



## Research on the application of an anatomy virtual teaching platform based on OBE concept

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### Abstract

This study explores the application and effectiveness of an anatomy virtual teaching platform based on the Outcome-Based Education (OBE) concept in medical education. Traditional anatomy teaching methods face challenges such as the scarcity of cadaver resources, high costs, and limited teaching effectiveness, making it challenging to meet the needs of modern medical education. The virtual teaching research platform utilizes virtual reality (VR) and 3D graphics technology to provide a personalized learning experience through a highly realistic virtual environment. The study designed a virtual teaching platform with 3D anatomical models and interactive experimental tools, with clear learning objectives and evaluation standards set according to OBE principles. The research demonstrates the effectiveness of the OBE-based virtual teaching research platform in anatomy education, offering new directions and tools for the future development of medical education.

**Keywords:** OBE, virtual teaching platform, anatomy education, virtual reality, learning outcome assessment

### Introduction

With the development of medical education, traditional anatomy teaching methods face challenges such as resource shortages, high costs, and limited teaching effectiveness. The emergence of virtual teaching platforms provides new solutions to these problems. Based on the Outcome-Based Education (OBE) concept, virtual teaching platforms aim to improve students' learning outcomes and practical abilities through clear learning outcome orientation. This study aims to explore the application of an anatomy virtual teaching platform based on OBE principles, providing practical solutions for medical education.

### Research Background

#### 1. Current Status and Challenges of Traditional Anatomy Teaching

Traditional anatomy teaching relies on lectures and demonstrations by teachers, with teaching effectiveness often limited by the experience of the teachers and the diversity of teaching methods. Students find it challenging to engage in personalized learning in class, and the teaching pace cannot easily be adjusted for individual differences. Moreover, traditional anatomy courses are highly theoretical, leading to confusion and frustration among students when faced with numerous abstract anatomical terms and complex structures. Especially for students

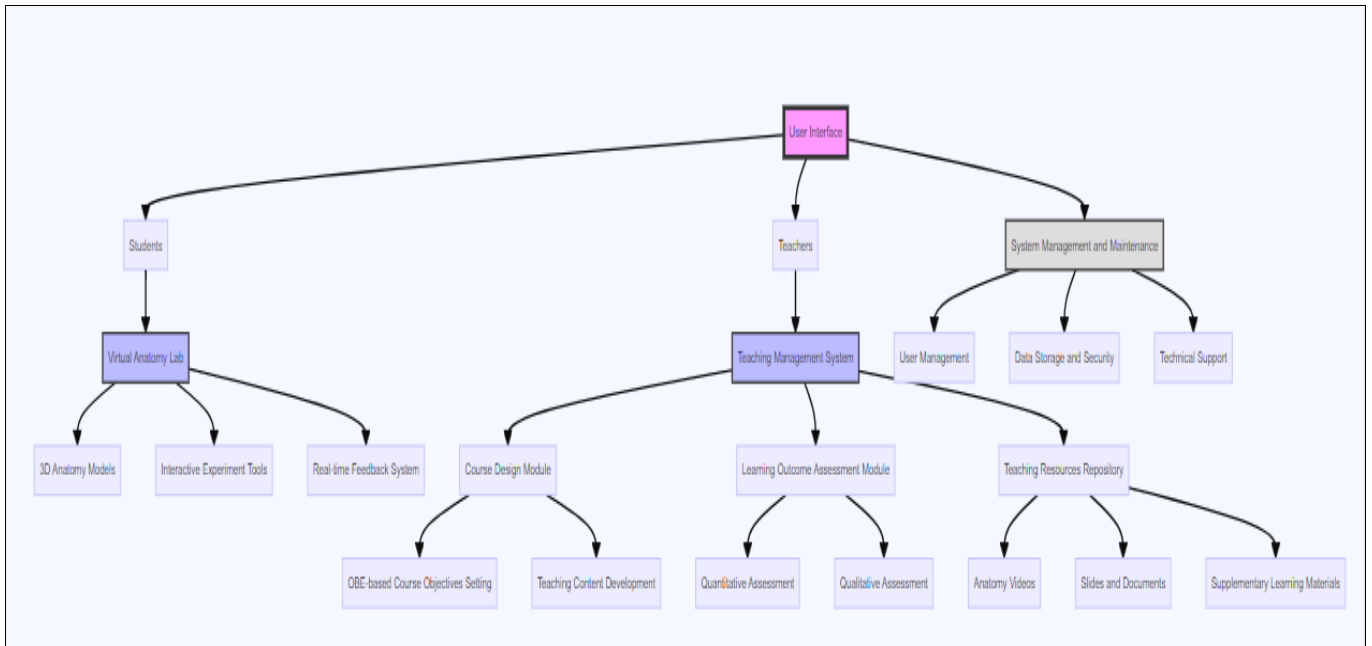
relying heavily on visual learning, it is challenging to understand the three-dimensional human structure through flat images and textual descriptions. In summary, while traditional anatomy teaching has irreplaceable advantages, it also faces significant deficiencies in resources, costs, and teaching effectiveness, necessitating new teaching models and tools for supplementation and optimization.

#### 2. The Rise and Application of Virtual Teaching Platforms

In recent years, with the rapid development of information technology and computer graphics, virtual teaching platforms have become increasingly prevalent in education, particularly in medical education. Virtual teaching platforms utilize VR, AR, and 3D graphics technology to create highly realistic virtual environments where students can interact and operate, enhancing learning engagement and effectiveness. As a typical application of this technology, virtual anatomy teaching platforms overcome many limitations of traditional teaching through realistic 3D human models and interactive learning experiences.

#### Design and Implementation of the Virtual Teaching Platform

1. Platform Configuration (Figure 1) and Functional Module Design (Figure 2)



**Fig 1: Platform Configuration**

**2. Virtual Reality Technology**

**3D Modeling:** Using high-resolution 3D scanning technology to create detailed human anatomy models. The models cover various systems and organs, allowing students to observe and manipulate them from different angles.

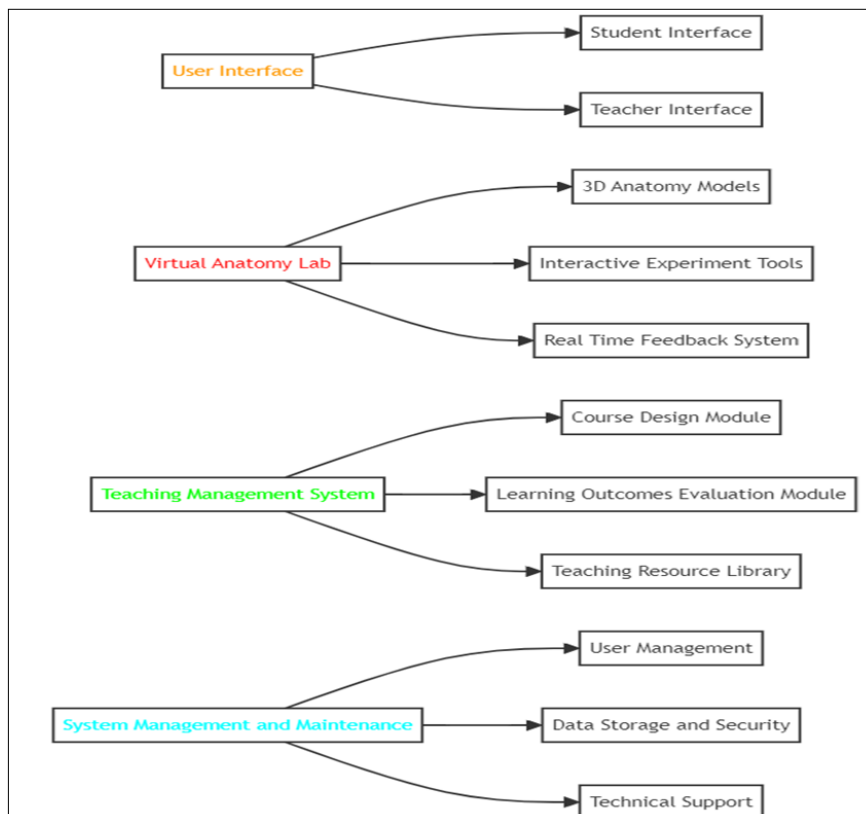
**Virtual Environment Construction:** Designing a realistic virtual laboratory environment where students can learn and operate in an immersive experience. It enhances students' understanding and memory through multi-sensory stimulation, such as visual and auditory inputs.

**3. Teaching Design Based on OBE Principles**

**3.1 Setting Teaching Objectives**

**1. Knowledge Objectives**

"Students can accurately describe the structure and function of the main systems and organs of the human body." This objective emphasizes students' grasp of basic anatomical knowledge. "Accurately describe" indicates that students should memorize and clearly express their knowledge. "Main systems and organs" suggests the scope of the teaching content, including but not limited to the circulatory, respiratory, digestive, etc.



**Fig 2: Functional Module Design**

**2. Skills Objectives**

"Students can apply anatomical knowledge to analyze and assess common sports injuries."

In this skills objective, students must apply anatomical knowledge to practical situations, understanding the positions, functions, and relationships of muscles, bones, ligaments, joints, etc. They should be able to identify common sports injuries, such as sprains, strains, fractures, dislocations, tendonitis, etc., and understand the anatomical structures involved. Students also need analytical and assessment skills to infer the affected anatomical structures based on injury location and symptoms, judge the severity of injuries, and predict possible complications or subsequent effects. To achieve this objective, teaching activities can include case analysis, simulated diagnosis, group discussions, and practical operations, allowing students to apply their knowledge and improve their ability to analyze and handle sports injuries.

**3. Attitude Objectives**

Demonstrate a rigorous scientific attitude, good professional ethics, and empathy in anatomical operations and sports injury analysis. This includes maintaining accuracy and objectivity, cultivating curiosity and critical thinking, respecting life and protecting privacy, being honest, and adhering to ethical norms. Additionally, students should have empathy, empathize with patients, communicate patiently, and collaborate with the team. Professional quality is also emphasized, encouraging continuous learning, responsible attitudes, and self-reflection abilities. The teaching process can adopt diverse methods such as case discussions, role-playing, team projects, ethics courses, and reflection logs to cultivate these attitudes and qualities. Students can develop the necessary professional attitudes and qualities through such comprehensive training.

**3.2. Breakdown of Learning Outcomes**

The learning outcome is "Students can use anatomical knowledge to analyze and assess sports injuries." This is then broken down into specific skill items. Using tools like Bloom's Taxonomy, we set goals at different cognitive levels for each skill item, ranging from remembering and understanding to applying, analyzing, evaluating, and creating. The following are specific use cases that demonstrate the development process of each skill from lower to higher-order thinking (Table.1)

**Table 1:** Different Cognitive Levels of Bloom Taxonomy

	<b>Memory</b>	<b>Comprehension</b>	<b>Application</b>	<b>Creativity</b>
Basic Anatomy Knowledge	List the prominent bones and muscles of the human body	Explain the relationship between joint types and their range of motion	Point out the origin and insertion of specific muscles in a human model	-
Understanding of Sports Biomechanics	-	Describe the basic principles of biomechanics.	Calculate the joint torque in specific movements.	-
Sports Injury Mechanism Analysis	List common types of sports injuries	Explain the mechanisms of various injuries	Infer the injuries that specific sports movements may cause	-
Injury Assessment Skills	-	Interpret the relationship between clinical symptoms and anatomical structures.	Perform standardized physical examination procedures	Design assessment plans for specific sports injuries
Comprehensive Analysis Ability	-	Integrate information from multiple sources to deduce the injured structure.	Propose personalized injury management strategies.	-
Prevention and Rehabilitation Suggestions	Formulate basic preventive measures based on anatomical	Analyze the impact of different rehabilitation training on the injured structure	Assess whether an athlete is suitable to return to competition	Design innovative injury prevention training programs

**Remembering:** Students can recall the names and functions of different muscles and bones.

**Understanding:** Students can explain the anatomical structures involved in common sports injuries.

**Applying:** Students can use anatomical knowledge to identify the specific structures affected in a sports injury case.

**Analyzing:** Students can differentiate between various sports injuries and their impacts on anatomical structures.

**Evaluating:** Students can assess the severity of sports injuries and suggest appropriate medical responses based on anatomical knowledge.

**Creating:** Students can develop a comprehensive rehabilitation plan for a specific sports injury using their understanding of anatomy.

**By structuring objectives in this way, we ensure Gradual Learning Progression:** Helping students build and deepen their knowledge system step by step.

**Guidance for Diverse Teaching Activities:** Enabling teachers to design varied activities to cultivate different levels of thinking.

**Clear Assessment Standards:** Allowing the measurement of student progress across different cognitive levels.

**Encouragement of Higher-Order Thinking:** Motivating students to go beyond mere memory and understanding to apply their knowledge creatively. Based on Bloom's Taxonomy, this structured goal setting provides a clear framework for OBE teaching, achieving comprehensive and in-depth learning outcomes.

**3.3. Design of Teaching Activities**

Design specific teaching activities based on learning outcomes to help students gradually achieve each learning task. Teaching activities should be diverse, Interactive and capable of stimulating students' interest in learning. For example:

	principles			
Professional Communication Skills	Explain the meanings of medical terms	Use appropriate terminology to describe anatomical findings	Use appropriate terminology to describe anatomical findings and write injury reports	Write injury reports for different audiences (e.g., athletes, coaches, medical teams)

**Theoretical Lectures:** Explain core anatomical concepts using multimedia presentations, animations, and videos.

**Virtual Experiments:** Utilize virtual anatomy laboratories for students to Perform simulated dissections and practice what they have learned.

**Group Discussions:** Organize students into groups to discuss learning insights Furthermore, anatomical experiences promote deep understanding.

**Case Analysis:** Help students apply theoretical knowledge to real-world problem-solving by analyzing cases.

### 3.4. Teaching Evaluation and Feedback

**Formative Evaluation:** Throughout the teaching process, use quizzes, classroom questions, and assignments to assess students' learning status timely promptly and provide feedback and guidance.

**Summative Evaluation:** At the end of the course, use comprehensive tests, practical exams, and project reports to evaluate students' knowledge and skill levels fully.

**Self-Evaluation:** Encourage students to self-reflect and self-assess to enhance their autonomous learning and self-management abilities.

**Teacher Feedback:** Teachers provide specific improvement suggestions based on evaluation results and reflect and adjust the teaching design and implementation.

Through the above teaching design process, the anatomy virtual teaching platform based on OBE principles can effectively guide students to achieve the expected learning outcomes, improving the quality and efficiency of anatomy education.

### Conclusion

The effectiveness of the OBE-based virtual teaching platform in anatomy teaching can be enhanced through various improvements and optimizations. Recommendations for platform enhancement include increasing interactivity, introducing personalized learning, adding collaboration features, integrating real-time feedback systems, using multimodal presentations, and constructing virtual laboratories. Optimizing teaching methods could involve innovative approaches such as case-based teaching, flipped classrooms, project-based learning, gamified learning, peer teaching, and virtual seminars. These suggestions aim to enhance student's learning experiences and outcomes, making the virtual teaching platform better serve the OBE principles and achieve the expected learning outcomes.

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