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Exploration of Reform in Seamanship Teaching Based on OBE Model

Yufeng Yang[1,a,*]

[1]*Department of Ship Command, China Coast Guard Academy, Ningbo, China*
[a]*yyf41212@163.com*
**Corresponding author*

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Abstract: Outcome-Based Education (OBE) focuses on cultivating students capabilities as its core, emphasizing the strategy of backward design and forward implementation in the teaching process. Aiming at the problems in traditional seamanship teaching, such as fragmented practice, insufficient technical integration, and shallow practical application, this paper reconstructs the seamanship teaching system based on OBE concepts. It anchors job requirements, builds a three-level outcome-oriented goal system, designs "three-stage progressive" curriculum modules guided by job capability needs, establishes a multi-dimensional evaluation mechanism, and explores a practical teaching path that meets the needs of navigation technology.

1. Deficiencies in Current Seamanship Teaching

Seamanship courses are core courses for navigation technology majors, playing a vital role in cultivating talents capable of operating and maintaining deck equipment on ships. In the teaching process, traditional seamanship teaching shows the following shortcomings.

Firstly, teaching is dominated by single-skill training, with relatively weak comprehensive application capabilities. Sailor's positions such as the deck department require the integrated use of skills like knot, heaving line, mooring, and lifeboat lowering to handle on the complex sea conditions[1]. However, traditional teaching mainly focuses on fragmented training of single skills, lacking systematic real-world scenarios. For example, the seamanship course for navigation technology majors only offers 50 class hours of teaching[2], which has a gap of 130 hours compared to the 180 practical hours required by the "Examination Outline for Able Seaman" in local navigation technology. There is a particular lack of training in complex scenarios such as ship towing cooperating with other ships, mooring operations in adverse weather, and lifeboat lowering. This single-skill-oriented teaching model often leads to students mastering individual skills but being unable to flexibly combine them in real sea conditions. For instance, they can knot proficiently but cannot select appropriate knot types for specific scenarios, resulting in the phenomenon of "being able to knot but not use them correctly."

Secondly, the coverage of virtual simulation technology in seamanship teaching is relatively low.

Although the college has built a navigation virtual simulation platform covering 40% of experimental teaching content, 60% of practical training such as anchor handling, towing operations, and lifeboat lowering still relies on physical operations or real-ship training. Traditional real-ship training has two major limitations, one is the difficulty in replicating high-risk scenarios such as ship collisions, leaving students lacking emergency training in extreme conditions. The other is the high training cost, with a single sea training session for a teaching practice ship costing 50,000 to 80,000 yuan, leading to compressed practical hours.

Thirdly, the integration of virtual and real teaching processes is relatively disjointed. In current teaching, virtual simulation and real-ship training often exist as independent links, lacking a closed-loop design of "virtual preview—simulation training—real-ship verification." For example, students may complete berthing operations in virtual simulation, but during real-ship training, they have a first-time operation error rate of up to 60% because they did not pre-familiarize themselves with the coordination between engine orders and mooring ropes during the ships dynamic movement.

Finally, the evaluation system for seamanship courses is one-sided, leading to a focus on skills over capabilities and results over processes. Assessments mainly focus on skill indicators such as knot speed and heaving line distance, neglecting professional qualities like decision-making ability and safety awareness, resulting in students who can operate but not apply knowledge. For example, knot assessment only selects 12 basic knots, with "completion speed" and "shape correctness" as the sole indicators, without assessing the applicability of knots in actual scenarios.

2. Design of Reform Path for Seamanship Teaching Based on OBE

2.1. Core Concepts of OBE Model

OBE (Outcome-Based Education), proposed by American scholar William Spady[4], is centered on the idea of "starting from students final learning outcomes, backwardly designing teaching goals, curriculum systems, teaching methods, and evaluation mechanisms" to ensure that students achieve expected outcomes through the education process. In seamanship teaching, the OBE model[5,6] requires clarifying the capability requirements of navigation positions and transforming them into quantifiable teaching goals, forming a closed loop of "capability goals—curriculum design—teaching implementation—evaluation feedback."

2.2. Anchoring Job Requirements and Building a Three-Level Outcome-Oriented Goal System

Through research, the core capabilities of seamanship are decomposed into three levels which are basic skills, virtual-real integration, and practical application.

Firstly, this is Basic Skills Layer. Master the basic operations of each module, such as 12 standard[3] knot methods and heaving line operations, with a practical assessment pass rate of over 95% to lay the foundation for seamanship operations.

Secondly this is Virtual-Real Integration Layer. For projects that can be trained using virtual simulation platforms, strengthen virtual simulation training to effectively reduce real-equipment training time and risks. During annual comprehensive internships, operations like berthing and unberthing with mooring lines and mooring/dismooring from buoys can quickly form combat capabilities through virtual-real integration training, saving over 30% of training costs.

The Practical Application Layer refers to competencies aligned with the core tasks of shipboard positions. It requires the ability to comprehensively apply multiple skills in complex scenarios (e.g., emergency anchoring in rough seas, dynamic adjustment of mooring rope tension, and coordinated team division of labor during full-process operations), while maintaining a decision-making error rate below 20% to meet emergency response requirements.

2.3. Constructing a Backward-Designed Curriculum System

Guided by job capability requirements, a "Three-Stage Progressive" curriculum module is designed in Table 1.

Table 1 "Three-Stage Progressive" Curriculum System

Capability Level	Curriculum Module	Core Content	Teaching Carrier	Outcome Mapping
Basic Skills Layer	Basic seamanship Training	Knot training, heaving line operations, rope splicing, rust removal, painting, etc.	Physical teaching aids, standardized training grounds	Single-skill assessment compliance rate ≥95%
Virtual-Real Integration Layer	Independent seamanship Module Training	Ship towing operations, lifeboat lowering training, etc.	Physical teaching aids, integrated ship simulation system	Independent module training compliance rate ≥90%
Practical Application Layer	Ship Scenario-Based Comprehensive Training	Multi-ship collaborative berthing, emergency anchoring in windy waves, dynamic mooring rope tension adjustment, man overboard rescue, etc.	Integrated ship simulation system, teaching practice ship	Complex scenario decision-making accuracy rate ≥80%

This is Basic Skills Training Module. Decompose each basic operation into three stages which are cognition, decomposed practice, and coherent operation. For example, in knot teaching, first use 3D animations to demonstrate knot principles which is cognition, then use detachable knot models for step-by-step assembly which is decomposed practice, and finally complete coherent operations on a simulated deck platform which is anti-interference training.

This is Virtual-Real Integration Module Training. Projects like ship towing and lifeboat lowering are inefficient and risky with pure real-equipment training. The integrated ship simulation training system overcomes these drawbacks, though it cannot fully replace real-equipment training. During lifeboat lowering training, lifeboat lowering devices[7,8] are installed on both sides of the ships bridge in the simulation system to combine the advantages of both and improve teaching effectiveness significantly.

This is Practical Application Module. Focus on the comprehensive application of seamanship, building scenario-based comprehensive training. After completing training on multi-ship collaborative berthing, emergency anchoring in windy waves, mooring rope tension adjustment, and man overboard rescue in the simulation system, use teaching practice ships for practical application and verification to test students combat capability formation.

3. Establishing a Multi-Dimensional Feedback Evaluation System

Based on OBE continuous improvement principle, a "Three-Dimension and Four-Stage" evaluation model is constructed in Table 2.

Table 2 OBE-Based Evaluation System for Seamanship Teaching

Evaluation Dimension	Assessment Form	Weight	Outcome Corresponding	Typical Case
Basic Skills	Sub-item Practical Operation Assessment	30%	Single-skill operation proficiency	Knot assessment, Complete 6 specified knots within 41 seconds with ≥90% accuracy
Practical Ability	Virtual Scenario Decision-Making + Real-Ship Drill Evaluation	50%	Comprehensive application capability in complex conditions	Ship berthing drill, Complete stopping, parallel berthing, inertia control, mooring adjustment, and team division within the specified time with ≤2 decision-making errors
Professional Quality	Process Record + Team Collaboration Evaluation	20%	Safety awareness, communication ability	Deduct 10 points per violation of safety operation procedures during real-ship training

4. Conclusion

The OBE model provides a scientific framework for the reform of seamanship teaching. Through backward design of goals, forward implementation of teaching, and continuous improvement of evaluation, it effectively solves problems in traditional teaching such as fragmented practice, insufficient technical integration, and shallow practical application. Guided by job capability requirements, the design of "three-stage progressive" curriculum modules and the establishment of a multi-dimensional evaluation mechanism have significantly improved students practical abilities and professional qualities in practice, achieving a paradigm shift from "skill training to capability cultivation."

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