# Research on the Curriculum System of Food Technology under the Background of Applied Talent Cultivation

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***Abstract:*** *With the deepening of engineering education reform, the cultivation of applied talents has become a crucial direction for optimizing university curricula. As a core component of food-related disciplines, the curriculum structure of food technology plays a decisive role in the efficiency of competence development. Focusing on the competency-oriented reconstruction of the curriculum, this study explores three dimensions: the logic of system construction, strategies for module optimization, and coordination mechanisms. A three-phase model of "Cognition–Integration–Application" is proposed to build a curriculum framework that integrates task-driven learning with competence development. By enhancing knowledge interaction among courses, aligning instructional content with technological tasks, and introducing a dynamic feedback regulation mechanism, the study forms a multi-dimensional optimization path. The aim is to promote the transformation of the food technology curriculum system toward a competence-oriented model that is structurally sound and functionally efficient, thereby providing theoretical support and structural strategies for improving the quality of talent cultivation.*

***Keywords:*** *applied talent; food technology; curriculum system; competence-oriented; structural optimization; dynamic coordination*

**Introduction**

At present, higher engineering education is rapidly shifting from a knowledge-dominated paradigm to a competence-oriented one. The curriculum system not only serves as the foundation for knowledge transmission but also represents a key arena for the development of students' professional competencies. As a critical part of food science and engineering programs, food technology courses significantly influence the development quality of students' technical cognition, systems thinking, and practical application skills through their design logic and structural configuration. However, traditional curriculum systems remain markedly outdated in content organization, module division, and competence alignment, making it difficult to support the coordinated development of multi-dimensional skills. Particularly in the context of complex industry demands such as intelligent manufacturing, process integration, and automation control, courses often lack interconnectivity, and there is a misalignment between instructional objectives and engineering tasks, resulting in course outputs that fail to meet job competency requirements. Therefore, reconstructing the food technology curriculum system has become a key task in advancing the transformation of applied talent cultivation. This study, grounded in competence structure, investigates the logic of curriculum system construction, module function optimization, and coordination mechanisms, with the aim of providing structural strategies and pathway support for developing a food technology education system that meets future engineering demands.

## 1. Curriculum System Construction Logic Oriented Toward the Competence of Applied Talents

### *1.1 Typological Differentiation of Competence Structures for Applied Talents and Instructional Demands in Food Technology Education*

In the field of food technology, the competence structure of applied talents is highly integrated and engineering-oriented, with its core characteristics reflected in the organic unification of knowledge integration ability, practical operational skills, and systems thinking. This structure requires not only a solid grasp of food processing principles, quality control methods, and equipment knowledge, but also the ability to identify process bottlenecks, adjust operational parameters, and optimize strategies within dynamic production environments. With the widespread application of intelligent manufacturing, information-based monitoring, and multi-equipment coordination in the food industry, future professionals in food engineering must possess an understanding of automation technologies, judgment capabilities based on data-driven analysis, and a high level of technical sensitivity for innovative restructuring oriented toward real-world challenges. Against this backdrop, curriculum system design should move away from the traditional knowledge-transmission model and shift toward the development of a teaching system aimed at the coordinated advancement of competencies, highlighting the functional transformation logic of "transferable skills–task analysis–application construction" [1].

In line with the above competence requirements, the food technology curriculum system urgently needs to be built upon a teaching model that integrates "engineering tasks–technical capabilities–knowledge systems," in order to strengthen students' cognitive development and competence transfer in real task environments. Course content should be structured around key control nodes and typical problem scenarios within representative processing workflows, with multi-dimensional module integration enhancing logical coherence and knowledge feedback across various stages. Instructionally, strategies such as process simulation, scenario reconstruction, role-based learning, and task decomposition may be employed to shift students from passive reception to active analysis and problem-solving, facilitating a transition from operational skills to comprehensive engineering competencies. The ultimate function of the curriculum system does not lie in the systematic delivery of knowledge, but in the development of a complete competence loop—"perception–judgment–execution–optimization"—within complex systems, thereby providing structural support for students' practical growth in engineering contexts.

### *1.2 Structural Deficiencies and Adaptation Barriers in Traditional Food Technology Curricula*

The current food technology curriculum system is largely structured around disciplinary knowledge, emphasizing systematic content coverage and theoretical coherence while neglecting the precise alignment between curriculum structure and students' competence development trajectories. This course logic, which places excessive focus on conceptual explanation and theoretical derivation, leads to fragmented knowledge structures and a disconnection between technological content and real-world applications, hindering the formation of a closed-loop system geared toward solving authentic problems. Instructionally, the absence of horizontal integration mechanisms and the lack of logical linkage among process-focused courses prevent students from building cross-phase systemic cognitive models throughout the learning process. The fragmentation of modules further diminishes the efficiency of knowledge transfer, resulting in difficulties in knowledge application and limited operational judgment when faced with real production tasks, making it challenging for students to handle complex task integration and dynamic adjustments.

In addition, the traditional curriculum system responds slowly to evolving technological trends within the industry. Instructional content is updated infrequently and fails to incorporate emerging elements such as intelligent control, digital modeling, and green processing, which are increasingly central to contemporary food manufacturing. Evaluation methods remain dominated by static written examinations, overlooking the dynamic tracking of competence development and process cognition transformation during the learning process, thereby contributing to a disjunction between instructional goals and engineering application. This disconnection becomes especially prominent as multi-equipment coordination, information integration, and end-to-end monitoring gradually become fundamental industry requirements. The key to reconstructing the curriculum system lies in breaking the discipline-centered model of content organization and establishing a task-driven system structure that enables functional complementarity among courses, integration of content, and alignment of assessment mechanisms, thereby offering more adaptive instructional support for the structured development of student competencies [2].

### *1.3 Fundamental Principles and Path Planning for Application-Oriented Curriculum System Reconstruction*

The construction of a food technology curriculum system aimed at cultivating applied talents must be guided by the fundamental principles of "task orientation, competence-driven development, and system integration." Course objectives should be precisely aligned with key competence nodes within the processing workflow, and instructional activities should guide students through the full transformation process from knowledge comprehension and skill formation to integrated application. In terms of course content, typical production tasks should serve as the foundation to connect the entire logical chain from raw material handling and processing control to quality evaluation. Regarding instructional methods, emphasis should be placed on project-based teaching and process-oriented assessment mechanisms grounded in real-world problem scenarios, encouraging students to develop systemic understanding in simulated or actual processing environments and enhancing their adaptability, optimization skills, and collaborative abilities.

As for path planning, it is recommended that the curriculum system be divided into three functional modules: "Cognition–Integration–Application." The cognition module focuses on the basic principles and core concepts of food technology, laying a foundation for technical understanding; the integration module emphasizes horizontal connections among various types of processing knowledge, enhancing students' system-level capabilities in areas such as process management and parameter control through integrated task training; the application module centers on designing solutions for complex tasks, cultivating advanced application abilities in process innovation, quality optimization, and workflow coordination. In addition, a cross-course linkage mechanism and a dynamic feedback system should be established to reinforce structural coupling among instructional content, competence indicators, and assessment frameworks, ensuring the curriculum system remains adjustable and iterative, thereby effectively supporting the continuous development of applied talents' competence spectrum.

## 2. Structural Optimization and Functional Positioning of Core Modules in Food Technology Courses

### *2.1 Construction of Core Course Clusters and Content Integration Mechanisms in a Modular System*

As a key strategy for enhancing curriculum flexibility and instructional adaptability, the modular course system emphasizes the construction of interrelated and functionally complementary course units within a competence-oriented framework. In food technology education, the development of core course clusters should focus on the three dimensions of "processing procedures, technical operations, and quality control," encompassing key subjects such as food processing principles, application of processing equipment, food quality and safety, and production line design. The logical relationships among these courses should reflect the sequential dependency of processing workflows, facilitating the integration of knowledge and skills from raw material recognition to final product control. By clearly defining the functional positioning of each course within the overall system and constructing a collaborative network among courses, internal coupling of knowledge and complete linkage of skill chains can be achieved [3].

The content integration mechanism should center on "task-driven" and "technology-fused" approaches, breaking traditional course boundaries and restructuring adjacent content into functional modules aligned with processing stage demands. At the instructional level, horizontally linked teaching projects and cross-course integrated training can be designed to guide students in reconstructing cognitive frameworks while addressing complex processing tasks at the intersection of multiple courses. For example, by integrating content from food technology and equipment engineering fundamentals, students can conduct full-process analyses of dairy, fermented, or thermally processed products, thereby deepening their understanding of the systemic relationships among raw material pretreatment, equipment control, and quality evaluation. This integration model not only increases the focus and alignment of instructional objectives but also strengthens students' capacity for technical transfer and comprehensive response, ultimately building a knowledge ecosystem more closely aligned with engineering practice.

### *2.2 Course-Level Hierarchies and the Design Path of Vertical Knowledge Progression*

Achieving progressive development of vertical knowledge within the curriculum system requires a well-structured course hierarchy that enables students to incrementally enhance their competencies at different learning stages. The tiered design of food technology courses should be systematically structured according to students' cognitive development and skill acquisition trajectories. Foundational-level courses focus on core concepts and principle comprehension—such as food chemistry, food microbiology, and an introduction to food engineering—with the goal of cultivating fundamental cognitive understanding and logical thinking. Intermediate-level courses emphasize structural analysis and parameter control in representative food processing methods—such as thermal processing, cold processing, and fermentation technologies—training students in operational standards and procedural judgment. Advanced-level courses target cross-stage integration and system optimization—such as integrated production line design, process simulation, and operations management—aiming to develop students' capacity for comprehensive integration and innovative expression.

The progression path should embody the competence evolution logic of "cognition–integration–application," with instructional content transitioning from static understanding to dynamic regulation, and from subject-specific knowledge to system-wide integration. Teaching activities should incorporate real-world scenarios, process orientation, and reflection mechanisms, guiding students to achieve multidimensional competence growth through the execution of complex processing tasks. Feedback mechanisms and competence-mapping relationships should be established between different course levels, ensuring that foundational courses provide solid support for higher-level courses, while advanced courses, in turn, refine the instructional objectives and content calibration of lower-level ones. By forming a spiraling learning path, the curriculum system not only realizes an integrated design of vertical competence development but also offers structural assurance for constructing a deep learning framework aligned with occupational competence demands.

### *2.3 Functional Redefinition of Courses from a Multidimensional Evaluation Perspective*

Within a competence-oriented instructional system, course functionality should not be evaluated solely on the basis of knowledge delivery, but rather expanded to include its role in competence formation, cognitive structuring, and application transfer. A multidimensional evaluation perspective requires course functionality to be situated within the dynamic process of students' competence development, thereby redefining the course's essential role in knowledge integration, skill training, and innovation facilitation. Taking food technology courses as an example, it is necessary to analyze the effectiveness of each course in cultivating competencies related to principle comprehension, equipment operation, process optimization, and product quality control, and to conduct systematic evaluations based on instructional goal decomposition and student performance data, thus enabling a structural reidentification of course functions [4].

The core of course function redefinition lies in achieving precise alignment and dynamic adjustment among knowledge, competence, and cognitive structure. Courses must not only serve as channels for information transmission but also act as platforms for constructing thinking patterns and generating problem-solving frameworks. Course evaluation should incorporate data sources such as formative feedback, process-based observation, and competence performance portfolios, offering a comprehensive picture of each course's effectiveness in promoting cognitive advancement, habit formation in operations, and the construction of integrated technical skills. The redefinition of course functionality supports the refined allocation of instructional resources and the iterative updating of content structures, while also providing data-driven support and theoretical grounding for internal optimization and goal alignment within the curriculum system.

## 3. Collaborative Optimization Mechanism of the Food Technology Curriculum System

### *3.1 Mechanism for Knowledge Interaction and Skill Transfer through Horizontal Course Linkages*

The construction of the food technology curriculum system should not only focus on the vertical progression of knowledge but also emphasize the logical interconnection and knowledge complementarity among horizontally aligned courses. Significant overlaps exist in knowledge domains and competence areas across different courses—for instance, the shared principles of biological reactions between food microbiology and fermentation engineering, and the operational integration between food engineering principles and processing equipment courses. Effective integration of these courses helps break down fragmented knowledge and enhances students' cognitive transfer capabilities across multiple technological contexts. By establishing cross-course nodes and designing task-driven linking content, a cross-disciplinary cognitive framework can be formed, enabling students to mobilize diverse knowledge sources and apply them rapidly when addressing complex process-related problems.

On the skill level, horizontal integration promotes systematic transfer of operational skills, data processing capabilities, and process optimization techniques. Skill linkages among courses are evident not only in the continuity of operational procedures but also in the shared use of tools, data analysis methods, and control strategies. Through shared laboratory platforms, joint course design, and parallel project-based training models, integrated skill development across multiple courses can be achieved, fostering the formation of systemic engineering cognition and behavioral patterns. Mechanisms for knowledge interaction and skill transfer not only optimize the efficiency of curriculum resource utilization but also provide multidimensional support for developing students' comprehensive problem-solving abilities [5].

### *3.2 Mechanism for Reconstructing the Alignment between Instructional Content and Engineering Tasks*

Instructional content in food technology courses should be anchored in typical engineering tasks, constructing a knowledge system that aligns closely with real-world production processes. At present, some courses still contain large amounts of abstract theory or content disconnected from industrial practice, which fails to stimulate students' awareness of application and problem-solving. Content reconstruction should center on task complexity, process characteristics, and technological parameters, extracting typical key tasks commonly encountered in industry—such as thermal processing control, fermentation curve adjustment, and food texture evaluation—and transforming them into the core structure of course instruction, thereby forming a content architecture driven by engineering tasks.

This reconstruction mechanism emphasizes accurate simulation of engineering cognitive pathways in the instructional content, allowing students to authentically experience the full logical process of task execution. In terms of content organization, a three-tier mapping structure of "knowledge modules–task types–competence indicators" should be established to ensure instructional design covers the full chain from problem identification and solution planning to operational implementation. The integration of diverse instructional approaches, such as virtual simulation platforms, training in process flow diagram construction, and analysis of process variables, can further strengthen the alignment between content and tasks, enabling students to continuously calibrate cognitive pathways and enhance consistency between understanding and execution during learning.

### *3.3 Internal Feedback Mechanism and Dynamic Adjustment Model within the Curriculum System*

In competence-oriented curriculum construction, feedback mechanisms serve not only as evaluation tools for teaching effectiveness but also as internal drivers for curriculum self-renewal and structural evolution. A curriculum system equipped with a cyclical feedback function should employ multidimensional data collection and dynamic analysis to enable full-process monitoring and intervention in both teaching and competence development. Feedback should not be limited to quantitative academic results but should also encompass complex dimensions such as the evolution of students' cognitive pathways during instructional activities, process data on operational performance, and logical deviations in technological application. By establishing a matrix of course performance indicators, models of competence progression, and archives of student behavior data, the structural coupling between course content, teaching strategies, and competence outputs can be accurately modeled, providing a data-driven foundation and structural reference for subsequent curriculum optimization and achieving effective alignment between instructional goals and competence development pathways [6].

The dynamic adjustment model should follow the logic of "feedback perception–structural diagnosis–system response," forming a closed-loop regulation system that integrates content refinement, methodological innovation, and goal reconstruction. Within this framework, each course module must define explicit competence-generation nodes and task completion standards. Periodic evaluations and phased reviews should assess students' levels of achievement in knowledge application, process understanding, and engineering execution. Instructional content should be promptly adjusted based on student competence feedback, and teaching methods should be specifically restructured to address cognitive barriers and skill deficiencies. Moreover, by leveraging system modeling and structural optimization algorithms, the degree of inter-course connectivity, content coverage density, and competence load distribution can be dynamically regulated, preventing knowledge redundancy and competence fragmentation. Ultimately, this approach enables the construction of an intelligent curriculum system with adaptive learning ecology, facilitating the transition from static structural configurations to dynamic system evolution.

## Conclusion

Systematic optimization of the food technology curriculum system should be grounded in a thorough analysis of the competence requirements for applied talents, with a structural logic centered on task-driven learning, competence orientation, and systemic coordination. This study proposes a strategy for constructing modular course clusters, clarifies horizontal interconnections and vertical progression pathways among courses, and enhances the effectiveness of curriculum design in fostering comprehensive competencies through functional redefinition and evaluative feedback mechanisms. At the same time, the curriculum system must possess adaptive adjustment capabilities to respond to dynamic challenges arising from technological evolution and shifts in competence structures. Future research may further explore the deep integration of food technology curricula with digital technologies and intelligent control systems, investigating data-driven personalized instructional strategies and curriculum model optimization methods, thereby providing both theoretical support and practical reference for building an application-oriented educational system characterized by greater intelligence, flexibility, and innovation.

## Fund Projects

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