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Standardization of Practical Teaching Processes in Information Systems Analysis and Design: A Systematic Framework

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Abstract: *Curriculum design constitutes an essential phase in which students consolidate theoretical knowledge through intensive practical application, representing a paradigmatic example of practical teaching processes. Focusing on the "Information System Analysis and Design Curriculum Design" practice within information management programs, this study examines current instructional practices and their implementation. It proposes a standardized framework for practical teaching management, built upon covering several core components: objectives, resources, organization, monitoring, and feedback etc. The paper outlines the development and application of standardized teaching content, procedural systems, assessment mechanisms, and management platforms. As a result, a replicable model for standardized practical instruction is established. This model aims to provide a systematic reference for reforming practical instruction in related disciplines and to offer both a theoretical foundation and a practical framework for enhancing the intrinsic quality of practical teaching in higher education, thereby effectively contributing to the overall improvement of curriculum design practicum quality.*

Keywords: *Curriculum Design; Process Standardization; Quality Assurance System; Practical Teaching*

1. Introduction

In the practical teaching process of higher education, the curriculum design teaching component plays a crucial role in cultivating students' practical operational skills, innovative spirit, and comprehensive competencies. However, current curriculum design practical teaching still encounters multifaceted challenges in implementation, particularly lagging behind in standardized process-oriented teaching development. The primary reasons include the absence of systematic, end-to-end standardized management and an incomplete quality assurance system for practical teaching. Additionally, there remains ineffective capture and utilization of process-related data, such as project completion metrics and skill acquisition trajectories, within practical teaching contexts [1]. Consequently, exploring a standardized curriculum design teaching model tailored to disciplinary characteristics is of great significance.

As a pivotal link bridging theoretical knowledge and applied skill development, practical curriculum design teaching serves as a crucial pathway for training students to apply learned theories to real-world problem-solving. Information management programs, functioning as interdisciplinary domains integrating management science with information technology, confront distinctive challenges in practical curriculum design instruction. These initiatives must synthesize knowledge from multiple managerial disciplines while incorporating hands-on components such as programming implementation, resulting in multifaceted implementation difficulties. In the context of expanding student enrollments and accelerating technological transformation, quality concerns in practical curriculum design teaching have grown increasingly prominent. Issues including the preference for form over substance, inadequate process supervision, superficial learning outcomes, and delayed assessment feedback significantly compromise the attainment of educational objectives.

Therefore, partial optimization of isolated curriculum design components is insufficient to address current challenges. A systemic approach is imperative, integrating Total Quality Management (TQM) and Outcome-Based Education (OBE) principles to establish a standardized management process for practical teaching [2][3]. This process features: Standardized procedure control; Measurable quality benchmarks; Comprehensive outcome evaluation; Sustainable system refinement. Designed to enhance

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instructional quality for courses like "Information System Analysis and Design", it provides a replicable and scalable reference model for practical teaching reform in related disciplines.

2. Core Components of Standardized Teaching Process in Curriculum Design

The core objective of standardizing practical teaching in curriculum design is to ensure the effectiveness and quality of practical instruction. Rooted in the principles of TQM, systematic process management and continuous improvement should be implemented to guarantee the overall quality of practical teaching in curriculum design. Addressing current issues such as insufficiently detailed quality standards, compromised implementation, and arbitrary process management, all elements and stages of practical teaching must be planned, executed, inspected, and addressed to establish a standardized teaching process management system. The core components include:

2.1. Objective Standards

Based on professional training objectives and graduation requirements, integrated with the core knowledge domains of the Information System Analysis and Design course, well-defined competency goals must be established. These objectives should be specific, measurable, and achievable, ensuring full alignment with the knowledge, skill, and competency targets specified in the educational plan. Furthermore, it is essential to specify standards across three critical dimensions: Teaching Content: Relevance of selected topics to professional development goals; Process Management: Rigor of investigation and analytical depth; Outcome Evaluation: Technical soundness and practical feasibility of proposed solutions. Simultaneously, a structured assessment framework with well-defined rubrics shall be implemented to guarantee both fairness and objectivity throughout the curriculum design evaluation process.

2.2. Resource and Infrastructure Requirements

This encompasses the on-campus teaching environment, qualified teaching faculty, syllabi, textbooks, and instructional materials required for the curriculum design. The quality and thoroughness of these preparations form the foundation for the operation of the standardized management system. Given that this curriculum design requires completing the entire system development process within a short timeframe and often employs simulated management scenarios, which can easily become disconnected from real-world demands, meticulous planning is essential for resource allocation and infrastructure development.

2.3. Organizational and Operational Standards

This involves the division of management responsibilities, the mechanisms for instructor-student collaboration, and the division of labor within student groups for the curriculum design instruction. It also standardizes the complete workflow from topic selection and approval, task assignment, and requirements analysis, through system design, development and implementation, testing, to final assessment and summarization. Considering the limited duration of the concentrated practical session, the entire system analysis and design process must be completed within a reasonable timeframe while ensuring the achievement of teaching objectives.

2.4. Monitoring and Evaluation Standards

Dynamic tracking and information collection of teaching processes and outcomes are achieved through multiple channels, including daily curriculum design inspections, mid-term presentations, and peer/supervisor feedback. A comprehensive evaluation mechanism involving multiple stakeholders (students, instructors, peers, supervisors) integrates process assessment with outcome assessment to avoid one-sided evaluations and ensure objectivity.

2.5. Feedback and Improvement Standards

Evaluation results are promptly communicated to both instructors and students. Based on this feedback, targeted analysis can be employed to identify issues and diagnose specific weaknesses within the curriculum design process. This facilitates continuous refinement of teaching content, methods,

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resources, and management. This process aims to foster quality assurance and proactive improvement among all participants, thereby enhancing the intrinsic quality awareness of teachers and students.

3. Standardized Curriculum Design for Information System Analysis and Design

The standardization of the curriculum design process primarily encompasses the following aspects: the standardization of teaching content, procedures, assessment, management procedures, and promotion.

3.1. Achieving Standardization of Teaching Content

By establishing unified teaching requirements and designing standardized practical content, consistency is ensured across different instructors in terms of the coverage, emphasis, depth, and difficulty level for the same teaching module. This approach minimizes fluctuations in teaching quality caused by individual instructor differences, thereby safeguarding the consistency and stability of instruction.

Clear and explicit teaching content standards are formulated, providing instructors with a well-defined basis for teaching and giving students clear learning objectives. Quality education, constructivism, and modern information technology form the three pillars of the instructional design framework [4]. Integrate quality education principles into curriculum design, emphasizing the cultivation of comprehensive competencies such as teamwork and communication skills to strengthen students' innovation and practical abilities. Incorporate comprehensive competency development elements, such as team collaboration and communication skills training, into curriculum design instruction, enabling students to continuously enhance their overall capabilities through practice. Propose recommendations for teaching, assessment, textbook selection, and resource development: Provide guidance on teaching methods and strategies; emphasize the developmental process in assessment recommendations to foster diverse insights; prioritize textbooks and reference materials suitable for comprehensive information application within the discipline for textbook selection guidance; offer efficient methods and pathways for accessing and utilizing curriculum design resources.

3.2. Establishing a Standardized Process System

Curriculum design must examine how to meet all aspects of the graduation requirements of the talent development program and the evaluation of achievement. From topic selection for the curriculum design to its final defense and acceptance, each phase is defined by clear standards and requirements. This ensures students achieve systematic improvement in knowledge integration, skill development, and quality cultivation. Develop a standardized curriculum design process tailored to the characteristics of information management majors to standardize teaching implementation at each stage. The curriculum design phase for Information System Analysis and Design primarily involves students conducting design work under faculty guidance in group settings. The process encompasses multiple stages: team formation, topic selection, topic review, analysis and design, system testing and operation, and final defense. All aspects of curriculum design need to be carefully studied, including content and organization, knowledge requirements, student participation, teamwork, etc. The standardized process is divided into the following six stages:

3.2.1. Topic Selection and Research

This stage involves defining the scope of the topic, discuss research content, determine team members and division of labor, conduct background research, and perform requirements analysis. Standardized documentation submission, including the topic assignment sheet, member division of labor sheet, and requirements analysis document.

3.2.2. Analysis and Modeling

Object-oriented analysis methods (e.g., UML modeling) and standardized tool specifications shall be employed. All model diagrams must be complete and adhere to prescribed formatting standards.

3.2.3. System Design

Information system architecture design, database design, interface design, etc., with corresponding detailed requirements and evaluation criteria established.

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3.2.4. Implementation and Development

Define requirements for coding standards, version control, and test case creation. Emphasize rational division of labor and collaboration among team members to prevent uneven task distribution.

3.2.5. Integration Testing

Recommend testing procedures, requirements for test case usage and execution. Ensure functionality aligns with initial requirements; from a system usage perspective, prioritize user-friendly interfaces and intuitive operations.

3.2.6. Final Defence and Documentation

Standardize the final defense process and content of the defense, fill in the defense record form, and specific evaluation indicators; Detailed curriculum design specifications (or final report) content and format requirements. Ensure consistency, clarity, and professionalism in the final submission.

3.3. Optimizing Assessment Mechanisms

A scientifically sound assessment indicator and evaluation system shall be established to achieve an organic integration of formative (process-oriented) and summative (outcome-oriented) evaluation. This involves analyzing and planning the standardized process for the curriculum design, clarifying the guidance and assessment methods for each phase. For instance, during the topic selection phase, principles and procedures for selection are defined; in the design phase, design specifications and standards are formulated; for the defense phase, requirements and detailed scoring rubrics are established.

This framework integrates students, instructors, and the practical work of the curriculum design, strengthening the formative evaluation process and fostering teacher-student interaction. This enhances the guidance-oriented and actionable nature of the assessment. Evaluations should comprehensively reflect students' practical abilities and analytical design proficiency, emphasize interactive guidance throughout the process, and embody the educational function of assessment. This enables students to experience the integrated application of knowledge acquired in management, information technology, and other relevant fields, ultimately contributing to the enhancement of enterprise informatization levels.

A diversified assessment and evaluation system is to be constructed, taking into comprehensive consideration factors such as students' performance during the practical process, the quality of deliverables, teamwork capabilities, and defense performance. The student's final overall grade is determined by a composite of: process evaluation, evaluation of the curriculum design specification, and evaluation based on system testing and the defense.

Furthermore, acceptance criteria for the curriculum design outcomes are established and rigorously applied to ensure the achievement of the intended objectives.

3.4. Promoting Standardization and Process Optimization

Through institutionalized and standardized process management, the quality of curriculum design outcomes is effectively enhanced, ensuring the orderly operation and continuous improvement of the practical teaching component. A comprehensive quality assurance system is established, encompassing mechanisms for quality monitoring, evaluation, and feedback. This system clarifies management workflows and responsibility allocation, strengthens supervision and guidance throughout the entire curriculum design process, and facilitates the timely identification and resolution of emerging issues, thereby ensuring the steady enhancement of practical teaching quality.

Strict guidance and supervision are required for every stage of the standardized curriculum design process. For example: During topic selection, define the scope and difficulty level to guide students in conducting targeted research within their chosen field. This ensures students fully apply acquired knowledge to analyze specific problems and propose reasonable solutions for practical information management challenges. During the analysis and modeling phase, emphasize the application of various modeling tools, with model diagrams strictly adhering to standard specifications. In the system design phase, structural diagrams, E-R model diagrams, etc., must be detailed and accompanied by explanatory notes. For the final defense phase, each team member must present independently completed work and answer questions autonomously. Defense scores are determined based on the on-site presentation of outcomes and performance in responding to defense questions.

Considering the practical constraint of the curriculum design being conducted within an intensive

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two-week period, alongside the dual objectives of completing the entire information system analysis, design, and implementation process with high quality within a reasonable timeframe and ensuring effective teaching outcomes and the achievement of learning goals, a meticulously designed standard process has been developed, as illustrated in Figure 1.

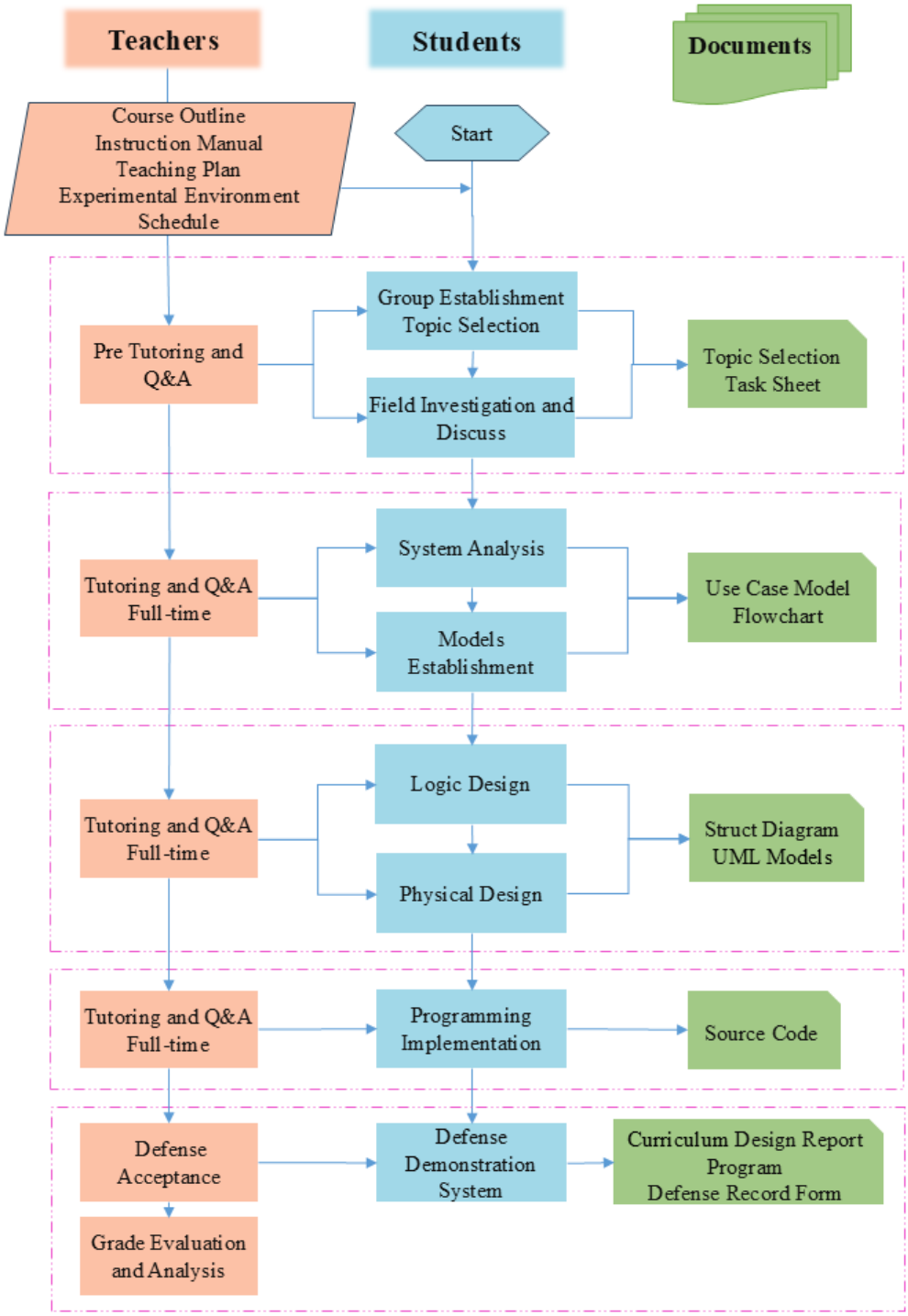

Figure 1: Standardized Process for Information System Analysis and Design Curriculum Design

Leverage information technology to establish a practical teaching management platform, integrating Chao-Xing Platform (Superstar), MOOC resources, and other tools into the curriculum design process. This enables unified management across the entire workflow, from planning, lab scheduling, attendance tracking, process documentation, and submission of design specifications to assessment and evaluation. Through OBE-based syllabus reform, the Information System Analysis and Design syllabus is aligned

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with talent development requirements. Standardized curriculum design procedures and documentation standards are established, including curriculum design syllabi, guidance manuals, assessment criteria, defense requirements, and report specifications, providing detailed implementation guidance.

3.5. Providing a Reproducible Model for Wider Replication and Promotion

Taking the standardized reform of the "information systems analysis and design curriculum design" as a template, a replicable methodology for standardized practical teaching management has been established. This methodology serves as a valuable reference for curriculum design activities in other closely related disciplines, aiming to drive the overall enhancement of practical teaching quality in higher education institutions.

By implementing a standardized design for the curriculum process, where each phase is supported by rationally designed procedures and assessment criteria, this framework can be extended to multiple other curriculum design components within the information management discipline. Consequently, the standardization of practical teaching across the entire professional program system is strengthened. This advancement will allow the systematic construction of practical teaching to be more fully and effectively reflected in future program evaluations and accreditation processes.

This approach contributes significantly to elevating the overall standard of practical instruction in information management programs at the university level, thereby providing a robust foundation for cultivating high-quality, application-oriented professionals.

4. Standardized Implementation Process for Curriculum Design

Standardizing curriculum design implementation requires a systematic process, a logically coherent workflow where each stage maintains relative independence while progressing sequentially. This systematic engineering effort can be divided into three primary phases to ensure effective achievement of teaching objectives.

4.1. Curriculum design Preparation Phase

This phase aims to establish the organizational and cognitive groundwork for subsequent intensive practical work and to ensure a successful project initiation. Core activities are centered on team formation, topic selection, and initial planning, implemented through a structured approach comprising three standardized components:

4.1.1. Instructional Organization and Team Formation

During the theoretical instruction of Information Systems Analysis and Design, curriculum design tasks are assigned in advance. This primarily involves team formation and topic selection. Based on knowledge and methodologies learned throughout the course, students discuss and finalize team composition according to shared interests. Teams then collaboratively address a specific information system design problem within a designated domain.

4.1.2. Topic Guidance and Preliminary Research

Groups may propose their own topics or select from a list of candidates. Instructors provide timely guidance, clarifying selection criteria, explaining the characteristics of each topic category, and highlighting key focus areas.

Students are encouraged to conduct field research within their chosen domain, analyzing management processes and data from actual enterprises or institutions. Feasibility studies should be thorough, with detailed data collection laying the groundwork for subsequent detailed analysis and design.

4.1.3. Standardized Task Specification Development

Upon completing their investigations, each group must draft a detailed curriculum design task specification. This document should include: a clearly defined topic, background context for the topic selection, research objectives, proposed research methods and steps, expected outcomes, team member responsibilities and division of labor, etc.

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4.2. Intensive Practical Session

As a critical intensive practical course, the Information Systems Analysis and Design curriculum design spans two weeks and is scheduled after the completion of theoretical course instruction. Building upon the preliminary topic validation phase, the curriculum design deepens and elaborates research content, culminating in program development to realize the system.

4.2.1. System Analysis and Requirements Modeling

During the intensive practice period, each group must systematically organize and deeply analyze the processes and data obtained from prior investigations. Employing project management methodologies, the curriculum design proceeds in a project-driven manner with reasonable division of labor among members. [5] Employing methodologies and tools learned during university studies, students must map the business processes of the information system. This involves comprehensively evaluating existing workflows to identify existing issues and shortcomings, proposing targeted optimization and improvement plans.

Concurrently, a thorough analysis of the data flow is performed to clarify key elements such as data sources, direction of flow, and processing methods, thereby providing robust support for the functional design of the information system. Building upon this foundation and integrating functional requirements analysis, teams employ mainstream object-oriented analysis and design methodologies, such as the Unified Modeling Language (UML), to complete the use case analysis. This analysis should provide a detailed description of the system's functional requirements, clearly define the system boundaries, and specify the interactions with external actors, laying the necessary groundwork for the subsequent detailed design phase.

4.2.2. System Architecture and Detailed Design

Following completion of preliminary work including process analysis, use case analysis, and use case specification analysis, proceed to the detailed design phase. The primary tasks in this phase involve completing the logical and physical structure designs based on prior analyses. Logical structure design requires comprehensive consideration of factors including functional requirements, performance demands, and user interaction needs. By applying scientific design methodologies and principles, a rational logical architecture for the system is constructed.

Concurrently, the physical structure of the information system is thoroughly analyzed to define physical elements such as hardware environment, software environment, and network environment, thereby proposing specific physical configuration solutions for system implementation. Through the organic integration of logical and physical structure designs, the overall structural design of the information system is finalized. This ensures the system meets functional requirements, delivers stable and reliable performance, features a rational and efficient structure, offers convenient and efficient operation, and aligns with user habits.

4.2.3. Information System Implementation and Testing

The implementation phase is a critical component of curriculum design, directly determining whether the system can be successfully built and operated. Team members leverage their specialized skills and expertise, employing mainstream development tools and programming languages such as Java or Python, to collaborate with clear division of labor. Front-end development, interface design and interactive features, back-end development, database implementation, and system testing are each assigned to specific team members for coordinated completion. Comprehensive testing of system functionality and performance identifies and resolves issues promptly. Through close collaboration and a concerted team effort, the entire development cycle—from system coding and testing to final deployment—is completed. This ensures the delivery of a stable and reliably operating system that meets practical application requirements.

4.3. Curriculum Design Acceptance and Final Defence

The final defense requires each team to comprehensively present the outcomes of their curriculum design project. This presentation should include a demonstration of system functionality, an explanation of the design rationale, a discussion of unique features, and an analysis of key technical challenges encountered. Following the presentation, individual team members respond to questions from teachers. Their responses demonstrate their personal understanding of the project, mastery of relevant knowledge, level of participation, and specific contributions.

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During the defense, the operational quality of the information system is rigorously assessed. Key evaluation criteria include system response speed, stability, compatibility, and the fulfillment of all expected functional requirements. Additionally, the completeness, accuracy, and usability of the system's features are thoroughly examined.

4.4. Curriculum Design Evaluation and Promotion

Based on the overall performance throughout the curriculum design process, the accuracy of responses during the defense, the quality of program system verification, and the evaluation of the curriculum design report, a comprehensive assessment score is determined. This score is analyzed to summarize lessons learned, identify areas for improvement, and promote effective practices through standardized models.

4.4.1. Comprehensive Score Evaluation

Regarding the preparation of the curriculum design report (or specification), its structural integrity, completeness of content, clarity of language, and adherence to standards in chart and diagram presentation must be evaluated. Based on each team member's individual contribution to the project and their performance during the defense, instructors assign corresponding grades. These grades serve as a crucial basis for determining the final course design score.

To ensure standardization and normalization across all phases of the curriculum design, a suite of standardized supporting documents has been established. These primarily include: the course design syllabus, instructor manuals, the project charter, assessment criteria, detailed grading rubrics, and defense evaluation forms. The final composite grade is determined by synthesizing regular performance evaluation, the quality of the curriculum design report, and the defense performance. This multi-faceted approach demonstrates the application of diversified assessment indicators.

4.4.2. Teaching Reflection and Continuous Improvement of Curriculum Design

The development of standardized curriculum design through practical exploration has promoted the effective implementation of professional practical teaching. This approach helps ensure and improve the overall quality of hands-on instruction in curriculum design. The curriculum design for Information System Analysis and Design underwent two rounds of practical trials over two years. Results show a significant enhancement in practical teaching outcomes, with notable increases in student participation, effort, and completion rates. Furthermore, the implementation of a standardized teaching process regulates each stage of practical instruction, ensuring that teaching methods and student training in every phase meet unified requirements. The procedures, analyses, and design methods in each stage comply with standardized norms, thereby ensuring students operate consistently and apply their practical skills comprehensively.

However, during the implementation, it was observed that tasks were unevenly distributed among student group members. Some students possessed stronger programming skills, while others had weaker practical abilities. In some groups, insufficient collaboration led to poorly functioning project teams, which in turn resulted in unsatisfactory performance during defenses and lower overall evaluations. In future guidance, it is essential to strengthen daily mentorship, encourage effective collaboration among group members, leverage team strengths, and foster cooperative completion of project tasks. Standardizing curriculum design is a long-term, iterative process that requires a gradual shift from quality monitoring to sustained improvement [6].

4.4.3. Promotion and Validation of the Standardized Curriculum Design Model

Throughout the process of implementing standardized curriculum design, experiences and lessons learned have been consolidated. The outcomes of this research are being extended to other curriculum design courses. Currently, a pilot program has been conducted for the "Introduction to Database Systems Curriculum Design". The process standardization framework was adapted from that of the Information System Analysis and Design course. This pilot has led to further regularization of the practical teaching process, enhanced monitoring, and a marked improvement in teaching effectiveness.

5. Conclusion

The construction of a comprehensive, standardized process for implementing practical teaching in curriculum design is a complex systemic endeavor, not merely a sum of individual tasks. It necessitates

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a fundamental shift in the philosophy of practical teaching management, from fragmented, post-hoc, and reactive quality control toward systematic, process-oriented, and proactive quality assurance. At its core, this approach adheres to the principles of "student-centeredness, outcome-based orientation, and continuous improvement." It involves integrating resources through top-level design, regulating processes via established standards, empowering management with information technology, and ultimately ensuring sustained operation through standardized mechanisms.

Moving forward, as higher education reforms deepen, the standardized curriculum design system must continue to explore and refine itself. This includes adapting to the rapid development and application of new technologies, particularly artificial intelligence and large models, while also serving lifelong learning needs [7]. Improving teaching methods, learning approaches, and guiding students toward active participation, hands-on practice, independent thinking, and collaborative inquiry represent pathways for further optimizing curriculum design. Through the establishment of standardized curriculum design frameworks, more detailed guidance can be provided for students' learning processes, fostering their awareness of self-directed learning while cultivating their initiative and innovative capabilities.

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