

Research on AI-Enabled Project-Based Teaching Integrating Ideological and Political Education in a Maritime-Oriented Big Data Technology Major

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Abstract: To address the weak alignment between business contexts and data tasks, the concentration of ideological and political education in introductory activities, and insufficient evidence for process assessment in the big data technology major at maritime-oriented higher vocational colleges, this study develops an AI-enabled framework that integrates a smart shipping business strand with a maritime data project strand. The framework connects the development of professional values and attributes with technical skills training. Using port vessel waiting-time analysis based on Automatic Identification System (AIS) data as an example, teaching is organized into four stages: business understanding, data processing, analysis and interpretation, and solution refinement. Commitment to national development, truth-seeking, safety responsibility, collaboration, and green development are incorporated into requirements analysis, trajectory processing, indicator interpretation, and solution improvement. AI helps identify connections between business contexts and tasks, provides differentiated guidance, and organizes process evidence, while teachers verify facts and assessment judgments. In this way, ideological and political education is reflected in students' technical practices and professional judgments. The proposed framework offers a reference for integrating ideological and political education into project-based teaching in the maritime-oriented big data technology major.

Keywords: Artificial Intelligence; Maritime Orientation; Big Data Technology; Curriculum-based Ideological and Political Education; Project-Based Teaching.

1. Introduction

Integrating ideological and political education in all courses is an important means of fulfilling the fundamental educational mission of cultivating virtue and developing students' character. The Guidelines for Integrating Ideological and Political Education into Higher Education Curricula require the integration of values development, knowledge instruction, and competence development [1]. The Opinions on Deepening the Reform of Key Elements of Vocational Education Teaching further call for identifying ideological and political education elements that reflect industry characteristics and occupational requirements, and for developing resource repositories and teaching case repositories [2]. These requirements provide a policy basis for maritime-oriented higher vocational colleges to translate shipping industry resources into disciplinary teaching content.

Previous research has explored both the integration of ideological and political education with project-based teaching and the development of industry-specific educational resources. In project-based teaching, Tao et al. propose a strategy that combines framework, content, and teaching methods across the stages of project implementation. By restructuring course content and resources, they incorporate values education into project-based course development [3]. For a data mining course, Deng et al. combine case-based and project-based approaches to deliver ideological and political education alongside disciplinary instruction. Their work provides a reference for coordinating the development of knowledge, skills, and professional values through data projects [4]. These studies indicate that ideological and political education requires an integrated design encompassing project objectives, task content, and

implementation processes, so that values are enacted in students' specific problem-solving activities.

Regarding the incorporation of industry characteristics, Zhai argues that curriculum-based ideological and political education should reflect institutional positioning and talent development objectives. Industry development cases, exemplary professionals, and representative achievements can be used to develop educational resources and support a distinctive, systematic approach [5]. Drawing on the characteristics of the energy and electric power industries and an introductory information security course, Li et al. explore the integration of industry characteristics with ideological and political education through faculty development, content design, and teaching implementation [6]. For a group of waterborne pollution prevention courses, Hao et al. identify educational elements in collaborative governance among ships, ports, and regulatory authorities. They develop a system with two objectives and two strands that combines values development with the enhancement of thinking skills [7]. These studies suggest that industry characteristics can supply educational materials while also providing business contexts, professional standards, and criteria for value judgments in disciplinary tasks.

Building on this research, the present study translates maritime industry resources into project tasks for a big data technology major and develops a framework integrating a smart shipping business strand with a maritime data project strand. The business strand uses industry stories and occupational requirements to develop professional values and attributes, while the project strand develops technical skills through maritime data processing. AI supports business interpretation, task design, differentiated guidance, and evidence organization, sustaining the connection between the

two strands across business understanding, data processing, analysis and interpretation, and solution refinement. The study seeks to embed safety responsibility, truth-seeking, collaboration, and green development in students' data operations, interpretation of findings, and evaluation of alternative solutions. It provides a teaching design reference for industry-oriented higher vocational colleges seeking to integrate technical skills development with ideological and political education.

2. Designing Project-Based Teaching with Integrated Ideological and Political Education

2.1. Learning Objective Design

The learning objectives are derived from the talent development requirements of the maritime-oriented big data technology major, translating smart shipping job requirements into technical skills objectives and ideological and political education objectives. Taking the course Applied Big Data Analysis Technology as an example, the skills objectives encompass business requirements analysis, AIS data processing, trajectory identification, statistical analysis, and communication of results. The values objectives include commitment to national development, truth-seeking, safety responsibility, collaboration, and an understanding of green

development. The two sets of objectives are connected through observable learning behaviors. For example, checking anomalous data demonstrates rigor and a commitment to accuracy; explaining the limits of conclusions demonstrates safety responsibility; and analyzing stakeholder coordination and environmental impacts in proposed solutions demonstrates collaboration and concern for green development. These connections provide a basis for subsequent task organization and assessment.

2.2. Project Design

As shown in Figure 1, project design is informed by course objectives, smart shipping job requirements, and students' prior knowledge. Typical problems in vessel operations, port activities, and shipping services are selected, and verified industry stories, professional standards, and data resources are translated into teaching content. The smart shipping business strand focuses on developing professional values and attributes, while the maritime data project strand focuses on technical skills training. The two strands are connected through shared business problems: occupational requirements guide the design of data tasks, and analytical evidence supports business judgments. Ideological and political education is thereby embedded in requirements analysis, procedural compliance, and the selection of solutions, establishing a project structure in which professional development and skills training reinforce each other.

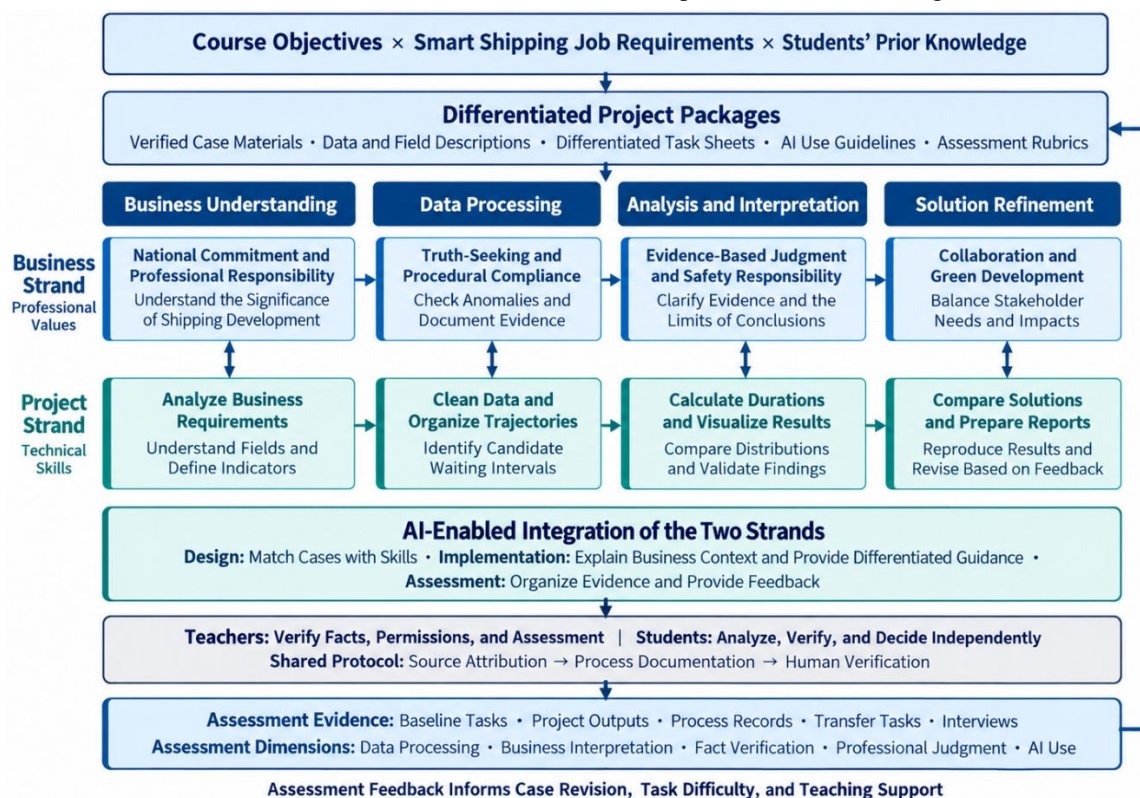


Figure 1. An AI-enabled project-based teaching framework integrating professional values and technical skills through maritime business and data project strands

2.3. Assessment Design

Assessment dimensions, evidence requirements, and methods are specified in advance in relation to the learning objectives. The dimensions encompass data processing, business interpretation, fact verification, professional judgment, and appropriate AI use. Skills assessment focuses on operational accuracy, analytical soundness, and

reproducibility, while the assessment of professional values and attributes examines the basis for processing decisions, judgments about responsibility, and choices among solutions. Both draw on process records, analytical reports, and revision explanations, but apply distinct criteria. Baseline tasks, project assessment rubrics, and transfer tasks are designed, and learning outcomes are evaluated through both team outputs and individual performance. AI helps organize

evidence and draft feedback, while teachers review assessment judgments, establishing a feedback mechanism that supports continuous project improvement.

3. Implementing Project-Based Teaching with Integrated Ideological and Political Education

3.1. Project Context and Resource Preparation

Taking Applied Big Data Analysis Technology as an example, the proposed teaching project examines port vessel waiting times using AIS data. AIS can provide information on vessel identity, position, speed, and navigational status. The project is situated in a period of concentrated vessel arrivals and associated service demands. Materials on port and shipping development, collaborative services, and green shipping help students understand the industry significance of data work. Students identify waiting intervals, conduct group-based comparisons, and develop improvement suggestions, learning to interpret results and support business needs under safety and resource constraints.

The resources consist of authorized, de-identified AIS data or clearly labeled simulated data. They include anonymized vessel identifiers, timestamps, latitude and longitude, speed over ground, navigational status, and vessel type where available. Spatial information describing anchorage and berth boundaries is also provided. Where conditions permit, port operation records are supplied for verification. Teachers distinguish factual reports from teaching adaptations and simulated scenarios, and specify data permissions and limitations. AI helps organize connections between stories and data fields, while teachers and industry practitioners review business interpretations to prevent conjecture from being presented as fact.

3.2. Business Understanding and Clarification of Project Requirements

Teaching begins with two questions: why do vessels wait after arriving at a port, and what activities can waiting-time analysis support? Students read business materials on coordinated port services and identify concerns from the perspectives of vessel operators, port operators, and service departments. By comparing needs related to vessel scheduling, berth utilization, and service coordination, students recognize that similar waiting patterns may arise under different operating conditions. They therefore need to specify the intended users and the scope of the problem before beginning analysis. Teachers guide students in translating the broad aim of improving port efficiency into analyzable questions, such as how waiting times differ across vessel types or whether longer waiting periods are concentrated in particular time windows. Students are discouraged from using waiting time alone to assess the performance of a particular department.

AI helps explain business terminology, organize operational processes, and identify data fields potentially relevant to the analytical questions. Students verify AI responses against field descriptions and business materials supplied by teachers. They provisionally define the units of analysis, time range, and conditions marking the beginning and end of waiting, distinguishing analyses supported by the available data from judgments that require additional information. Each group prepares a project requirements statement and draft indicators, specifying their purpose,

required fields, operational definitions, and issues awaiting confirmation. Subsequent processing tasks are finalized through discussion and teacher review.

Ideological and political education is incorporated into requirements discussions and the clarification of operational definitions. Using port and shipping development cases, teachers guide students in understanding the significance of accurate data analysis for shipping services and industry development, strengthening their professional identification with service to the industry. Comparing the needs of different occupational roles develops perspective-taking and collaboration. Questions about whether safety conditions may be disregarded to shorten waiting times, or whether causes can be assigned when data are insufficient, help students translate safety responsibility and a commitment to factual accuracy into analytical boundaries and indicator descriptions. At this stage, attention is paid to whether students respect business facts, actively verify uncertainties, and define problems cautiously, establishing a clear business basis for subsequent skills training.

3.3. Data Processing and Training in Procedural Compliance

Students standardize time and coordinate conventions, check for duplicate records, missing values, abrupt position changes, and reporting gaps, and organize trajectories by vessel identifier and time. They identify candidate waiting intervals by considering anchorage boundaries, low-speed stationary behavior, navigational status, and subsequent berthing trajectories. They explain the basis for the thresholds, avoid classifying all low-speed or anchored states as waiting, and retain the original and cleaned data together with processing rule records.

AI helps propose cleaning approaches, debug code, and flag anomalies. Students verify its suggestions by checking sampled records and document their reasons for accepting or rejecting them. Tasks progress from template-based operations to independently refining rules and processing complex trajectories, with anomaly review required at every level. Teachers explain that processing errors can affect business judgments and incorporate truth-seeking, procedural compliance, and safety responsibility into technical practice. Students must not arbitrarily delete or modify records to make results appear more attractive, conceal missing data or uncertainty, or disregard data access permissions and privacy requirements. A traceable and verifiable processing workflow provides observable evidence of professional integrity.

3.4. Analysis and Interpretation and the Development of Evidence-Based Judgment

Students calculate the durations of candidate waiting intervals, compare medians and distributions across vessel types and time periods, re-examine anomalous samples, and test how thresholds and the treatment of reporting gaps affect conclusions. When supporting records are unavailable, results are described as estimated anchorage waiting durations, with the associated uncertainty stated explicitly. AI suggests comparison perspectives and verification questions, while students independently validate findings using code, trajectories, and operational records, producing an evidence-supported analytical account.

Teachers organize discussions about whether longer waiting times can be attributed to a department's low efficiency and whether the data are sufficient to explain

congestion. A scientific approach, professional fairness, and safety responsibility are integrated into the interpretation of conclusions. Students are guided to distinguish correlation from causation, avoid overstating results or concealing errors, and refrain from assigning responsibility without evidence. They consider coordination needs from the perspectives of vessel operators, port operators, and service departments, and specify the conditions under which analytical recommendations apply. Evidence verification and the revision of views develop a professional commitment to factual accuracy and accountability for conclusions.

3.5. Solution Refinement and the Enactment of Professional Responsibility

Students use their analyses to propose improvements such as information sharing and coordinated appointment scheduling, comparing the applicable conditions, stakeholder needs, and safety constraints. AI helps organize supporting evidence, potential impacts, and information requiring further collection. Students independently justify their proposals, and teachers review them. Discussion of efficiency, safety, and environmental effects develops an orientation toward safety first, collaborative service, and green development. Students learn that technical solutions should accommodate the reasonable needs of all parties. Where energy consumption data are absent, changes in waiting time must not be equated directly with emissions reductions; cautious reporting provides evidence of environmental responsibility.

Each group submits code, charts, reports, source documentation, AI use records, and a verification checklist, and presents and defends its work. Teachers vary thresholds or sample conditions to examine students' independent analytical competence. Students reproduce results in response to questions, revise solutions, and explain the basis for revisions and their individual contributions. Professional integrity, team responsibility, and the pursuit of quality are incorporated into the delivery of project outputs. Students are expected to disclose limitations accurately, acknowledge collaborative contributions, and correct errors proactively, thereby enacting professional responsibility in responding to business needs.

4. Conclusion

To address the weak alignment between business contexts and data tasks, the concentration of ideological and political education in introductory activities, and insufficient evidence for process assessment in the maritime-oriented higher vocational big data technology major, this study develops an AI-enabled teaching framework that integrates two strands across business understanding, data processing, analysis and interpretation, and solution refinement. Smart shipping contexts and industry stories support the development of professional values and attributes, while AIS data projects organize technical skills training. Commitment to national development, truth-seeking, safety responsibility, collaboration, and green development are translated into requirements statements, anomaly checks, result interpretation, and solution revision. AI assists material matching, differentiated guidance, and evidence organization. Teachers verify facts and assess performance, while students independently conduct key analyses and verify results. Source attribution, process documentation, and human verification

sustain values education throughout professional tasks and provide evidence for assessing technical skills and professional development together.

At present, the study has produced a teaching design and implementation plan; its applicability and educational effects still require classroom pilot testing. Future work will combine baseline tasks, project outputs, transfer tasks, and interviews to examine changes in students' data processing, business interpretation, fact verification, and professional judgment, with particular attention to independent analysis and responsible application in unfamiliar contexts. Teaching evidence will also inform ongoing refinement of business materials, task difficulty, AI feedback, and assessment rubrics. The approach may subsequently be extended to projects involving vessel operations, port activities, and green shipping, providing a practical reference for project-based teaching with integrated ideological and political education in maritime-oriented majors.

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