficient guidance, lack of materials) were noted as important contributors.

According to the research findings, the primary factors affecting students' lesson design ability are personal factors, such as incomplete knowledge, lack of experience and practice opportunities, and weak self-directed learning and reflection skills. Teaching-related factors, including insufficient understanding of child development and unclear instructional objectives, also play a significant role. In addition, environmental factors (e.g., limited group collaboration and resource constraints) and lack of external support (e.g., inadequate teacher guidance and insufficient reference materials) further hinder development, indicating that current instructional design courses need improvement in practical application, resource provision, and instructional support.

Question 14: Do you have any specific suggestions or ideas that can help improve our lesson design courses or activities? The students' responses are summarized in the table 26.

Table 26 Students' advice about lesson design ability course

Category	Count	Keywords
Increase Practical Opportunities	49	More practice, simulated teaching, trainee activities, increase the proportion of practical courses, more lesson plan writing, more activity design, more participation in kindergarten activities
Provide More Learning Resources	33	View more excellent lesson plans, increase reference materials, offer specialized courses, provide teaching materials, reference books
Enhance Self-Directed Learning Ability	32	Self-directed learning, more reflection, more summarization, more reading, more observation, self-directed learning and reflection
Strengthen Integration of Theory and Practice	30	Integration of theory and practice, teacher demonstrations,observation excellent cases, applying theory to practice
Group Collaboration and Interaction	20	Group discussions, collaborative learning, teacher-student interaction, simulated teaching and evaluate, mutual inspiration
Focus on childhood's Characteristics	18	Child-centered,Attention, childhood's interests, age characteristics, physical and mental development, integrating games,Interesting, understanding childhood's psychology
Teacher Support and Guidance	18	Patient teacher guidance, more demonstrations, more explanations, providing valuable insights, teacher support
Other Suggestions	8	Add reward activities, emotional management courses, more observation, more thinking, more participation, more practice

Source : Zhao Ting (2025)

As can be seen from the table22, Students' suggestions highlight the need for more practical opportunities, better integration of theory and practice, and increased access to learning resources. They also emphasize the importance of self-directed learning, group collaboration, focusing on childhood's characteristics, and teacher support. These insights provide valuable guidance for improving instructional design courses and activities.

Based on students' suggestions for course improvement, the most prominent needs identified were the lack of practical opportunities (49 mentions), insufficient learning resources (33 mentions), and the need to enhance self-directed reflection skills (32 mentions). Students widely called for more hands-on experiences such as simulated teaching, lesson plan writing, and kindergarten internships, which aligns closely with Bandura's self-efficacy theory emphasizing the importance of direct experience. Additionally, students expressed a desire for access to exemplary lesson plans and professional reference materials, suggesting the establishment of a shared resource platform.

Regarding teaching methods, students hoped for better integration of theory and practice (30 mentions), achievable through dual-teacher classrooms and comparative case studies. The lack of group collaboration (20 mentions) and child-centered approaches (18 mentions) could be addressed using jigsaw teaching methods and gamified design. For teacher support (18 mentions), there is a need for more personalized guidance and demonstration teaching.

In summary, course reforms should adopt a practice-oriented approach, building a progressive training model that includes "theoretical input-micro-teaching-real-world application," complemented by a shared resource platform and reflection toolkit， systematically enhancing students' instructional design capabilities.

2) Related course teachers' needs

The researchers interviewed five teachers of relevant courses and found out from the teacher interview results.

Interviews with teachers revealed that students generally lack autonomy, self-learning, and reflection skills, as well as practical experience in the process of developing early childhood curriculum design abilities. These deficiencies result in ineffective improvement of students' lesson design skills. Therefore, the creation of a new instructional model is essential. Teachers proposed the following core requirements for optimizing and developing the Early Childhood Curriculum Design course, mainly focusing on enhancing practical teaching, fostering self-directed learning, and promoting collaborative learning.

1. Enhancing practical teaching: Improve students' curriculum design abilities by increasing hands-on learning opportunities. Currently, the course content is more theory-oriented, and teachers believe there is room for improvement in practical training.

2. Promoting self-directed learning: Strengthen students' ability to learn independently and increase their interest in learning.

3. Encouraging collaborative learning: Adopt group-based cooperative learning models, allowing students to complete curriculum design tasks as teams and engage in peer assessment, broadening their perspectives through discussion.

4. Teachers hope to optimize the instructional model by strengthening students' autonomy, reflection skills, and practical training. They suggest:

5. Increasing hands-on learning opportunities (e.g., kindergarten internships, simulated teaching);

6. Improving teaching methods (e.g., case-based teaching, group collaborative learning);

7. Providing more teaching resources (e.g., high-quality lesson design examples, teaching tools);

8. Enhancing teaching evaluation and feedback mechanisms to effectively develop students' teaching design competence.

In-depth interviews with five early childhood education course instructors revealed three major issues in current instructional design teaching: students' lack of self-directed learning skills, insufficient reflective awareness, and severe deficiencies in practical experience. To address these problems, teachers proposed establishing a new "practice-autonomy-collaboration" tripartite teaching model, specifically including: (1) strengthening practical components through hands-on training like kindergarten field teaching and simulated classrooms to compensate for shortcomings in theoretical instruction; (2) cultivating autonomous learning capabilities by utilizing reflective journals and scaffolded learning supports to enhance professional development awareness; and (3) promoting collaborative learning through group projects and jigsaw-style discussions to broaden professional perspectives. Concurrently, supporting measures are needed such as building exemplary lesson libraries, improving formative assessment mechanisms, and experimenting with blended learning innovations. These recommendations align closely with student needs, collectively pointing toward the necessity of establishing a new cultivation system featuring authentic task-driven approaches, iterative design-implementation-reflection cycles, and simulations of real teaching-research scenarios to systematically enhance early childhood curriculum design capabilities.

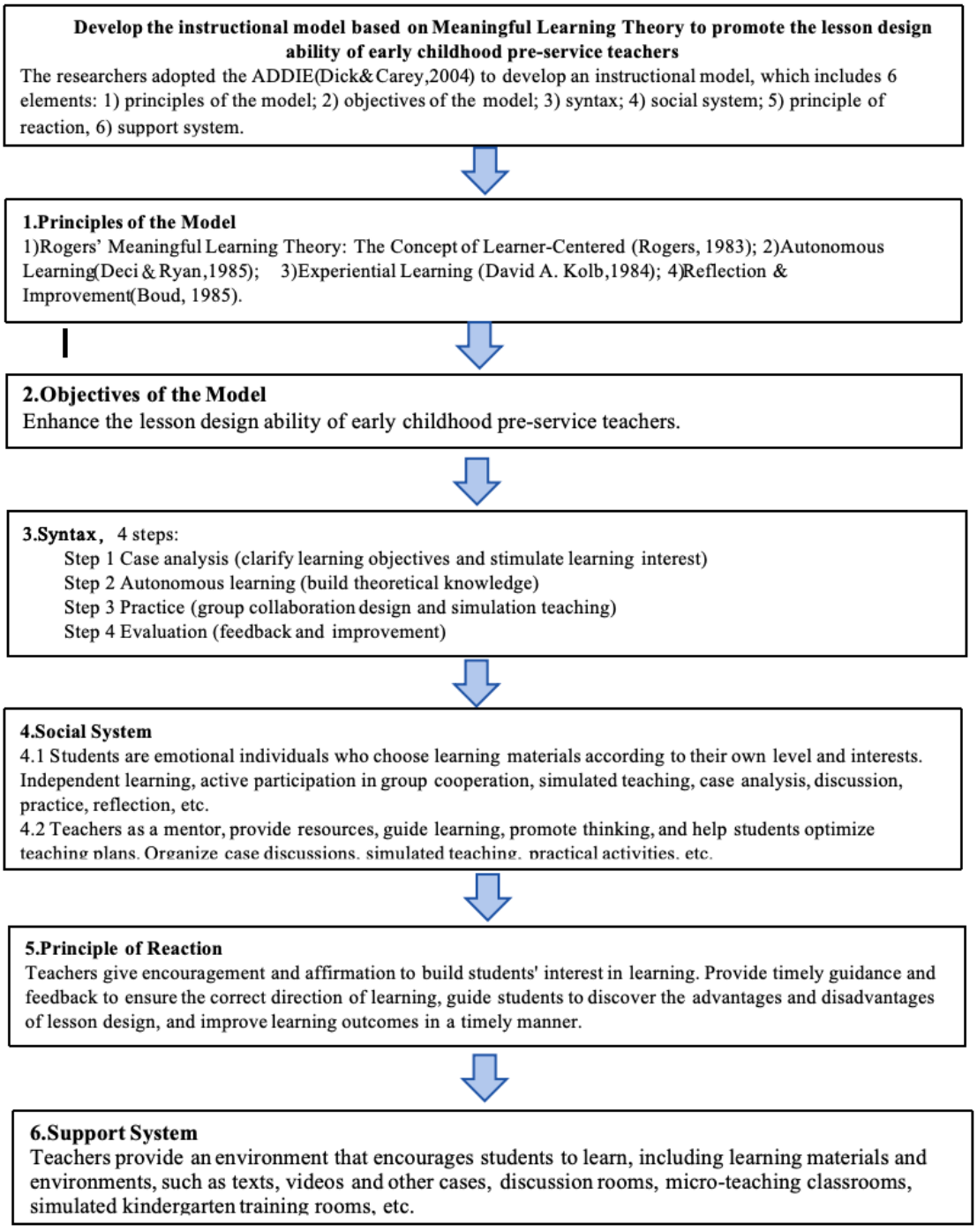
4.2 Phase II: Developing instructional model

Results of Developing an Instructional Model Based on Meaningful Learning Theory to Enhance Pre-service Early Childhood Teachers' Lesson Design Ability

Based on the research results of the first phase, this phase will develop a instructional model based on meaningful learning theory to enhance the lesson design ability of early childhood pre-service teachers. The researchers divided it into three sub-parts: 1) the draft instructional model; 2) the results of expert evaluation; 3) the final instructional model.

4.2.1 Instructional model drafted based on the results of the first phase of research

Based on the research results of the first phase, the researchers discussed with the focus group and drafted a preliminary instructional model, which includes the following elements: 1) principles of the model; 2) objectives of the model; 3) syntax; 4) social system; 5) principle of reaction, 6) support system. The preliminary instructional model is shown in the figure 3.



Figures 3 Draft of instructional model
Source : Zhao Ting (2025)

From the figure, we can see that the instructional model for improving the lesson design ability of early childhood pre-service teachers consists of 6 parts: elements: 1) principles of the model; 2) objectives of the model; 3) syntax; 4) social system; 5) principle of reaction, 6) support system. The specific details are as follows:

4.2.1.1.Principles of the Model. which consists of the following 4 concepts: 1) Rogers' Meaningful Learning Theory: The Concept of Learner-Centered (Rogers, 1983); 2) Autonomous Learning (Deci & Ryan, 1985); 3) Experiential Learning (David A. Kolb, 1984); 4) Reflection & Improvement (Boud, 1985).

This model is grounded in Rogers' Meaningful Learning Theory, which emphasizes the learner-centered concept. Instruction is built upon learners' personal experiences, aiming to trigger intrinsic motivation and promote deep, personally meaningful understanding.

Self-Determination Theory (Deci & Ryan, 1985) stresses that when learners' needs for autonomy, competence, and relatedness are met, they are more likely to engage in self-directed learning. Thus, the model encourages students to select learning materials and personalize their learning pathways.

Experiential Learning Theory (Kolb, 1984) proposes that learning is a cyclical process that includes experience, reflection, conceptualization, and experimentation. This model reflects that cycle through the four instructional phases: case analysis, autonomous learning, practice, and evaluation.

Reflection and improvement (Boud, 1985) are integrated in the final phase, emphasizing that learning requires critical reflection on one's own experiences to reconstruct knowledge and guide improvement.

4.2.1.2.Objectives of the Model: Improve the instructional design capabilities of early childhood pre-service teachers, including: 1) PCK (Pedagogical Content Knowledge): knowledge of teaching content, knowledge of teaching objects and knowledge of teaching methods; 2) Teaching design skills: including learning situation analysis, teaching goal setting, teaching preparation, teaching content selection, teaching implementation planning, teaching evaluation and reflection.

Meaningful learning theory supports the internalization of these abilities through personally relevant and emotionally engaging experiences. Self-Efficacy Theory (Bandura) is reflected in the structured opportunities for practice and success, gradually building learners' belief in their ability to design effective instruction.

4.2.1.3.Syntax: The instructional model based on meaningful learning theory includes four steps to help students gradually improve their teaching design capabilities:

Step 1: case analysis. By watching others, clarify learning goals and stimulate learning interest.

Step 2: autonomous learning. Students choose learning materials according to their own interests, deeply study the theoretical framework and methods of teaching design, and build theoretical knowledge.

Step 3: practice. Through group cooperation to design courses and simulate teaching, constantly adjust and improve teaching design.

Step 4: evaluation. Through two-way feedback from teachers and students, timely discover deficiencies in teaching design, optimize and adjust.

The model consists of four sequential steps that support the progressive development of instructional design capabilities:

Step 1: Case Analysis – Learners observe real teaching cases to clarify learning goals and spark interest. This represents the “concrete experience” phase in experiential learning and aligns with meaningful learning through the connection between observed practice and personal relevance.

Step 2: Autonomous Learning – Students select materials based on their own interests and proficiency levels to explore instructional theories and strategies. This step emphasizes learner autonomy and motivation as highlighted in Self-Determination Theory.

Step 3: Practice – Students collaboratively design lessons and conduct simulated teaching, refining their plans through iteration. This step embodies Kolb’s “active experimentation” and fosters competence and ownership, supporting both experiential and self-efficacy principles.

Step 4: Evaluation – Bi-directional feedback between teachers and students helps identify design flaws and guide optimization. This phase reflects Boud’s emphasis on critical reflection and meaning-making, as well as Bandura’s guidance on improvement through constructive feedback.

4.2.1.4. Social System:

The role of learners: Students are active learners who choose learning materials according to their own level and interests, participate in group cooperation and simulated teaching activities, and continuously improve their teaching design capabilities through practice and reflection.

The role of teachers: As a guide, teachers provide learning materials, resources, and tools to help students build a knowledge system and guide students to conduct case analysis, simulated teaching, and practical design. Teachers should pay attention to students' emotional and psychological needs, stimulate their motivation for independent learning, and ensure that students can grow in an appropriate feedback mechanism.

Learners take the role of active knowledge constructors, choosing learning paths based on their needs, participating in collaborative lesson design, and improving through continuous reflection and practice. This aligns closely with the learner-centered perspective of meaningful learning theory.

Teachers serve as facilitators and guides, providing learning resources, instructional tools, and emotional support. They assist with case analysis, group projects, and simulations while being attentive to students’ emotional and psychological needs. This guidance fosters learner autonomy and motivation, as described in Self-Determination Theory.

4.2.1.5. Principle of Reaction:

Timely feedback: Teachers need to provide guidance and feedback in a

timely manner to help students discover the advantages and disadvantages of teaching design.

Encouragement and affirmation: Teachers should encourage students, especially when students are self-discovering and innovating, and give positive feedback in a timely manner to motivate students to maintain a positive learning attitude.

Guiding improvement: Through effective feedback, help students recognize their own shortcomings, and provide optimized ideas and methods to encourage students to improve their teaching design.

Teachers provide timely, formative feedback, helping students recognize strengths and weaknesses in their instructional design.

Positive reinforcement and encouragement are essential, especially when students engage in innovation or self-discovery. This supports learners' confidence and persistence, in line with Self-Efficacy Theory.

In addition to recognizing errors, teachers offer strategic suggestions for improvement, promoting growth through supportive dialogue. This echoes Rogers' emphasis on a safe, respectful environment that fosters personal growth and deep learning

4.2.1.6. Support System (Support System)

Learning resources: Provide a variety of learning materials, such as teaching case texts, video materials, reference books, etc., to help students fully understand the knowledge system of teaching design.

Learning environment: Discussion room: used for discussion, sharing and collaborative learning among students. Micro-teaching classroom: Provide a simulated teaching space to help students conduct small-scale teaching drills. Simulated kindergarten training room: Through the actual kindergarten teaching environment, students can experience the real teaching situation.

Teacher support: Teachers provide personalized learning guidance and provide targeted suggestions and feedback based on students' learning progress and needs.

Learning Resources – A diverse range of materials (e.g., teaching cases, videos, reference books) are provided to scaffold students' understanding of instructional design.

Learning Environment – Includes discussion rooms for collaborative learning, micro-teaching labs for practice, and simulated kindergarten classrooms to expose students to authentic teaching contexts. These environments facilitate experiential learning and real-world application.

Teacher Support – Personalized guidance is offered by instructors based on learners' progress and needs. Teachers offer emotional support, encouragement, and tailored feedback, promoting motivation and deep engagement consistent with all four learning theories.

4.2.2 Expert evaluation results

The researchers brought the instructional model to 5 experts, who then checked the quality of the instructional model and made recommendations. Table 27 shows the evaluation results of the experts on the instructional model.

Table 27 Expert' evaluational results of the instructional model

Instructional Model	**item**	Expert					mean	S.D	level
		1	**2**	**3**	**4**	**5**			
Principles of the model	1	5	5	4	5	4	4.6	0.55	Highly Usable
	2	5	4	4	5	4	4.4	0.55	
Objectives of the model	3	5	5	5	4	5	4.8	0.45	Highly Usable
	4	5	4	4	5	4	4.4	0.55	
Syntax	5	4	4	5	4	5	4.4	0.55	Highly Usable
	6	5	4	4	5	4	4.4	0.55	
Social System	7	5	5	4	5	4	4.6	0.55	Highly Usable
	8	5	4	4	5	4	4.4	0.55	
Principle of Reaction	9	4	4	5	4	5	4.4	0.55	Highly Usable
	10	5	4	4	5	4	4.4	0.55	
Support System	11	4	5	4	5	4	4.4	0.55	Highly Usable
	12	5	4	4	5	4	4.4	0.55	
	view						4.47	0.54	Highly Usable

Source : Zhao Ting (2025)

From the table 27, it can be seen that the experts' evaluation of the instructional model has an overall Mean = 4.47 (SD = 0.54), indicating that the instructional model is in highly usable level. The ratings for Syntax (Mean = 4.4, SD = 0.55), Principle of Reaction (Mean = 4.4, SD = 0.55), and Support System (Mean = 4.4, SD = 0.55) .The experts also provided suggestions for improvement, as shown in Table 28.

Table 28 Experts' opinions and suggestions for the draft of instructional mode

Instructional Model	Experts' opinions and suggestions
Principles of model	The principle as a whole is consistent with the core idea of meaningful learning theory. However, the meaning of the principle can be elaborated in detail.
Objective of model	The objectives are clear and meet the training needs of pre-service teachers. Additional methods and standards for measurement and evaluation can be added.
Syntax	The four stages are well connected with the theory. The second stage: autonomous learning. Consider introducing more interactive resources, such as micro-classes, teaching case libraries, etc. In addition, tasks need to be completed in the autonomous learning stage, otherwise it is difficult to judge the students' learning outcomes. The fourth stage, evaluation, can increase the process of student participation in evaluation, provide students with evaluation scales, and discuss and modify them according to the scales.
Social System	The roles of learners and teachers are relatively clearly defined, but the interaction model can be more flexible, such as adding teaching design seminars in which teachers and students participate together.
Principle of Reaction	The feedback mechanism is relatively complete, and it is recommended to add multiple evaluation methods, such as peer evaluation and self-evaluation, to promote in-depth reflection.
Support System	The resource support is relatively rich, but it is recommended to provide more abundant online resources so that students can learn in different scenarios.

Source : Zhao Ting (2025)

As can be seen from the table28, the experts proposed modifications to the instructional model, and the researchers adjusted the instructional model based on the suggestions.

4.2.3 The final instructional model

The following is the instructional model modified according to expert opinions:

4.2.3.1. Principles of the Model. which consists of the following 4 concepts: 1) Rogers' Meaningful Learning Theory: The Concept of Learner-Centered (Rogers, 1983); 2) Autonomous Learning (Deci & Ryan, 1985); 3) Experiential Learning (David

A. Kolb, 1984); 4) Reflection & Improvement (Boud, 1985). Learner-Centered: Students are the main body of learning, and the learning process should revolve around the student's interests, needs, and learning pace. Experiential Learning: Through participation in practice and real-life situations, students can better integrate theory with practice and gain a deeper understanding of the practical application of teaching design. Autonomous Learning: Encouraging students to independently choose learning materials, methods, and pace, which stimulates intrinsic motivation and enhances learning outcomes. Reflection & Improvement: Reflection during the learning process helps students identify shortcomings and continuously improve their teaching design abilities through optimization.

4.2.3.2. Objectives of the Model: Improve the lesson design ability of early childhood pre-service teachers, including: 1) PCK (Pedagogical Content Knowledge): teaching content knowledge, teaching object knowledge and teaching method knowledge; 2) Teaching design skills: including learning situation analysis, teaching goal setting, teaching preparation, teaching content selection, teaching implementation planning, teaching evaluation and reflection. The teaching design template and standard are attached to the teaching plan at the end.

4.2.3.3. Syntax: The instructional model based on meaningful learning theory includes four stages to help students gradually improve their lesson design ability:

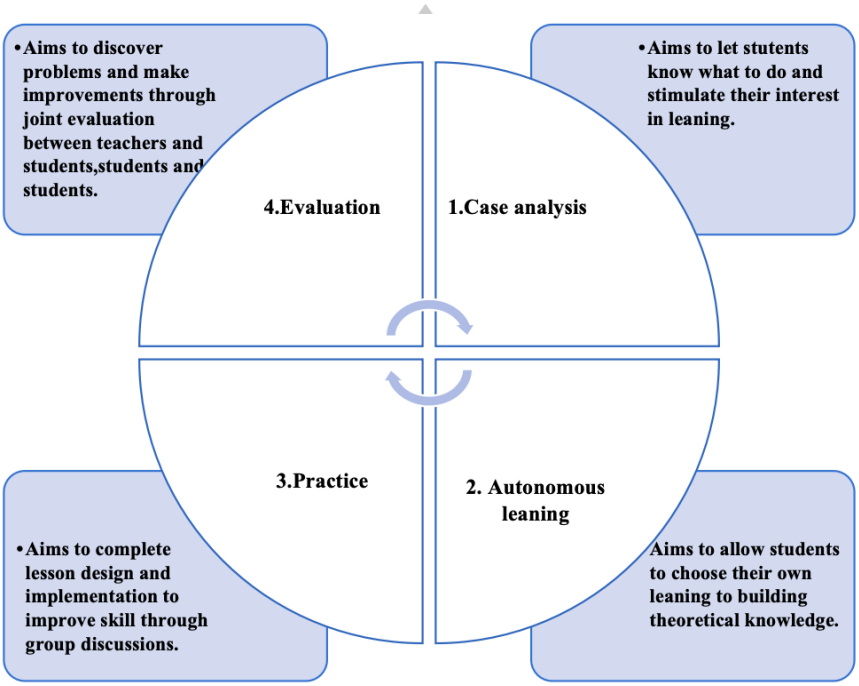
Stage 1: case analysis. Teachers and students jointly analyze the advantages and disadvantages of the case. Initially perceive the learning standards and stimulate learning interest.

Stage 2: autonomous learning. Students choose learning materials according to their own interests, deeply study the theoretical framework and methods of teaching design, and build theoretical knowledge. Learning materials and tasks include kindergarten quality course videos (imitation teaching), micro-teaching (analyzing teaching activities and optimizing them), teaching quality program documents (trying to simulate teaching), theoretical knowledge (summarizing overall goals, content and methods), etc. Provide deeper theoretical knowledge documents, such as common kindergarten courses: Montessori teaching method, Reggio Emilia education method, British Early Years Foundation Stage, etc., to support students' independent and deeper learning.

Stage 3: practice. Through group cooperation to design courses and simulate teaching, constantly adjust and improve teaching design.

Stage 4: evaluation. Through two-way feedback from teachers and students, and feedback between students. Timely discover deficiencies in teaching design, optimize and adjust.

The teaching steps are shown in the figure 4.



Figures 4 Syntax (Teaching process) in the CAPE Model
Source : Zhao Ting (2025)

4.2.3.4. Social System:

Role of learners: Students are active learners who choose learning materials according to their own level and interests, participate in group cooperation and simulated teaching activities, and continuously improve their teaching design capabilities through practice and reflection.

Role of teachers: As a guide, teachers provide learning materials, resources, and tools to help students build a knowledge system and guide students in case analysis, simulated teaching, and course design. Teachers should pay attention to students' emotional and psychological needs, stimulate their motivation for independent learning, and ensure that students can grow in an appropriate feedback mechanism.

4.2.3.5. Principle of Reaction:

Multiple feedback: Students evaluate each other, and teachers and students provide interactive feedback to help students discover the advantages and disadvantages of teaching design.

Encouragement and affirmation: Teachers should encourage students, especially when students are self-discovering and innovating, and give positive feedback in time to encourage students to maintain a positive learning attitude.

Guidance and improvement: Through effective feedback, help students

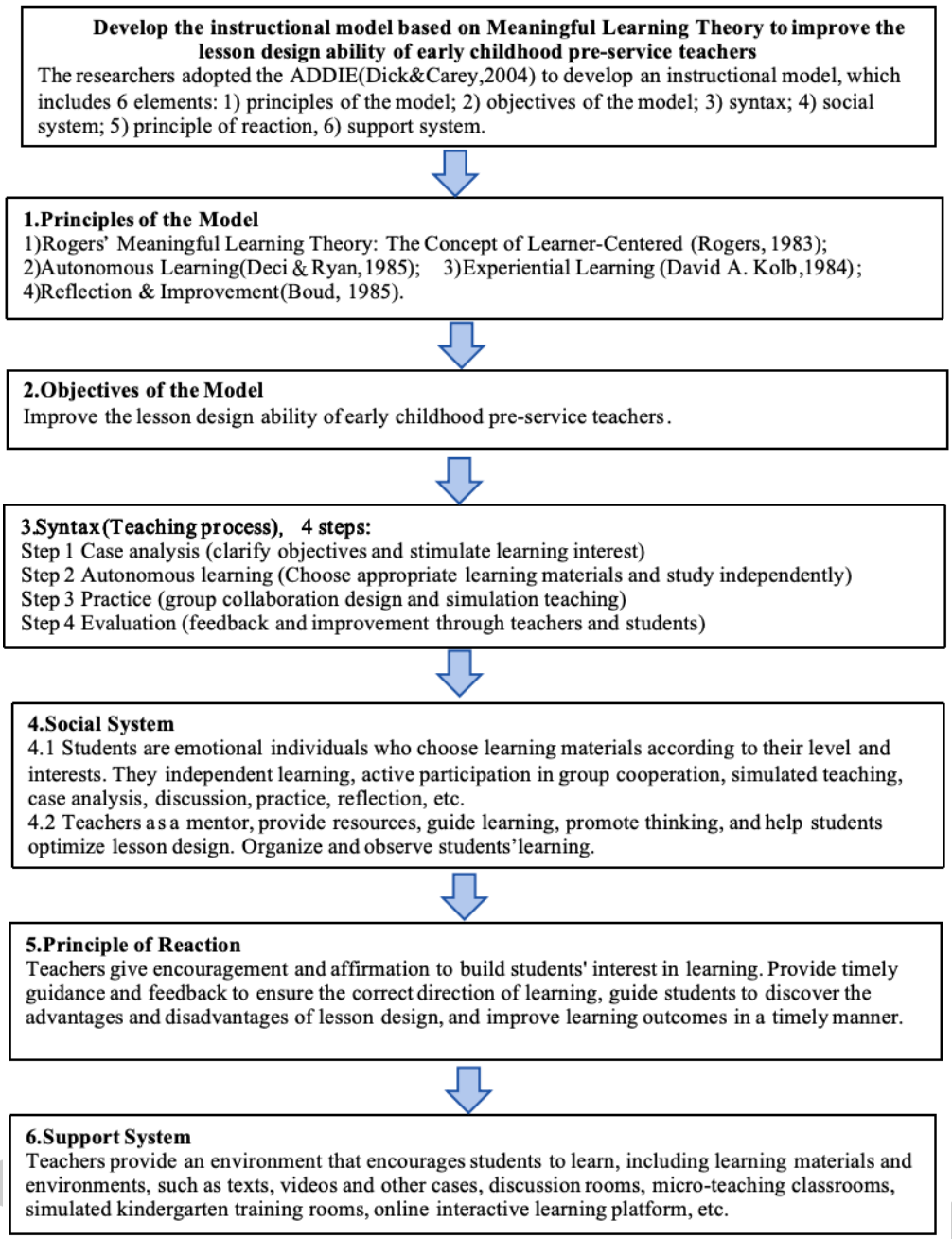
recognize their own shortcomings, and provide optimized ideas and methods to encourage students to improve their teaching design.

4.2.3.6. Support System

Learning resources: Provide a variety of learning materials, such as teaching case texts, video materials, reference books, etc., to help students fully understand the knowledge system of teaching design. Online interactive system, students and teachers discuss together.

Learning environment: Discussion room: used for discussion, sharing and cooperative learning among students. Micro-teaching classroom: Provide simulated teaching space to help students conduct small-scale teaching exercises. Simulated kindergarten training room: Through the actual kindergarten teaching environment, let students experience real teaching situations.

Teacher support: Teachers provide personalized learning guidance, and provide targeted suggestions and feedback based on students' learning progress and needs. The modified instructional model is shown in the figure 5.According to the Syntax, the researchers called this instructional model the CAPE model.



Figures 5 The CAPE Model
Source : Zhao Ting (2025)

4.3 Phase III: Implementation

Results of Implement the CAPE Model in the "Early Childhood Science Lesson Design" and verify the effectiveness of the instructional model.

The researchers divided it into two sub-parts:

1) Effectiveness of the instructional model: The lesson design ability of

the experimental group before and after the intervention

2) Effectiveness of the instructional model: Comparison between experimental and control groups to evaluate the instructional model's effectiveness

The researcher designed the course syllabus for Early Childhood Science Lesson Design based on the CAPE model and presented it to experts for evaluation . The expert evaluation results are as table 29:

Table 29 Expert Evaluation Form for the Teaching Syllabus of "Early Childhood Science Lesson Design" Based on the CAPE Model

item	Evaluation Criteria	Expert					mean	SD	grade
		1	2	3	4	5			
1	Are the course objectives clear, specific, and aligned with early childhood education training requirements?	5	5	4	4	5	4.6	0.547723	Available
2	Do the objectives cover the core aspects of PCK (Content Knowledge, Learner Knowledge, and Pedagogical Knowledge) and lesson design skills?	5	5	5	4	5	4.8	0.447214	Available
3	Are the objectives aligned with early childhood science education standards and childhood's cognitive development characteristics?	5	5	4	4	5	4.6	0.547723	Available
4	Is the course content systematically structured, covering observation-based, experiment-based, and mathematics-based science education?	4	5	3	5	4	4.2	0.836660	Available
5	Is the course content based on the latest research in early childhood education and aligned with childhood's cognitive characteristics?	5	5	4	4	5	4.6	0.547723	Available
6	Does the course content have logical progression and increasing depth, making it suitable for early childhood education students?	5	5	3	4	4	4.2	0.836660	Available
7	Does the course adopt the four-phase instructional model (Case Analysis, Autonomous Learning, Practice, Evaluation), with appropriate distribution of instructional hours?	4	4	4	5	5	4.4	0.547723	Available

item	Evaluation Criteria	Expert					mean	SD	grade
		1	2	3	4	5			
8	Does the course reflect the Learner-Centered Approach?	4	5	5	5	5	4.8	0.447214	Available
9	Does the course include diverse activities, such as case analysis, group discussions, microteaching, and simulated teaching?	5	5	4	5	5	4.8	0.447214	Available
10	Are the assessment methods diversified (e.g., participation, autonomous learning reports, lesson design, and simulated teaching)?	4	4	5	5	4	4.4	0.547723	Available
11	Are the assessment criteria clear, fair, and able to objectively measure students' learning outcomes?	5	4	5	5	5	4.8	0.447214	Available
12	Are rich learning resources (e.g., case videos, academic literature, preschool curriculum plans) provided?	4	5	5	4	5	4.6	0.547723	Available
13	Are appropriate learning environments available (discussion rooms, microteaching classrooms, preschool training labs)?	5	5	4	4	5	4.6	0.547723	Available
14	Are digital tools (e.g., online interactive platforms, lesson design software) used to enhance learning experiences?	4	5	5	5	5	4.8	0.447214	Available
15	Can the course be smoothly implemented within the existing early childhood education curriculum framework?	4	5	5	5	4	4.6	0.547723	Available
16	Is the course applicable to early childhood education students with different proficiency levels?	5	4	4	5	5	4.6	0.547723	Available
	Overview						4.59		Available

Source : Zhao Ting (2025)

Among the 16 evaluation criteria, 11 items received a mean score of ≥ 4.5 and were rated as Strongly Approved (Available), indicating a high level of expert recognition for the course syllabus. Five items had mean scores between 4.0 and 4.5, rated as Generally Good (Available), suggesting room for further optimization in these areas. The overall mean score was 4.59, demonstrating strong expert approval and indicating that the course syllabus is suitable for implementation.

The researcher randomly selected two classes (2201, 2202) to conduct a pre-test on lesson design ability. The results are shown in the table 30.

Table 30 Pre-test of Lesson Design Aability-Test (LDA-T) of the experimental group and the control group

Pre-test	Group	class	N	Mean	S.D	P	df
PCK-Test	Experimental	2201	30	48.57	8.52	0.586	58
	Control	2202	30	47.37	8.43		
LDS-Test	Experimental	2201	30	51.43	4.45	0.312	54
	Control	2202	30	50.07	5.79		
LDA-Test (sum)	Experimental	2201	30	100.00	9.27	0.305	57
	Control	2202	30	97.37	10.39		

Source : Zhao Ting (2025)

As can be seen from the table, the total average score of the experimental group (Class 2201) (LDA-Test Mean=100.00) is slightly higher than the total average score of the control group (Class 2202) (LDA-Test Mean=97.37, but the T test results show that P = 0.305 > 0.05, and the difference is not significant. There is no significant difference between the experimental group and the control group in the LDA dimension. Among them, PCK dimension: the average score of the experimental group (Mean=48.57) is slightly higher than that of the control group (Mean=47.37), but the T test results show that P = 0.586 > 0.05, and the difference is not significant. Therefore, there is no significant difference between the experimental group and the control group in the PCK dimension. LDS dimension: The average score of the experimental group (51.43) is slightly higher than that of the control group (50.07), but the T test results show that P = 0.312 > 0.05, and the difference is not significant. There is no significant difference between the experimental group and the control group in the LDS dimension. The initial level of lesson design ability in both groups was generally consistent, making them suitable for subsequent experimental research.

According to the teaching syllabus, the experimental group 2201 class 30 students were taught under the new model, with a total of 36 hours of study. At the same time, the control group 2202 class 30 students were taught under the traditional model, with a total of 36 hours of study.

After a 36-hour instructional intervention, with 2 hours per week over a total of 18 weeks, the researcher conducted a post-test for the experimental group (2201) and the control group (2202). The post-test results are provided in the appendix, and statistical analysis was performed on the data.

4.3.1 Effectiveness of the instructional model: The lesson design ability of the experimental group before and after the intervention

The researchers performed an independent samples t-test analysis on the pre-test and post-test data of the lesson design ability test of the experimental group, and the results are shown in Table 31.

Table 31 Pre-test and Post-test Scores of the Experimental Group (2201)

Dimensions	**TEST**	**group**	**N**	**Mean**	**S.D.**	**df**	**P**	**t**
PCK	Pre-test	Experimental	30	48.57	8.52	58	0.00000	-14.87
	post-test	Experimental	30	75.40	4.41			
LDS	Pre-test	Experimental	30	51.43	4.45	58	0.00000	-27.84
	post-test	Experimental	30	89.13	4.74			
LDA (Sum）	Pre-test	Experimental	30	100.00	9.27	58	0.00000	-27.01
	post-test	Experimental	30	164.53	6.75			

Source : Zhao Ting (2025)

From the table, it is evident that the experimental group showed significant improvement in their lesson design ability before and after the teaching intervention.

For Lesson Design Ability (LDA), the experimental group's pre-test mean=51.43, which increased to 89.13 in the post-test, with the standard deviation remaining stable. The t=－27.84, P=0.00000. indicating a significant improvement in instructional design ability for both groups.

For the PCK dimension, the experimental group had a pre-test mean =48.57, which increased to 75.40 in the post-test, while the standard deviation decreased from 8.52 to 4.41. The t=－14.87, P= 0.00000, demonstrating a significant difference.

For LDS (Lesson Design Skills), the experimental group's pre-test mean=51.43, which increased to 89.13, with the standard deviation remaining stable. t=－27.84, and the P=0.00000, indicating a statistically significant improvement.

PCK and LDS dimensions in the experimental group showed significant improvements in the post-test, P< 0.05, indicating that the teaching intervention had a significant impact on the students' ability development.

4.3.2 Effectiveness of the instructional model: Comparison between experimental and control groups Post-test

The researchers performed an independent samples t-test analysis on the post-test data of the lesson design ability test of the experimental group and control groups, the results are shown in Table 32.

Table 32 Post-test of the Experimental and Control Groups

Post-test	**Group**	**class**	**N**	**Mean**	**S.D**	**t**	**P**
PCK	Experimental	2201	30	75.40	4.41	3.73	0.00048
	Control	2202	30	71.77	3.01		
LDS	Experimental	2201	30	89.13	4.74	2.40	0.020
	Control	2202	30	85.73	6.16		
LDA (sum)	Experimental	2201	30	164.53	6.75	4.04	0.00016
	Control	2202	30	157.50	6.74		

Source : Zhao Ting (2025)

From the table, it can be seen that the Lesson Design Ability Test results of the experimental group (M = 164.53, SD = 6.75) were significantly higher than those of the control group (M = 157.50, SD = 6.74), with T = 4.04, P = 0.00016 < 0.05, indicating a significant improvement in the experimental group's leeon design ability.

For the PCK dimension, the experimental group (M = 75.40, SD = 4.41) was significantly higher than the control group (M = 71.77, SD = 3.01), with T = 3.73 and P = 0.00048 < 0.05, demonstrating a significant improvement in pedagogical content knowledge.

For the LDS dimension, the experimental group (M = 89.13, SD = 4.74) was significantly higher than the control group (M = 85.73, SD = 6.16), with T = 2.40 and P = 0.020 < 0.05, indicating a significant improvement in teaching design skills.

The results indicate that the CAPE Model has a significant positive impact on enhancing the lesson design abilities of early childhood pre-service teachers. The findings validate the effectiveness of the instructional model based on meaningful learning theory, demonstrating substantial improvements in pre-service teachers' Pedagogical Content Knowledge (PCK) and Lesson Design Skill(LDS). Compared to traditional teaching methods, the CAPE Model is more effective in improving lesson design abilities, better preparing pre-service teachers for their future roles in early childhood education.

CHAPTER V

CONCLUSION

Develop an instructional model based on meaningful learning theory to improve early childhood pre-service teacher' lesson design ability. The researcher presents the research results in order as follows:

1. Research Objectives
2. Conclusion
3. Discussion
4. Suggestion

5.1 Research Objectives

1) To study the basic information of developing an instructional model based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers.

2) To develop an instructional model based on meaningful learning theory to improve the lesson design ability of early childhood pre-service teachers.

3) To examine the results of implementing the developed instructional model based on meaningful learning theory in improving the lesson design ability of early childhood pre-service teachers in a normal college.

5.2 Conclusion

5.2.1 Phase I: Contextual Study

The research aimed to develop a instructional model based on meaningful learning theory to enhance the lesson design ability of early childhood pre-service teachers. The findings from this phase are summarized as follows:

5.2.1.1 Fundamental information used to Develop the instructional model Based on Meaningful Learning Theory:

5.2.1.1.1 Theoretical Foundations.

1) Roger's Meaningful Learning Theory: Rogers emphasized four core concepts:

Learner-Centered Approach: Focus on the autonomy of the learner, with the belief that students should take responsibility for their learning rather than passively receiving knowledge. Experiential Learning: Students gain a deeper understanding and

mastery of knowledge through personal experience, exploration, and practice. Self-Directed Learning: Learning that has meaningful impact occurs through self-discovery and self-influence, with students given the freedom to choose the content, method, and pace of their learning. Emotional Significance: Learning is not just a cognitive process but also involves emotions and attitudes, creating a supportive and respectful learning environment to encourage student exploration and creativity.

2）Curriculum standards

This study's analysis of curriculum standards related to early childhood pre-service teachers' lesson design reveals a comprehensive, coherent, and developmentally appropriate framework that aligns closely with the proposed indicators of teaching design competence. The standards across the five key domains—health, language, social, science, and art—not only emphasize a deep understanding of child development and educational goals, but also systematically address the essential dimensions of pedagogical content knowledge (PCK) and instructional design skills. These standards effectively guide pre-service teachers through the full process of lesson planning, from learner analysis and goal setting to implementation and reflective evaluation.

5.2.1.1.2 Lesson Design Ability

Lesson design ability is a critical competency for pre-service early childhood teachers, encompassing both Pedagogical Content Knowledge (PCK) and the skills to translate subject knowledge into effective teaching practices. This ability is fundamental for ensuring that teaching activities are not only aligned with the developmental needs of young childhood but also responsive to their unique learning characteristics. As emphasized by Darling-Hammond and Bransford (2005), the mastery of PCK is essential, as it allows teachers to deeply understand subject content and adapt it for young learners. Additionally, lesson design skills—including goal setting, learner analysis, activity planning, and reflection—are necessary for teachers to implement lessons that achieve meaningful learning outcomes.

In the context of pre-service teacher training, the Ministry of Education (2017) and related professional standards highlight that early childhood teacher preparation programs must ensure that pre-service teachers possess both solid subject knowledge and the practical skills required for lesson design. The identified learning indicators for lesson design ability, such as knowledge of content, learners, and teaching methods, as well as skills like learner analysis and lesson implementation, offer a comprehensive framework for assessing and developing these competencies.

Furthermore, various assessment tools—such as questionnaires, lesson activity analysis, classroom observations, and expert evaluations—are crucial for measuring pre-service teachers' lesson design abilities. These tools provide valuable insights into teachers' strengths and areas for improvement, facilitating targeted development strategies.

Research suggests that pre-service teachers' lesson design abilities can be significantly enhanced through practical experiences such as case studies, project-based

learning, and reflective practices. By engaging in these activities, pre-service teachers can better understand students' needs, refine their teaching strategies, and ensure that their lesson designs are developmentally appropriate and effective.

In conclusion, effective lesson design is a key element in the preparation of early childhood educators. It requires a balanced combination of theoretical knowledge and practical skills, both of which can be cultivated through targeted training, contextualized learning, and reflective practice. Ensuring that pre-service teachers develop these abilities is essential for fostering high-quality early childhood education that meets the diverse needs of young learners.

5.2.1.1.3 Current Teaching Practices.

This study provides an in-depth analysis of current teaching practices related to the development of lesson design ability among early childhood pre-service teachers. The findings reveal that existing instructional models commonly suffer from several critical issues: a lack of systematic training pathways, insufficient practical engagement, static content delivery, and low levels of student participation. Although course content is largely guided by policy documents such as the Professional Standards for Kindergarten Teachers and the Guidelines for Kindergarten Education, there is a notable absence of unified and standardized frameworks for implementation. Instruction is predominantly theory-driven, which limits students' active involvement in the lesson design process and hinders the development of comprehensive instructional skills.

Moreover, current curricula lack essential support mechanisms such as task-driven activities, repeated simulations, individualized feedback, and guided reflection. Core components like instructional objectives, content selection, and teaching methods are often delivered in a decontextualized and rigid manner, making it difficult for students to develop dynamic instructional thinking. These shortcomings highlight the urgent need for a student-centered instructional model that integrates theory and practice, and emphasizes reflection and knowledge transfer.

To address these challenges, the study draws on Hardré's (2005) IDE Model and other validated instructional strategies to propose a variety of effective approaches. These include microteaching, lesson presentations with peer feedback, classroom observation, case analysis, task-based instruction, and simulation teaching. Each strategy offers unique opportunities for students to strengthen their pedagogical thinking, improve real-time responsiveness, and engage in reflective practice. Furthermore, integrated and scaffolded training models—such as those proposed by Fu Rong (2013) and Xie Xiaoying & Wu Siyong (2019)—combine multiple methods to accommodate diverse learning styles and provide sustained, progressive skill development.

In conclusion, the effective cultivation of lesson design ability among pre-service early childhood educators should be grounded in a systematic and practice-oriented instructional framework. A multidimensional and diversified approach,

incorporating theory, practice, collaboration, and reflection, is essential for supporting students' mastery of professional teaching knowledge, the development of design skills, and the internalization of instructional thinking. This will lay a solid foundation for their future work as competent and reflective educators.

5.2.1.2 The current status, and needs of early childhood pre-service teachers, and their teachers' needs

5.2.1.2.1 Current Status and needs of Early Childhood Pre-service Teachers

This study, based on the "Self-assessment and Needs Survey on Lesson Design Ability of Preschool Education Majors" conducted among early childhood pre-service teachers at Xichang minzu Preschool College in Liangshan Prefecture, Sichuan Province, provides a comprehensive understanding of the current status and training needs regarding lesson design abilities. A total of 300 questionnaires were distributed, with 279 valid responses collected, yielding a 100% response rate and offering solid data support for future improvements in teacher education programs.

Firstly, the self-assessment results indicate that the overall level of lesson design ability among pre-service teachers is moderate (mean score = 3.25). Among the six sub-skills, "lesson preparation ability" received the highest score (3.48), suggesting that students are relatively competent in preparing and utilizing teaching materials and resources. However, "lesson implementation planning" (3.12) and "learner analysis ability" (3.20) scored the lowest, highlighting clear weaknesses in organizing the instructional process, structuring lesson flow, and analyzing children's developmental characteristics—skills that are foundational for effective lesson design.

Secondly, regarding the need for skill enhancement, all six sub-skills were identified as areas in need of improvement by more than 73% of respondents. Notably, the strongest needs were expressed for improving "lesson implementation planning" (85.3%), "lesson content selection" (82.4%), and "lesson evaluation and reflection" (79.5%). This reflects a widespread and urgent desire among students to enhance their professional competencies through more structured and systematic training.

Thirdly, the analysis of preferred forms of instructional support reveals that students most hope to receive "lesson design or activity case studies" (78.9%), "guidance on lesson design and planning" (78.1%), and "opportunities for simulated teaching" (76.8%). This indicates a strong preference for practical, experience-based learning approaches that integrate theory and practice. Additionally, the high demand for learning "child psychology and educational theory" (76.5%) suggests that students recognize the importance of a solid theoretical foundation in effective teaching.

Finally, students face several challenges in developing their lesson design abilities, including a lack of high-quality case resources, insufficient practical experience, limited individualized guidance, and inadequate understanding of children's learning needs. These difficulties further highlight the shortcomings of current teacher

education programs, especially in terms of practical training, personalized support, and resource availability.

In summary, there is considerable room for improvement in the lesson design abilities of early childhood pre-service teachers, especially in key areas such as lesson implementation planning, learner analysis, and content selection. Based on the findings, the following suggestions are proposed for teacher education programs:

Increase practical training opportunities, such as simulated teaching, situational exercises, and micro-teaching;

Introduce high-quality lesson design cases for analysis and comparison;

Strengthen theoretical instruction on learner analysis and content selection;

Provide continuous and systematic training in all stages of lesson design, including learner analysis, objective setting, resource preparation, activity design, implementation planning, and evaluation and reflection;

Offer individualized guidance and resource support, such as group discussions and one-on-one mentoring.

5.2.1.2.2 Needs of Related Course Teachers

This study also conducted interviews with five instructors of early childhood lesson design–related courses to further explore teaching challenges and instructional development needs. The results reveal a consistent concern: current teaching practices insufficiently support students in developing essential lesson design competencies. Instructors highlighted significant student weaknesses in self-directed learning, reflective thinking, and practical experience, all of which hinder the effective improvement of curriculum design abilities.

To address these gaps, instructors unanimously emphasized the need for a redesigned instructional model grounded in practical application, learner autonomy, and collaborative engagement.

First, enhancing practical teaching is seen as essential. Teachers noted that the existing course content is overly theoretical, with limited real-world application. They recommend increasing hands-on learning opportunities—such as kindergarten field teaching, simulated teaching, and case-based practice—to bridge the gap between theory and practice and cultivate authentic curriculum design skills.

Second, promoting self-directed learning is viewed as critical for fostering long-term professional development. Instructors proposed integrating reflective journals, scaffolded learning tools, and opportunities for metacognitive reflection to help students take greater ownership of their learning process.

Third, encouraging collaborative learning is necessary to develop broader professional perspectives and cooperative problem-solving skills. Teachers suggested group-based curriculum design projects, jigsaw discussions, and peer review activities to foster teamwork and deepen engagement with instructional design challenges.

Additionally, instructors proposed a series of supportive measures to complement the new model:

Building high-quality exemplar lesson libraries to serve as references for student work;

Improving formative assessment and feedback mechanisms to guide and monitor student progress;

Experimenting with blended learning approaches to enhance accessibility and flexibility in instruction.

These teacher recommendations align closely with the needs expressed by students and underscore the urgency of creating a more authentic, dynamic, and responsive instructional model.

5.2.2 Phase II: Developing instructional model

Based on the research results of the phase I, the researchers discussed with the focus group and drafted a preliminary instructional model, which includes the following elements: 1) principles of the model; 2) objectives of the model; 3) syntax; 4) social system; 5) principle of reaction, 6) support system.

The model was theoretically supported by Rogers' learner-centered approach, Deci and Ryan's Self-Determination Theory, Kolb's Experiential Learning Cycle, and Bandura's Self-Efficacy Theory. Each of these frameworks provided foundational support to ensure the model promotes internal motivation, practical engagement, and continuous reflection—key elements for developing lesson design competencies in pre-service teachers.

The instructional model follows a four-step process—case analysis, autonomous learning, practice, and evaluation—each carefully designed to build both Pedagogical Content Knowledge (PCK) and instructional design skills. It also emphasizes the dual roles of learners as active participants and teachers as facilitators, while embedding emotional, cognitive, and contextual support systems to foster effective and meaningful learning.

To validate the draft model, five domain experts were invited to evaluate its structure and content. The results showed that the instructional model received a "Highly Usable" rating across all components, with average scores ranging from 4.4 to 4.8 on a 5-point scale. Expert feedback affirmed the model's theoretical soundness, practical applicability, and relevance to teacher education. Based on the expert evaluation feedback, the researchers made necessary adjustments to the instructional model, resulting in the final version of the CAPE model (APPENDICES the CAPE model).

In summary, Phase II successfully developed and validated an instructional model tailored to the needs of early childhood pre-service teachers. The model not only aligns with established educational theories but also addresses real-world instructional challenges, providing a structured yet flexible framework for cultivating essential lesson design capabilities.

5.2.3 Phase III: Implementation

This phase assessed the effectiveness of the CAPE Model in improve the lesson design abilities of early childhood pre-service teachers. Through pre- and post-assessments of the lesson design abilities of both the experimental and control groups, the results indicate that the CAPE model significantly improved the lesson design capabilities of the experimental group.

Firstly, the expert evaluation results revealed strong approval for the "Early Childhood Science Lesson Design" syllabus based on the CAPE model, with an overall mean score of 4.59. This indicates that the syllabus is well-structured, aligns with early childhood education standards, and meets the needs of pre-service teachers. The four-phase instructional model (Case Analysis, Autonomous Learning, Practice, Evaluation) used in the course was also well-received, and the course was found to effectively incorporate various learning activities, such as case studies, group discussions, microteaching, and simulated teaching.

Secondly, the experimental group demonstrated significant improvement in their lesson design abilities after the intervention. Independent samples t-test analysis of the pre- and post-test scores showed that the experimental group's scores in Pedagogical Content Knowledge (PCK) and Lesson Design Skills (LDS) significantly increased. The overall Lesson Design Ability (LDA) of the experimental group improved from 51.43 in the pre-test to 89.13 in the post-test, PCK rose from 48.57 to 75.40, and LDS improved from 51.43 to 89.13, all showing statistically significant changes ($P<0.05$). These results confirm that the CAPE model had a positive impact on enhancing the participants' instructional design capabilities.

Finally, a comparison between the post-test results of the experimental and control groups revealed that the experimental group outperformed the control group in all measured areas. The experimental group's post-test scores in LDA, PCK, and LDS were significantly higher than those of the control group, with P-values of 0.00016, 0.00048, and 0.020, respectively, all less than 0.05. This indicates that the CAPE model was more effective in improving lesson design abilities compared to traditional teaching methods.

The CAPE Model proves to be an effective instructional approach for enhancing the lesson design abilities of early childhood pre-service teachers. Compared to traditional teaching methods, the CAPE model leads to significant improvements in both pedagogical content knowledge and lesson design skills, offering strong support for future teacher training in early childhood education.

5.3 Discussion

5.3.1. To study the basic information and needs of developing an instructional model based on meaningful learning theory to improve the lesson design ability of early children pre-service teachers.

The contextual study conducted in Phase I provides a comprehensive foundation for the development of an instructional model grounded in meaningful learning theory aimed at enhancing early childhood pre-service teachers' lesson design abilities. The findings offer insights into three core aspects: theoretical underpinnings, current teaching practices, and the actual needs of both students and instructors in teacher education programs.

First, the theoretical analysis confirms that Roger's Meaningful Learning Theory offers a strong pedagogical foundation for the proposed instructional model. Its core principles—learner-centeredness, experiential learning, self-directed learning, and emotional significance—resonate well with the developmental and instructional needs of early childhood education. These principles support a shift away from traditional teacher-centered approaches and encourage the design of learning environments that promote autonomy, engagement, and emotional connection, all of which are crucial for future early childhood educators.

Second, the analysis of curriculum standards and the concept of lesson design ability reinforces the importance of integrating both Pedagogical Content Knowledge (PCK) and lesson design skills in teacher preparation programs. The findings emphasize that effective teaching goes beyond mastering subject content; it involves the ability to analyze learners, set instructional goals, prepare materials, design content, plan implementation strategies, and reflect critically. These competencies align with Darling-Hammond and Bransford's (2005) argument that teaching effectiveness relies on the ability to translate subject knowledge into developmentally appropriate instructional practices. The study highlights that these abilities are not always fully developed in pre-service teachers, pointing to the need for more focused and structured training mechanisms.

Third, the investigation into current teaching practices reveals significant challenges. Instructional models in use are often fragmented, overly theoretical, and disconnected from real classroom contexts. This situation results in low levels of student engagement and limited opportunities for authentic skill development. While national guidelines and professional standards exist, the absence of practical, unified, and learner-centered instructional approaches hinders pre-service teachers' capacity to design and deliver effective lessons. The lack of task-driven learning, repeated simulation, feedback, and reflection opportunities further exacerbates the problem. As a response, the study advocates for integrated instructional strategies, such as microteaching, peer feedback, simulation, and case-based learning, which can bridge the gap between theory and practice.

Additionally, the survey of early childhood pre-service teachers reveals a moderate overall competence in lesson design ability, with particular weaknesses in lesson implementation planning and learner analysis. This indicates that while students are relatively confident in preparing teaching materials, they struggle with higher-order instructional planning and contextual understanding of children's developmental needs. The strong demand for improved training in areas such as content selection, evaluation, and reflective practice further confirms these gaps. Importantly, students express a preference for practical, experience-based learning modalities, including case studies, simulated teaching, and structured guidance—all of which echo the theoretical principles of meaningful learning.

The interviews with course instructors reinforce these findings. Teachers report similar concerns regarding the lack of student autonomy, insufficient reflective habits, and a disconnect between course content and classroom application. They emphasize the need to reframe instructional approaches in a way that fosters collaboration, practical application, and self-directed growth.

In summary, this phase provides critical insights into the conditions necessary for developing a meaningful learning–based instructional model. The current state of early childhood teacher education reveals clear gaps between policy and practice, theory and application, and expectation and outcome. The findings underscore the urgent need for a redesigned instructional model that not only aligns with theoretical and policy frameworks but also addresses the practical, emotional, and developmental realities of future educators. By embedding meaningful learning principles into a structured, reflective, and student-centered framework, teacher education programs can more effectively cultivate lesson design competencies that are essential for high-quality early childhood education.

5.3.2. To develop the instructional model based on meaningful learning theory to improve the lesson design ability of early children pre-service teachers.

The second phase of this study aimed to develop a instructional model to enhance the lesson design abilities of pre-service early childhood educators, based on Rogers' Theory of Meaningful Learning. The results of the study indicate that the developed instructional model is highly appropriate and has great potential for further development in terms of structure, theoretical foundation, and practical applicability. The following discussion will address the theoretical construction, teaching practices, the development of pre-service teachers' abilities, and feedback from expert evaluations.

1) Theoretical Construction: Rationality and Innovation

The teaching model developed in this study is grounded in Rogers' Theory of Meaningful Learning, emphasizing learner-centeredness, autonomy, and intrinsic motivation. The model also integrates various learning theories, including Deci &

Ryan's (1985) Self-Determination Theory, Kolb's (1984) Experiential Learning Theory. This multi-theoretical support not only enhances the depth of the model's theory but also improves its practical operability.

Moreover, this study refines the concept of "lesson design ability" into two main dimensions: Pedagogical Content Knowledge (PCK) and Lesson Design Skills, with the latter further divided into six sub-skills. This clear differentiation allows for precise teaching goals and evaluation criteria. This ability-based approach to model construction is both targeted and scientifically robust.

2) Practical Orientation of the Teaching Structure and Process

The four stages of the teaching structure—Case Analysis, Autonomous Learning, Practical Operation, and Evaluation Feedback—align with current educational reforms that emphasize “integration of theory and practice” and “reflection-driven growth.” By guiding students through real or simulated case analyses, the model helps activate their learning interest and enhances their perception of teaching contexts. The autonomous learning phase provides students with the opportunity to engage in resource integration according to their needs. The practical operation phase emphasizes the integration of design and implementation, improving students' hands-on capabilities and adaptability to teaching contexts. The evaluation feedback stage, which includes peer reviews and teacher guidance, fosters reflection on and improvement in the students' lesson design.

This structural arrangement embodies the essence of Rogers' Theory of Meaningful Learning, which emphasizes the transformation of experience into deep understanding, while also adhering to the emphasis on “effective teaching” in current pre-service teacher education.

3) Clear Pathways for Enhancing Pre-Service Teachers’ Lesson Design Abilities

From a research perspective, this model focuses on the development of lesson design abilities in pre-service early childhood education students, helping them enhance specific design skills based on their understanding of PCK. Compared to traditional theoretical teaching or fragmented internship experiences, this model leads students from “cognitive understanding” to “practical application,” actively contributing to the improvement of their comprehensive teaching abilities.

Additionally, the learner-centered approach employed in this study encourages students to take an active role in their learning, shifting them from mere “receivers” of knowledge to “participants” and “creators” of lesson designs. This is crucial for boosting their teaching confidence and professional identity.

4) Expert Feedback Validating the Scientific and Practical Feasibility of the Model

In this study, five experts were invited to evaluate the model across six dimensions: Teaching Principles, Model Objectives, Teaching Structure, Social System, Reaction Principles, and Support System. The results showed an average score above 4.4 for all dimensions, indicating strong expert approval for the model’s theoretical

soundness and practical feasibility. This outcome supports the professional validity of the model and provides a solid foundation for future pilot experiments.

Experts noted that the model is comprehensive, conceptually clear, and highly adaptable, making it especially suitable for addressing the current challenges in improving pre-service teachers' lesson design abilities. However, experts also suggested that future iterations could strengthen the integration of digital resources and information technology to enhance the model's adaptability to modern educational environments.

The CAPE Model, refined through expert validation, marks a significant step in integrating theory with practice to enhance lesson design ability. The next phase of research will focus on real-world implementation, assessing its practicality, effectiveness, and areas for further refinement. By applying the model in authentic teaching settings, this research will generate empirical data to optimize instructional strategies and contribute to more effective early childhood teacher preparation.

This study not only advances the theoretical framework of Meaningful Learning Theory in teacher education but also provides a practical, evidence-based model for enhancing lesson design capabilities. Moving forward, quasi-experimental study will be conducted to evaluate the sustained impact of the CAPE Model, ensuring its adaptability to evolving educational needs.

5.3.3. To study the lesson design ability of early childhood pre-service teachers implementation of the instructional model based on meaningful learning theory.

This study evaluated the effectiveness of the CAPE model in enhancing pre-service early childhood teachers' lesson design abilities by comparing the pre-test and post-test results between the experimental and control groups. The experimental group showed a significant improvement in lesson design ability (LDA), with a pre-test score of 51.43 and a post-test score of 89.13, demonstrating a highly significant difference ($T = -27.84$, $P = 0.00000$). This indicates that the CAPE model had a notable impact on improving lesson design ability.

The comparison between the experimental and control groups further validated the superiority of the CAPE model. The experimental group had a post-test score of 164.53 for lesson design ability (LDA), significantly higher than the control group's score of 157.50 ($T = 4.04$, $P = 0.00016$). In terms of pedagogical content knowledge (PCK), the experimental group's post-test score was 75.40, significantly higher than the control group's 71.77 ($T = 3.73$, $P = 0.00048$). For lesson design skills (LDS), the experimental group scored 89.13, while the control group scored 85.73 ($T = 2.40$, $P = 0.020$). These comparisons show that the experimental group outperformed the control group in all dimensions of lesson design ability, demonstrating that the CAPE model is significantly more effective than traditional teaching methods.

The effectiveness of the CAPE model can be attributed to its learner-centered approach, which includes four stages: case analysis, independent learning, practice, and evaluation. These stages effectively stimulated students' interest and engagement. Additionally, the PCK and LDS dimensions of the CAPE model were fully integrated into the teaching process, enabling students to not only acquire subject knowledge but also enhance their practical lesson design skills. This comprehensive approach is one of the key reasons for the significant improvements in the experimental group's scores.

Moreover, the diverse teaching methods employed in the CAPE model, such as group discussions, micro-teaching, and simulation-based teaching, enhanced students' hands-on skills and helped them better translate theoretical knowledge into practical teaching abilities. The effectiveness of this innovative teaching model was clearly evidenced by the experimental group's marked improvement in test scores.

Existing research underscores the importance of teaching design ability in the professional development of pre-service teachers. Darling-Hammond and Bransford (2005) highlighted that effective teaching design requires not only strong subject knowledge (PCK) but also the ability to effectively translate that knowledge into teaching practice. Compared to traditional teaching methods, learner-centered models like the CAPE model are more effective in promoting the development of teaching design skills.

For example, Meng Xianghong and Wang Xiaoli (2023) proposed a "double-chain cycle" model, which significantly improved STEM teachers' lesson design abilities. Similarly, the CAPE model incorporates elements such as learner analysis, goal setting, and teaching implementation, which help students understand and apply core lesson design elements in practice. Therefore, the findings from this study align with previous research, further validating the effectiveness of the CAPE model in enhancing pre-service teachers' teaching design abilities.

This study not only validates the effectiveness of the CAPE model in enhancing the lesson design abilities of pre-service early childhood teachers but also provides a new perspective on the innovation of teaching models in teacher education. Traditional teaching methods primarily focus on knowledge transmission by the teacher, whereas the CAPE model emphasizes learner-centered, practice-driven, and diversified assessment approaches, which help pre-service teachers develop teaching design abilities from multiple dimensions.

The innovation of this study lies in its integration of the CAPE model based on the theory of meaningful learning. This model not only enhances teachers' pedagogical content knowledge (PCK) but also strengthens their ability to translate that knowledge into teaching practice (LDS). Furthermore, by comparing pre- and post-test data and analyzing the results from both the experimental and control groups, this study provides strong empirical support for the effectiveness of the CAPE model in teacher education.

5.4 Suggestion

This study developed the CAPE Model based on Meaningful Learning Theory and validated its effectiveness in enhancing the lesson design ability of pre-service early childhood teachers. The results indicate that this instructional model, compared to traditional teaching methods, more effectively promotes improvements in pre-service teachers' Pedagogical Content Knowledge (PCK) and Lesson Design Skills (LDS), thereby enhancing their overall Lesson Design Ability (LDA). Based on the findings, the following recommendations are proposed:

5.4.1 General Suggestion

5.4.1.1 Strengthen the Application of Instructional Models Based on Meaningful Learning Theory

The study found that the core principles of the CAPE Model—learner-centeredness, experiential learning, self-directed learning, and emotional support—contribute to improving pre-service teachers' instructional design competence. Therefore, it is recommended to widely implement the CAPE Model in teacher education programs and further explore its application in different subjects and teaching contexts to ensure its adaptability and effectiveness.

5.4.1.2 Increase Practical Teaching Activities to Enhance Lesson Design Skills

The findings indicate that the development of lesson design skills is closely related to practical training. Therefore, it is suggested to incorporate more practice-based teaching activities such as lesson design case studies, micro-teaching, and simulated classrooms. These activities will allow students to engage in lesson design within authentic or semi-authentic contexts, thereby improving their practical skills.

5.4.1.3 Promote Self-Directed Learning and Reflective Thinking

The study demonstrates that self-directed learning and instructional reflection are crucial factors in improving lesson design competence. Therefore, it is recommended to include self-directed learning modules in the curriculum, such as open-ended tasks and personalized learning pathways. Additionally, students should be encouraged to engage in reflective practices through teaching journals and lesson case analyses to enhance their self-regulated learning abilities.

5.4.1.4 Improve Teaching Evaluation and Feedback Mechanisms

The research indicates that teaching feedback plays a significant role in

students' instructional design development. Therefore, it is suggested to establish a systematic evaluation and feedback mechanism, incorporating diverse evaluation methods such as peer review, teacher feedback, and classroom discussions. These approaches will help students identify challenges in lesson design and refine their instructional strategies.

5.4.2 Further Suggestion

5.4.2.1 Enhance Teacher Training to Improve the Implementation of the CAPE Model

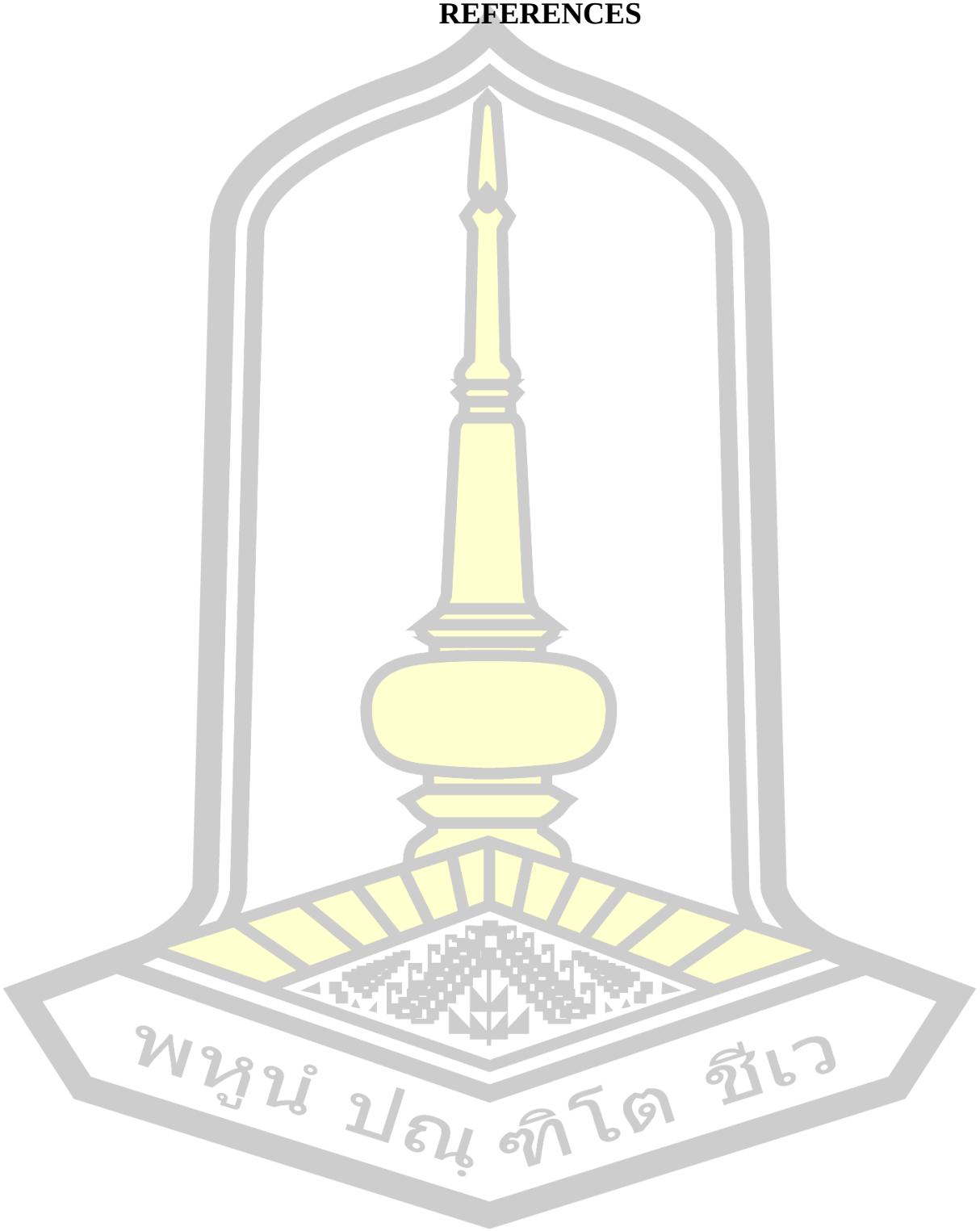
The successful implementation of the CAPE Model relies on teacher support. Therefore, it is recommended to provide specialized training for educators to deepen their understanding of the CAPE Model's core principles and instructional strategies. This will enable teachers to apply the model effectively in real teaching scenarios, thereby fostering the professional growth of pre-service teachers.

5.4.2.2 Conduct Further Empirical Research to Optimize the Instructional Model

Although this study has validated the effectiveness of the CAPE Model, further empirical research is needed in diverse teaching environments to refine and optimize the model. Future studies should continue exploring the application of the CAPE Model across different courses and educational levels. Additionally, integrating modern educational technologies (such as online)

Learning platforms and virtual reality) could further innovate and enhance instructional design.

REFERENCES



Alexander, J. M., Fabricius, W. V., Fleming, V. M., Zwahr, M., & Brown, S. A. (2001). The development of metacognitive causal explanations. *Learning & Individual Differences*, 13(3), 227-238.

Alkan, M. F., Arslan, M. (2019). Learner autonomy of pre-service teachers and its associations with academic motivation and self-efficacy. *Malaysian Journal of Learning and Instruction*, 16(2), 75-96.

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology*, 84(3), 261-271.

Anjai, S. (2012). Improvement of the ability of the students in an education program to design the lesson plans by using an instruction model based on the theories of constructivism and metacognition. *Procedia Engineering*, 32, 1163-1168.

Artzt, A. F., & Armour-Thomas, E. (1992). Development of a cognitive-metacognitive framework for protocol analysis of mathematical problem solving in small groups. *Cognition & Instruction*, 9(2), 137-175.

Ausubel, D. P. (1963). The psychology of meaningful verbal learning. New York: Grune & Stratton.

Ausubel, D. P. (1968). Educational psychology: A cognitive view. Holt, Rinehart and Winston.

Ausubel, D. P., Novak, J. D., & Hanesian, H. (1978). Educational psychology: A cognitive view (2nd ed.). New York: Holt, Rinehart and Winston.

Baker, L., & Brown A. L. (1984). *Metacognitive skills and reading*. New York: Longman.

Baker, L., & Cerro, L. (2000) . Assessing metacognition in childhood and adults. In G. Schraw & J. Impara (Eds.). *Issues in the Measurement of Metacognition* (pp.99-145). USA: Buros Institute.

Bandura, A. (1997). *Self-Efficacy: The Exercise of Control*. Freeman.

Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology*, 52, 1-26.

Benson, P. (2001).Learner Autonomy in the Classroom. *Practical English language teaching*, 289-308.

Benson, P. (2003). Learner autonomy in the classroom. In D. Nunan (ed.), *Practical English Language Teaching*. New York: McGraw Hill: 239.

Berman, P., McLaughlin, M., Bass, G., Pauly, E., & Zellman, G. (1977). Federal programs supporting educational change, vol. vii: factors affecting implementation and continuation. *Diffusion*, 1–5, 245.

Boud, D. (1985). An Introduction to Self-assessment & Self-evaluation in Higher Education. *Assessment & Evaluation in Higher Education*, 10(2), 129-133.

Boud, D. (2001). Reflection: A key to learning in practice. In D. Boud, R. Keogh, & D. Walker (Eds.), *Reflection: Turning experience into learning* (pp. 1-17). Routledge.

Boud, D., Keogh, R., & Walker, D. (1985). *Reflection: Turning experience into learning*. Routledge.

Branch，R.M., &Kopcha, T.J. (2014).Instructional De-sign Models.in J.M. Spector et al.(Eds.), H*andbook of Research on Educational Communications and Technology* [M]. New York: Springer..

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How People Learn: Brain, Mind, Experience, and School*. National Academy Press.

Brooks,M.G,&Brooks,J.G., (1999). The courage to be constructivist. *Educational Leadership*, 57(3), 18-24.

Brown, A. (1987). Metacognition, executive control, self -regulation and other more mysterious mechanisms. In Frann Weinert & Rainer Kluwe (Eds.). *Metacognition, Motivation and Under-standing* (pp. 65-115). London: LEA.

Brown, M. (2009). The teacher-tool relationship: Theorizing the design and use of curriculum materials. In J. T. Remillard, B. Herbel-Eisenmann, & G. Lloyd (Eds.), *Mathematics teachers at work: Connecting curriculum materials and classroom instruction* (pp. 17-36). New York : Routledge.

Cao Yiming. (2004). Mathematics classroom instructional model. Middle School Mathematics Teaching Reference, 1993(3), 6Miriam B Larson,Barbara B Lockee. Instructional design practice: career environments, job roles, and a climate of change[J]. *Performance Improvement Quartly*, (3), 26-37.

Carl Rogers,H.Jerome Freiberg(1969). *Freedom to Learn*, 253-313.

Carr, D. M., Alexander, J., & Folds-Bennett, T. (2010). Metacognition and mathematics strategy use. *Applied Cognitive Psychology*, 8(6), 583-595.

Carr, M., & Jessup, D. L. (1995). Cognitive and metacognitive predictors of mathematics strategy use. *Learning & Individual Differences*, 7(3), 235-247.

Cha Youliang. (2003). *Educational Modeling*. Nanning : Guangxi Education Press.

Chen Wei. (2013). Empirical research on the cultivation of pre-service English teachers' lesson design capabilities from the perspective of ecological teaching [J]. *China Distance Education*, (07), 60-63.

Chen Xiaoru. (2014). *An Empirical Study of Scaffolding Instruction for the Development of Chinese Non-English Majors' Learning Autonomy*. 113.

Chen, W. (2013). Collaborative lesson preparation platform to enhance lesson design ability for pre-service English teachers. *Education Research Review*.

Cheng Xi. (2018). *Research on cultivating learner autonomy based on flipped classroom* [D]. Jiangnan University.

Cheon, S. H., Reeve, J., & Moon, I. (2018). How to teach students to be more autonomous. *Educational Psychologist*, 53(4), 221-233.

Chick, N. (2012). Promoting Metacognition in Students. In D. S. Mccabe & C. A. B. McCann (Eds.), *Teaching and Learning in the Social Context: A Festschrift in Honor of Annemarie Palincsar* (pp. 87-102). Springer Netherlands.

Cohors-Fresenborg, E., Kramer, S., Pundsack, F., Sjuts, J., & Sommer, N. (2010). The role of metacognitive monitoring in explaining differences in mathematics achievement. *ZDM*, 42(2), 231-244.

Compiled by Zha Youliang. (2001). *"Classroom Model Theory"*, Guangxi Normal University Press.

Cornoldi, C., Carretti, B., Drusi, S., & Tencati, C. (2015). Improving problem solving in primary school students: the effect of a training programme focusing on metacognition and working memory. *British Journal of Educational Psychology*, 85(3), 424-439.

Costa, A. E. (2001). *Developing Minds: A Resource Book for Teaching Thinking. Association for Supervision and Curriculum Development*.

Dabbagh, N., & Kitsantas, A. (2012). Personal Learning Environments, Self-Regulated Learning, and the Development of Critical Thinking Dispositions. *Journal of Educational Computing Research*, 46(1), 1-22.

Darling-Hammond, L., & Bransford, J. (2005). *Preparing teachers for a changing world: What teachers should learn and be able to do*. San Francisco, CA: Jossey-Bass.

Davis, E. A., Beyer, C., Forbes, C. T., & Stevens, S. (2011). Understanding pedagogical design capacity through teachers' narratives. *Teaching and Teacher Education*, 27(4), 797-810. doi: 10.1016/j.tate.2011.01.005.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. Springer Science & Business Media.

Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macro theory of human motivation, development, and health. *Canadian Psychology/Psychologie canadienne*, 49(3), 182-185.

Defu.H.(2014).On Rogers' Humanistic Educational Thought. *Journal of Lanzhou University (Social Sciences Edition)*, (04), 153.

Dewey, J. (1938). *Experience and education*. Macmillan.

Diane Barrett Kris, Pedagogical Content Knowledge as a Foundation for an Interdisciplinary Graduate Program. *Science Educator*, 18(1), 17-18.

Dickinson, L. (1987). *Self-instruction in Language Learning*. Cambridge: Cambridge University Press.

Dorin Herlo. (2013). Pass Through Exemples of Instructional Design. *Journal Plus Education*, (1), 10-15.

Du Ping. (2011). Development and reflection on basic teaching ability standards for contemporary primary and secondary school teachers. *Curriculum Textbook Teaching Methods*, (8), 96-97.

Du Weiyu, Meng Qi. (2006). Situational context of the development of learning theory [J]. *Global Education Outlook*, 35(12), 23-26.

Dweck, C. S. (2006). *Mindset: The New Psychology of Success*. Random House.

Editor-in-Chief Tang Wenzhong. (1990). *'Teaching Theory,' Heilongjiang Education Publishing House*.

Efklides, A. (2008). Metacognition and affect: What can metacognitive experiences tell us about the learning process? *Educational Research Review*, 3(3), 245-257.

Elen, J. (1995). *Blocks on the road to instructional design prescriptions*. Leuven: Leuven University Press.

Ellis, R. (2005). Principles of Instructed Language Learning. *System*, 33(2), 209-224.

Fang Hui. (2010). *Reflection and construction of experiential learning*. Southwest University.

Flavell, J. H. (1979). Metacognition and Cognitive Monitoring: A New Area of Cognitive-Developmental Inquiry. *American Psychologist*, 34(10), 906-911.

Forbes, C. T. (2009). *Preservice elementary teachers' development of pedagogical design capacity for inquiry-an activity-theoretical perspective*. (Doctoral dissertation, University of Michigan.

Gao, X., & Zhao, Y. (2021). The impact of experiential learning on pre-service teachers' self-efficacy and instructional design skills. Journal of Teacher Education Research, 33(2), 45–60.

Gibbs, G. (2013). Learning by doing: A guide to teaching and learning methods. Further Education Unit.

Gong Zikun, Li Sen. (2005). On the classroom situation from the perspective of situational cognition theory. *Curriculum. Teaching Materials. Teaching Methods*, (08), 26-29+53.

Guang.R.J.(2000). *The Loss and Return of Human Nature: Rogers' Humanistic Psychology*. Wuhan: Hubei Education Press.

Hardr é P L, Chen C H. (2005). A Case Study Analysis of the Role of Instructional Design in the Development of Teaching Expertise. *Performance Improvement Quarterly*, 18(1), 34-58.

Hardré P L. (2003). The Effects of Instructional Training on University Teaching Assistants. *Performance Improvement Quarterly*, 16(4), 23-39.

Hardré, P.L., Ge,X.,Thomas, M.K. (2005). Toward a Model of Development for Instructional Design Expertise. *Educational Technology*, 45(1), 53-57.

Harris, S., & Jones, M. (2011). The impact of self-assessment on teacher development. *Teaching and Teacher Education*, 27(2), 344-348.

Hatton, N., & Smith, D. (1995). Reflection in teacher education: Towards definition and implementation. Teaching and Teacher Education, 11(1), 33–49.

HU Jinping. (2013). Out of the misunderstanding of the function of international model. *Education Development Research*, 33(22), 76-80.

Hua.Z.(2009).7 Learn from Rogers Meaning Talk about English Teaching. *Zizhi Digest*, (03), 129.

Hogan, K. E., & Pressley, M. E. (1997). *Scaffolding Student Learning: Instructional Approaches and Issues*. Brookline Books.

Ho, I. T., & Hau, K. T. (2010). A within-culture study of the antecedents of mathematics self-efficacy among Chinese students. *Educational Psychology*, 30(4), 437-452.

Huizinga T, Handelzalts A, Nieveen N, et al. (2014). Teacher involvement in curriculum design: need for support to enhance teachers' design expertise. *Journal of Curriculum Studies*.

Jang, H., Reeve, J., & Deci, E. L. (2010). Engraining self-determination in the classroom: Reeve. *Theory and Research in Education*, 8(2), 226-251.

Jiang Chunxiao, Lin Gang. (2007). Research on "Instructional Design" Training Strategies-Investigation and Thoughts on the Current Status of Instructional Design Abilities of Primary and Secondary School Teachers. *Modern Educational Technology*, (2), 68-70.

Johnson, B. (2009). Emotional support and teacher burnout: A review of current research. *Educational Psychology Review*.

Johnson, D. W., Johnson, R. T., & Smith, K. A. (2000). *Active Learning: Cooperation in the College Classroom*. Interaction Book Company.

Jonassen, D. H. (1991). Objectivism versus constructivism: Do we need a new philosophical paradigm? Educational Technology Research and Development, 39(3), 5–14.

Joyce, B. & WiiI, M. (1972). *Models of Teaching*. Englewood, New Jersey, Prentice Hall.

Joyce, B. Well, M. & Calhoun, E. (2002). *Translated by Jing Jianhua, Song Fugang, and Hua Qingliang. Models of Teaching*. 6th ed. Beijing: China Light Industry Press.

Joyce, B., & Weil, M. (2011). *Models of teaching*. 9th ed. Pearson Education.

Joyce,B. Well, M. & Calhoun, E., Jing Jianhua, Song Fugang, Hua Qingliang. (2002). *Models of Teaching*. 6th ed. Beijing: China Light Industry Industry Press.

Jukic Matić, Lj. (2019). The pedagogical design capacity of a lower secondary mathematics teacher and her interaction with curriculum resources. *REDIMAT–Journal of Research in Mathematics Education*, 8(1), 53-75. doi: 10.4471/redimat.2019.2396.

Kind, V. (2014). Pedagogical content knowledge in science education: Perspectives and progress. *Research in Science Education*, 44(5), 761-791.

Knight-Bardsley, A. & McNeill, K.L. (2016). Teachers' Pedagogical Design Capacity for Scientific Argumentation. *Science Education*, 100(4), 645–672. doi: 10.1002/sce.21222.

Knowles, M. S. (1975). *Self-Directed Learning: A Guide for Learners and Teachers*. Association Press.

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice Hall.

Korthagen, F. A. J. (2010). Situated learning theory and the pedagogy of teacher education: *Towards an integrative view of teacher behavior and teacher learning*. Teaching and Teacher Education, 26(2), 163–176.

Krauss, S., Baumert, J., Blum, W., et al. (2013). Pedagogical content knowledge and its impact on teaching and learning: Findings from the COACTIV project. *International Journal of Science Education*, 35(8), 1351-1373.

Lai Huasheng. (2021). Rogers's Discourse and Enlightenment on Education. *Journal of Western*. 0077, 03.

Li Bingde. (1991). *Teaching Theory*. Beijing: People's Education Press.

Li, B. (1991). Application of information-based teaching model in teacher education. *Journal of Teacher Education and Development*, 19(3), 112-125.

Li, F. (2022). A study on teachers' PCK in kindergarten science teaching—Based on the application of the RTOP observation tool. *Journal of Early Childhood Education*, 40(4), 62-70.

Li, Y. (2014). Teaching mode of information-based lesson design ability for normal students. *Educational Technology Research*.

Liangfang.S. (1994). *Theory of Learning: Theories and Principles of Learning Psychology*. Beijing: People's Education Press.

Lihui.F.(2021). The application of Ausubel's theory of meaningful learning in teaching practice. *pre-social sciences*, (02), 153-154.

Litle,D. (1991). Learner Autonomy1:Definitions,Issues and problems. *teacher & learner perspectives*.

Liu Ping. (2013). Research on the effectiveness of network autonomous learning ability cultivation under the "Trinity" instructional model. *Audio-visual Education Research*, 34(08), 42-46.

Liu Qu, Li Guoqiang, Yang Jie, Xu Shanshan, Cai Fei. (2023). *Report on the development of pre-service training for Chinese preschool teachers*. Ling Kang, Wang Benyu, Sun Youran.

Liu Xiaoling. (2015). Research on action strategies for self-improvement of teachers' teaching ability in local normal colleges. *Educational Theory and Practice*, 35(15), 41-43.

Liu Zhiping, Liu Meifeng, Lu Jinjiao. (2009). Research on the lesson design ability and its components of primary school mathematics teachers. *China Audio-visual Education*, (09), 77-81.

Loughran, J. (2010). What expert teachers do: Enhancing professional knowledge for classroom practice. Allen & Unwin.

Lu J, Bridges S, Hmelo-Silver C E. (2014)Problem-Based Learning. Sawyer R K. The Cambridge Handbook of the Learning Sciences (Second Edition). New York: Cambridge University Press, 298.

Luo Xiaoduan. (2012). On the composition and cultivation of lesson design ability of normal college students. *Journal of China Three Gorges University (Humanities and Social Sciences Edition)*, 34(S1), 196-197.

Lynch, M. (2014). The role of motivation in online learning. *Journal of Interactive Online Learning*, 12(1), 13-23.

Ma Lan, Sheng Qunli (2016). *Development of teachers' lesson design capabilities*. Hangzhou: Zhejiang University Press.

Manusson S,Krajcik J, Borko H. (2002). *Nature, sources, and development of pedagogical content knowledge for science teaching*. Dordrecht: Kluwer Academic Publisher.

Marilou Hyson. (2003). *The Emotional Development of Yong childhood: Building an Emotion-centered Curriculum*.

Maslow, A. H. (1970). *Motivation and Personality*. Harper & Row.

Meng, X., & Wang, X. (2023). A double-chain cycle training model to improve lesson design ability for STEM teachers. *Journal of STEM Education*.

Merrill, M. D., Zhong min Li & Jones, M. K. (1990). Utah State University. Second Generation Instructional Design (ID2). *Educational Technology*, 30(2), 21-23.

Moller.L.(1998). Designing Communities of Learners for Asynchronous Distance Education. *Educational Technology Research & Developement*, 46(4), 115 一 122.

Mynard, J., & Sorflaten, R. (2003). Independent learning in your classroom. *Teachers, Learners and Curriculum Journal*, 1, 34-38.

Na Zhang.(2009).Implications of Rogers' Theory of Meaning Learning in Kindergarten Teaching. *Education Guide*, (07)007.

Nelson, T. O., & Narens, L. (1990). Metamemory: A Theoretical Framework and New Findings. In G. H. Bower (Ed.), *The Psychology of Learning and Motivation: Advances in Research and Theory*, (125 -173). Academic Press.

OECD． (2004). Learnin91 or lomorrow, sworld: FirstresultsfromPISA 2003 U 1． Paris: OECD, 25．

O'Neil, H. F., & Perez, R. S. (2008). Computer-Based Learning Environments and Metacognitive Skill Development. In J. M. Spector, M. D. Merrill, J. J. G. van Merrienboer, & M. P. Driscoll (Eds.), *Handbook of Research on Educational Communications and Technology* (pp. 103-117). Lawrence Erlbaum Associates Publishers.

Oxford, R. (2003). Toward a more systematic model of L2 learner autonomy. In In D. Palfreyman, and R. Smith (Eds.), *Learner autonomy across cultures: Language education perspectives* (p. 75-91). Great Britain: Palgrave McMillian.

Paris, S. G., Lipson, M. Y., & Wixson, K. K. (2005). Teaching for Metacognitive Awareness. In J. E. Jacobs & P. A. Cooney (Eds.), *Metacognition in Education: Theory, Assessment, and Instructional Design* (pp. 55-76) . Greenwich, CT: Information Age Publishing.

Park, S., & Oliver, J. S. (2008). Revisiting the conceptualization of pedagogical content knowledge in science education. *Science Education*, 92(3), 1-12.

Parks,OliverJS. (2008). *Journal of Research in Science Teaching*, 45(7), 812-834.

Peng, Y. (2015). Study on the training model of teaching ability based on cognitive learning theory and humanistic learning theory. *Journal of Educational Research*, 23(4), 45-58.

Peng, Y. (2015). Training model of teaching ability based on cognitive learning theory. *Journal of Educational Research*.

Piaget, Jean. (1970). *Principles of Generative Epistemology. Translated by Wang Xiantian*. The Commercial Press.

Pintrich, P. R. (2002). The Role of Goal Orientation in Self-Regulated Learning. In M. Wosnitza, S. Boekarts, & P. R. Pintrich (Eds.), *Self-Regulation of Learning and Performance: Issues and Educational Applications* (pp. 55-76). Academic Press.

Pintrich, P. R., & De Groot, E. V. (1990). *Motivated and Self-Regulated Learning: Theory, Research, and Applications*. Kluwer Academic Publishers.

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. Journal of Educational Psychology, 82(1), 33–40.

Qi Yuan, Zhang Sheng. (2009). Review of teachers' lesson design ability. *Modern Educational Technology*, 19(01), 43-46.

Qian, Z. (2020). Study on the instructional design model based on outcome-based education (OBE). *International Journal of Educational Research*, 45(1), 32-47.

Quintana, C., Reiser, B. J., Davis, E. A., Krajcik, J., Fretz, E., Duncan, R. G., Kyza, E., Edelson, D., & Soloway, E. A. (2004). Scaffolding Design Framework for Software to Support Science Inquiry. *The journal of the learning sciences*, 13(3), 337-386.

Reeve, J. (2006). Teachers as facilitators: A self-determination theory perspective. In J. M. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 183-206). University of Rochester Press.

Reigeluth, C. M. (1983). lnstructiona1 design: What it is and why is it? In C. M. Reigeluth (Ed.), *Instructional design theories and models: An overview oftheir current status* (pp. 3-36). Hillsdale, NJ: Lawrence Erlbaum.

Report on the development of Chinese teacher education. (2023). *Beijing: Society Scientific Literature Press*. 86-110. Paper database: https://www.pishu.com.cn/skwx_ps/initDatabaseDetail?siteId=14&contentId=14719907&contentType=literature.

Richey R C, Fields D C, Foxon M. (2001). Instructional Design Competencies: The Standards. Third Edition. *Educational Technology Research & Development*, 49(4), 107-110.

Rita C.Richey, Dennis C.Fields, Marguerite Foxon. (2001). *Instructional Design Competencies: The Standards*. 3rd ed. New York: Clearinghouse on Information and Technology.

Rogers, C. R. (1969). Freedom to learn: A view of what education might become. Columbus, OH: Merrill.

Rogers, C. (1983). The interpersonal relationship in the facilitation of learning. *Journal of Applied Behavioral Science*, 19(2), 201-215.

Rogers, C. R. (1983). Freedom to learn for the 80s. Columbus, OH: Charles Merrill Publishing Company.

Romiszowski, A. J. (1981). *Designing instructional systems. Decision making in course planning and curriculum design*. London: Kogan Page.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68-78.

Samaras, A. P. (2011). *Reflective practice and the role of the teacher educator: A global perspective*. Springer.

Sawada, D., Piburn, M. D., Judson, E., et al. (2002). Reformed Teaching Observation Protocol (RTOP): A tool for assessing the quality of reform-oriented teaching. *School Science and Mathematics*, 102(6), 12-22.

Schmidt, F. L., & Hunter, J. E. (2004). The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research findings. *Psychological Bulletin*, 130(3), 354-376.

Schön, D. A. (1983). The reflective practitioner: How professionals think in action. Basic Books.

Schunk, D. H. (1991). Self-Efficacy and Academic Motivation. *Educational Psychologist*, 26(3-4), 207-231.

Schunk, D. H., & Pajares, F. (2009). Self-Efficacy Theory. In K. R. Wentzel & A. Wigfield (Eds.), *Handbook of Motivation at School* (pp. 209-228). Routledge.

Shavelson, R. J., Hubner, J. J., & Stanton, G. C. (1976). Self-concept: Validation of construct interpretations. Review of Educational Research, 46(3), 407-441.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4-14.

Shulman,L.S. (1987). Knowledge and teaching:Foundations of the New Reform. *Harvard Educational Review*, 57(1), 1-22.

Tanner, D. (2012). *Promoting Student Metacognition*. Faculty Publications, Department of Teaching and Learning, University of Nebraska-Lincoln.

Tomlinson, C.A. (2005) Grading and Differentiation: Paradox or Good Practice? *Theory into Practice*, 44, 262-269.

Tschannen-Moran, M., & Hoy, A. W. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and Teacher Education*, 17(7), 783–805.

Twenge, J. M. (2017). *iGen: Why today's super-connected kids are growing up less rebellious, more tolerant, less happy—and completely unprepared for adulthood.* New York: Atria Books.

Usher, E. L., & Pajares, F. (2008). Sources of self-efficacy in school: Critical review of the literature and future directions. *Review of Educational Research*, 78(4), 751–796.

Usher, E. L., & Pajares, F. (2008). Sources of self-efficacy in mathematics: A validation study. *Contemporary Educational Psychology*, 33(1), 139-167.

UNESCO. (2023). Global education monitoring report 2023: Technology in education – A tool on whose terms? Paris: UNESCO.

Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. *Advances in Experimental Social Psychology*, 29, 271-360.

Van de Walle, J. A. (2006). *Elementary and middle school mathematics: Teaching developmentally*. Pearson.

Veenman, M. V. J., Wilhelm, P., & Beishuizen, J. J. (2004). The Relationship between Intellectual and Metacognitive Skills in Explaining Attainment and Learning Strategies. *Learning and Instruction*, 14(3), 287-309.

Vygotsky, L. S. (1978). *Mind and Society: The Development of Higher Mental Processes*. Cambridge, MA: Harvard University Press.

Vygotsky, L. S. (1978). *Problems of General Psychology*. Cambridge University Press.

Walter Dick, Lou Carey, and James O. Carey. (2009). *The Systematic Design of Instruction*. New York: Longman.

Wang Yu, Wang Qiong. (2018). Authentic learning design in MOOC environment: perspective based on situational cognition. *China Distance Education*, (03), 5-13+79.

Wang Zhixian. (2018). Strategies for cultivating independent learning abilities of middle school students with the core of improving psychological capital. *Teaching and Management*, (27), 65-67.

Wang, H. (2021). Application of the RTOP observation tool in kindergarten mathematics classrooms. *Early Childhood Education Research*, 35(2), 50-55.

Wang, M. (2018). Practical teaching experiences and their influence on preschool education students' self-efficacy [Unpublished doctoral dissertation]. East China Normal University.

Wang, Y. & Liang, S. (2022). Research on innovative teaching paths of blended learning mode in activity design courses for preschool education majors based on the BOPPPS model. *Educational Observation*, 11(24), 109.

Weimer, M. (2012). *Learner-Centered Teaching: Five Key Changes to Practice*. Jossey-Bass.

Weinberger, A. (2011).Principles of Transactive Computer-Supported Collaboration Scripts. *Nordic Journal of Digital Literacy*, 6(3), 189-202.

Wu Feng'e. (2014). Preliminary study on pre-service training strategies for early childhood teachers' educational activity design ability. *China Off-Campus Education*, (3), 145.

Xu Binyan. M. Ludwig. (2005). Design of teachers' professional development practice model based on cognitive apprenticeship concept. *Global Education Prospects*, 34(03), 48-51.

Xu Xuelian, Fan Xiaoming. (2013). Investigation and thinking on the mathematics lesson design ability of normal college students. *Educational Exploration*, (08), 70-71.

Xu, Z. Y. (2017). The connotation and development path of preschool teachers' PCK. *Theory and Practice of Education*, 37(6), 25-30.

Yanqiong, Z. (2009). Rogers Meaningful Learning Theory has implications for acknowledging learning. *Young writer*, (16), 102.

Yao Zhenyu. (2023). Differentiated teaching practice in the United States: the emergence, development and enlightenment of differentiated instructional models. *Educational Progress*, 13(9), 7012-7020. https://doi.org/10.12677/AE.2023.1391091.

Zeidner, M. (1998). Test anxiety: The state of the art. In X. M. Chen & J. J. VandenBos (Eds.), *Encyclopedia of Psychology* (pp.1-5). American Psychological Association.

Zhang Shiyuan. (2020). *Research on Experiential Teaching of Ancient Poetry in Junior High Schools under the Background of Rogers Meaning Learning*. Liaoning Normal University.

Zhang, X. (2022). Study on the interdisciplinary teaching model for preschool education students. *Early Childhood Education Journal*, 10(2), 78-92.

Zhao Lian. (2004). Rogers' meaning learning theory and its inspiration for curriculum reform. *Jiangxi Educational Research*, 01, 44-46.

Zheng Ling, Guo Mingxin, Fan Huijuan. (2016). Cultivation of "student-centered" lesson design ability of normal college students under the new curriculum. *Middle School Biology Teaching*, (06), 36-38.

Zheng Qiyun. (2020). *Practice-oriented classroom teaching reform of preschool education professional education courses*. Changsha: Hunan Normal University.

Zhong Zhixian. (2019). Research on the current status of primary and secondary school teachers' theoretical knowledge level of instructional design. *Audio-visual Education Research*, (3), 106-117.

Zhou Duanyun. (2014). Strategies for cultivating the design ability of educational activities for Tibetan kindergarten teachers and students in the Mainland. *Tibet Education*, (1), 54-56.

Zimmerman, B. J. (2000). Self-Efficacy: An Essential Motive to Learn. *Contemporary Educational Psychology*, 25(1), 82-91.

Zimmerman, B. J. (2002). Becoming a Self-Regulated Learner: An Overview. *Theory Into Practice*, 41(2), 64-70.

Zimmerman, B. J., & Schunk, D. H. (2011). Self-Regulated Learning and Performance: An Introduction and Overview. In B. J. Zimmerman & D. H. Schunk (Eds.), *Handbook of Self-Regulation of Learning and Performance* (pp. 1-15). Routledge.

APPENDIX

APPENDIX A

Self-Assessment and Needs Survey on Early Childhood Pre-Service Teachers' Lesson Design Ability

Hello, students. This questionnaire survey is mainly to understand students' evaluation of yours own lesson design ability and needs for improving lesson design ability. It is used for research. The questionnaire is anonymous and will not affect you in any way.

One. Basic information.

1. Gender:
   - Male - Female
2. Grade:
   - Freshman - Sophomore - Junior
3. Duration of your educational internship:
   - Within a week - Within a month - More than a month

Two. Self-evaluation of lesson design ability. Please rate the following items according to your actual situation (1=completely incompatible, 5=completely in line).

4. I can design lesson considering the development characteristics and development needs of early childhood.
   - Completely incompatible - Incompatible - Generally in line - In line - Completely in line
5. I can determine lesson goals considering the comprehensive development of young childhood.
   - Completely incompatible - Incompatible - Generally in line - In line - Completely in line
6. I can use creative teaching methods to attract the attention of young childhood.
   -Not at all -Not at all -Generally compliant -Comply -Completely compliant
7. I can design activities, games and interactive activities suitable for early childhood.
   -Not at all -Not at all -Generally compliant -Comply -Completely compliant
8. I can evaluate and reflect on the effectiveness of lesson and make necessary adjustments.
   -Not at all -Not at all -Generally compliant -Comply -Completely compliant

9. I can use teaching aids and multimedia resources to assist teaching.
-Not at all -Not at all -Generally compliant -Comply -Completely compliant

Three. Needs for improvement in lesson design abilities (multiple choices are allowed)

10. What abilities do you think need to be improved most in lesson design?
- □ Learning situation analysis capability
- □ Goal setting capability
- □ Activity preparation capability
- □ Teaching content selection capability
- □ Activity implementation planning capability
- □ Teaching evaluation and reflection capability
- □ Other (please specify):_____

11. In which areas do you hope to get more guidance or resources?
- □ Child psychology and education theory learning
- □ Instructional design and planning
- □ Cases of instructional design or teaching activities
- □ Simulated teaching
- □ Microteaching
- □ Group discussion
- □ Independent learning
- □ Teaching evaluation and reflection
- □ Acquisition of teaching resources and materials
- □ Other (please specify):_____

Four. Open questions

12. What challenges did you encounter in the process of learning lesson design?

13.What do you think are the reasons that affect the development of your lesson design ability?

14. Do you have any specific suggestions or ideas that can help improve our lesson design courses or activities?

Thank you for taking the time to complete this questionnaire. Your opinions are very important to us and will help us improve lesson design courses and activities to better meet the needs of early childhood education students.

APPENDIX B

Interview Outline on Teachers' Needs for Instructional Models

This interview aims to explore the needs and expectations of teachers regarding an instructional model designed to enhance the lesson design abilities of early childhood pre-service teachers. The insights gathered will be used to inform the development of an optimized instructional model. Your feedback is invaluable and will play a crucial role in shaping the new instructional model.

Please rest assured that all information will be kept confidential and used solely for academic research purposes.

I. Basic Information

1. Your Name (can be kept anonymous):
2. Your Title and Years of Teaching Experience:
3. How many years have you been teaching the “Early Childhood Curriculum Design” course, and what are the main content areas you cover?

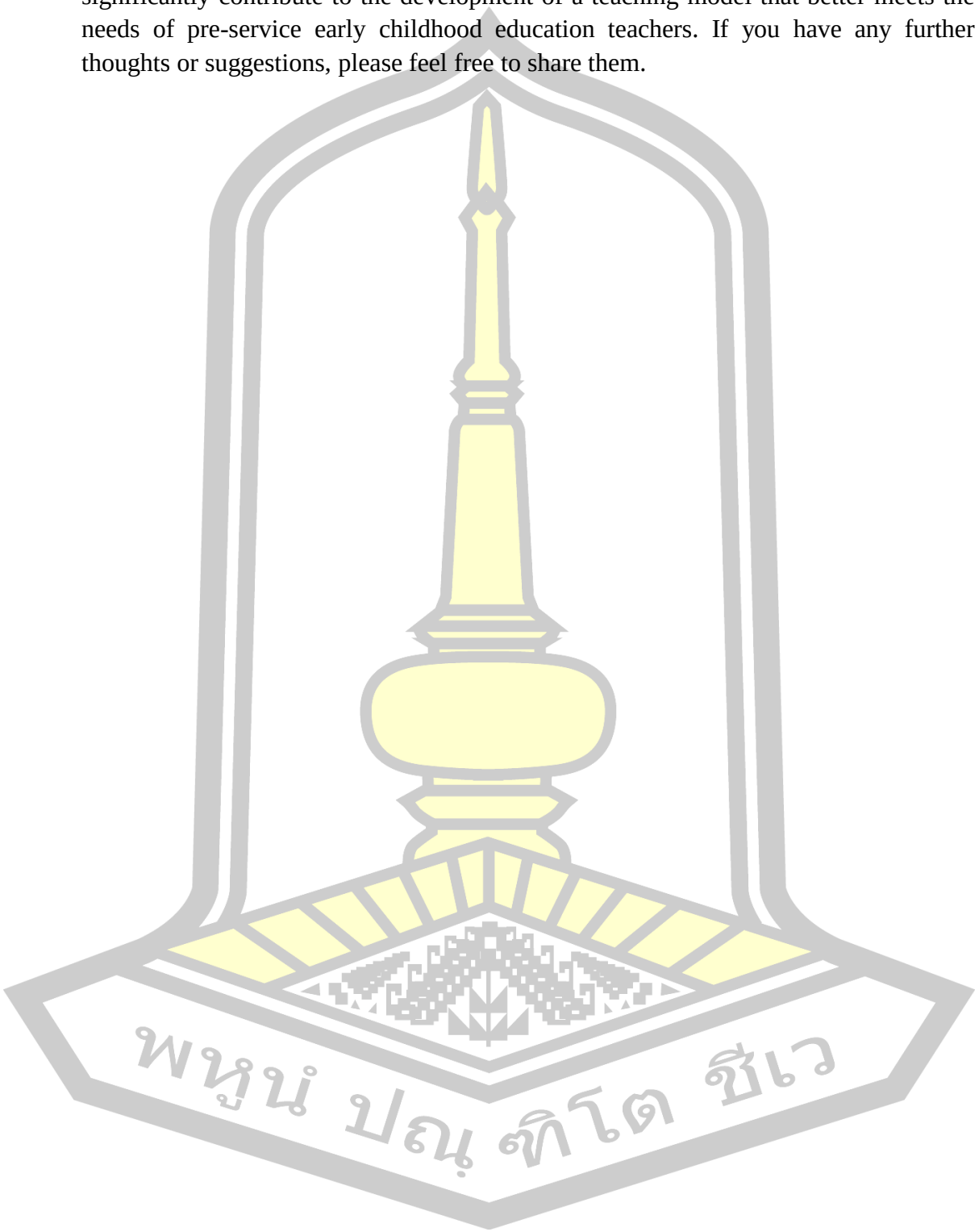
II. Current instructional Model and Issues

4. What is the current teaching model used in your “Early Childhood Curriculum Design” course? How does it help students enhance their lesson design abilities?
5. What do you think are the problems or shortcomings of the current teaching model in terms of developing students’ lesson design abilities?
6. What are the most common challenges or difficulties you encounter in teaching? How do these challenges affect students’ lesson design abilities?

III. Needs and Expectations for a New Teaching Model

7. What specific support do you think students need most to improve their lesson design abilities?
8. If a new teaching model were to be created, what problems or challenges in the current teaching model would you hope it could solve?
9. What innovative teaching methods or content would you like to see incorporated into a new teaching model? For example, are there any new teaching techniques, tools, or activity formats that could more effectively help students improve their lesson design abilities?
10. In the current teaching model, what aspects (e.g., goal setting, activity design, assessment and reflection, etc.) do you think have the most room for improvement, or what aspects would you most like to strengthen?

Thank you very much for your time and valuable input. Your insights will significantly contribute to the development of a teaching model that better meets the needs of pre-service early childhood education teachers. If you have any further thoughts or suggestions, please feel free to share them.



APPENDIX C

The CAPE Model

Background: Lesson design ability is a core professional competency for early childhood educators. However, the current training of pre-service early childhood teachers in this area faces several challenges, including a lack of case resources, insufficient practical experience, monotonous teaching methods, and a disconnect from actual kindergarten practices. To address these issues, the researcher conducted a survey on stakeholders involved in courses aimed at developing lesson design abilities in pre-service early childhood education programs. The study examined their current status and needs. Additionally, five instructors of relevant courses were invited to participate in a focus group discussion with the researcher. Based on the theory of meaningful learning, they collaboratively developed the CAPE Model. The following presents the content of the model, which includes:

1. Principles of the Model

which consists of the following 4 concepts:

1) Rogers' Meaningful Learning Theory: The Concept of Learner-Centered (Rogers, 1983);

Students are the main body of learning, and the learning process should revolve around the student's interests, needs, and learning pace.

2) Autonomous Learning (Deci & Ryan, 1985);

Encouraging students to independently choose learning materials, methods, and pace, which stimulates intrinsic motivation and enhances learning outcomes.

3) Experiential Learning (David A. Kolb, 1984);

Through participation in practice and real-life situations, students can better integrate theory with practice and gain a deeper understanding of the practical application of teaching design.

4) Reflection & Improvement (Boud, 1985).

Reflection during the learning process helps students identify shortcomings and continuously improve their teaching design abilities through optimization.

2. Objectives of the Model

Improve the lesson design ability of early childhood pre-service teachers, including:

1) PCK (Pedagogical Content Knowledge): teaching content knowledge (CK),teaching learner knowledge(LK), and teaching method knowledge(MK);

2) Lesson design skills: including learning situation analysis, teaching goal setting, teaching preparation, teaching content selection, teaching implementation planning, teaching evaluation and reflection..

3. Syntax (Teaching process)

The instructional model based on meaningful learning theory includes four stages to help students gradually improve their lesson design ability:

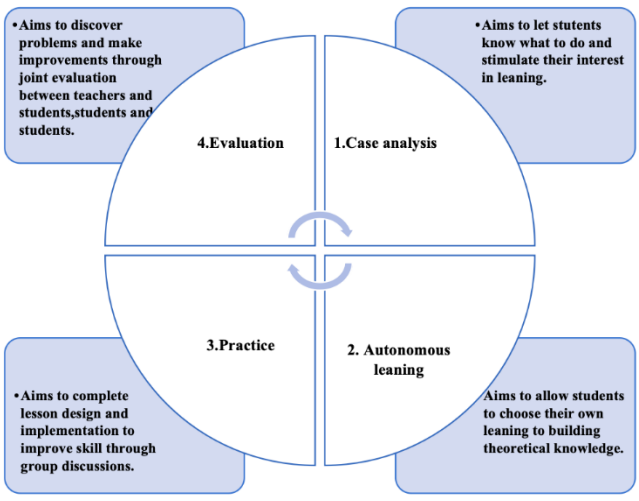
Stage 1: Case analysis. Teachers and students jointly analyze the advantages and disadvantages of the case. Initially perceive the learning standards and stimulate learning interest.

Stage 2: Autonomous learning. Students choose learning materials according to their own interests, deeply study the theoretical framework and methods of lesson design, and build theoretical knowledge. Learning materials and tasks include kindergarten quality course videos (imitation teaching), micro-teaching (analyzing teaching activities and optimizing them), teaching quality program documents (trying to simulate teaching), theoretical knowledge (summarizing overall goals, content and methods), etc. Provide deeper theoretical knowledge documents, such as common kindergarten courses: Montessori teaching method, Reggio Emilia education method, British Early Years Foundation Stage, etc., to support students' independent and deeper learning.

Stage 3: Practice. Through group cooperation to design lesson and simulate teaching, constantly adjust and improve lesson design.

Stage 4: Evaluation. Through two-way feedback from teachers and students, and feedback between students. Timely discover deficiencies in teaching design, optimize and adjust.

The teaching process are shown in the figure:



Figures 6 The teaching process
Source : Zhao Ting (2025)

4. Social System

Role of learners: Students are active learners who choose learning materials according to their own level and interests, participate in group cooperation and simulated teaching activities, and continuously improve their lesson design ability through practice and reflection.

Role of teachers: As a guide, teachers provide learning materials, resources, and tools to help students build a knowledge system and guide students in case analysis, simulated teaching, and lesson design. Teachers should pay attention to students' emotional and psychological needs, stimulate their motivation for independent learning, and ensure that students can grow in an appropriate feedback mechanism.

5. Principle of Reaction

Multiple feedback: Students evaluate each other, and teachers and students provide interactive feedback to help students discover the advantages and disadvantages of lesson design program.

Encouragement and affirmation: Teachers should encourage students, especially when students are self-discovering and innovating, and give positive feedback in time to encourage students to maintain a positive learning attitude.

Guidance and improvement: Through effective feedback, help students recognize their own shortcomings, and provide optimized ideas and methods to encourage students to improve their lesson design program.

6. Support System

Learning resources: Provide a variety of learning materials, such as teaching case texts, video materials, reference books, etc., to help students fully understand the knowledge system of lesson design. Online interactive system, students and teachers discuss together.

Learning environment: Discussion room: used for discussion, sharing and cooperative learning among students. Micro-teaching classroom: Provide simulated teaching space to help students conduct small-scale teaching exercises. Simulated kindergarten training room: Through the actual kindergarten teaching environment, let students experience real teaching situations.

Teacher support: Teachers provide personalized learning guidance, and provide targeted suggestions and feedback based on students' learning progress and needs. Evaluation criteria for lesson design program.

APPENDIX D

Experts' Evaluate and Advices of the Instructional Model

Description: This Evaluation Questionnaire is used to invite experts to evaluate the Instructional Model that *Based on Meaningful Learning Theory Develop Instructional Model to Promotes the lesson design ability for early childhood pre-service teachers,* Experts are intvited to evaluated the instructional model and make suggestions for modifications.

1. Basic information

Name:
Gender:
Positional title:
Research field:
University:

2. Evaluate of the Instructional Model

Please rate the evaluate of the Instructional Model based on the following:
Rating Scale (1-5 Points)

1 = Seriously does not meet the requirements; cannot be used, needs to be redesigned from scratch.

2 = Major problems; cannot be effectively implemented, requires significant modification.

3 = Basically meets the requirements; has some flaws, can be partially implemented.

4 = Well-designed; effectively supports the objectives, can be implemented smoothly.

5 = Perfectly designed; fully meets the requirements, outstanding effectiveness, can be implemented efficiently.

Table 33 Evaluate of the Instructional Model

Instructional Model	**Evaluation Criteria**	**Points (1-5)**
Pprinciples of the model	1. Does the instructional model follow the core principles of Meaningful Learning Theory?	
	2. Do the teaching principles effectively support the development of pre-service teachers' lesson design abilities?	
Objectives of the	3. Are the objectives of the instructional model clear, specific, and aligned with the needs of pre-service teachers?	

model	4. Do the objectives of the instructional model effectively guide pre-service teachers in enhancing their lesson design abilities?	
Syntax	5. Is the design of the teaching process in line with Meaningful Learning Theory and does it effectively promote teachers' learning?	
	6. Does the teaching process align with the teaching objectives and help pre-service teachers improve their lesson design abilities?	
Social System	7. Does the instructional model fully consider the interaction and cooperation among pre-service teachers?	
	8. Does the instructional model foster effective interaction and cooperation between teachers and students?	
Principle of Reaction	9. Does the instructional model adjust the teaching content and methods in response to pre-service teachers' feedback?	
	10. Is the instructional model flexible enough to adapt to the learning needs of different pre-service teachers?	
6.Support System	11. Does the instructional model provide sufficient support for pre-service teachers to effectively apply what they have learned in lesson design?	
	12. Does the support system of the instructional model help pre-service teachers solve practical problems in lesson design?	

Source : Zhao Ting (2025)

3. Suggestion of the Instructional Model

Table 34 Suggestion of the Instructional Model

Instructional Model	Expert opinions/modification suggestions
1.Pprinciples of the model	
2.Objectives of the model	
3. Syntax	
4. Social System	
5. Principle of Reaction	
6. Support System	

Source : Zhao Ting (2025)

APPENDIX E

Teaching Syllabus for "Early Childhood Science Lesson Design" Based on CAPE Model

1. Course Information

Course Title: Early Childhood Science Lesson Design

Applicable Major: Early Childhood Education

Total Hours: 36 hours (2 credits)

Target Students: Second-year students majoring in Early Childhood Education

Prerequisite Courses: Early Childhood Education, Child Psychology, Fundamentals of Early Childhood Science Education

Course Type: Compulsory

2. Course Objectives

This course is designed based on Meaningful Learning Theory, aiming to enhance pre-service early childhood teachers' lesson design abilities, including:

(1) Pedagogical Content Knowledge (PCK)

Knowledge of Lesson Content: Mastering the core elements of early childhood science curricula, including observation-based, experiment-based, and mathematics-based science education.

Knowledge of Learners: Understanding the cognitive development of childhood aged 3-6 and designing appropriate science lessons based on different age groups.

Knowledge of Teaching Methods: Acquiring expertise in inquiry-based learning, experimental learning, and play-based learning, and applying these methods flexibly in lesson design.

(2) Lesson Design Skills

Learner Analysis Skills: Analyzing childhood's developmental characteristics, prior experiences, and scientific cognitive levels.

Lesson Objective Setting Skills: Developing science education goals aligned with childhood's developmental needs, covering cognitive, skill-based, and affective dimensions.

Lesson Preparation Skills: Selecting appropriate teaching resources, such as experimental materials, exploration tools, and learning environments.

Lesson Content Selection Skills: Choosing appropriate content based on educational goals and integrating it with childhood's real-life experiences.

Lesson Implementation Planning Skills: Organizing lesson activities effectively to ensure smooth delivery, clear objectives, and progressive learning stages.

Lesson Evaluation and Reflection Skills: Utilizing multiple assessment methods (teacher evaluation, child feedback, peer review) to analyze lesson effectiveness and enhance teaching practices.

3. Course Content and Schedule

This course consists of three modules, each lasting 12 hours (total 36 hours) and follows a four-phase instructional model: Case Analysis, Autonomous Learning, Practice, and Evaluation.

Module 1: Observation-Based Science Lesson Design (12 Hours)

Phase 1: Case Analysis (2 Hours)

Teacher-led analysis of high-quality observation-based science lesson videos, helping students identify effective practices.

Analysis of PCK application:

Knowledge of Lesson Content: How does the lesson engage childhood in observing plants, animals, weather, and environmental phenomena?

Knowledge of Learners: How does the lesson align with childhood's cognitive development?

Knowledge of Teaching Methods: How is inquiry-based learning incorporated into the lesson?

Analysis of Lesson Design Skills:

How are observation tasks designed for young childhood?

How is observation recorded and discussed?

How is childhood's observational ability assessed?

Class Discussion: Summarizing key features of observation-based lessons and establishing learning goals.

Phase 2: Autonomous Learning (4 Hours)

Students choose learning materials based on their interests to deepen their understanding of observation-based lesson design.

Learning Tasks:

Watching high-quality kindergarten lesson videos (lesson imitation)

Microteaching sessions (analyzing and improving lesson activities)

Reviewing high-quality lesson plans (simulating instruction)

Studying relevant theories (summarizing objectives, content, and methods)

Access to in-depth theoretical literature, such as Montessori Education, Reggio Emilia Approach, and the UK Early Years Foundation Stage (EYFS), supporting independent learning.

Phase 3: Practice (2 Hours)

Group-based lesson design for observation-based science topics and simulated teaching.

Emphasis on peer interaction for collaborative improvement.

Teacher-guided feedback to refine lesson plans.

Phase 4: Evaluation (4 Hours)

Teacher-student evaluation: Using assessment rubrics to provide constructive feedback.

Peer review: Groups evaluate each other's lesson plans.

Final revision: Students refine their lesson designs based on feedback.

Module 2: Experiment-Based Science Lesson Design (12 Hours)

Phase 1: Case Analysis (2 Hours)

Teacher-led analysis of high-quality experiment-based science lesson videos, exploring how childhood engage with scientific experiments (e.g., material changes, magnetism, light and shadows).

Analysis of PCK application:

Knowledge of Lesson Content: What scientific concepts are introduced?

Knowledge of Learners: Are the experiments age-appropriate?

Knowledge of Teaching Methods: How is the experimental inquiry approach applied?

Analysis of Lesson Design Skills:

How are engaging and safe experiments designed?

How is childhood's scientific curiosity nurtured?

Phase 2: Autonomous Learning (4 Hours)

Students select experiment-based lesson materials to deepen their knowledge.

Learning Tasks:

Observing experiment-based lesson demonstrations

Exploring hands-on experimental teaching strategies

Engaging with advanced theoretical literature on experimental science education

Phase 3: Practice (2 Hours)

Group-based development of experiment-based lesson plans and teaching simulations.

Teacher feedback provided to optimize experimental lesson plans.

Phase 4: Evaluation (4 Hours)

Comprehensive assessment involving teacher, peer, and self-evaluation.

Students refine their lesson plans based on feedback.

Module 3: Mathematics-Based Science Lesson Design (12 Hours)

Phase 1: Case Analysis (2 Hours)

Teacher-led analysis of high-quality mathematics-based lesson videos, examining number sense, geometry, measurement, and sorting.

Analysis of PCK application:

Knowledge of Lesson Content: How are mathematical concepts taught in early childhood?

Knowledge of Teaching Methods: How does play-based learning enhance mathematical thinking?

Phase 2: Autonomous Learning (4 Hours)

Students engage in independent study of mathematics-based teaching strategies.

Learning Tasks:

Exploring play-based mathematics teaching

Analyzing successful lesson designs

Reviewing relevant theoretical frameworks

Phase 3: Practice (2 Hours)

Group collaboration on mathematics-based lesson design and simulated instruction.

Emphasis on hands-on learning and active engagement.

Phase 4: Evaluation (4 Hours)

Comprehensive review and refinement of lesson plans.

4. Assessment Criteria

Table 35 Assessment Criteria

Assessment Component	Content	Weight
Class Participation	Case analysis, discussions, interactive activities	20%
Autonomous Learning Report	Independent study and submission of learning reflections	20%
Lesson Design Program	Comprehensive lesson plans aligning with science education goals	30%
Simulated Teaching	Teaching performance, organization, child engagement	30%

Source : Zhao Ting (2025)

5. Course Resources

Primary Textbooks & Readings
Guidelines for Kindergarten Science Education
Inquiry-Based Learning: Theories and Practices in Early Science Education
Montessori Science Education
Video Resources: High-quality kindergarten science lesson demonstrations
Online Learning Platform: Interactive learning forums and microteaching tools
Learning Environments:
Discussion rooms for student collaboration
Microteaching classrooms for practice
Simulated kindergarten lab for real-world teaching scenarios

APPENDIX F

Expert Evaluation Form for the Teaching Syllabus of "Early Childhood Science Lesson Design" Based on the CAPE Model

Evaluation Purpose:

This evaluation invites experts in early childhood education and lesson design to assess the teaching syllabus based on the Meaningful Learning Theory, ensuring its scientific validity, rationality, and feasibility, and to provide optimization suggestions.

Evaluation Instructions:

Evaluation Scope: Course objectives, course content, lesson design, assessment methods, course resources, and implementation feasibility.

Evaluation Method: Experts rate the criteria based on the scoring standard and provide suggestions for improvement.

Scoring Standard: A 5-point Likert scale is used as follows:

1 = Completely non-conforming (requires significant revision)
2 = Partially conforming (has major issues)
3 = Basically conforming (but needs improvement)
4 = Conforming (generally reasonable, with minor adjustments)
5 = Highly conforming (completely reasonable, no revision needed)

Expert Evaluation Form

Table 36 Expert Evaluation Form

Evaluation Dimension	Evaluation Criteria	Score (1-5)
1. Rationality of Course Objectives	1.Are the course objectives clear, specific, and aligned with early childhood education training requirements?	
	2.Do the objectives cover the core aspects of PCK (Content Knowledge, Learner Knowledge, and Pedagogical Knowledge) and lesson design skills?	
	3.Are the objectives aligned with early childhood science education standards and childhood's cognitive development characteristics?	
2. Scientific Validity and Completeness	4.Is the course content systematically structured, covering observation-based, experiment-based, and mathematics-based science education?	

Evaluation Dimension	Evaluation Criteria	Score (1-5)
of Course Content	5.Is the course content based on the latest research in early childhood education and aligned with childhood's cognitive characteristics?	
	6.Does the course content have logical progression and increasing depth, making it suitable for early childhood education students?	
3. Rationality of Lesson Design	7.Does the course adopt the four-phase instructional model (Case Analysis, Autonomous Learning, Practice, Evaluation), with appropriate distribution of instructional hours?	
	8.Does the course reflect the Learner-Centered Approach?	
	9.Does the course include diverse activities, such as case analysis, group discussions, microteaching, and simulated teaching?	
4. Scientific Validity of Assessment Methods	10Are the assessment methods diversified (e.g., participation, autonomous learning reports, lesson design, and simulated teaching)?	
	11.Are the assessment criteria clear, fair, and able to objectively measure students' learning outcomes?	
5. Supportiveness of Course Resources and Learning Environment	12.Are rich learning resources (e.g., case videos, academic literature, preschool curriculum plans) provided?	
	13.Are appropriate learning environments available (discussion rooms, microteaching classrooms, preschool training labs)?	
	14.Are digital tools (e.g., online interactive platforms, lesson design software) used to enhance learning experiences?	
6. Feasibility of Course Implementation	15.Can the course be smoothly implemented within the existing early childhood education curriculum framework?	
	16.Is the course applicable to early childhood education students with different proficiency levels?	

Source : Zhao Ting (2025)

Evaluation Result Analysis

mean≥ 4.5: Experts strongly approve; the course can be implemented as designed.

4.0 ≤ mean < 4.5: The course is generally good,the course can be implemented as designed.

3.5 ≤ mean < 4.0: Some deficiencies exist; the course requires revisions before implementation.

3.0 ≤ mean < 3.5: Many issues need significant modifications.

mean< 3.0: The course has serious problems and is not recommended for implementation.

Expert Information

Name:

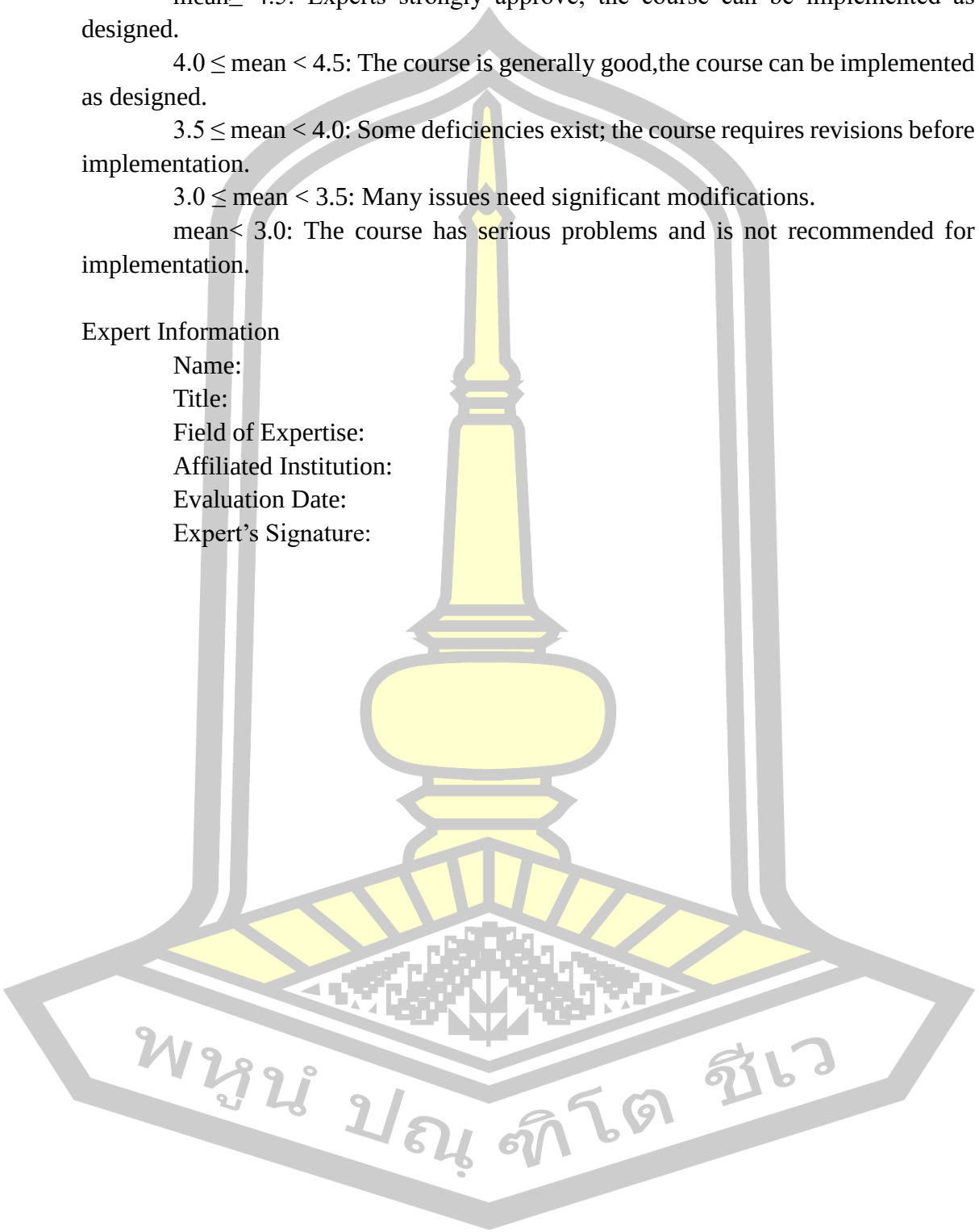
Title:

Field of Expertise:

Affiliated Institution:

Evaluation Date:

Expert's Signature:



APPENDIX G

Lesson Design Ability Test

Total Score: PCK 100 points + Lesson Design Skills 120 points = 220 points
Test Format: Written Exam (PCK) + Lesson Design Skills

Part One: Basic Information

Name:
Student ID:
Class:

Part Two: PCK Written Exam (100 points)

I. Multiple-Choice Questions (10 questions × 3 points = 30 points)

（1）Knowledge of Teaching Content (3 questions, 9 points)

1. Which of the following is NOT one of the main goals of early childhood science education? ( )

A. Developing childhood's observation and inquiry skills
B. Cultivating childhood's interest in science
C. Enabling childhood to master scientific laws
D. Promoting childhood's social communication skills

2. Which of the following phenomena falls under the category of "material change"? ( )

A. Ice melting into water
B. Glass breaking
C. Iron rusting
D. Eraser removing pencil marks

3. Which of the following is NOT a core content area in early childhood science education? ( )

A. Life Science
B. Material Science
C. Space Science
D. Earth and Environmental Science

（2） Knowledge of Learners (3 questions, 9 points)

4. The cognitive characteristics of young childhood in scientific exploration activities mainly include ( )

A. Intuitive thinking and preference for hands-on activities
B. Ability to engage in abstract reasoning
C. A well-formed system of scientific concepts
D. Independent completion of scientific experiments

5. Young childhood’s scientific inquiry is most influenced by ( )

A. Life experiences
B. Logical reasoning ability
C. Memorization of formulas
D. Textbook knowledge

6. Early childhood science education should avoid ( )

A. Conducting activities in a playful manner
B. Directly instilling knowledge
C. Connecting with childhood's life experiences
D. Encouraging childhood to explore independently

（3）Knowledge of Teaching Methods (4 questions, 12 points)

7. When organizing a science activity, how should teachers guide childhood in exploration? ( )

A. Directly tell childhood the conclusion
B. Ask childhood to read textbooks by themselves
C. Guide childhood to discover patterns through experiments and observation
D. Rely mainly on parental guidance

8. Which teaching method is most suitable for developing childhood's scientific inquiry ability? ( )

A. Lecture method
B. Experimental inquiry method
C. Mechanical memorization
D. Direct demonstration

9. Early childhood science education emphasizes ( )

A. Passive knowledge reception
B. Gaining experience through practice and exploration
C. Using exams as the primary assessment method
D. Focusing only on the transmission of scientific concepts

10. The core of "inquiry-based learning" is ( )

A. Teachers providing standard answers
B. childhood actively asking questions and conducting experiments
C. childhood memorizing scientific principles
D. Learning scientific knowledge only through storytelling

****

II. Essay Questions (3 questions × 10 points = 30 points)

11. Knowledge of Teaching Content (10 points)

Based on the goals of early childhood science education, analyze the characteristics of teaching content in early childhood science education and give examples of how to reflect these characteristics in teaching.

12. Knowledge of Learners (10 points)

Analyze the cognitive characteristics of 5-6-year-old childhood in scientific inquiry and provide a real-life teaching example to illustrate how to design a scientific activity based on these characteristics.

13. Knowledge of Teaching Methods (10 points)

Discuss the application value of the "experimental inquiry method" in early childhood science education and provide examples of how to effectively organize science experiments for childhood.

****

III. Case Analysis (2 questions × 20 points = 40 points)

（1）Case 1 (Teaching Content Knowledge + Knowledge of Learners, 20 points)

A kindergarten teacher conducted a "Mystery of Magnets" activity in a preschool class. The teacher directly told the childhood that magnets attract iron but did not provide any materials for hands-on exploration. The childhood showed little interest, and some failed to understand the properties of magnets.

Questions:

14. What are the problems with this teacher’s lesson design? (10 points)

15. Based on preschoolers' cognitive characteristics, propose a more effective teaching method and explain the reasoning. (10 points)

（2）Case 2 (Knowledge of Teaching Methods, 20 points)

A teacher conducted a "Seed Germination" experiment but only asked childhood to observe seed changes and record data. However, the childhood were not very engaged in the process.

Questions:

16. What are the shortcomings of this teaching method? (10 points)

17. How would you adjust the teaching method to increase childhood's interest in exploration and participation? (10 points)

Part Three: Lesson Design Skills Assessment (120 points)

18. Lesson Design (1 question × 120 points = 120 points)

The goal of early childhood science education is to stimulate childhood's curiosity and interest in exploration, and to develop their observation, thinking, and hands-on abilities.

Task: Based on the cognitive characteristics of preschoolers (aged 5-6), design a scientific inquiry activity. Choose your own theme (e.g., Water Buoyancy, Magnetic Properties, Plant Growth, etc.).

APPENDIX H

Lesson Design Ability Test - Answer Key or Scoring Criteria

Total Score: PCK 100 points + Teaching Design Skills 120 points = 220 points
Test Format: Written Exam (PCK) + Teaching Activity Design (Teaching Design Skills)

Part One: PCK Written Exam (100 points) - Answer Key

I. Multiple-Choice Questions (10 questions ×3 points = 30 points)

Table 37 Multiple-Choice Questions

Dimension	Question	Answer	Points
Knowledge of Teaching Content	Main goal of early childhood science education	C	3
	Material change example	C	3
	Core content in early childhood science	C	3
Knowledge of Learners	Cognitive characteristics in scientific inquiry	A	3
	Factors influencing childhood's inquiry	A	3
	What should be avoided in early childhood science education	B	3
Knowledge of Teaching Methods	Guiding childhood in exploration	C	3
	Most suitable teaching method	B	3
	Emphasis in early childhood science education	B	3
	Core of inquiry-based learning	B	3

Source : Zhao Ting (2025)

II. Essay Questions (3 questions × 10 points = 30 points)

Table 38 Essay Questions

Dimension	Question	Scoring Criteria	Reference Answer	Score
Knowledge of Teaching Content	Analyze the characteristics of kindergarten science education content based on the goals of science education, and provide examples of how these characteristics are reflected in teaching.	Accuracy of content (4 points), reasonable example (4 points), clear expression (2 points)	Kindergarten science education emphasizes concreteness, visualization, and strong operability, requiring integration with games and exploratory activities, such as the "Three States of Water" experiment.	10
Knowledge of Learners	Analyze the cognitive characteristics of 5-6-year-old childhood in scientific exploration, and provide an actual teaching case to illustrate how to design scientific education activities based on these characteristics.	Analysis of cognitive characteristics (4 points), reasonable example (4 points), clear expression (2 points)	childhood aged 5-6 are highly curious and enjoy hands-on experiments, such as observing growth conditions in the "Seed Germination" experiment.	10
Knowledge of Teaching Methods	Discuss the application value of the "experimental inquiry method" in kindergarten science education, and provide an example to illustrate how to effectively organize childhood for scientific experiments.	Method analysis (4 points), reasonable example (4 points), clear expression (2 points)	Using the experimental inquiry method, such as the "Floating and Sinking Experiment," allows childhood to predict and observe results through hands-on exploration.	10

Source : Zhao Ting (2025)

III. Case Analysis (2 questions × 20 points = 40 points)

Table 39 Case Analysis

Question	Scoring Criteria	Reference Answer	Score
Case 1 (Knowledge of Teaching Content + Knowledge of Learners) A teacher directly tells childhood that magnets attract iron in the "Mystery of Magnets" activity without providing any materials for hands-on exploration. As a result, childhood show low interest, and some do not understand the properties of magnets. **Questions:** ① Analyze the problems in the teaching design. ② Propose a more effective teaching method and explain the rationale.	Problem analysis (10 points), optimized solution (10 points)	Lacks a hands-on exploration component. The teacher should provide materials for childhood to experiment, such as sorting and testing different objects for magnetic properties.	20
Case 2 (Knowledge of Teaching Methods) A teacher conducting a "Seed Germination" experiment only asks childhood to observe and record changes, but the childhood show little interest. **Questions:** ① What are the shortcomings of this teaching method? ② How would you adjust the method to enhance childhood's active exploration and engagement?	Method analysis (10 points), optimized solution (10 points)	Solely observing and recording is too passive. The teacher should introduce hands-on experimental elements, such as comparing seed germination under different environmental conditions.	20

Source : Zhao Ting (2025)

Part Three: Lesson Design Skills Assessment (120 points)

Table 40 Lesson Design Ability Evaluation Scale

Dimension	Criteria	0	1	2	3	4	5
Analyze Learning Situations Skill(15 points)	1. Ability to correctly analyze childhood's age characteristics and physical and mental development status.						
	2. Ability to correctly analyze						

Dimension	Criteria	0	1	2	3	4	5
	childhood's prior life and learning experiences.						
	3. Ability to correctly analyze the characteristics of teaching content and its value for childhood's development.						
Set Activity Objectives Skill (20 points)	4. Activity objectives align with national policies and guidelines and fit childhood's developmental characteristics.						
	5. Activity objectives reflect childhood's active participation and are clearly stated, specific, and operable.						
	6. Activity objectives are comprehensive (including cognitive, affective, and psychomotor goals) and prioritized based on importance.						
	7. Activity objectives include essential elements (behavior, conditions, criteria).						
Activity Preparation Skill (10 points)	8. Clearly identifies the prior experiences childhood need before engaging in the activity.						
	9. Specifies teaching environment, equipment, teaching aids, and materials based on the activity content and childhood's characteristics.						
Select Activity Content Skill (20 points)	10. Selected activity content corresponds to and covers the required objectives.						
	11. Selected activity content matches childhood's age characteristics, interests, and needs.						
	12. Selected activity content is relevant to childhood's daily life and learning experiences.						
	13. Selected activity content considers factors such as season, region, and contemporary context.						
Activity Implementation Planning Skill(35 points)	14. Activity process is goal-oriented, with each stage corresponding to the						

Dimension	Criteria	0	1	2	3	4	5
	activity objectives.						
	15. Reasonably plans time and space for each stage based on the number and age of childhood.						
	16. Selects and designs appropriate teaching methods based on childhood's characteristics and content features.						
	17. Ensures logical sequencing and smooth transitions between different stages of the activity.						
	18. Encourages childhood's active participation by providing opportunities for expression, collaboration, and exploration.						
	19. Reflects individual differences and includes effective questioning strategies to guide childhood in overcoming difficulties.						
	20. Integrates multiple learning domains and utilizes resources such as play areas, daily routines, and home-school collaboration.						
Evaluation and Reflection Skill (20 points)	21. Evaluates and reflects on the achievement of activity objectives.						
	22. Evaluates and reflects on childhood's engagement and active participation.						
	23. Evaluates and reflects on the effectiveness of teaching content and methods.						
	24. Evaluates and reflects on the developmental value of the activity for childhood.						

Source : Zhao Ting (2025)

APPENDIX I

Pre-test and Post-test Scores of the Lesson Design Ability-Test of the Experimental Group (2201) and the Control Group (2202)

Table 41 Pre-test and Post-test Scores of the Lesson Design Ability-Test of the Experimental Group (2201) and the Control Group (2202)

Class	Student ID	Name	Pre-test			Post-test		
			PCK	LDS	total(LDA)	PCK	LDS	total(LDA)
2201	22010130101	曾忻怡	54	46	100	79	85	164
2201	22010130102	李庆雯	47	47	94	75	85	160
2201	22010130103	严露	56	52	108	75	91	166
2201	22010130104	陈明香	51	47	98	71	90	161
2201	22010130105	毕成奇	40	48	88	71	90	161
2201	22010130106	彭忠翠	54	44	98	79	93	172
2201	22010130107	张云婷	56	50	106	83	86	169
2201	22010130108	罗友倩	52	46	98	79	83	162
2201	22010130109	杨彤	42	49	91	68	87	155
2201	22010130110	杨文花	65	45	110	80	98	178
2201	22010130111	刘玉凤	38	56	94	78	89	167
2201	22010130112	李馨	51	54	105	76	91	167
2201	22010130113	吕惠怡	50	52	102	78	92	170
2201	22010130114	唐洪英	44	55	99	76	79	155
2201	22010130115	叶晓慧	38	61	99	83	90	173
2201	22010130116	王林萍	50	52	102	74	93	167
2201	22010130117	窦志群	48	55	103	77	89	166
2201	22010130118	王虹钧	55	52	107	74	89	163
2201	22010130119	段照敏	39	42	81	71	86	157
2201	22010130120	姜冯燕	30	51	81	66	82	148
2201	22010130121	周若曦	66	55	121	80	88	168
2201	22010130122	石成松	53	56	109	77	82	159
2201	22010130123	江登欢	54	55	109	72	91	163
2201	22010130124	陈春蕊	41	53	94	74	88	162
2201	22010130125	李应花	42	54	96	66	92	158
2201	22010130126	姚然	57	56	113	72	98	170
2201	22010130127	赵芹	44	47	91	75	88	163
2201	22010130128	吴兴文	59	55	114	80	100	180

Class	Student ID	Name	Pre-test			Post-test		
			PCK	LDS	total(LDA)	PCK	LDS	total(LDA)
2201	22010130129	罗宪	43	53	96	78	87	165
2201	22010130130	卢孝弟	38	55	93	75	92	167
2202	22010130201	滕科	55	53	108	74	80	154
2202	22010130202	亢珑玲	54	53	107	69	82	151
2202	22010130203	钱鸿艳	49	49	98	73	94	167
2202	22010130204	陶静	47	56	103	66	80	146
2202	22010130205	马荣珍	40	46	86	73	96	169
2202	22010130206	李灿	43	47	90	72	87	159
2202	22010130207	秦碧莉	42	52	94	74	87	161
2202	22010130208	王玉平	27	53	80	69	89	158
2202	22010130209	陈鸿灵	45	52	97	78	77	155
2202	22010130210	张萍	47	38	85	72	94	166
2202	22010130211	王雪	47	46	93	71	88	159
2202	22010130212	古朝艳	45	51	96	75	73	148
2202	22010130213	王权琴	48	45	93	73	84	157
2202	22010130214	杨文秀	34	51	85	70	87	157
2202	22010130215	袁梦蝶	44	56	100	75	91	166
2202	22010130216	冯敏映	35	54	89	73	84	157
2202	22010130217	刘盈吟	59	55	114	69	82	151
2202	22010130218	罗蕊	61	51	112	75	75	150
2202	22010130219	王盼	37	49	86	72	96	168
2202	22010130220	卢丽萍	39	52	91	67	91	158
2202	22010130221	柴玓琪	46	48	94	68	78	146
2202	22010130222	杨爽	55	45	100	70	82	152
2202	22010130223	陈馨怡	45	49	94	69	85	154
2202	22010130224	张忠燕	56	52	108	72	77	149
2202	22010130225	张兴雨	60	45	105	66	87	153
2202	22010130226	陈静	45	55	100	75	89	164
2202	22010130227	杨孟冉	41	49	90	75	89	164
2202	22010130228	的日秀英莫	51	61	112	75	88	163
2202	22010130229	陈继琴	59	55	114	70	88	158
2202	22010130230	胡静	49	55	104	73	92	165

Source : Zhao Ting (2025)

APPENDIX J

Tool Quality

The Experts' Evaluation of the Self-Assessment and Needs Survey on Early Childhood Pre-Service Teachers' Lesson Design Ability

Table 42 The Experts' Evaluation of the Self-Assessment and Needs Survey on Early Childhood Pre-Service Teachers' Lesson Design Ability

Item	Opinion of experts					Subtotal	Index of Coincidence (IOC)	Interpret
	1	2	3	4	5			
1	+1	+1	+1	+1	+1	5	1.0	available
2	+1	+1	+1	+1	+1	5	1.0	available
3	+1	+1	+1	+1	+1	5	1.0	available
4	+1	+1	+1	+1	+1	5	1.0	available
5	+1	+1	+1	+1	+1	5	1.0	available
6	+1	+1	+1	+1	+1	5	1.0	available
7	+1	+1	+1	+1	+1	5	1.0	available
8	+1	+1	+1	+1	+1	5	1.0	available
9	+1	+1	+1	+1	+1	5	1.0	available
10	+1	+1	+1	+1	+1	5	1.0	available
11	+1	+1	+1	+1	+1	5	1.0	available
12	+1	+1	+1	+1	+1	5	1.0	available
13	+1	+1	+1	+1	+1	5	1.0	available
14	+1	+1	+1	+1	+1	5	1.0	available

Source : Zhao Ting (2025)

The Experts' Evaluation of the Interview Outline on Teachers' Needs for Instructional Models

Table 43 The Experts' Evaluation of the Interview Outline on Teachers' Needs for Instructional Models

Item	Opinion of experts					Subtotal	Index of Coincidence (IOC)	Interpret
	1	2	3	4	5			
1	+1	+1	+1	+1	+1	5	1.0	available
2	+1	+1	+1	+1	+1	5	1.0	available
3	+1	+1	+1	+1	+1	5	1.0	available
4	+1	+1	+1	+1	+1	5	1.0	available
5	+1	+1	+1	+1	+1	5	1.0	available
6	+1	+1	+1	+1	+1	5	1.0	available
7	+1	+1	+1	+1	+1	5	1.0	available
8	+1	+1	+1	+1	+1	5	1.0	available
9	+1	+1	+1	+1	+1	5	1.0	available
10	+1	+1	+1	+1	+1	5	1.0	available

Source : Zhao Ting (2025)

BIOGRAPHY

NAME	Ms.Ting Zhao
DATE OF BIRTH	13th July 1992
PLACE OF BIRTH	Yun Nan ,China
ADDRESS	No. 1 Yuanding Road, Anning Town, Xichang City, Sichuan Province
PLACE OF WORK	No. 1 Yuanding Road, Anning Town, Xichang City, Sichuan Province, Xichang Minzu Preschool Normal College
EDUCATION	2014 Bachelor Degree, School of Educational Sciences, Dali University, Majoring in Early Childhood Education 2017 Master Degree, Dali University, School of Educational Sciences, Major in Early Childhood Education. 2025 Doctor of Philosophy (Ph.D.), Curriculum and Instruction, Mahasarakham University

พหุน ปณฺ ฑิโต ชีเว