Research on the Curriculum Reform of "Agricultural Cold Chain Logistics" Based on OBE Concept and Information Technology

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Abstract. This article explores the optimization strategy of the "Agricultural Cold Chain Logistics" course based on Outcome Based Education (OBE) and driven by information technology. Its purpose is to promote the integration of higher education quality and student ability development. This article outlines a detailed curriculum implementation plan, introduces a dynamic curriculum reform evaluation framework, and analyzes the effectiveness of curriculum implementation. In order to address the challenges encountered during implementation, this article suggests strengthening technical support, enhancing teacher training, adopting student-centered classroom design, and providing personalized learning support in the integration process. These suggestions aim to provide specific approaches and strategies for reforming the course of "agricultural cold chain logistics". In addition, the insights provided provide valuable references for implementing results oriented education in other professional courses of higher education and the application of information technology in teaching.

Keywords: Outcome-Based Education; Information technology; Curriculum teaching reform; Course Implementation Plan.

1 Introduction

With the improvement of the economy and living standards, the quality and safety of agricultural products are increasingly valued. As a key to ensuring the freshness, quality, and reducing losses of agricultural products, the development of cold chain logistics in our country faces challenges in facilities, standards, and regulation. The core obstacle lies in the lagging professional talent cultivation, where traditional educational models fail to closely align with industry needs, focusing more on knowledge acquisition than on skill development. Therefore, the educational model urgently needs to shift towards competency-based training, guided by the Outcome-Based Education (OBE) concept, which emphasizes student learning outcomes as the center and focuses

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on the cultivation of practical abilities and lifelong learning capabilities. With the rapid development of information technology, modern education is undergoing profound changes. Technology integration can not only enrich teaching methods, but also improve teaching effectiveness and students' learning experience. By integrating various technological tools and platforms into curriculum design and implementation, we can significantly improve teaching quality and better cultivate students' core competencies. Integrating outcome oriented education into the "Agricultural Cold Chain Logistics" course and emphasizing the application of information technology in course implementation can accurately meet industry needs, improve teaching quality, promote students' comprehensive development, enhance their practical skills and overall quality, and provide high-quality talents for the cold chain logistics industry. This study provides an innovative curriculum design paradigm for higher education, leading education reform, improving the flexibility of education, and providing reference for the innovation of other courses.

2 Overview of Outcome Based Education Concept and the Application of Information Technology in Education

2.1 Overview of Outcome Based Education (OBE)

OBE, or Outcome-Based Education concept was first proposed by the American scholar Spady [1]. Through the design, implementation, and evaluation of corresponding teaching activities, students are ultimately encouraged to achieve their expected goals [2]. The concept of Outcome based education can be traced back to the education reform movement in the United States, such as Benjamin Bloom's "Taxonomy of Educational Objectives," which provided a theoretical foundation for Outcome based education [3]. Bloom emphasized that student learning outcomes should be the center, rather than just focusing on the teaching process. Since the 1980s, Outcome based education has been more systematically introduced into higher education, especially in the field of engineering education [4]. With the adoption of Outcome based education as a certification standard by professional accreditation bodies such as ABET, this concept quickly spread [5]. After entering the 21st century, many countries and regions began to implement Outcome based education in their higher education systems, guiding curriculum design and improving teaching quality by setting clear graduation requirements and learning outcomes [6]. In specific teaching practices, educators need to set clear learning goals and outcomes, improve the assessment system for teaching and learning objectives, attach importance to incorporating interdisciplinary knowledge and practical experience, and establish a continuous improvement and feedback mechanism for the curriculum [7]. Course teaching quality is one of the most critical issues in university education. The OBE philosophy emphasizes the core of actual outcomes, centers on the student, and adopts a backward design approach to construct the curriculum framework, representing a forward-thinking educational mindset [8]. In regions such as the United States, Europe, and Australia, OBE has become an integral part of educational reform. Educational institutions in multiple

locations have adopted the OBE framework to innovate in course design, teaching methods, and evaluation approaches, aiming to enhance students' overall quality and practical application abilities. For example, universities such as Ocean University of China, Peking University, and East China Normal University have introduced the OBE philosophy, driving educational modernization through backward-designed curriculum frameworks, classroom teaching reforms, and continuous improvement of quality management systems. In the OBE pyramid model, the bottom layer consists of five implementation steps: Define Outcomes, Design Curriculum, Deliver Instruction, Document Results, and Determine Advancement [9]. In higher education, this model provides educators with a systematic approach to ensure that students achieve the expected learning outcomes.

2.2 The Application of Information Technology in Education

The application of information technology in education has penetrated into multiple levels, greatly enriching teaching methods and improving teaching efficiency. Information technology has demonstrated many advantages in teacher lesson preparation, classroom teaching demonstrations, remote teaching resource construction, virtual simulation teaching, and data analysis and evaluation. In traditional lesson preparation methods, teachers often rely on paper lesson plans, while information technology makes the lesson preparation process more convenient and efficient. Teachers can share resources, discuss lesson plans, and improve the cooperation and utilization of resources in lesson preparation through online platforms. Information technology enables teachers to use multimedia materials or teaching software to write multimedia courseware or presentations, dynamically display charts, animations, films, etc. in the classroom, and help students understand abstract concepts and complex processes in an intuitive way. Online learning platforms, such as MOOCs and other online resources, greatly expand the boundaries of learning. They not only provide a large amount of learning materials such as video lectures, e-books, and interactive tutorials, but also allow students to flexibly arrange their studies according to their own time and pace. The application of virtual simulation software in education is becoming increasingly widespread, especially in highly operational professional courses. By creating realistic operating environments, virtual simulation software can help students conduct practical operations under risk-free conditions, enhancing their practical skills. The application of data analysis tools in the field of education helps teachers and educational institutions understand students' learning patterns, predict learning outcomes, evaluate teaching effectiveness, and optimize teaching and curriculum design. It can be said that information technology has become an essential part of modern education and teaching, as well as an important means to promote teaching reform and improve educational quality.

3 Curriculum Reform Plan Design for "Cold Chain Logistics of Agricultural Products"

3.1 Introduction to the Course

The "Cold Chain Logistics of Agricultural Products" course covers the basic theory of cold chain logistics, quality and safety control in the circulation of agricultural products, cold chain logistics of fruits and vegetables, aquatic products, livestock, dairy products, poultry eggs, and the relationship between cold chain logistics and deep processing of agricultural products. The most core content is chapters 3 to 6. Course teaching is conducted by theory teaching, experimental operation and case analysis. The theory teaching part aims to introduce the basic principles and technology of cold chain logistics; the experimental operation part allows students to conduct practical operation practice through virtual simulation software; and the case analysis part deepens students' understanding of theory by analyzing real cases. The learning outcomes of each part are closely linked to the course objectives to ensure that students can fully master the knowledge and skills of cold chain logistics. During the teaching process, all the participating classroom interactions, topic discussions and online learning records will be recorded and course points converted on the Learning Pass platform, and the homework and project reports submitted by students can also be submitted to the platform. Through setting, teachers can also let students conduct self-evaluation and mutual evaluation, and through multi-directional comments, give students whole-process management and relatively fair evaluation of academic performance.

3.2 Course Implementation Plan

To ensure the smooth implementation of the reform of the "Cold Chain Logistics of Agricultural Products" course under the Outcome-Based Education philosophy, the implementation plan is outlined in Fig.1.

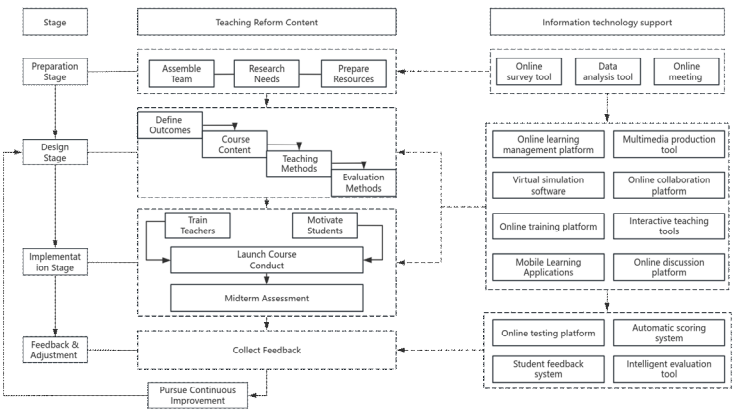

Fig. 1. General Process of Curriculum Teaching Reform.

In the preparatory stage of curriculum reform, we established a project team responsible for the overall planning and implementation of the reform. Through surveys and interviews, we collected feedback and suggestions from students, teachers, and industry experts to clarify the direction of the reforms. We used online survey tools to design and publish questionnaires, and conducted multiple seminars via online conferencing software to gather valuable feedback. Online collaboration platforms helped us organize data and develop detailed course objectives and learning outcomes.

The design stage of curriculum reform focuses on four key areas: definition of learning outcomes, curriculum content design, instructional method design, and assessment method design. During the implementation stage, teachers involved in the reform should receive training on OBE principles and new pedagogical methods to ensure effective execution. Prior to the commencement of classes, students should be informed about the purposes, contents, and expected outcomes of the reform to enhance their engagement and enthusiasm. Courses should be conducted strictly according to the designed teaching plans, ensuring all stages proceed as scheduled. Mid-term evaluations should be conducted during the implementation phase to promptly identify issues and make necessary adjustments.

In the course design stage, we utilized online learning management platforms to publish detailed course outlines and learning materials. Multimedia production tools helped us create high-quality instructional materials. We used Unity to create a virtual operating environment for cold chain logistics. Additionally, teachers received training on OBE concepts and information technology applications through online training platforms.

In the process of teaching implementation, we primarily used the Chaoxing Learning Platform, a virtual classroom for real-time online teaching. This platform includes interactive teaching tools and online discussion platforms, enabling students to access course materials anytime and anywhere to complete course tasks. In the teaching implementation stage, we primarily used the Chaoxing Learning Platform as a virtual classroom for real-time online teaching. This platform includes interactive teaching tools and online discussion forums, enabling students to access course materials anytime and anywhere to complete course tasks.

Through methods such as student surveys and teacher feedback meetings, we collected opinions and suggestions regarding the implementation process. Based on this feedback, necessary adjustments and optimizations were made to the course content, teaching methods, and assessment approaches to ensure continuous improvement. To ensure the accuracy and timeliness of evaluations, we used the Chaoxing online testing platform to publish online tests and provided instant feedback through an automatic scoring system. Data analysis toolshelped us analyze students' learning data, while intelligent assessment tools provided objective evaluation results.

3.3 Evaluation Methods of Curriculum Reform

To evaluate the effectiveness of the reform, it is necessary to define evaluation metrics, tools, and procedures, as shown in Fig. 2.

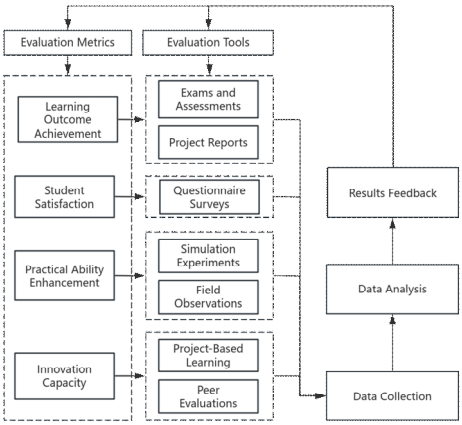

Fig. 2. Course Reform Evaluation System.

Determine evaluation metrics and tools and develop a detailed evaluation plan. Collect evaluation data regularly during the course implementation. Organize and analyze the collected data to form an evaluation report. Provide feedback on the evaluation results to both instructors and students and make necessary adjustments based on the evaluation findings. By following this structured evaluation system, the effectiveness of the course reform can be systematically assessed and continuously improved.

4 Curriculum Implementation and Evaluation

4.1 Defining Learning Outcomes

This case study took place during the fall semester of 2023 at Guangdong University of Science and Technology, China. Taught by faculty members from the Logistics Management Department, the course was attended by 59 fourth-year undergraduate students majoring in Logistics Management.

The course objectives for "Cold Chain Logistics of Agricultural Products" as detailed in Table 1.

Table 1. Learning Outcomes for "Cold Chain Logistics of Agricultural Products".

Course Learning Objectives	Achievement Pathways	Contribution
LO1： Master the basic theory of cold chain logistics, conduct preliminary analysis and judgment on professional issues in logistics management, form personal insights, possess the ability to make reasonable decisions under complex circumstances, design and optimize cold chain logistics solutions, solve practical problems in cold chain logistics, and ensure the safety and quality of cold	Supported by classroom interaction, after-class assignments, online learn-	0.7

Course Learning Objectives	Achievement Pathways	Contribution
chain logistics	ing, Curriculum practice, and course papers.	
LO2: Understand the dialectical relationship between cold chain logistics and supply chain efficiency, as well as the value of mathematical abilities in problem-solving	Supported by classroom interaction and online learning.	0.1
LO3: Proficiently master the main sources and acquisition methods of materials in the field of logistics management, able to query and retrieve literature and materials related to the profession using the internet and relevant software tools, and capable of identifying, expressing, analyzing, and presenting general issues in cold chain logistics management using computer-assisted software	Supported by classroom interaction, online learning, and after-class assignments.	0.2

4.2 Reverse Course Design

Based on the above learning outcomes, design course content, teaching methods, and evaluation methods, as shown in Table 2.

Table 2. Course Content for "Cold Chain Logistics of Agricultural Products".

Teaching Content	**Teaching Methods**	**Evaluation methods**	**Course Objectives**
Fundamentals of Cold Chain Logistics in Agricultural Products	Lecture method, case study method	Online learning platform course points, Homework grades	LO1, LO2
Quality Control in Agricultural Product Logistics	Simulation and role-playing, case study method	Online learning platform course points, project reports	LO1, LO2, LO3
Cold Chain Logistics for Fruits and Vegetables	Blended learning, case study method	Online learning platform course points, project reports,	LO1, LO3
Cold Chain Logistics for Aquatic Products	Blended learning, project-based learning	Online learning platform course points, project reports	LO1, LO3
Cold Chain Logistics for Meat and Poultry	Blended learning, case study method	Online learning platform course points, project reports	LO1, LO3
Cold Chain Logistics for Dairy Products and Eggs	Blended learning, Project-Based Learning	Online learning platform course points, peer evaluations	LO1, LO3
Cold Chain Logistics and Deep Processing of Agricultural Products	Blended learning, field trips	Online learning platform course points, project reports	LO3

In addition to the overall design of the course, we use fruit and vegetable cold chain logistics as an example to illustrate the 'student-centered' course design, as shown in Fig.3.

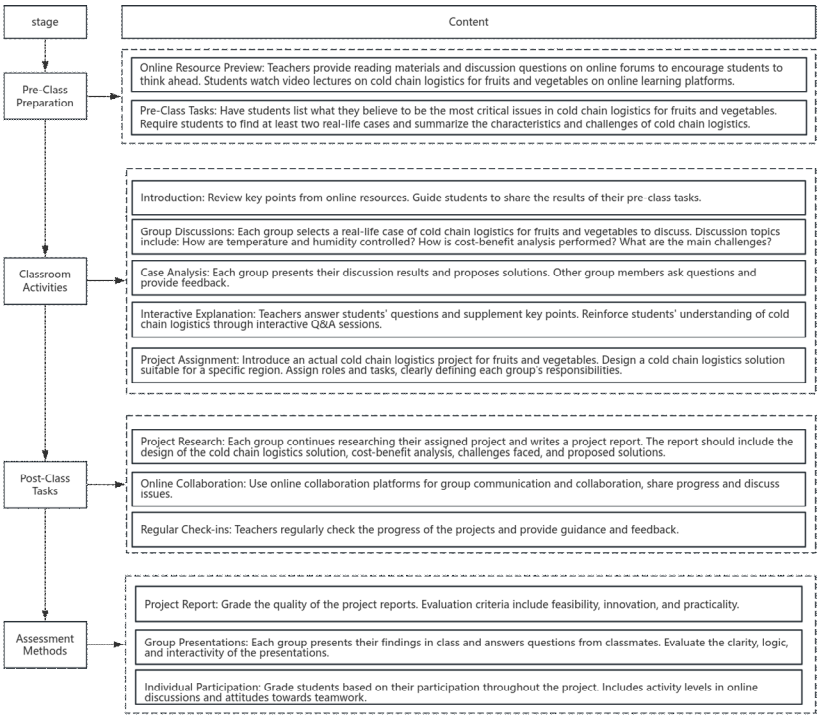

Fig. 3. Classroom design plan: Fruit and vegetable cold chain logistics.

In the chapter on fruit and vegetable cold chain logistics, the course objectives include: Understanding the characteristics and operational processes of fruit and vegetable cold chain logistics. Master the temperature and humidity control methods in the cold chain logistics of fruits and vegetables. Addressing practical issues in the cold chain logistics of fruits and vegetables. Cultivate students' self-learning ability and teamwork spirit. The teaching method adopts blended learning and project-based teaching. It combines online learning resources with offline classroom interaction to enhance students' learning enthusiasm. On the other hand, it involves students in solving problems through practical projects.

Through this student-centered classroom design, students can not only better understand and master the relevant knowledge of fruit and vegetable cold chain logistics, but also exercise their problem-solving skills and teamwork spirit through practical projects. This classroom program not only focuses on students' learning process, but also emphasizes the output of learning outcomes. Students are able to gradually

achieve course objectives during the participation process and ensure learning outcomes through various evaluation methods.

5 Discussion on the Effectiveness of Course Implementation

5.1 Curriculum Implementation Effect

According to the implementation of the reform plan, course evaluation data showed that the average scores of students in theoretical examinations and practical examinations had improved. In particular, the students' comprehensive application ability has been improved significantly. Through the questionnaire survey, it is found that most students are satisfied with the curriculum reform, believing that the curriculum content is closer to the reality, and the teaching method is more conducive to learning. Students generally believe that case teaching and project-based learning contribute to improving practical ability and innovation ability. In addition, through simulation experiments and field investigation, students' practical operation ability is significantly enhanced, and they can solve problems independently in complex situations. The performance of the students during the internship has also been praised by the enterprise, showing a high professional quality. In the process of project-based learning, students show strong innovative thinking and can put forward novel solutions. Through teamwork, students learn how to communicate and cooperate effectively, and improve their comprehensive quality. This study also shows that integrating various technological means such as virtual simulation software, online learning platforms, and intelligent assessment tools into course design and implementation can not only significantly improve the quality of courses, but also better cultivate students' practical abilities and innovative spirit.

5.2 Problems in Implementation

In the Agricultural Products Cold Chain Logistics course, due to the use of online platforms for real-time interaction with students, the three most common technical issues are link redirection failures, network latency, and simulation system lag. Investigate its reason, the school network broadband bottleneck. During peak hours, network traffic surges, leading to a significant decrease in data transmission speed, resulting in delays and lags. Students may encounter situations such as prolonged video buffering time, slow page loading, or even inability to load. Due to the inability of teachers to ensure that all students can smoothly participate in online classrooms and virtual simulation experiments, the quality of teaching has declined.

Outcome-Based Education (OBE) emphasizes a focus on student learning outcomes and the cultivation of comprehensive abilities and core competencies. However, in practice, some teachers lack a deep understanding and application of these new teaching methods, particularly in areas such as the use of teaching evaluation indicators and the analysis and calculation of the degree of curriculum goal attainment. There is a lack of systematic knowledge among some teachers regarding how to scientifically set evaluation indicators, leading to unclear or unreasonable indicators. On

the other hand, the rapid development of educational technology requires teachers to continuously learn new knowledge and skills. However, due to limitations in time, energy, or resources, teachers often struggle to keep up with the pace of technological updates, resulting in their inability to fully utilize the latest technologies in their teaching.

There are significant differences among students in terms of personal interest, motivation, and learning capacity, leading to uneven learning outcomes. Students generally show more interest in practical sessions than theoretical learning. Although clear learning objectives are set for students in lesson plans, they do not fully understand or accept these goals during implementation, resulting in a lack of direction in their actual learning processes. Students lack self-management and self-motivation skills and do not have clear personal goals, making them prone to procrastination and negative emotions.

Differences in learning capacity also affect participation levels; students with stronger learning abilities tend to participate more actively in class, while those with weaker abilities may reduce their participation due to difficulties.

Students often encounter difficulties when using new technological tools or learning specific knowledge points. Although teachers and students can communicate through social media apps, feedback is not timely. Due to the lack of effective online tutoring platforms or instant feedback tools, these issues cannot be resolved in a timely manner. The backlog of students' problems seriously affects their learning progress and enthusiasm.

Although the course content and progress are consistent, the lack of personalized learning path design makes it difficult to effectively meet the learning needs of different students. Lack of personalized learning resource recommendations and learning path planning leads to significant differences in students' learning experiences and outcomes, further exacerbating the learning gap between students.

5.3 Directions for Future Improvement

In response to the issue of insufficient technological infrastructure, schools need to actively take measures to improve and upgrade to ensure smooth operation of online learning and virtual simulation software, providing students with a good learning experience. For students accessing remotely, schools should provide VPN services for external access to internal resources. It is recommended that schools optimize the performance and configuration of VPN servers to improve data transmission speed and stability. Consider using more efficient VPN protocols and encryption methods to reduce network latency and packet loss. The school network center can deploy load balancers to distribute remote access requests across multiple servers for processing, in order to alleviate the load pressure on a single server.

Arrange specialized training sessions for OBE methodologies led by experienced experts. Create teacher development records to track training experiences and progress. Continuously offer support and compile detailed OBE teaching guidelines covering the design of evaluation metrics and methods for analyzing the attainment of course objectives. Provide practical templates and tools to help teachers quickly adopt and cor-

rectly implement OBE teaching. Establish a teacher exchange group or forum to promote sharing of experiences and mutual assistance. Regularly hold teacher seminars to discuss issues encountered in teaching practice and solutions.

Organize regular new technology workshops, online courses or seminars, covering educational software (such as online teaching platforms, multimedia teaching tools), digital teaching resource production (such as video editing, advanced PPT skills), and basic knowledge of information technology. Establish or strengthen the technical support department of the school to provide immediate technical consultation and assistance to teachers, and solve specific problems encountered by teachers in the process of using new technologies.

Design teaching activities aligned with student interests, such as case studies and project-based learning. Use competitions and presentations to enhance students' sense of achievement and stimulate interest. Conduct one-on-one conversations with students to understand their interests and needs, helping them set specific achievable personal learning goals. Provide additional tutoring and support for students with weaker learning abilities to ensure everyone keeps up. Incorporate group discussions and interactive Q&A sessions in classroom teaching to increase student engagement. Regularly provide feedback on students' learning progress to help them understand their strengths and areas for improvement.

In order to promptly solve the problems encountered by students in the learning process, we can establish a dedicated online tutoring center or help desk, equipped with sufficient technical support personnel. In addition, online Q&A sessions can be scheduled regularly, and teachers or teaching assistants can answer students' questions online during fixed time periods. Use instant messaging tools such as QQ groups, WeChat groups, etc. to create class groups for students to ask questions and communicate at any time. In order to meet the learning needs of different students, we can use questionnaire surveys or tests to understand their different learning styles and preferences, and then develop personalized learning plans for each student based on their abilities and progress. Utilize learning management systems or other online platforms to recommend personalized learning resources based on students' interests and needs, ensuring that each student can learn at their own pace. Aim to build a diversified cooperation network, enhance OBE teaching method training, promote teacher-student interaction, and integrate technology with diverse assessment methods to comprehensively elevate education quality and student participation in practical activities.

6 Conclusion

Through in-depth research and practical application, this study successfully implemented the principles of Outcome-Based Education (OBE) in optimizing the "Cold Chain Logistics for Agricultural Products" course. By applying various information technologies to the teaching process, achieving notable results. The study not only constructed a detailed curriculum implementation plan, but also designed a dynamic evaluation framework for curriculum reform, achieving comprehensive and accurate

evaluation of students' comprehensive abilities. Through the analysis of the implementation process and effectiveness of the course, improvement suggestions have been proposed, including strengthening technical support, improving teacher training system, increasing student participation, and providing feedback and personalized learning support, with the aim of enhancing teaching quality and students' learning experience. This research not only provides feasible pathways and strategies for deepening reforms in the "Cold Chain Logistics for Agricultural Products" course but also offers valuable insights and inspiration for the implementation of OBE in other specialized courses within higher education.

References

1. Spady, D. M. H. Outcome-based education. Journal of Veterinary Medical Education, 2003: 230-231.
2. Tong Cuiyun. Design of Blended Teaching Mode for Accounting Major Courses Based on OBE Concept. Modern Vocational Education, 2024:93-96.
3. Wang Tongxing. Initial Exploration of Curriculum Reform Based on Bloom's Cognitive Model and OBE Concept: A Case Study of Developmental Psychology. Science and Education Guide (Lower Monthly Edition), 2020:29-30. DOI: 10.16400/j.cnki.kjdkx.2020.07.014.
4. Lin Luyang. Research on the Application of BOPPPS Teaching Model in Experimental Teaching of Mechanical Design and Manufacturing Based on OBE Concept. Proceedings of the 4th Digital Education Seminar for the Steel Industry. Harbin Far East University of Science and Technology, 2024:54-58. DOI: 10.26914/c.cnkihy.2024.003257.
5. Han Ke. Research and Practice of Teaching Methods in Physical Education Courses Based on OBE Concept. Academic Weekly, 2024:7-9. DOI: 10.16657/j.cnki.issn1673-9132.2024.23.003.
6. Wang Minghai. Theoretical Analysis of High-Performance Output in Physical Education Teaching at Local Universities Based on OBE Concept. Sports Horizon,2021: 45-46.
7. Zhao Yihuan & Sun Chu. Research on the Construction of Agricultural Product Marketing Course Based on OBE Concept. Higher Education Journal, 2024:74-78. DOI: 10.19980/j.CN23-1593/G4.2024.12.018.
8. Xu Dongyang. Exploration and Practice of OBE Concept in Higher Education Teaching. Chinese Multimedia and Network Teaching Journal (Upper Monthly Edition), 2023:13-17.
9. Chen Jingjing. A Preliminary Analysis of the "Evaluation as Learning" Pyramid Evaluation Mechanism in Outcome-Based Education (OBE) Talent Cultivation. In Proceedings of the Labor Security Research Conference (Volume 10). Heilongjiang Vocational College. 2021: 86-87. DOI: 10.26914/c.cnkihy.2021.022421.