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Research on Innovative Blended-Teaching Mode of Maritime English from the Dual Perspectives of Industry-Education Integration and the "Three-Teaching" Reform

Xiang Huang

Jiangsu Maritime Institute, Nanjing, Jiangsu 211170, China

ABSTRACT

Against the backdrop of the Maritime Power strategy, the continuous updates of IMO conventions and PSC inspection standards raise higher requirements for seafarers' job-oriented competence in maritime-English. As a core ESP course for maritime majors, Maritime English is confronted with problems including insufficient implementation of the "Three-Teaching" reform, disconnection between online and offline teaching, shortage of practical-training scenarios, and superficial industry-education integration. Its teaching needs to cater to two differentiated learner groups: full-time vocational-college students and on-the-job seafarers for further education. Supported by the Community of Inquiry Model and situated-learning theory, this paper draws on domestic and international vocational-education reform outcomes and existing studies on maritime-related ESP courses. It constructs a three-stage closed-loop blended-teaching mode: pre-class autonomous research-learning - VR-based virtual scenario training - industry-education-integrated active classroom, specifies implementation details concerning platforms, class-hour allocation and school-enterprise collaboration, and carries out small-scale pilot practice. Preliminary practice shows that the mode has potential value for improving job-related English competence and classroom-engagement experience, and can provide references for the curriculum reform of maritime-related English courses.

KEYWORDS

Maritime English; Blended teaching; The "Three-Teaching" reform; Industry-education integration; Stratified teaching; Vocational education.

1. BACKGROUND

China's shipping industry keeps expanding in scale. Merchant-fleet and port businesses are deeply integrated into the global-trade system, and international shipping puts forward continuously upgraded requirements for seafarers' comprehensive vocational competence. Maritime English directly serves post duties such as ship-watch-keeping communication, Port-State-Control(PSC)inspections, maritime-emergency disposal and maritime-report composition. Seafarers' English competence bears a direct relation to navigation safety and the efficiency of maritime-dispute settlement, and constitutes an indispensable core vocational competence for maritime talents.

In the field of vocational education, the "Three-Teaching" reform and classroom revolution keep being promoted. Proposals such as integrating posts, courses, competitions and certificates and deepening industry-education integration have been advocated to drive vocational education from scale expansion to connotation-oriented quality improvement. Maritime-English teaching serves two learner groups with distinct learning characteristics. One group refers to full-time students majoring

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in maritime-technology and marine-engineering in higher vocational colleges. The other group consists of on-the-job seafarers receiving further-education training. On-the-job seafarers are faced with realistic features such as fragmented learning time and prominent work-study conflicts, while full-time students lack post-practice experience. Uniform teaching arrangements can hardly satisfy the learning foundations and development demands of the two groups.

Traditional Maritime-English classes have long been dominated by textbook intensive-reading, vocabulary and grammar lectures, laying stress on the memorization of linguistic knowledge points while weakening practical-scenario operational training. On-campus hardware can hardly reconstruct real-world working scenarios such as ship-bridge communication and PSC on-board inspections, resulting in limited practical-training conditions. Enterprises have low participation in curriculum development, and teaching-content updates lag behind new standards of maritime conventions and port inspections. Blended teaching can give consideration to the flexibility of online learning and the strengths of offline hands-on training, providing a feasible path for solving the bottlenecks in Maritime-English teaching.

Some existing studies on maritime-related ESP courses have paid attention to blended modes and curriculum optimization, yet stratified implementation practices targeting learners with different learning backgrounds still need further deepening. Accordingly, this study focuses on stratified cultivation for the two groups of learners with differentiated learning backgrounds, constructs a three-stage closed-loop blended-teaching mode, clarifies key elements for mode operation, and conducts small-scale pilot-practice so as to deliver implementable solutions for Maritime-English curriculum reform.

2. DOMESTIC AND INTERNATIONAL RESEARCH STATUS

2.1 International Research Status

In terms of blended-learning theories, Garrison et al. put forward the Community of Inquiry (CoI) model. It establishes a three-dimensional analytical framework of social presence, teaching presence and cognitive presence, serving as a classic analytical tool for distance and blended-learning[1]. It emphasizes the construction of learning communities and the design of diverse interactive activities to eliminate learners' sense of isolation and facilitate deep-learning. The original literature of this model lays a theoretical foundation for blended-teaching evaluation, and numerous subsequent online-learning studies adopt it as an analytical framework.

In respect of vocational-education industry-education collaboration, the American P-TECH (Pathways in Technology Early College High School) mode builds a trinity collaborative-education mechanism covering secondary-school, higher-education institutions and enterprises. Enterprises get deeply involved in the whole chain including curriculum development, practical-training-project design, workplace-based learning and assessment. It cultivates not only hard post-competences but also workplace soft-skills such as communication and collaboration, breaking down barriers between school education and industrial posts. Its official public report elaborates on its operational procedures and implementation conditions[2]. Germany's "Dual-System" and Britain's "Sandwich-Mode" both stress practical training based on real-work scenarios and transform post-work tasks into curriculum units.

In the field of technology application, VR/AR virtual simulation is widely adopted in high-risk and high-cost practical-training fields such as maritime affairs and medical care. Role-playing in virtual-scenarios makes up for the limitations of real-world practical-training conditions. Nevertheless, overseas seafarer education is based on local maritime-laws and seafarer-training systems. Its teaching contexts differ from the post-demands of domestic shipping enterprises. Relevant modes cannot be directly transplanted and require localized adaptation.

2.2 Domestic Research Status

In the domestic blended-teaching field, Yu Ting constructs a three-ladder mode of “autonomous learning - interactive virtual learning - classroom teaching” taking English courses as the carrier. It applies the CoI model to improve three kinds of presence, and points out realistic pain-points such as work-study conflicts and delayed online Q-and-A among non-full-time learners[3]. Its activity-design ideas provide references for online interactive sessions in Maritime-English teaching.

From the perspective of vocational-education practical-training reform, Yu Yuefan et al. propose an online-offline virtual-real integrated blended-training mode, and put forward implementation paths including collaborative lesson-preparation by school-enterprise teachers and mutual access to process-data. It verifies the value of virtual-simulation in making up for shortages of practical-training equipment and scenarios, yet its research object focuses on engineering practical-training courses without adaptive transformation for linguistic ESP courses[4]. Zhou Limin puts forward construction paths for positive classes in higher-vocational English, and proposes improvement strategies targeting problems such as insufficient class participation and weak language output[5]. Jiang Huan et al. introduce the American P-TECH mode and sort out its collaboration mechanism, providing international references for domestic vocational-education industry-education integration[6]. However, most domestic relevant references stay at the level of conceptual introduction, lacking localized implementation transformation for Maritime-English courses.

Cui Ling systematically interprets the connotation of the "Three-Teaching" reform, and puts forward collaborative-reform paths for teachers, teaching materials and teaching methods, highlighting the practical significance of loose-leaf textbooks and dual-teacher teams[7]. Zhang Qihong explores implementation paths for curriculum-ideological-and-political construction in higher-vocational colleges[8]. Guo Shuo confirms the effectiveness and existing limitations of virtual-reality technology in vocational-skill training through meta-analysis, offering references for VR-supported training in linguistic courses[9].

Focusing on Maritime-English-specific studies, Yang Cen and Jin Zhiru construct the "TFT" blended-teaching mode for maritime-related ESP courses, supplying direct references for process-design of online-offline Maritime-English sessions[10]. From the perspective of the New Liberal-Arts initiative, Yang Yang and Shi Xiaojie put forward optimization paths for curriculum-content, teaching-resources and evaluation-systems of maritime-related ESP courses[11]. Chen Rong and Gao Yueqin point out that learners of Maritime-English have huge gaps in learning foundations, and stratification and classification constitute critical paths to break the drawbacks of one-size-fits-all teaching. However, existing stratified schemes lack complete and implementable closed-loop blended-teaching design[12].

Literature review and research gaps: Existing studies have yielded abundant outcomes in blended teaching, virtual-real practical training, industry-education integration, maritime-related ESP courses and stratified-classified talent cultivation. Still, three deficiencies remain. First, most Maritime-English reforms only target full-time students, lacking complete closed-loop stratified teaching design covering both full-time students and on-the-job further-education seafarers. Second, mode construction tends to be conceptual combination, lacking implementable details such as class-hour allocation, platform selection and school-enterprise organizational-operation rules. Third, relevant teaching practices are mostly experience summaries, without standardized illustration of research tools and discussion of confounding variables. Given the above-mentioned gaps, the incremental contribution of this study lies in: based on the two groups of Maritime-English learners with differentiated learning backgrounds, adaptively reorganizing the three-ladder-teaching framework, virtual-real practical-training and industry-education-integration concepts, emphasizing stratified-task design, specifying implementable operational details, and discussing confounding variables emerging in practice.

3. DILEMMAS AND CAUSE ANALYSIS OF CURRENT MARITIME-ENGLISH TEACHING

3.1 Superficial Implementation of the "Three-Teaching" Reform and Insufficient Effectiveness of Dual-teacher Education

For teachers: Most full-time Maritime-English teachers have foreign-language-literature backgrounds, yet lack front-line maritime-practice experience. Their command of the latest PSC inspection practices and updated IMO-convention contents is limited. Captains and senior-seafarers assigned by enterprises possess solid post-practical experience, while they receive little training in educational theories and curriculum design, and are weak in learning-situation control and classroom-organization. Schools lack normalized joint teaching-research mechanisms, ship-board follow-up practice for teachers and teaching-training for enterprise mentors, so the advantages of dual-teacher collaborative education cannot be brought into full-play.

For teaching materials: Mainstream commercial Maritime-English textbooks have long updating cycles and obvious disciplinary characteristics. They attach great importance to general-text content but lack first-hand post-materials such as PSC-inspection records, English maritime-accident reports and cross-cultural-conflict-handling cases. The construction of school-based loose-leaf and work-manual-style teaching-resources targeting post-tasks lags behind, and teaching-content updates cannot keep up with iteration of industrial standards.

For teaching methods: Most classes follow the traditional path of “lecture-memorization-exercise-drill”. Scenario-simulation and project-based tasks account for a small proportion. Classroom interaction becomes formalistic, students receive knowledge passively, and language-output training is insufficient, making it hard to build positive-classroom atmosphere. Although some studies have realized the necessity of stratification and classification, supporting stratified objectives, stratified tasks and stratified evaluation are inadequate in real-world practice, and stratified teaching becomes a mere slogan.

3.2 Lack of Closed-loop Process-logic in Blended-teaching Design and Disconnection between Online and Offline Teaching

Though blended teaching has been carried out in some colleges, teachers merely upload courseware and videos onto platforms. Online tasks are confined to watching videos and finishing objective exercises, without exploratory and interactive practical-training assignments. Online-learning data are only used for attendance statistics rather than learning-situation diagnosis, and cannot guide offline-teaching design in reverse. Offline classes still repeat knowledge-point explanation instead of conducting targeted special training for weaknesses exposed in online sessions. Online and offline teaching are decoupled, and the value of blended-teaching cannot be fully realized.

3.3 Restricted Practical-training Hardware and Insufficient Post-scenario Linguistic Practice

Maritime-English is a highly scenario-dependent course. Nevertheless, campuses cannot restore real-world working contexts including bridge communication, on-board PSC inspection and maritime-emergency communication. Traditional teaching relies on reading textbook dialogues with weak scenario immersion. The application of VR virtual-simulation is limited to simple scenario demonstration, without interactive practical-training tasks designed for linguistic-communication objectives. Students commonly show the competence defect that “they can understand texts but fail to listen to and speak appropriately in real-world scenarios”.

3.4 Insufficient Depth of Industry-education Integration and Misalignment between Courses and Post-requirements

Drawing lessons from the P-TECH mode, in-depth industry-education integration requires enterprises to participate in the whole chain of curriculum objectives, teaching-content, practical-training-projects and evaluation criteria. At present, industry-education cooperation of Maritime-English mostly stays at the level of enterprise lectures and student-site-visits. Post-English-competence standards formulated by shipping enterprises have not been systematically transformed into curriculum-teaching requirements. Enterprise experts seldom take part in curriculum-design and assessment, so there exists misalignment between course-content and real-post-demands.

3.5 Distinct Learner-background Divergence and Poor Adaptability of One-Size-Fits-All Teaching

Two categories of teaching objects are identified. Full-time higher-vocational students have systematic study time but no ship-board-practice experience, and their cognition of maritime-scenarios is limited. On-the-job further-education seafarers have front-line post-experience. Their learning demands focus on solving real-world ship-board problems, yet ship-board work brings prominent work-study conflicts, unstable network conditions and fragmented learning time. Existing courses lack stratified-teaching objectives and stratified practical-training tasks. Uniform teaching arrangements fail to satisfy differentiated demands of the two groups.

3.6 Superficial Integration of Curriculum-ideological-and-political Elements and Separation between Value-shaping and Competence Cultivation

Curriculum ideological-and-political education mostly adopts the pattern of attaching ideological-and-political slogans after knowledge-points. Maritime-safety awareness, professional responsibility and the aspiration for a powerful maritime-nation are not embedded in post-tasks and practical-training scenarios. Knowledge-imparting, competence-cultivation and value-shaping are separated from each other, making it impossible to realize trinity talent-education.

4. CONSTRUCTION OF THE THREE-STAGE CLOSED-LOOP BLENDED-TEACHING MODE FOR MARITIME ENGLISH

Supported by the Garrison Community of Inquiry Model, situated-learning theory and work-process-oriented curriculum concept, targeting two groups of differentiated-background learners: full-time on-campus students and on-the-job further-education seafarers, this paper draws on three-ladder-teaching frameworks, virtual-real practical-training, P-TECH industry-education-collaboration experience, maritime-related-ESP blended-teaching mode and stratified-classified talent-cultivation concepts. A three-stage closed-loop blended-teaching mode is constructed: pre-class autonomous research-learning (online stratified foundation-building) - VR-based virtual scenario training (online interactive empowerment) - industry-education-integrated active classroom (offline quality improvement). Platform selection, class-hour allocation and organizational-operation rules are specified, together with a multi-dimensional evaluation system.

4.1 Stage 1: Pre-class Autonomous Research-Learning (Online Stratified Foundation-Building)

As the pre-positive online teaching phase, this stage accounts for 25 % of total class hours. Superstar Learning Platform is adopted as the general online-teaching platform. All learning resources are provided with offline downloadable packages to cope with poor ship-board network conditions.

(1) Stratified resources and stratified-task design: School-enterprise dual-teachers jointly develop loose-leaf learning-task sheets, covering five major modules: ship-watch-keeping communication, PSC port-state inspection, maritime-emergency rescue, maritime-document composition and cross-cultural port-communication. The proportion of general English content is appropriately reduced, while first-hand post-real-world corpus is increased.

- For full-time students: Master maritime-terminology memorization and reading of post-oriented texts to build cognition of maritime-working scenarios.

- For on-the-job further-education seafarers: Review English-communication weaknesses combined with their own ship-board experience and sort out real-world post-communication problems.

(2) Learning-support services: Implement on-duty Q-and-A at staggered time slots. Full-time teachers answer linguistic-knowledge questions; enterprise mentors interpret post-practical affairs. The platform automatically collects process-data such as learning duration, exercise accuracy and forum-discussion messages, generates learning-situation briefings, sorts out common-problems and provides references for subsequent teaching.

4.2 Stage 2: VR-based Virtual Scenario Training (Online Interactive Empowerment)

This stage occupies 35 % of total class hours. A maritime-specialized VR Maritime-English practical-training system is selected as the practical-training carrier. It embeds typical scenarios including bridge-operation, on-board PSC inspection and maritime distress, and supports role-playing, oral-speech recording and process-data export. Centered on the Community of Inquiry Model, social presence, teaching presence and cognitive-presence are promoted simultaneously.

(1) Build social presence and set-up intra-class learning-communities: Group-tasks are carried out only within each class, without cross-class mixing. Inside each class, learners share real-world ship-board communication cases or cooperate in scenario deduction, eliminating the sense of isolation in online-learning and building mutual-assistance learning-communities.

(2) Build teaching presence and implement flexible stratified practical-training guidance:

- For full-time-student groups: Focus on standard-dialogue training under regular post-scenarios to consolidate basic communicative expressions.

- For on-the-job-seafarer groups: Lay emphasis on high-order-tasks such as emergency-fault disposal and cross-cultural-dispute resolution.

Teachers adopt think-aloud demonstrations to show analytical thinking of maritime-texts. Pop-up questions, scenario-jumps and other interactive-designs are embedded in teaching videos to strengthen process-guidance.

(3) Build cognitive presence and carry out exploratory virtual-tasks: Complete role-playing, simulated PSC on-board inspection, maritime-distress communication and maritime-document composition inside the VR simulation environment. The system records the whole process of oral-speech output and task disposal. Intra-class self-assessment, peer-mutual-evaluation and dual-teacher online-commentary are organized to guide learners to discuss expression defects and promote knowledge internalization and transfer. All practical-training process-data are exported for offline-teaching.

4.3 Stage 3: Industry-Education-Integrated Active Classroom (Offline Quality Improvement)

This stage accounts for 40 % of total class hours, co-taught by full-time English teachers and senior-seafarer enterprise mentors. Enterprise mentors undertake 40 % of teaching tasks in this stage. The two groups take offline classes separately.

(1) Learning-situation review and reconstruction of systematic-knowledge framework: Targeting common-problems such as terminology-misuse and confused emergency-communication-logic identified from online autonomous-learning and VR-training data, centralized explanation is delivered, together with personalized tutoring for individual weaknesses. Mind-maps are applied to integrate fragmented Maritime-English knowledge into systematic knowledge graphs.

(2) Project-driven introduction of real-world enterprise-cases: Enterprise mentors bring real-world shipping-enterprise projects and assign comprehensive open-ended tasks adapted to class-specific learning backgrounds, such as full-process English responses for PSC on-board-inspection, composition of maritime-accident English reports and simulation of cross-cultural-port-conflict disposal. Group-discussion, scenario-performance and result-defense are organized following work-process-orientation, meanwhile cultivating collaborative, critical-thinking and other professional soft-skills.

(3) Organic integration of curriculum ideological-and-political education: Cultivate rigorous professional-attitude through ship-safety-cases; foster the aspiration for a powerful maritime-nation relying on achievements of China's shipping-industry development; cultivate rule-awareness and professional responsibility of great-power seafarers through international-maritime-communication scenarios, so as to realize trinity education of knowledge-imparting, competence-cultivation and value-shaping.

4.4 Construction of Multi-dimensional Closed-Loop Evaluation System

Abandon the single final-written examination. Build a multi-dimensional evaluation system with 60 % process-oriented evaluation and 40 % result-oriented evaluation. Evaluators include full-time teachers, enterprise mentors, student self-assessment and peer-mutual-evaluation. Evaluation dimensions cover professional knowledge, post-English competence, professional quality and ideological-and-political performance. Different evaluation benchmarks are set for the two groups to implement stratified-classified evaluation.

- Process-oriented-evaluation indicators: online autonomous-learning, VR-virtual-training performance, group-project outputs and class participation.

- Result-oriented-evaluation indicators: post-scenario practical-assessment and comprehensive evaluation of maritime-document composition.

Enterprise mentors score practical-training items in accordance with shipping-industry post-standards to realize alignment between evaluation criteria and industrial post-requirements.

4.5 Detailed Implementation Guarantees for the Mode

(1) Dual-teacher and organizational-operation mechanism: Referring to the P-TECH mode, establish a Maritime-English Curriculum-Construction Steering-Committee[6]. Its members include 2 full-time Maritime-English teachers, 2 captains / senior-seafarers from shipping enterprises and 1 information-technology specialist. Regular meetings are held every two months, whose responsibilities cover reviewing curriculum objectives, updating loose-leaf-task resources, auditing VR practical-training projects and revising evaluation-standards. A two-way training system is built:

full-time teachers shall complete no less than 2 weeks of ship-board follow-up practice every year; enterprise mentors shall receive no less than 16 hours of special teaching-skill training annually.

(2) Teaching-material-resource guarantee: Establish a dynamic-updating mechanism for school-based loose-leaf resources. The committee renews case-banks and practical-training-tasks annually in accordance with updated IMO conventions and PSC-inspection-rules, and supports term-banks, micro-lecture resource-banks and FAQ-banks. Iterate resources continuously in compliance with new-liberal-arts requirements for maritime-related ESP courses[11].

(3) Platform and institutional guarantee: Ensure stable operation of Superstar Learning Platform and VR Maritime-English practical-training-system, and enable automatic collection and export of process-data. Colleges shall issue incentive-systems for school-enterprise collaboration, clarifying payment standards and assessment criteria for enterprise-mentors.

5. IMPLEMENTATION EFFECTS

Exploratory action-research is adopted in this small-scale practice. Separate classes are selected for full-time-student group and on-the-job-seafarer group respectively. No traditional parallel-control-group is set up. The practice focuses on testing the feasibility of the complete three-stage mode in two independent classes rather than inter-group statistical comparison. Conclusions should be generalized with caution because of limited sample-size and confounding variables.

5.1 Practice Objects and Scheme

Two independent classes from a local higher-vocational college are selected for the practice.

(1) Full-time-student class: 23 students, majoring in maritime-technology, receiving on-campus full-time education.

(2) On-the-job-seafarer further-education class: 21 seafarers receiving off-job further-education; some of them suffer from poor-network-conditions after returning to ships.

The practice lasts for 16 weeks, 4 class-hours per week. The complete three-stage closed-loop blended-teaching mode proposed in this paper is implemented for both classes. Intra-class grouping is adopted without cross-class interaction. Adapted-tasks are assigned respectively for full-time students and on-the-job-seafarers, together with offline resource-packages for the seafarer group.

Limitation statement: Two new variables including VR-training equipment and regular dual-teacher teaching are introduced in the experimental scheme. Independent effects of VR hardware and dual-teacher teaching cannot be separated. Only the comprehensive effect of the whole set of mode can be observed. Multi-group controlled experiments are required in follow-up studies to separate independent effects of each variable.

5.2 Research Instruments

(1) Questionnaire: Revised from existing questionnaires for positive English classes and vocational-education practical-training. The scale contains 22 items with 5-point Likert-scale scoring. Pre-test is conducted among 32 students of relevant majors before formal practice, yielding Cronbach's $\alpha = 0.821$ and KMO = 0.743, which shows acceptable reliability and validity. Dimensions cover suitability of learning-resources, class-participation experience, practical-training-gain, perception of alleviated work-study conflicts and ideological-and-political gain. Questionnaires are distributed separately in the two classes after courses, only for descriptive qualitative-analysis without statistical inference.

(2) Academic outputs: Collect post-scenario practical-tasks, maritime-document assignments and online-practical-training records of both classes as process-materials for qualitative-analysis, without score-comparison between classes.

(3) Semi-structured interviews: Interviewees include 2 full-time teachers, 2 enterprise-mentors, 4 students selected randomly from each class (4 full-time students, 4 on-the-job seafarers). Open-coding thematic-analysis is performed after transcription of interviews.

5.3 Process-oriented Findings (Qualitative Description, No t-test)

(1) Full-time-student class: Most students finish all phases of tasks. VR-simulation practical-training effectively compensates for their lack of ship-board-experience. Some students show obvious deficiencies in logical expression when facing high-order emergency-oriented tasks, which needs further reinforcement in offline-classes. Students give positive feedback on visualized VR-scenarios and mind-map knowledge-organization.

(2) On-the-job-seafarer further-education class: Practical-training proceeds smoothly during centralized on-campus study. After returning to ships, some seafarers are restricted by ship-board-network-conditions and can hardly use VR-modules, while offline text-based resource-packages enjoy higher usage frequency. Seafarers generally hold positive attitudes towards staggered-time Q-and-A and post-oriented-tasks. Nevertheless, peer-mutual-evaluation tends to be formalistic and needs refined evaluation rubrics.

(3) Online-behavior observation: Intra-class group-discussions gain certain activity-level in both classes. The phenomenon of passive video-browsing is alleviated compared with traditional resource-push-only teaching.

5.4 Thematic-coding Results of Interviews

Four core themes are extracted from open-coding of interview transcripts.

(1) Teaching pertinence: Teachers can rapidly identify common-problems of the whole class based on process-data exported from VR-training, improving pertinence of offline-class-teaching.

(2) Post-relevance: Enterprise-mentors comment that students are capable of organizing English-expression combined with business-logic, and mechanical recitation of textbook-dialogues decreases.

(3) Differentiated gains of two groups: Full-time-students acknowledge that VR-simulation lowers the threshold of accessing real-world maritime-scenarios. On-the-job seafarers affirm the support brought by offline-resources and staggered-time Q-and-A for fragmented-learning, meanwhile pointing out network-restrictions on-board for VR-modules.

(4) Common practical-barriers: High-frequency coded barriers include “unstable ship-board network”, “inconsistent classroom-organization competence of partial enterprise-mentors”, “peer-mutual-evaluation tends to be formalistic”.

5.5 Practical Limitations Revealed in the Practice

(1) Ship-board network conditions exert direct constraints on the effect of VR-practical-training modules, so alternatives under low-network-conditions must be provided.

(2) Even after training, partial enterprise-mentors still show uneven classroom-organization competence.

(3) Group peer-mutual-evaluation is prone to formalism and must be supported by detailed and operable evaluation-rubrics.

(4) This is action-research with limited sample-size. VR hardware and dual-teacher-teaching are confounding-variables. Generalization of conclusions shall be prudent.

6. CONCLUSION

Against the background of the Maritime-Power-strategy, Maritime-English teaching has to cope with practical contradictions including disconnection between courses and post-requirements, insufficient practical-training-conditions and prominent divergence among learner backgrounds. Synthesizing achievements in blended-teaching, virtual-real practical-training, P-TECH industry-education-integration, maritime-related ESP courses and stratified-classified talent-cultivation, this study takes stratified closed-loop teaching design for two independent-classes as its incremental contribution point. The three-stage closed-loop blended-teaching mode of "pre-class autonomous research-learning - VR-based virtual scenario training - industry-education-integrated active classroom" is constructed, with implementable specifications including platform-selection, class-hour allocation, steering-committee operation and multi-dimensional-evaluation.

Through 16-week action-research respectively carried out in full-time-student class and on-the-job-seafarer further-education class, it is proved that the whole-set mode framework is feasible in both classes. It can improve class-participation experience and satisfy differentiated learning-demands of different-background learners to a certain degree. Restricted by the nature of action-research, limited sample-size, ship-board-network-constraints, uneven competence of enterprise-mentors and formalism risks of peer-evaluation, conclusions shall not be over-generalized.

Follow-up work includes expanding the number of practical-teaching classes in multiple rounds of action-research; optimizing alternative practical-training schemes under low-network-conditions; refining rubrics for peer-mutual-evaluation; normalizing the operation of curriculum-steering-committee and iterating the mode continuously, so as to support cultivation of international-oriented high-quality maritime talents.

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