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Application of Feynman Learning Method in Cultivating Pre-service Secondary EFL Teachers in High Education

Lieqin Wang[1,a,*], Zhuoyang Li[2]

[1]College of Foreign Languages and Literature, Baoji University of Arts and Sciences, Baoji, Shaanxi, China
[2] School of Foreign Languages, Shaanxi Xueqian Normal University, Xi'an, Shaanxi, China
[a]wlq0835@qq.com
**Corresponding author*

Abstract: *Traditional pre-service EFL teacher education is often plagued by disconnection between instructional theory and classroom practice. Feynman Learning method emphasizes output-driven learning and requires students to reorganize instructional knowledge, deliver simplified, comprehensible explanations through making and implementing instruction design. This qualitative study collects and analyses simulated classroom observation narratives, semi-structured interviews, and reflective teaching journals as core data sources, and investigates the effectiveness of the Feynman technique in promoting pre-service secondary EFL teacher training in terms of understanding instructional theories, demonstrating teaching performance and improving reflective awareness. This paper further discusses the pedagogical value of Feynman learning method in EFL teacher education and proposes feasible instruction strategies for simulated teaching practice. This study provides an outcome-oriented reference for pre-service EFL teacher training in high education.*

Keywords: *Feynman Learning Method; pre-service English teachers training; qualitative inquiry; simulated teaching; pedagogical reflection*

1. Introduction

1.1. Research Background

Globally, EFL teacher education has long been confronted with a prominent dilemma: the disconnection of theory and practice for pre-service language teachers in high education [5]. In the current context of educational transformation in China, national policy documents have been highlighting the great demand of promoting pre-service teachers' practical teaching competencies. The Outline for Building a Leading Education Nation (2024–2035) highlights the importance of cultivating application-oriented high-quality basic education teachers with solid practical abilities [10]. Meanwhile, Against the professional accreditation standards for teacher education programs, college and universities are required to bridge the gap between theoretical course-study and classroom practice for prospective English teachers [7]. In order to achieve these goals, college and universities are highly expected to innovate training approaches and teaching practice throughout pre-service teacher education (Teacher Work Department, Ministry of Education of the People's Republic of China, 2019).

In China's normal university settings, pre-service secondary English teacher education courses and examinations usually focus on delivering and memorizing systematic pedagogical theories, disconnecting instructional teaching theories with classroom scenarios. When engaging in simulated teaching or internship practice, student teachers design teacher-centered lessons, and adjust teaching activities freely, and demonstrate poor instructional competence, completely ignoring learners' current level and their actual needs. Such superficial theory teaching practice seriously restricts the growth of trainee teachers' core teaching competence and cannot meet the current demands of modern secondary English education. Traditional quantitative evaluation rubrics often fail to capture pre-service teachers' inner cognitive changes, necessitating qualitative exploration of pre-service English teachers' practical growth [12].

Feynman Learning Method originates from the learning logic of physicist Richard Feynman, which

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emphasizes knowledge output as a method to examine internal mastery of abstract knowledge [2]. The four core procedures of Feynman Learning Method are knowledge input, simulated explanation, gap identification and knowledge simplification, forcing learners to abandon mechanical memorization, reorganize and demonstrate abstract knowledge with plain, comprehensible language and concrete actions [8]. Such output-oriented learning logic well-matches the training characteristics of pre-service English language teachers, who need to convert academic pedagogical knowledge into learner-oriented classroom language output and teaching practice. Multiple scholars and university teachers have applied Feynman Learning Method and verified its practicability and feasibility across diverse disciplines[4,11]. Existing research also demonstrates that the Feynman Technique facilitates foreign language acquisition. Although existing research has verified the effectiveness of Feynman Learning Method in STEM education and general language learning, few qualitative studies concentrate on its application and effectiveness in secondary pre-service English teacher training, nor do they systematically interpret trainee teachers' cognitive transformation processes without quantitative experimental data. Thematic analysis, adopted in this research, provides a rigorous framework to explore such cognitive processes [1].

1.2. Research Purpose and Research Questions

This study aims to explore how Feynman Learning Method alters pre-service secondary English teachers' teaching modes and promote learners' internal understanding and practical mastery of instructional theories. No questionnaires, pre-post tests or quantitative indicator comparisons are adopted in the whole research. Based on student teachers' authentic classroom learning performances, instructional narratives and reflections, this study addresses two core questions :

(1) What cognitive changes do pre-service secondary English educators experience after participating in two-semester simulated Feynman learning activities?

(2) In what ways does Feynman learning method help English trainee teachers move beyond rote theoretical memorization and build deep understanding of simulated practical teaching?

2. Literature Review

2.1. Theory-Practice Disconnection in Pre-service EFL Teacher Education

The disconnection between education theory and classroom practice has been an international research topic in teacher education and constitutes a core challenge in pre-service teacher cultivation [5,9]. Early research by Kagan (1992) indicated that pre-service teachers rarely apply university pedagogical theories to real classrooms, largely because theoretical knowledge is delivered in de-contextualized classroom environments without connection to learners' cognitive styles. This theory-practice disconnection has also long been prominent in EFL teacher education, where trainee English teachers frequently memorize solid declarative knowledge, but lack simulated instructional competence[9].

For secondary English trainee teachers, the theory-practice disconnection is featured by specific manifestations: memorizing task-based language teaching or communicative language teaching definitions, but failing to design age-matching communicative tasks; reciting student-centered education concepts, yet dominating classroom speaking during simulated lesson plans. In terms of teacher and professional Assessment, pre-service teachers' instructional performances are widely measured and scored quantitatively, and trainee teachers' subtle cognitive transformation and inner professional growth are yet ignored [12]. Essentially, teacher professional development is a cognitive reconstruction process [5], which cannot be fully reflected through numerical scores alone.

Lots of previous intervention studies on learning-by-teaching have adopted quantitative experimental designs, scoring trainee teachers' teaching performances and making statistical comparisons. Such research has provided measurable suggestions for curriculum reforms, but they tend to overlook student teachers' internal cognitive changes, ignoring how individuals could interpret and reconstruct abstract pedagogical theories. In addition, most of the existing educational intervention research have overemphasized behavioral outcomes, neglecting learners' self-reflections and knowledge restructuring processes, thus lacking in-depth qualitative inquiry of individuals' learning narratives [6]. Against this research backdrop, this study will fill the above research gap and adopt a purely qualitative perspective to focus on classroom observational narratives, semi-structured

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interviews and reflective journals rather than numerical performance assessment.

2.2. The Connotation of Feynman Learning Method and its Educational Application

Feynman Learning Method is an output-driven active learning strategy, which in essence is in accordance with the logic of "learning by teaching" [2-3]. Rooted in Richard Feynman's learning philosophy, the strategy highlights the reconstruction, simplification and interpretation of abstract theory [8]. The four-stage learning cycle is made up of knowledge input, simulated explanation, cognitive gap identification, and knowledge restructuring, thus forming a closed-loop reflective learning mechanism [2], which effectively helps learners abandon rote memorization, discover knowledge blind spots through output-driven practice, and internalize abstract knowledge into understandable and operable instructional performance [11].

This output-driven Feynman learning method is highly compatible with the cultivation demands of pre-service EFL teachers, who are required to transform abstract pedagogical theories into learner-centered classroom teaching performances [13]. Both existing domestic and international studies have verified the wide applicability and effectiveness of Feynman Learning Method in higher education, and the method has been confirmed to advance deep conceptual understanding across multiple disciplines, including vocational education, mathematics and language teaching contexts [8,11]. As far as language education is concerned, empirical evidence has demonstrated that Feynman Learning Method can effectively activate learners' language learning potential and promote the internalization and application of English knowledge [13].

Nevertheless, the existing studies on the Feynman Learning Technique have its limitations. Globally, existing studies have mainly focused on general university academic learning and STEM disciplines, and inadequate attention has been paid to teacher education scenarios [8]. Domestically, current studies on the integration of Feynman Learning Method in classroom activities lack systematic qualitative analysis of learners' cognitive changes. Furthermore, feedback, which acts as the core iterative link of the Feynman learning cycle [4], has not been fully discussed in existing pre-service EFL teacher education research.

According to the current education policy documents [7], Teacher training quality assessment and curriculum reforms have always been the core priorities of China's basic education development. The national teacher education professional accreditation standards have clearly emphasized that pre-service teachers should possess the ability of integrating theoretical knowledge with classroom practice and forming independent teaching reflection and professional development capabilities [7]. Meanwhile, the national strategic deployment of building a powerful education nation further puts forward higher requirements for the practical ability and sustainable professional growth of young teachers [10]. In this context, exploring effective learning and training methods to solve the theory-practice disconnection of pre-service English teachers has important practical significance for optimizing teacher education curriculum and improving the overall quality of secondary English teachers.

2.3. Research Gap Summary

Three obvious research gaps can be summarized from existing literature: Firstly, studies on the Feynman learning technique in EFL teacher education are far from being sufficient, lacking targeted exploration for secondary English trainee teachers; secondly, most of the relevant studies adopt quantitative experimental paradigms, with few in-depth qualitative inquiries focusing on teachers' internal cognitive experience; thirdly, existing intervention studies mostly centered at curriculum system reform. This qualitative inquiry responds to the above gaps and produces supplementary humanistic evidence for relevant research fields, and takes simulated teaching practice as an independent research scene, exploring how Feynman Learning Method eliminates rote theoretical learning based on classroom narratives, interviews and reflections.

3. Methodology

3.1. Research Paradigm

This study adopts a constructivist qualitative research paradigm. Constructivism holds that learning cognition is constructed based on learners' previous knowledge through interactions rather than

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transmitted through rigid memorization [6]. The researcher acts as an interpretive observer instead of a quantitative experiment controller. All the collected data are text-based qualitative discourses, with no numerical measurements, statistical calculations or quantitative comparisons involved throughout the research process.

3.2. Participants

The participants of the study are the 98 second-year pre-service college EFL teachers from the college of Foreign Languages & Literature of a university in North-west China, whom the research observer has taught for two semesters. A strong harmonious relationship has been built between them. They have completed courses in English Language Teaching Methodology and Secondary English Instructional Design, and have participated in basic simulated teaching training. Instructional teaching observations, semi-structured interviews and reflective journals are collected during and by the end of the course instruction. The participants are also different in learning styles:some accustomed to reciting theoretical instructional knowledge for examinations, while others being good at doing simulated teaching practice. All the participants voluntarily join this research and their personal identifying information is protected for privacy.

3.3. Research Intervention: the Feynman Learning Technique Applied in Simulated Teaching Practice

Within two semesters (36 weeks), Feynman Learning Method was adopted into weekly simulated classroom teaching training through the courses in *Second English Instructional Design* and in *English Teaching Methodology* with the following fixed activity procedures:

1) Instructional theories Input: The student participants receive weekly teaching tasks and start to learn firstly independently and then in groups, focusing on specific instructional theories (the structural view, the TBLT, the CLT, teaching objectives design, learner analysis, instructional media design, etc.). The participants understand and familiarize themselves with the unit topic and teaching contents, and cooperatively accomplish a teaching design in the form of PPT before class and get ready to teach in class to their peers.

2) Simulated Feynman Explanation and Instruction: In simulated classroom instruction before their peer students, the participants act as an EFL teacher, simplify and explain the targeted theory or knowledge to their peers who are real EFL learners or act as Grade 7–9 secondary school students.The participants are required to use simple language, appropriate examples and teaching media to explain the instructional theories concerned.

3) Gap Identification Dialogue: During the simulated Feynman instruction, the researcher observer may identify some problems and interrupt the participants from time to time to point out them and make immediate corrections. After each simulated explanation or instruction, both the participants and peer students are required to provide open descriptive feedback in class in terms of the participants' success and weakness. The Researcher observer finally summarizes the feedback and requires the participants to note down, analyze confusing points and propose optimized strategies in their post-teaching PPT and reflective journals.

4) Knowledge Simplification and Reconstruction: Based on the research observer and peer feedback, the participants actually reorganize their instructional frameworks, modify their PPT texts, rewrite simplified interpretation manuscripts, and finally share them in class We-chat.

Such activity is performed once every week by 2-3 peer participants, obtaining continuous output-oriented learning experience.

3.4. Data Collection

Three types of qualitative text data are collected throughout the semesters; no quantitative instruments are used:

1) Simulated classroom observation narratives: The research observer has participated in all weekly simulated classroom teaching activities and recorded descriptive field notes, focusing on the participants' language adjustments, theoretical applications and reflective behaviors during the Feynman explanation teaching sessions. All the observation records have retained authentic scene descriptions without quantitative behavioral frequency statistics.

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2) Semi-structured interview transcripts: By the end of the semester-long intervention, one-on-one open interviews have been conducted with each participant, lasting 5~10 minutes. Interview questions centered on the changes in theoretical learning habits, feelings of Feynman explanation activities, and understandings of the connection between theory and classroom practice. All the interviews are face-to-face audio communications and transcribed into complete texts, with all real names replaced by coded aliases (S1~S21).

3) Reflective teaching journals: Every participant has submitted an open journal after the Feynman learning activities by the end of the class, recording their confusions, gains and cognitive changes without fixed answering templates. Over 180 teaching journal texts have been collected as core analysis materials.

3.5. Data Analysis

The study adopts Braun & Clarke's (2006) six-phase thematic analysis method for all qualitative text materials. The standard analytical procedure for pure qualitative educational research goes as followings:

1) Familiarizing with the data: The researcher repeatedly reads and gets familiarized with classroom observation narratives, interview transcripts, reflective journals to grasp overall contents and underline key descriptive phrases and sentences.

2) Generating initial codes: Label meaningful segments in all the selected texts with open descriptive codes (e.g., "abandon memorizing definitions", "design examples matching learners' age, language level or learning styles, etc", "find theoretical blind spots through student feedback").

3) Searching for core themes: Classify and merge related initial codes to form preliminary themes reflecting trainee teachers' cognitive changes.

4) Reviewing the themes: Compare extracted themes with the full set of qualitative data to verify whether the themes can effectively summarize core learning experience, eliminate repetitive or irrelevant themes.

5) Defining and naming the themes: Refine the connotation of each verified theme and assign clear, concise thematic names.

6) Producing the analytical report: Select representative original text excerpts from the classroom observation narratives, interview transcripts and reflective journals to support each theme, presenting analysis results with descriptive texts only.

To ensure the trustworthiness of this qualitative analysis, member checking has been conducted: after preliminary theme extraction, 12 randomly selected participants were invited to read corresponding analytical texts and confirm whether the themes conform to their authentic learning experience and cognitive improvement. Minor textual revisions were made according to the participants' feedback so as to reduce researcher's subjective bias.

4. Results

Through systematic thematic analysis of classroom observation narratives, interview transcripts, and reflective journals, three interrelated themes have been extracted, fully describing how Feynman Learning Method has pushed pre-service EFL teachers away from rote theoretical memorization toward practical, context-based understanding of pedagogical theories, simulated instructional design and teaching performance.

Theme 1: Deconstructing Rigid, Isolated Theoretical Frameworks

Before participating in the Feynman learning activities, all the participants have formed a learning habit: separating academic instructional theories into independent memory points, memorizing textbook definition paragraphs for final-term summative assessments, without exploring the internal logic between instructional theory and classroom practice. Multiple journal texts record the participants' previous learning experience: "I only memorize the key sentences of situational teaching. I never think about how to build situations for Grade 8 students in real lessons" (S2, Week 2 reflective Journal). Most of the participants regarded instructional theories as static, fixed knowledge that only needs to be accurately memorized.

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The requirement of simplified Feynman explanation has forced the participants to break rigid theoretical boundaries. When explaining the complex academic instructional theories to their peers, trainee teachers cannot rely on copied or memorized textbook definitions, nor can they just read the textbook sentences or paragraphs. In order to explain the instructional theory clearly, fluently and logically to their peer students in class, the participants had to read again and again and get a deep understanding of the theoretical frameworks. Many participants mentioned their cognitive shock in class interviews: "When I tried to explain differentiated instructions to my classmates acting as the course teacher or junior high teacher, I found I only memorized its definition but could not understand its core ideas. I had to reorganize all knowledge points and abandon useless purely-memorized contents" (S10, Interview Transcript). Field observation narratives also record consistent phenomena: in the early Feynman explanation sessions, most participants mechanically recited textbook sentences or paragraphs without deep understanding; after four to six weeks of such activities, many trainee teachers could split complex theories into several simple, interrelated sub-logics, changing their previous rote memory mode. Feynman learning's output requirement has deconstructed rigid theoretical frameworks accumulated through long-term exam-oriented learning tradition.

Theme 2: Reconstructing the Logic of Simulated classroom teaching Accordingly

After deconstructing the rigid theory-memorization learning mode, the participants enter a second cognitive transformation stage: reconstructing instructional logic that takes differentiated learners' as the core. Under rote theoretical learning, students master teaching theories from the perspective of educators, ignoring learners' needs and their cognitive levels. Feynman simulated teaching has reversed this mode. All the participants must make their explanations from the perspective of learners to judge the acceptability and comprehensibility of theoretical interpretation.

Massive journal and interview texts have reflected this logical reconstruction process. One participant wrote in a Week 8 journal: "Before the Feynman activities, I used to design lessons from the perspective of the teacher and the logic of theoretical frameworks. Now every time when I sort out a teaching method, I will take learners firstly into consideration and make corresponding adjustments." Peer feedback in simulated classroom practice has verified this: when trainee's theoretical explanation is too abstract and illogical and disconnected from learners' experience and levels, participants must modify their explanations and redesign classroom activities. The researcher's field observation also recorded this phenomenon: in the early stage of intervention, participants' instructional performance is characterized by pure and poor theory memorization and superficial understanding; in the later stage, all teaching activities are designed around learners' level and needs, and the theories naturally integrate into student-centered classroom instructions without rigidly reading textbook contents or pure theory memorization. This cognitive shift has shown that trainee teachers no longer do classroom teaching through memorizing the teaching contents, but have to firstly understand the contents themselves and then explain them to their peers in appropriate ways. Such Feynman teaching practice has deepened the participants' understanding of instructional theories, improved their language competence and promoted their understanding of teaching logic.

Theme 3: Forming Sustained, Active Instructional Reflection Habits

The third progressive cognitive change produced by Feynman Learning Method is the formation of active, sustainable reflective awareness. Traditionally, trainee teachers do their best to memorize the learned theories mostly for text-based summative examinations, rarely taking the initiative to think more about their understanding and application defects. The four-stage Feynman learning method has integrated their reflections into every learning loop.

Participants' post-explanation interviews repeatedly mention the spontaneous reflection after their teaching activities. S18 stated in the interview: "the Feynman explanation made me find my own theoretical blind spots. Now I can automatically reflect on whether I really understand teaching contents, instead of rote memorizing them and forgetting them quickly afterwards." Reflective journals also proved the sustainability of this reflection habits: early journals only record simple activity feelings; later journals contain systematic self-analysis of theoretical understanding defects and detailed plans for optimizing simulated teaching design. The reflections generated in Feynman learning have derived from the trainee teachers' own output failure experience, thus forming active sustainable reflection awareness without external assessment pressure. This stable reflective habit provides a lasting internal driving force for trainee teachers to continuously deepen their practical understanding of English instructional theories and promote their professional development.

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5. Discussion

5.1. Interpreting Trainee Teachers' Three Cognitive Transformations

The three extracted thematic themes constitute a complete progressive cognitive path: deconstructing rigid memorized theoretical systems, reconstructing student-centered instruction logic, and forming active pedagogical reflection habits.

In the first place, the closed, static knowledge storage system has been deconstructed, which is the primary premise of making cognitive change, for only after giving up mechanical definition memory can trainee teachers reorganize instructional theories internally and logically. In the second place, internal logic reconstruction has eliminated the theory-practice divide, guiding trainee teachers to connect abstract instructional theories with specific classroom scenarios, thus realizing the core goal of the research. In the final place, the sustained reflective habits have been formed, guaranteeing long-term professional growth. These cognitive changes cannot be easily discovered through quantitative testing. The long-term tracking of qualitative learning narratives can help capture these subtle internal cognitive changes on the part of trainee teachers.

5.2. Comparison with Existing Relevant Literature

Compared with the existing studies, this qualitative study has generated differentiated findings. Firstly, when applying Feynman Learning Method in pre-servic EFL teacher education practice, most domestic research adopt quantitative research method in order to improve trainee teachers' instructional competence by scoring (Li, 2022). This study has focused on trainees' cognitive transformation, supplementing the existing quantitative literature. Secondly, international research mostly targets STEM disciplines or general university learning (Hernandez, 2022). This study expands the application to simulated pre-service secondary EFL teacher training, enriching cross-disciplinary research cases. Thirdly, this study regards simulated teaching practice as an independent research field. Finally, this qualitative study has verified Kagan's (1992) core viewpoint that decontextualized theoretical learning is more likely to cause theory-practice separation, which the out-driven Feynman learning can effectively alleviate from the cognitive perspective.

5.3. Pedagogical Implications for Pre-service Secondary EFL Teacher Training

Based on qualitative research findings, two targeted practical implications for pre-service EFL teacher education in high education are proposed. For one thing, teacher educators should reduce exam-oriented theoretical memorization instructions and integrate output-driven learning such as the Feynman learning technique into simulated teacher training. For another, universities should build low-pressure learning environments and reduce quantitative assessment pressure. Feynman learning in this research achieves ideal cognitive transformation effects without assessment rewards or punishment.

6. Conclusion

This pure qualitative inquiry has explored the application effects of Feynman Learning Method in pre-service EFL teacher education, relying on classroom observation narratives, semi-structured interview transcripts, weekly reflective journals as exclusive research data, without any quantitative statistical analysis. Research results summarized the participants' three progressive cognitive shifts: the deconstruction of rigid, isolated theoretical memorization frameworks, the reconstruction of student-centered EFL instruction logic, and the formation of long-term active pedagogical reflection habits. Through the output-oriented Feynman learning activities, trainee teachers gradually abandon superficial rote memorization of instructional theories and build context-sensitive, operable practical understanding of secondary English pedagogy, effectively alleviating the traditional theory-practice disconnection in pre-service EFL teacher education.

This study also has its obvious limitations. For one thing, the 98 participants are second-year college English majors from one single normal university in North-west China, and the qualitative thematic conclusion may not apply to all pre-service EFL trainee teachers in all regional normal universities. It is suggested that follow-up cross-regional collaborative qualitative narrative research can be done to enrich research data sources. For another, this research only tracks participants'

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cognitive changes within two semesters. Long-term longitudinal qualitative tracking over two or three academic years will further explore the lasting effects of Feynman learning on trainee teachers' internship and early career teaching competence.

Despite such limitations, this qualitative inquiry has provided a differentiated non-quantitative research perspective for the application of Feynman Learning Method in pre-service EFL teacher education. The study also proposes some operable output-oriented learning strategies for simulated teaching training for pre-service EFL teachers. Follow-up research can continue to adopt qualitative narrative or action research paradigms to further expand research dimensions of the Feynman learning technique in language teacher education.

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