International Journal of Multidisciplinary Research and Growth Evaluation.

Curriculum Reform and Practice of the Course "Aquatic Products Processing and Utilization

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Article Info

ISSN (online): 2582-7138
Volume: 06
Issue: 03
May - June 2025
Received: 21-04-2025
Accepted: 22-05-2025
Page No: 1755-1757

Abstract

As a core course in aquatic-related majors, "Aquatic Products Processing and Utilization" emphasizes strong practicality and applicability. Its objective is to enable students to master fundamental theories, common processing techniques, and technical workflows of aquatic product processing and preservation, while also understanding industry development trends and standard regulations. With the in-depth implementation of the New Agricultural Science (NAS) initiative and the rising demand for high-quality, interdisciplinary talents in the aquatic food industry, the original course content and teaching models have revealed delays and disconnection from current industry needs. Systematic teaching reform and practical exploration are urgently required.

This paper focuses on reconstructing the course system, optimizing teaching content, expanding practical teaching, and building a mechanism for industry-education integration. The study also incorporates actual teaching explorations and feedback collection, resulting in significant achievements.

Keywords: Aquatic Product Processing, Curriculum Reform, Practical Teaching, Industry-Education Integration, New Agricultural Science

1. Introduction

1.1. Research Background and Problem Identification

The course "Aquatic Products Processing and Utilization" is designed primarily for undergraduates majoring in aquaculture, food science and engineering, and aquatic food processing. It covers key aspects such as pre-treatment, primary and deep processing, preservation, quality control, and comprehensive utilization of aquatic products [1]. However, with the development of the aquatic processing industry towards intelligentization, value enhancement, and green transformation, the course faces several challenges

1. The teaching content updates slowly and has not systematically incorporated cutting-edge technologies such as high-value utilization of by-products and non-thermal processing technologies (e.g., high-pressure processing, pulsed electric field) [2].
2. The laboratory courses are fragmented and do not fully cover real processing flows or industry standards, leading to insufficient job readiness [1].
3. Traditional lecture-based methods dominate, with limited hands-on, inquiry-based, task-oriented, and project-driven teaching design [3].
4. Cooperation with enterprises is shallow, and it is difficult to integrate enterprise standards, production equipment, and R&D processes into teaching, which limits the development of students' comprehensive capabilities [4].

1.2. Teaching Reform Goals and Strategic Design

To address the above challenges, this curriculum reform has established the following objectives:

- Update teaching content in line with industry trends, integrating modern aquatic processing technologies and standards [5].
- Diversify teaching methods by implementing student-centered approaches, emphasizing engagement and practical skills [6].
- Deepen laboratory instruction by building a multi-level, modular, and contextualized training system

- Strengthen industry-education integration by co-developing teaching resources, practical platforms, and evaluation mechanisms with enterprises.

The overall reform framework follows a "goal-oriented, problem-oriented, competency-oriented" logic, aiming to build a four-in-one system of "theory–training–project–industry" to cultivate students capable of analysis, operation, understanding of workflows, and innovation.

1.3. Curriculum Content Optimization and Modular Design

Optimizing the content structure is a core part of the teaching reform. Based on industry development and technological evolution, the course is systematically reconstructed into a three-tier modular system: "Theoretical Foundation – Processing Technology – Case Studies", with further division into instructional units.

- **Theoretical Foundation:** covers properties of aquatic products, water activity, microbial spoilage, protein denaturation, and lipid oxidation.
- **Processing Technology:** systematically introduces freezing, drying, curing, thermal processing, preservation, packaging, and quality inspection techniques.
- **Case Studies:** Introduces emerging topics like functional aquatic foods, ready-to-eat products, intelligent equipment, and eco-friendly packaging. Case-based teaching is used to develop problem-solving skills.

1.4. Innovation in Teaching Methods and Mode Transformation

To enhance classroom participation and student competence, various teaching innovations are introduced:

- **Flipped Classroom:** Pre-class videos and reading materials are provided, with in-class sessions focused on interactive discussions, quizzes, and group presentations.
- **Project-Based Learning:** Students design specific aquatic food products, completing formulation, processing workflows, packaging plans, and cost accounting.
- **Task-Oriented Group Work:** The class is divided into groups, each designing processing plans for different raw materials. Cross-group competitions and presentations are encouraged.
- **Multi-dimensional Evaluation:** Process-based assessment accounts for 60%, covering project reports, logs, class performance, and teamwork.

1.5. Construction of Practical Teaching System

Practical teaching is crucial to skill development and job readiness. The reform addresses this by:

- **Upgrading on-campus training systems:** Integrating labs (processing, microbiology, sensory evaluation), building a simulated processing workshop, and offering comprehensive modular experiments covering from raw material receipt to final packaging.
- **Establishing off-campus bases:** Cooperating with leading enterprises (e.g., ready-to-eat food producers, export processing plants) to build training bases combining internships and project incubation, including on-site work rotations.
- **Promoting results transformation:** Encouraging students to extend experimental projects into competitions, business plans, or graduation theses, linking "course–project–research–innovation" seamlessly.

1.6. Collaborative Education Mechanism of Industry-Education Integration

Establishing collaborative mechanisms is key to achieving integration of teaching, learning, practice, and research. Reform measures include:

- **Implementing dual mentorship:** Pairing academic teachers with enterprise technicians to co-supervise student projects and practices using real cases and tasks.
- **Developing co-built teaching materials and case libraries:** Such as "Ready-to-Eat Aquatic Products Development and Application" and "Standards Compilation for Local Specialty Products", increasing relevance and applicability.
- **Building shared digital platforms:** Creating cloud-based labs and smart teaching systems to host videos, SOPs, product cases, and fault diagnosis clips, supporting self-paced and repeated learning.

1.7. Reform Outcomes and Student Feedback

After nearly two years of pilot reforms, significant outcomes have been observed:

- Teaching evaluation scores improved, with student satisfaction increasing from 83% to 92%.
- Project participation rose from 40% to 85%, supported by new comprehensive design labs (e.g., kelp product development), leading to more student-generated outputs like papers, prototypes, and enterprise research reports.
- The number of student awards in competitions like "Internet+", "Challenge Cup", and food design has steadily increased.
- Employer feedback indicates that students involved in the reformed curriculum perform better in process design, operational standards, and team communication.

2. Conclusion and Prospects

The reform of the "Aquatic Products Processing and Utilization" course reflects not only updates in content and methods but also a transformation in educational philosophy. Looking forward, further actions are needed:

- Strengthening school-enterprise collaboration and expanding international teaching resources.
- Building multilingual course materials and promoting global education strategies.
- Enhancing faculty development and interdisciplinary teaching teams.
- Promoting cross-border research integration and expanding digital, simulation-based training.

These efforts aim to cultivate innovative, practical, and interdisciplinary professionals to support local industries and the modernization of aquaculture.

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