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Outcome-Based Lesson Plan Design for Nutrition and Food Hygiene: A Case Study on Bacterial Food Poisoning

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Abstract: *This study explores the design of lesson plans for a Nutrition and Food Hygiene course based on the Outcome-Based Education (OBE) philosophy, using bacterial food poisoning as a case study. The OBE philosophy, along with the revised Bloom's taxonomy of cognitive domains — remembering, understanding, applying, analyzing, evaluating, and creating — was applied to structure and organize the course content on bacterial food poisoning. Preliminary lesson plans aligned with both OBE principles and Bloom's Taxonomy were developed. Lesson plans designed within the OBE framework improve the clarity and implementation of educational objectives, ultimately enhancing teaching effectiveness and ensuring that students gain a deeper understanding of the subject matter.*

Keywords: *Outcome-Based Education (OBE), Nutrition and Food Hygiene, Lesson Plan, Food Poisoning*

1. Introduction

The Nutrition and Food Hygiene course is a core subject within the public health and preventive medicine curriculum, recognized for its strong scientific foundation, social relevance, and practical application. It emphasizes the integration of theoretical knowledge with hands-on skills. This course is closely connected to national economic development and public welfare, playing a vital role in promoting healthy dietary habits, enhancing food safety oversight, preventing and managing diseases, improving public health, raising health standards, and contributing to the creation of a healthier China. However, the broad scope of the course, the large amount of content to be memorized, and the fragmented nature of the material — which often lacks clear connections — have led students to report that the learning process is tedious and difficult, hindering their ability to engage in deeper learning. Furthermore, the current teaching approach faces several challenges, including a disconnect between the curriculum and real-world applications, unclear teaching objectives, limited practical relevance, a lack of variety in instructional methods, and low student engagement. These issues not only impede students' ability to master and apply the knowledge, but also restrict their capacity to address real-world challenges in their future careers. Therefore, it is crucial to explore reforms in both the course content and teaching methods for the Nutrition and Food Hygiene course.

Outcome-Based Education (OBE), introduced by American scholar Spady in 1981, is a student-centered educational philosophy. In practice, it is a developmental model that emphasizes the skills students should acquire and the achievements they can attain after completing their education. All educational activities, processes, and curriculum designs are centered on achieving the desired learning outcomes [1]. The OBE model has developed into a comprehensive theoretical framework and has been recognized as a promising approach for reforming higher engineering education. It has been widely adopted globally [2-4]. In 2016, China became the 18th official member of the Washington Accord, and the OBE teaching model gradually gained recognition and widespread application in teaching practices. The OBE concept has become a mainstream trend in educational reform and innovation in Chinese universities, aiming to cultivate applied talents, and it has been widely applied beyond engineering courses [5-7]. Teaching activities based on the OBE philosophy have shifted away from one-way knowledge transmission, emphasizing a student-centered approach that focuses on learning outcomes and the practical problem-solving skills developed through learning. OBE emphasizes the reverse design of students' educational structures and related evaluation systems, all aimed at achieving the expected learning outcomes. In this reverse design process, Benjamin Bloom's taxonomy of educational objectives

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is utilized as a tool to help educators identify and evaluate students' learning outcomes at various levels [8]. In the cognitive domain, the revised Bloom's taxonomy includes six levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating [9]. These objectives align with the OBE philosophy, which emphasizes that students should be able to understand and apply acquired knowledge, rather than merely memorize and recognize information. In teaching practice, the implementation of the OBE philosophy is evident across various stages of the educational process, including curriculum design, formulation of learning objectives, teaching evaluation, and other key educational activities. Among these elements, lesson plan design is the most fundamental and integral component of course delivery. They serve not only as the foundation of effective teaching but also as the focal point of the OBE philosophy, making them a central area of focus in educational reform efforts. The development of lesson plans, aligned with OBE principles, represents both a critical and challenging aspect of teaching innovation. This article delves into the process of designing lesson plans within the framework of OBE, using the core topic of common bacterial food poisoning in the Nutrition and Food Hygiene course as a practical example to illustrate how OBE can be effectively integrated into lesson planning.

2. Teaching Objectives

The philosophy of OBE emphasizes that all educational activities must center on achieving the desired learning outcomes. Instructional design typically adopts a backward design approach to ensure alignment with these outcomes. This lesson plan is developed based on Bloom's taxonomy of educational objectives, with a focus on cultivating students' initiative, practical skills, and innovative abilities throughout the course. The approach aims to foster a deeper understanding and practical application of knowledge in the field of Nutrition and Food Hygiene, thereby enhancing students' problem-solving abilities and readiness for real-world challenges.

2.1 Cognitive Domain Objectives

2.1.1 Remembering

Students must memorize the definition of bacterial food poisoning, describe its causes and epidemiological characteristics, list common foods linked to bacterial food poisoning, and recall the traits of pathogens associated with it. These pathogens include Salmonella, Vibrio parahaemolyticus, Clostridium botulinum, and Staphylococcus aureus, as well as their characteristic clinical manifestations.

2.1.2 Understanding

Students are tasked with classifying bacterial food poisoning, explaining the mechanisms behind various types, and describing the epidemiological characteristics of Salmonella, Clostridium botulinum, Staphylococcus aureus, and Vibrio parahaemolyticus - induced food poisoning. Additionally, they are expected to explain why Salmonella is the most common cause of bacterial food poisoning and elaborate on preventive measures.

2.1.3 Applying

Students are expected to apply the diagnostic principles of bacterial food poisoning, effectively manage various types of cases, and implement proper food handling practices to prevent their occurrence.

2.1.4 Analyzing

Students are required to perform preliminary analyses of food poisoning cases, accurately identify the causes of food poisoning, propose effective preventive and control measures, and clearly distinguish between food poisoning caused by Clostridium botulinum and other neurological diseases.

2.1.5 Evaluating

Students are expected to assess the effectiveness of preventive measures against bacterial food poisoning through the synthesis of acquired knowledge, and to evaluate the sanitary conditions of catering establishments during on-site inspections.

2.1.6 Creating

Drawing on their acquired knowledge, students are able to provide recommendations for improving management practices, operational procedures, and facility conditions that do not to comply with food safety standards during investigations of dining establishments.

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2.2 Affective Domain Objectives

The goal is to cultivate students' awareness and literacy in food safety, fostering a strong sense of responsibility and commitment. Students are encouraged to actively promote food safety knowledge in their daily lives, enhance public food safety awareness, and contribute to the prevention of food poisoning incidents. Additionally, the program aims to instill a sense of professional mission and responsibility in students, equipping them to effectively respond to and assist patients suffering from food poisoning.

3. Teaching Content and Time Allocation

Overview of bacterial food poisoning: 10 minutes; Salmonella-induced food poisoning: 7 minutes; Clostridium botulinum-induced food poisoning: 8 minutes; Staphylococcus aureus-induced food poisoning: 5 minutes; Vibrio parahaemolyticus-induced food poisoning: 10 minutes.

4. Key Points and Difficulties in Teaching

4.1 Teaching Emphasis

The focus is on the prevention and management of bacterial food poisoning, encompassing the pathogenesis, epidemiological characteristics, toxic mechanisms, clinical manifestations, and preventive strategies for food poisoning caused by Salmonella, Vibrio parahaemolyticus, Staphylococcus aureus, and Clostridium botulinum.

4.2 Teaching Challenges

The key teaching challenge in this section is the differential diagnosis of bacterial food poisoning, particularly the distinction between sporadic cases of Clostridium botulinum-induced food poisoning and neurological disorders.

5. Teaching Organization

5.1 Teaching Methods

The course includes small-class theoretical instruction, multimedia courseware, case analysis, and group discussions. Test questions are integrated into the courseware and shared with students through online platforms such as "Xue Xi Tong" for review and discussion.

5.2 Introduction of Teaching Content

The lesson begins with the presentation of statistical data on food poisoning cases from previous years, as provided by the Health Commission, emphasizing that bacterial food poisoning is the most prevalent type. To illustrate this, Salmonella-induced food poisoning is introduced using the 2021 outbreak in the United States, which involved an "unknown food source." Students' understanding of food poisoning symptoms is further enriched through the video clip "Mystery of Strange Diseases," which recounts a detailed case of food poisoning caused by Clostridium botulinum affecting a family of five.

5.3 Key Points of Teaching

(1) The concept and classification of bacterial food poisoning, along with its etiology, epidemiological characteristics, clinical manifestations, diagnostic principles, and preventive measures, are introduced.

(2) The characteristics of Salmonella are discussed, encouraging students to reflect on why it is the most common cause of bacterial food poisoning. A U.S. Salmonella outbreak case is presented to prompt students to analyze and propose effective preventive measures.

(3) The lesson focuses on the characteristics of Clostridium botulinum-induced food poisoning. Epidemiologically, most cases are linked to the consumption of home-made fermented foods. The

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primary clinical manifestation is motor nerve paralysis, with gastrointestinal symptoms being rare. This condition is associated with a high mortality rate. The importance of epidemiological characteristics is underscored through case videos used to guide diagnostic processes. Specific treatments for Clostridium botulinum food poisoning are available. Key preventive measures include properly cooking raw materials when preparing home-canned foods and thoroughly heating suspect food to neutralize toxins.

(4) Staphylococcus food poisoning is a toxin-mediated form of food poisoning. The toxin produced by Staphylococcus aureus is heat-resistant and cannot be destroyed by conventional cooking methods. The typical clinical manifestation is severe vomiting, and diagnosis primarily depends on the identification of the toxin.

(5) Real-world field investigation data on Vibrio parahaemolyticus-induced food poisoning are presented to the students. They engage in small group discussions to analyze the causes and propose preventive measures. The session concludes with a comprehensive summary covering the microbiology, epidemiological characteristics, clinical manifestations, and other relevant aspects of Vibrio parahaemolyticus food poisoning.

6. Assessment of Learning Outcomes

Learning outcomes will be assessed through the following methods.

6.1 In-Class Performance

Students' immediate responses to in-class test questions will be assessed. Performance during small-group discussions will be evaluated based on their ability to apply knowledge, collaborate, communicate effectively, and other relevant factors.

6.2 Post-Class Assignments

Online platforms such as "Xue Xi Tong" will be used to distribute post-class assignments. These assignments will assess students' understanding of common bacterial food poisoning. Additionally, students will be encouraged to independently design a food safety survey to investigate food safety conditions in their homes or local eateries. Based on their findings, students will propose suggestions for improvement.

6.3 Feedback Collection

Feedback from students regarding course content and teaching methods will be collected. This feedback will provide valuable insights into students' perspectives and help identify areas for improvement of the course.

7. Discussion and Conclusion

OBE is an educational philosophy that prioritizes outcomes, emphasizing a clear focus and structured approach to ensure that every student achieves the expected learning outcomes. A key feature of OBE is the reverse design of educational frameworks and corresponding assessment systems, meaning the educational process is planned and evaluated based on anticipated learning outcomes. In this reverse design process, Bloom's taxonomy of educational objectives serves as a valuable tool [10]. Guided by the principles of OBE and incorporating Bloom's taxonomy, this study seeks to design a lesson plan focused on common bacterial food poisoning. The lesson content is aligned with the training objectives of the preventive medicine major, aiming to enhance students' mastery of core concepts and methods in food hygiene, as well as their ability to analyze and resolve food hygiene-related problems.

In traditional Chinese lesson plans, teaching objectives are often articulated using terms such as understanding, familiarity, and mastery to outline instructional content requirements. However, these terms often lack precise definitions, leading to ambiguity in distinguishing between them. The revised Bloom's Taxonomy provides a more detailed and actionable framework for classifying educational objectives, dividing them into three domains: cognitive, affective, and psychomotor. Within the cognitive domain, Bloom's Taxonomy identifies six hierarchical levels, progressing from lower-order to higher-order thinking: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating. Each

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level is associated with specific reference verbs that define corresponding learning objectives. For instance, at the Remembering level, verbs such as memorize, recite, identify, and recognize are commonly used. At the Applying level, verbs like utilize, execute, formulate, and modify are applicable [9]. Curriculum reform and accreditation represent a substantial and complex undertaking, requiring innovative approaches and alignment with educational frameworks [11]. How can the principles of OBE be effectively integrated with Bloom's Taxonomy of Educational Objectives to enhance teaching effectiveness? The following section explores some preliminary strategies and insights.

(1) Clearly Define Teaching Objectives

Teaching objectives should be explicitly outlined at the beginning of the course to ensure students have a clear understanding of the goals they need to achieve. This clarity helps students better comprehend the expected learning outcomes and enables them to plan their study schedules more effectively.

(2) Emphasize Assessment and Feedback

Regular assessments should be conducted throughout the teaching process to monitor students' learning progress and outcomes. Timely and constructive feedback based on these assessments should be provided to guide students in improving their study methods and skills.

(3) Foster an Engaging Teaching Atmosphere

Promote active student participation by encouraging discussions, questions, and the exchange of viewpoints. This interactive approach stimulates students' interest in learning, enhances their motivation, and builds their confidence in the subject matter.

(4) Cultivate Self-Directed Learning Skills

Encourage students to independently explore and solve problems, fostering their self-directed learning abilities. These skills equip them with the ability to tackle future academic and professional challenges with greater confidence and competence.

(5) Address Individual Student Needs

Acknowledge and respect the unique needs and learning styles of each student by providing personalized guidance and support. This individualized approach helps students maximize their potential and enhances their overall satisfaction with the learning experience.

OBE is a comprehensive educational system that integrates intricate theoretical frameworks and methodologies, encompassing specialized training programs, syllabi, lesson plans, courseware, and other essential components. While OBE offers significant potential for enhancing educational outcomes, it also faces challenges, including the difficulty of standardizing its implementation, the subjectivity involved in assessing soft skills, and the need for faculty development and adaptation [8]. This study presents a preliminary exploration focused on lesson plan design. By integrating the principles of OBE and Bloom's Taxonomy of Educational Objectives into the instructional design of the "Nutrition and Food Hygiene" course, we aim to enhance pedagogical outcomes. This approach is expected to improve the clarity and focus of teaching objectives, foster students' ability to analyze and solve practical problems, and contribute to their professional development, ultimately elevating the overall quality of education in the preventive medicine field.

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References

[1] Spady WG. Outcome-Based Education: Critical Issues and Answers[M]. Arlington, VA 22209, American Association of School Administrators, 1994.
[2] Wang H, Zhang X, Huang X. The practical value of OBE education concept in sports training[J]. Minerva Medica, 2024,115(3): 390-392.
[3] Iqbal S, Willis I, H. Almigbal T, et al. Outcome-based education: evaluation, implementation and faculty development[J]. MedEdPublish, 2020,9: 121.

ISSN 2522-6398 Vol. 8, Issue 2: 66-71, DOI: 10.25236/FER.2025.080210

[4] Kretzer MM, Oluoch-Suleh E. (Hidden) potentials for African languages in curriculum reforms: examples from Kenya and South Africa[J]. SN Social Sciences, 2022,2(8): 154.
[5] Guo Y, Zhao Q, Cao Z, et al. The influence of tourism and hospitality students' perceived effectiveness of outcome-based education on their VUCA skills[J]. Scientific Reports, 2023,13(1): 8079.
[6] Huang Y, Guo H, Li Y. Study on the construction and practice of blended teaching mode of emergency first aid specialty based on OBE concept[J]. Medicine, 2023,102(28): e34252.
[7] Liang J, Ning X. "OBE" Concept for New Training Mode of Electronic Information Science and Technology Professionals under Big Data Analysis[J]. Computational Intelligence and Neuroscience, 2022,2022(1): 8075708.
[8] Guggari S, Okoye K, Abraham A. Review of Challenges and Best Practices for Outcome Based Education: An Exploratory Outlook on Main Contributions and Research Topics. In: International Conference on Innovations in Bio-Inspired Computing and Applications[C]. Switzerland, Springer Nature, 2022.
[9] Conklin, J. Review of A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives Complete Edition, by L. W. Anderson, D. Krathwohl, P. Airasian, K. A. Cruikshank, R. E. Mayer, P. Pintrich, J. Raths, & M. C. Wittrock. Educational Horizons, 2005,83(3), 154–159.
[10] Rao NJ. Outcome-based Education: An Outline[J]. Higher Education for the Future, 2020,7(1): 5-21.
[11] Becker TB, Lucas J, Li W, et al. Redesign and process of reforming an existing undergraduate Nutritional Sciences program[J]. Advances in Physiology Education, 2020,44(4): 570-578.