Research on the Design Model of Lesson Plans for Educational Practice Based on WeChat-Mini Programs

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Abstract: Against the backdrop of the digital transformation of education and the education reform oriented to core competencies, lesson plan design serves as a pivotal carrier connecting educational theory and practice, and its scientificit y is of paramount importance. However, current relevant research in China is plagued by such problems as fragmented application of theories, the disconnection between research outcomes and teaching practice, and the lack of effective transformation paths, which make it difficult to meet the practical demands of teaching. Based on the theoretical system of educational practice and guided by three core theories including Constructivism, Cognitive Load Theory and Multiple Intelligences Theory, this study adopts a combined approach of literature research, theoretical construction and case analysis to systematically sort out the theoretical logic and practical key points of lesson plan design, and constructs an optimized lesson plan design model of the Integration of the Three Core Theories. Meanwhile, the practical transformation of the research outcomes is achieved through the development of WeChat Mini Programs. From four dimensions—technical architecture, development paradigm, performance optimization and security mechanism—the study, by combining the principles of front-end development technology with the demands of educational practice, expounds on the technical implementation path of WeChat Mini Programs as a carrier for the transformation of educational academic achievements. It also puts forward the core value, teaching approaches and solutions to learning difficulties of WeChat Mini Programs in front-end development teaching based on practical educational experience. The study finds that the organic integration of the three core theories effectively addresses the dilemma of the disconnection between theory and practice in lesson plan design and optimizes the core links of teaching. By virtue of its advantages such as light weight and ease of use, WeChat Mini Programs translate abstract educational theories into practical operational tools and provide teachers with full-process guidance for lesson plan design. The study demonstrates that this lesson plan design model boasts both academic value and practical feasibility, and its technical transformation path furnishes a new paradigm for the implementation of educational practice outcomes. It can not only improve teachers' lesson plan design capabilities and underpin teacher qualification certification and actual teaching practice, but also provide a solid theoretical foundation and practical example for front-end technology teaching and the transformation of academic achievements in the context of educational digitalization.

Keywords: Lesson Plan Design, WeChat Mini Program, Front-end Technology, Educational Practice.

1. Research Background and Significance

Against the backdrop of the advancement of the Digital China Strategy and the digital transformation of education entering a critical stage, the deep integration of mobile internet technology with education and teaching has become the core driving force for the high-quality development of education. According to the domestic research data on educational informatization as of 2025, WeChat Mini Programs have been widely applied in all school stages including basic education, higher education and vocational education, forming an application system covering the entire teaching links of "teaching, learning, practice, evaluation and management". They exhibit the characteristics of high popularity, diverse scenarios and strong adaptability, yet there exist obvious unbalanced development problems. In terms of school stages, the adoption rate of Mini Programs in basic education exceeds 75%, focusing on scenarios such as lesson plan sharing and home-school communication; higher education emphasizes academic resource inquiry and other scenarios, with the integration of Mini Programs and professional lesson plan design gradually improved but the adoption rate relatively low; vocational education centers on supporting Mini Programs for skill training, meeting the demand for vocational skill improvement. In terms of application scenarios, educational Mini Programs are divided into four categories: resource sharing, interactive teaching, personalized learning and educational management. However, most of them suffer from serious homogenization, loose integration with lesson plan design and other drawbacks, merely staying at the level of resource display, failing to deeply integrate into the whole process of lesson plan design and exert the technical supporting effect on teaching. The theoretical significance of this study is reflected in three aspects: first, it enriches the research on the integration of WeChat Mini Programs and educational practice, constructs a relevant model based on the core link of lesson plan design, and fills the research gap of "Mini Program technology + lesson plan design"; second, it improves the theoretical system of lesson plan design in the informatization

environment, explores the optimization path of lesson plan design by Mini Program technology in combination with core educational theories such as Constructivism, and promotes the interdisciplinary integration of educational technology and instructional design theory; third, it provides operable lesson plan design schemes and tool support for front-line teachers. The lesson plan design model built based on WeChat Mini Programs can help teachers quickly design lesson plans for online and offline collaborative teaching, integrate high-quality resources, optimize teaching evaluation, effectively reduce the burden of lesson preparation, improve teaching quality, and is especially suitable for grass-roots and young teachers.

2. Literature Review

In recent years, WeChat Mini Programs have been increasingly widely used in the education field and have become an important driving force for the development of educational informatization. With the characteristics of no download required and instant use, WeChat Mini Programs have greatly lowered the user's usage threshold and provided a convenient learning and communication platform for teachers and students. Scholars at home and abroad have carried out a lot of research on the application of WeChat Mini Programs in the education field, mainly focusing on online learning, resource sharing, interactive communication and other aspects. For example, Li Haiyan et al. (2022) realized online and offline blended teaching by developing a teaching platform based on WeChat Mini Programs, which significantly improved students' learning effects and satisfaction. In addition, WeChat Mini Programs are also widely used in library services, campus management and other fields, showing their diverse application potential.

The technical characteristics of WeChat Mini Programs mainly include cross-platform compatibility, instantaneity, lightweight, social attribute and so on. These characteristics endow WeChat Mini Programs with unique advantages in educational practice. Cross-platform compatibility ensures that Mini Programs can run seamlessly on different operating systems and devices, improving the accessibility of educational resources; instantaneity enables teachers and students to obtain learning resources and conduct interactive communication anytime and anywhere; the lightweight characteristic reduces the user's usage cost and improves the user experience; the social attribute promotes communication and collaboration between teachers and students and enhances the cohesion of the learning community. Scholars at home and abroad have verified the positive impact of the technical characteristics of WeChat Mini Programs on educational practice through empirical research. For example, Yang Yueting (2024) effectively improved the quality of students' online collaborative learning by developing an online discussion Mini Program with real-time feedback on group perceptual information.

The organic integration of the technical advantages of WeChat Mini Programs with educational lesson plan design is an important way to realize educational informatization and personalization. On the one hand, the technical characteristics of WeChat Mini Programs such as cross-platform compatibility, instantaneity and lightweight can provide convenient technical support for lesson plan design and reduce technical thresholds and usage costs. On the other hand, the theoretical basis and design principles of lesson plan design can provide scientific guidance for the development of WeChat Mini Programs and ensure the educational value and practicality of Mini Programs. Scholars at home and abroad have verified the effectiveness of the integration of WeChat Mini Programs and lesson plan design through empirical research. For example, Ma Xiaomin (2024) not only improved students' traditional cultural literacy but also enhanced their learning interest and initiative by developing a couplet recognition Mini Program based on deep learning.

3. Analysis of the Characteristics of WeChat Mini Programs in Educational Applications

WeChat Mini Programs adopt a three-tier architecture of View Layer-Logic Layer-Render Layer, which is a lightweight adaptation and optimization of the traditional front-end MVC (Model-View-Controller) architecture. Its core goal is to address the performance bottlenecks and experience shortcomings of Web applications on mobile terminals, while lowering the development threshold, which is highly consistent with the core demands of educational applications for "lightweight, high efficiency and ease of use". The View Layer takes WXML (WeChat Markup Language) and WXSS (WeChat Style Sheet) as development carriers, builds page structures through componentized tags and achieves cross-device adaptation with rpx (responsive pixel) units, matching the demand for modular knowledge presentation in educational applications. The Logic Layer completes core functions such as business logic processing and data management based on JavaScript. The Render Layer adopts a dual-thread model, which separates the rendering thread from the JavaScript thread and enables communication via JSBridge, effectively solving the page lag problem of traditional Web applications. In addition, Mini Programs integrate the Cloud Development mode, providing native services such as cloud functions and cloud databases, which enable data storage and other functions without the need for an independent back-end server. This greatly reduces the development and deployment costs in the development of lesson plan Mini Programs, and its architectural advantages make it suitable for front-end development teaching in educational practice. The development paradigm of Mini Programs, featuring "componentization, declarative programming and engineering", balances development efficiency and maintainability. It not only conforms to the development trend of front-end technology, but also highly aligns with the concepts of modular teaching and standardized processes in education, providing support for the rapid development and iteration of educational front-end applications. Moreover, the essential attribute of Mini Programs as an "instant service" defined by "lightweight" and "instant use without installation" stands in sharp contrast to traditional heavyweight Apps or desktop software, adapting to the trends of fragmented cognition and micro-learning. From the perspective of Cognitive Load Theory, its characteristics of no need for download and installation and a concise interface result in extremely low extraneous cognitive load, which perfectly fits the core characteristics of modern learning with limited attention span and fragmented learning time.

4. Construction of a Lesson Plan Design Model for Educational Practice

4.1. Core Ideas of Model Construction

This study constructs a lesson plan design model for educational practice based on WeChat Mini Programs, following the core idea of demand-oriented, theory-supported, technology-carried and practice-goaled. Based on the technical characteristics and functional advantages of WeChat Mini Programs, focusing on the core needs and existing pain points of lesson plan design, and combining the differentiated needs of lesson plan design in different school stages and disciplines, this study builds a trinity lesson plan design model of Theoretical Support - Technical Carrier - Practical Application, realizing a logical closed loop of demand analysis - model construction - strategy formulation - practical adaptation. The specific ideas are as follows:

The model construction must adhere to the core idea of unifying practice orientation and scientific orientation, and closely follow five key points to ensure its practical value, theoretical scientificity, technical adaptability and long-term practicality, and fully demonstrate the academic connotation and application prospects of the research. First, the model construction is based on the actual needs of front-line teachers for lesson plan design, focusing on the core pain points in the integration of traditional lesson plan design and Mini Program educational applications, such as insufficient integration depth, lack of personalized adaptation, unbalanced adaptation of disciplines and school stages, and poor data collaboration. It clearly takes optimizing the lesson plan design process, improving lesson preparation efficiency, realizing personalized lesson plan design, promoting the collaboration of teaching and research and home-school, and supporting the dynamic optimization of lesson plans as the core goals, ensuring that the model can accurately respond to the actual demands of front-line teachers and highlight strong practical pertinence.

At the same time, with core educational theories such as Constructivist Learning Theory, Cognitive Load Theory and Multiple Intelligences Theory as the support, the core viewpoints of various theories are systematically integrated into each module and design link of the model to ensure the scientificity and theoretical depth of the model construction. For example, combining the Constructivist Learning Theory

to strengthen the interaction, situational creation and independent inquiry links in lesson plan design, relying on the interactive functions of Mini Programs to build a situational and interactive lesson plan module; relying on the Cognitive Load Theory to optimize the presentation of learning plans and link design to reduce the cognitive burden of teachers and students; combining the Multiple Intelligences Theory to realize student-centered teaching based on the personalized recommendation and data statistics functions of Mini Programs.

In terms of technology application, the study fully taps the technical characteristics and functional advantages of WeChat Mini Programs, and deeply integrates its core functions such as search and screening, template reuse, data storage, social sharing and data statistics with the core links of lesson plan design such as teaching objectives, teaching content, teaching activities, teaching evaluation and optimization iteration. It eliminates the disconnection between technology and teaching, makes Mini Programs a real core carrier for lesson plan design, and highlights the distinct advantages of the model such as lightweight, convenience, digitalization and intelligence.

In addition, the model construction must fully take into account the differentiated needs of teachers and students at different school stages, disciplines and levels. It sets up differentiated modules and design key points according to the characteristics of lesson plan design in each school stage and discipline, optimizes the operation process and personalized adaptation functions according to the usage needs of different teachers, and strengthens the support for students' personalized learning needs based on data-driven, so as to achieve the adaptation goal of full school stage coverage, full discipline adaptation and full user satisfaction.

Finally, the model construction is based on front-line educational practice, fully drawing on the successful experience of typical cases and avoiding the existing problems in practice. It ensures that the framework design, element setting and implementation strategies are in line with the actual teaching scenarios, the operation process is simple and easy to understand, and teachers with different information technology capabilities and academic literacy can quickly get started. At the same time, it reserves optimization space to continuously improve in combination with the changes in educational practice and technological iteration, ensuring the long-term effectiveness and operability of the model.
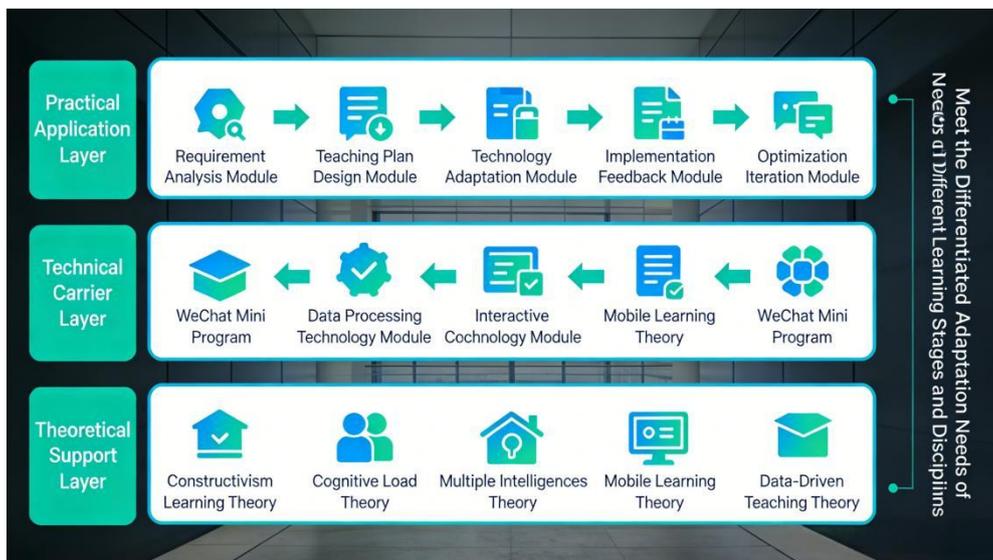
Figure 1. Lesson Plan Design Model for Educational Practice Based on WeChat Mini Programs

4.2. Theoretical Foundation of Lesson Plan Design

The construction of the educational application model based on WeChat Mini Programs needs to take a solid educational theory as the foundation to ensure its educational purpose and scientific effectiveness. This model mainly integrates four core theories, supplemented by relevant theories, to provide principled guidance for Mini Program lesson plan design from multiple dimensions, highlighting the academic value and practice orientation of the research.

The Constructivist Learning Theory (Piaget, 1970; Vygotsky, 1978) emphasizes the initiative, sociality and situationality of learning. In the design of Mini Program lesson plans, its multimedia and interactive capabilities can be used to create learning scenarios, its social and sharing functions to support collaborative inquiry, and its independent expression module to help students complete the meaningful construction of knowledge. The Cognitive Load Theory (Sweller, 1988) is based on the characteristics of human cognitive structure, guiding the simplification of Mini Program interface processes to reduce extraneous cognitive load, the optimization of content disassembly to adapt to the working memory capacity, and the design of interactive feedback to increase relevant cognitive load. The Multiple Intelligences Theory (Gardner, 1983) advocates diversified teaching and evaluation; Mini Programs can rely on the advantages of multi-modal interaction to design diversified activity and achievement expression paths to adapt to the intelligence differences of different learners.

In addition, the Connectivism Learning Theory (Siemens, 2005) and Situated Learning Theory (Lave & Wenger, 1991) serve as supplements. The former builds a knowledge node network relying on the social attribute of WeChat, and the latter integrates learning with real scenarios with the help of the sensor function of Mini Programs, further improving the theoretical support system of the model and promoting the deep integration of theory and the educational application of Mini Programs.

4.3. Model Construction Based on WeChat Mini Programs
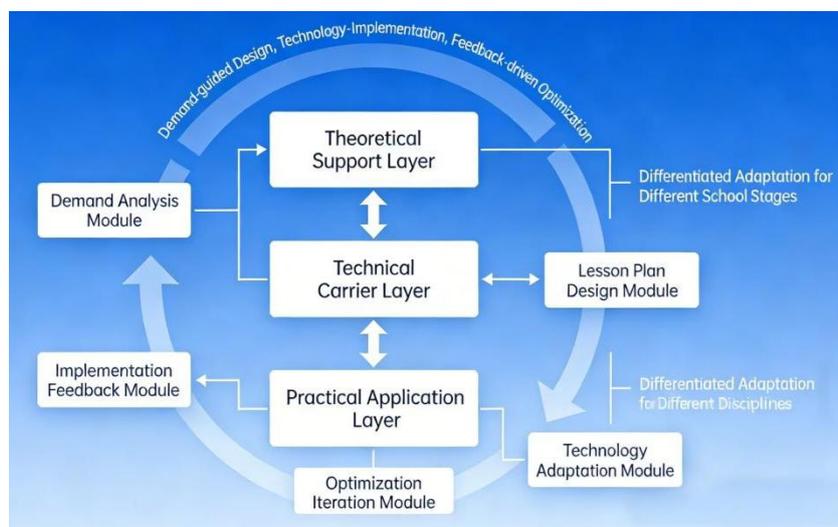
4.3.1. Framework Design

Figure 2. Framework of the Lesson Plan Design Model

The WeChat Mini Program-based lesson plan design model constructed in this study adopts a three-tier progressive architecture, where each tier performs its own functions, connects closely and collaborates interactively, forming a closed-loop lesson plan design system that provides systematic support for digital lesson plan design across

4

multiple school stages including basic education, higher education and vocational education. The theoretical support layer, as the bottom layer of the framework, serves as the core guiding foundation of the model, providing scientific theoretical basis and design criteria for the overall construction and operation. It takes the three core theories of the Constructivist Learning Theory, Cognitive Load Theory and Multiple Intelligences Theory as the main body, and integrates the Mobile Learning Theory and Data-driven Teaching Theory as supplements, clarifying the core orientation and principles of the model design. This tier standardizes the design logic of each module, avoids the problem of "technological supremacy and detachment from teaching", and the theories with distinct focuses support the interactive and situational design, lightweight and rational presentation, personalized and differentiated adaptation, and dynamic optimization of lesson plans respectively, facilitating a positive interaction of "theory guiding practice and practice verifying theory". The technical carrier layer, the middle layer of the framework, is the core supporting carrier that acts as a bridge connecting the theoretical support layer and the practical application layer, and the fundamental reliance for realizing the digitalization and intellectualization of lesson plan design. Aiming at the shortcomings of insufficient integration depth and weak data collaboration between current Mini Programs and lesson plan design, it takes WeChat Mini Programs as the core carrier to integrate its technologies and functions, and constructs four technical support modules: resource integration, interactive collaboration, data processing and personalized adaptation. These modules realize the efficient management of teaching resources, collaborative interaction of multiple subjects, systematic analysis of teaching data and personalized adaptation of lesson plan design respectively. Meanwhile, this tier achieves data interconnection with the school's educational administration and teaching research systems, breaks "data silos", realizes the systematic management of lesson plan data, and reduces teachers' additional operational costs. The practical application layer, the top layer of the framework, is the specific implementation level of theories and technologies. Focusing on the entire process of lesson plan design including "demand analysis-design and editing-implementation and feedback-optimization and iteration", and addressing the problems of insufficient personalization in lesson plan design and unbalanced adaptation across school stages and disciplines, it sets five interlocking core closed-loop practical modules: the demand analysis module collects the demands of teachers, students and schools by virtue of Mini Program functions, and clarifies the design orientation in combination with the characteristics of different school stages and disciplines; the lesson plan design module, as the core implementation link, integrates technologies and theories to realize the digital and personalized design of lesson plans, adapting to the lesson preparation needs of different teachers and the design characteristics of various school stages and disciplines; the technical adaptation module achieves the seamless adaptation of lesson plan content with Mini Program functions and multi-terminal devices, ensuring the convenient implementation of lesson plans; the implementation and feedback module collects feedback opinions and relevant data from teachers, students and teaching research parties, forming a multi-dimensional feedback system; the optimization and iteration module completes the targeted optimization of lesson plans and the improvement of the model's own adaptability based on feedback information, realizing a positive iteration of "lesson plan optimization-model improvement-effect enhancement". The overall three-tier architecture is progressive layer by layer with in-depth integration of theory and technology. It not only ensures the theoretical scientificity of the model design, but also realizes the practical operability of technical implementation and the multi-stage adaptability of practical application. It provides a systematic and implementable practical plan for lesson plan design under the background of educational digitalization across multiple school stages, demonstrating the academic characteristics of the research with both theoretical depth and practical value..

4.3.2. Element Analysis

In this three-layer model, the elements of traditional lesson plans are redefined and generate dynamic interactions, as shown in Figure 3:
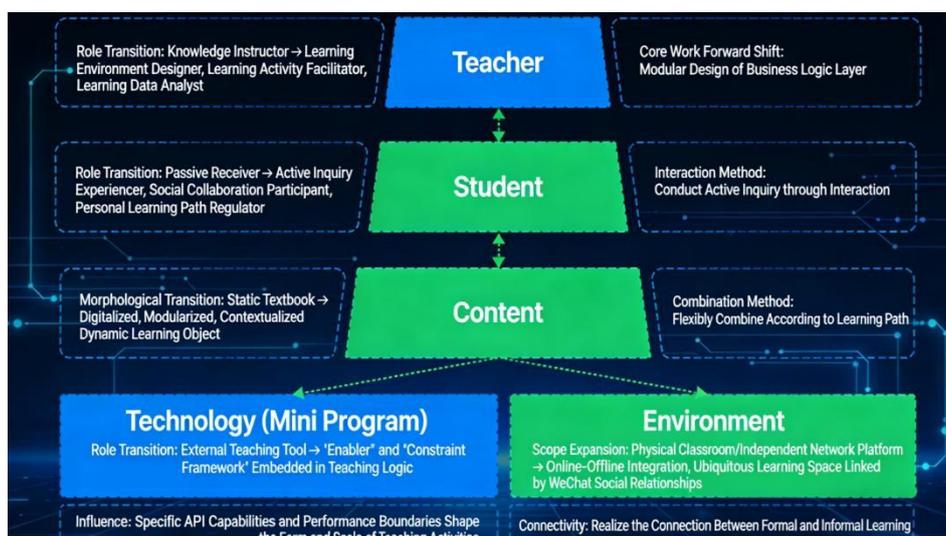

Figure 3. Model Elements Diagram

Teachers: Their role has changed from mere knowledge instructors to designers of learning environments, guides of learning activities and analysts of learning data. Their core work has moved forward to the modular design of the business logic layer.

Students: From passive recipients to active inquirers through interaction, participants in social collaboration and potential regulators of personal learning paths.

Content: From static textbook texts to dynamic learning objects processed by digitalization, modularization and situationalization, whose forms can be flexibly combined according to learning paths.

Technology (Mini Programs): From tools external to teaching to enablers and constraint frameworks embedded in teaching logic, its specific API capabilities and performance boundaries directly shape the possible forms and scales of teaching activities.

Environment: From physical classrooms or independent online learning platforms to ubiquitous learning spaces integrating online and offline and linked by WeChat social relations, realizing the connection between formal learning and informal learning.

The interrelationship of the five core elements: Teachers lead the design of teaching content and the application of Mini Program technology, and optimize the lesson plan design and technology adaptation methods according to students' learning needs and the characteristics of the teaching environment; students' learning needs and feedback opinions determine the adjustment direction of teaching content and the optimization focus of Mini Program technology; teaching content is the core carrier of interaction between teachers and students and also the core object of Mini Program technology adaptation; WeChat Mini Program technology provides support for the collaborative operation of teachers, students and teaching content, promoting the digital presentation of teaching content and the full-process implementation of lesson plans; the teaching environment provides a guarantee for the collaborative operation of the other four elements and is also affected by them, forming a collaborative operation system of teacher-led, student-centered, content-core, technology-supported and environment-guaranteed, which jointly promotes the efficient operation of the model and the improvement of the quality of lesson plan design, and effectively solves the actual pain points of front-line teachers in lesson plan design.

4.4. Design Principles of Lesson Plan Design for Educational Practice Based on WeChat Mini Programs

Based on the aforementioned theoretical basis, model framework and core elements, and combined with the adaptive advantages and existing shortcomings of the educational application of WeChat Mini Programs, the model design abides by five core principles: Theoretical Consistency, Technical Adaptation, Stage Differentiation, Practical Implementation and Dynamic Optimization, defining clear criteria for the subsequent stage-specific implementation strategies. Theoretical Consistency takes the three core theories of Constructivism, Cognitive Load and Multiple Intelligences as the guide, adhering to teaching laws and rejecting technological supremacy. Technical Adaptation focuses on lightweight application and other cores, relying on the characteristics of WeChat Mini Programs to achieve in-depth integration with the whole process of lesson plan design, and adopts the principle of minimum viable technology to simplify operations. Stage Differentiation constructs the mode of "general framework plus stage-specific modules" to accurately adapt to the core needs of the three educational stages. Practical Implementation balances the scientificity of the model and the operability in practice to ensure on-the-ground application. Dynamic Optimization establishes a closed-loop mechanism of "feedback-iteration-upgrade",

realizes targeted optimization through data tracking, and reserves technical expansion interfaces to guarantee the long-term effectiveness and advancement of the model.

4.5. Stage-Specific Implementation Strategies

Based on the model design principles, combined with the characteristics, core needs and existing pain points of lesson plan design in the three educational stages, targeted and implementable stage-specific strategies are formulated from the five core links of demand analysis, lesson plan design, technology adaptation, implementation and feedback, and optimization and iteration, to ensure that the strategies are deeply bound to teaching practice and have clear operation paths.

The implementation strategies of WeChat Mini Program-based lesson plan design for the three school stages—basic education, higher education, and vocational education—all focus on the five core links: demand analysis, lesson plan design, technical adaptation, implementation and feedback, and optimization and iteration. Based on the core needs, existing pain points and educational positioning of each stage, combined with core educational theories and the technical characteristics of WeChat Mini Programs, differentiated implementation plans with distinct focuses and accurate adaptation are formed, providing implementable paths for digital lesson plan design in each stage and demonstrating the stage adaptability and practical value of the research results. The basic education stage takes lightweight operation and home-school collaboration as the core orientation, closely following the needs of basic knowledge transfer and home-school communication. Aiming at the pain point of teachers' fragmented lesson preparation, it constructs a four-dimensional research module of "school stage-discipline-grade-lesson type", builds a full-discipline template library covering three basic lesson types, supports one-click application, presents teaching content in a lightweight form to reduce students' cognitive load, and synchronously generates a parent version of lesson plan abstract to realize the pre-positioning of home-school collaboration. The technical adaptation adopts an interface with core functions prioritized to optimize multi-terminal adaptation and lower teachers' technical threshold; the implementation and feedback forms a tripartite closed-loop system of teachers, students and parents; the optimization and iteration updates templates in accordance with textbooks and syllabuses, deeply integrating Cognitive Load Theory and Constructivism to effectively reduce teachers' lesson preparation burden and promote the low-threshold application of Mini Program technology in frontline teaching. The higher education stage focuses on academicization and teaching-research collaboration, addressing the pain points of cumbersome resource integration and disconnection between teaching and scientific research. It constructs a multi-dimensional research system and connects with core academic resource databases, builds a professional template library according to disciplines such as liberal arts, science, engineering and art, embeds academic norms and adds a sub-module for the transformation of scientific research achievements to realize the two-way empowerment of teaching and scientific research. The technical adaptation balances the lightweight characteristics of Mini Programs and the professional needs of higher education; the implementation and feedback constructs a multi-subject feedback system; the optimization and iteration establishes a regular mechanism combined with university

talent cultivation goals and reserves technical expansion interfaces, integrating core educational theories with university teaching and research practice to solve the dilemmas of lesson plan design in higher education. The vocational education stage takes cultivating high-quality technical and skilled talents as the core, closely following the needs of practicality, the integration of courses, certificates, competitions and post requirements, and practical training adaptability. Aiming at the pain point of the disconnection between lesson plans and post demands, combined with the characteristics of school-enterprise collaboration and the integration of knowledge and practice, it constructs a tripartite research system of teachers, enterprise mentors and industry experts, builds a practical template library, strengthens practical training-specific functions and school-enterprise collaborative technical framework, connects with the skill assessment system, constructs a four-party collaborative closed-loop feedback system, and builds a full-process closed-loop iteration mechanism centered on industry orientation to promote the accurate connection between lesson plans and post demands. The three strategies not only maintain the consistency of the overall model framework, but also realize differentiated adaptation across stages, effectively solving the core pain points of lesson plan design in each stage, promoting the in-depth integration of educational technology and teaching practice, providing practical support for the reform of lesson plan design under the background of multi-stage educational digital transformation, and demonstrating the academic adaptability and broad promotion value of the research results.

5. Research Conclusions and Prospects

Focusing on the core issue of constructing a multi-stage lesson plan design model based on WeChat Mini Programs, this study, supported by three core educational theories—Constructivism, Cognitive Load Theory and Multiple Intelligences Theory—has formed four core conclusions through theoretical combing, framework construction and other research efforts. It clarifies the differentiated needs and universal laws of lesson plan design in basic education, higher education and vocational education, laying a practical foundation for the "general framework + stage-specific modules" model and solving the dilemmas in similar studies. It constructs a closed-loop multi-stage lesson plan design model guided by five principles and supported by five modules, realizing the unity of theoretical scientificity and practical operability, and addressing the problem of overemphasizing theory over implementation in digital lesson plan design. Targeting the core needs and pain points of the three stages, it formulates stage-specific implementation strategies with distinct focuses to achieve accurate adaptation between the model and teaching practice. It also verifies the technical adaptation advantages of WeChat Mini Programs and the feasibility of model promotion; their characteristics are adaptable to various educational scenarios, which can reduce teachers' lesson preparation burden, improve lesson plan quality, and provide a new path for the reform of lesson plan design under the background of educational digital transformation. In the future, WeChat Mini Programs will break through the limitations of general educational scenarios, integrate deeply with specific educational scenarios, and develop targeted applications for different stages to promote the digital development of education at all levels. Meanwhile, front-end development teaching will design teaching projects and explain technical key points combined with specific educational scenarios, improving teaching practicality and pertinence, and helping learners enhance their practical ability and scenario adaptation ability. This study not only provides actionable theoretical and practical support for multi-stage digital lesson plan design, but also points out the direction for the in-depth integration of educational scenarios and front-end technology, boosting important academic value and broad promotion and application prospects.

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