 DOI: 10.19601/j.cnki.issn1943 - 9903.2026.04.009

A Study on Course Reform and Implementation of Integrating Theory and Practice in Environmental Impact Assessment Course

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Abstract Addressing prevalent issues in Environmental Impact Assessment education, including the gap between theoretical instruction and practical application, as well as insufficient hands-on training, this study reconstructs an integrated teaching framework grounded in the Outcome-Based Education (OBE) philosophy. The revised course defines clear competencies for applied talent development and embeds ideological and political dimensions within the coursework. By incorporating up-to-date legal statutes and real-world cases, the approach employs diverse pedagogies, including case-based and project-based learning, within a four-stage instructional sequence: theory acquisition, case analysis, practical implementation, and oral defense. In addition, a multi-faceted evaluation system encompassing continuous assessment, practical performance, and a comprehensive final examination has been instituted. Practical implementation indicates that this reform significantly strengthens students' theoretical knowledge, practical skills, and innovative capacity, yielding substantial improvements in teaching effectiveness.

Key words Environmental impact assessment, Teaching reform, Integration of theory and practice, OBE concept, Diversified assessment

0 Introduction

The national initiative to construct a "Beautiful China" has precipitated historic, pivotal, and sweeping changes in both the theory and practice of ecological civilization, raising the bar for the training of environmental specialists. The Environmental Impact Assessment (EIA) course, which tightly couples theoretical knowledge with practical application, integrates interdisciplinary content, including legal frameworks, technical guidelines, engineering analysis, and management principles. As a cornerstone of environmental degree programs, it aims at strengthening students' professional preparedness and competitive edge. Yet, conventional instructional approaches have increasingly exposed critical shortcomings: a disconnect between course goals and real-world demands, inflexible teaching methods, and a lack of hands-on practice[1-3]. Addressing these deficiencies through pedagogical reform to bolster student competencies has thus emerged as a central challenge in higher environmental education. Consequently, the continuous refinement and innovation of the EIA course are of considerable practical import.

Through a critical analysis of deficiencies in current EIA instruction, this paper proposes an innovative, theory-practice integrated course framework that addresses teaching content, pedagogical approaches, and assessment systems. The objective is to foster students' comprehensive understanding and systematic mastery of China's EIA-related legal statutes, regulatory policies, institutional structures, and evaluation techniques. Ultimately, the reform seeks to cultivate the capability to utilize core EIA principles and methodologies in the analysis and assessment of environmental consequences arising from real-world engineering projects.

1 Background of course teaching reform

Environmental Impact Assessment is a required core course within the Environmental and Ecological Engineering course, integral to the synthesis of disciplinary knowledge and the cultivation of both practical proficiency and professional acumen. The course is customarily delivered to third-year undergraduates majoring in environmental sciences, who have by this stage developed a foundational theoretical repertoire, intellectual curiosity, and preliminary hands-on capabilities. Foundational courses, including Water Pollution Control Engineering, Air Pollution Control Engineering, Noise Pollution Control Engineering, Ecology, and Environmental Monitoring, have typically been completed, affording students the requisite conceptual underpinnings. Nonetheless, a prevalent shortcoming in certain universities is a teaching paradigm that privileges theoretical exposition over applied practice. This imbalance leaves students with few opportunities to engage in substantive analytical work, impeding their ability to adeptly deploy theoretical tools such as technical guidelines, impact prediction methods, and evaluation frameworks in the resolution of authentic EIA challenges.

The EIA course is inherently interdisciplinary and application-driven, though certain concepts remain notably abstract. The extensive reliance on mathematical formulations and predictive modeling, especially in pollution baseline analysis and impact forecasting, skews the course heavily toward theoretical exposition, which often dampens students' intrinsic engagement. Learners typically exhibit resistance toward overly theoretical or didactic

Received: February 2, 2026 Accepted: April 5, 2026

Supported by the Project of Henan Provincial Science and Technology Research Project (252102320110), Doctoral Research Foundation of Pingdingshan University (PXY-BSQD-2022032, PXY-BSQD-2023043) and Enterprise Commissioned Projects (PXY-HX-2025216-1).

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delivery, and this limited enthusiasm constrains the reciprocal enrichment of teaching and learning[4]. Compounding this issue, the evaluation process within the course necessitates intricate trade-offs among economic viability, environmental integrity, and social equity. The breadth and synthetic nature of the material impede students from cultivating a holistic, intuitive grasp of the subject, thereby undermining their ability to operationalize theoretical knowledge in addressing real-world engineering challenges[5]. Furthermore, EIA instruction must navigate a dense thicket of domestic laws, regulations, and policy instruments, yet instructional resources frequently lag behind the rapid evolution of legal statutes, quality standards, and technical directives. In the practicum setting, authentic EIA endeavors involve labyrinthine regulatory clearances and delicate stakeholder negotiations; students are consequently confronted with barriers such as data unavailability, methodological ambiguities in guideline application, and interpersonal friction within project teams. These constraints often reduce EIA practice components to perfunctory exercises rather than substantive, project-grounded experiences[6-7]. Finally, a persistent reliance on summative, closed-book final examinations in many universities marginalizes formative and performance-based assessment, thereby offering an incomplete portrait of student competencies[8].

2 Ideas of teaching reform

Adhering to the Outcome-Based Education (OBE) philosophy, the course employs a "reverse design, forward implementation" approach. By moderately curtailing theoretical lectures and expanding the allotment for practical design activities, it establishes an integrated teaching framework that systematically aligns four key components: learning objectives, course content, instructional methods, and assessment strategies.

2.1 Making clearing the course objectives With the overarching goal of developing applied professionals proficient in EIA report compilation, engineering analysis, environmental impact prediction, and relevant professional ethics, the course delineates graduation requirements into a set of quantifiable and assessable course-level learning objectives[9].

The course seamlessly weaves professional content with ideological and political education, subtly yet purposefully cultivating sound values in students. Anchored in the principle of fostering virtue through education, it systematically unearths the ideological and political resonance inherent in disciplinary knowledge. Throughout the instructional sequence, the following themes are embedded: the historical insight that ecological vitality underpins civilizational flourishing; the scientific worldview of human-nature symbiosis; the green development ethos epitomized by the maxim "Lucid waters and lush mountains are invaluable assets"; the holistic perspective of integrated ecosystem management encompassing mountains, rivers, forests, farmlands, lakes, grasslands, and deserts; key national initiatives such as the "Air Ten" and "Water Ten" action plans; and contemporary policy imperatives including the advancement of a Beautiful China, the promotion of green transitions, the pursuit of harmonious human-nature coexistence, the protection of air, water, and soil quality, and the enhanced management of solid waste and emerging contaminants.

The course emphasizes in-depth engagement with key policy documents, including the *Report of the 20th National Congress of the Communist Party of China* and the *Guidelines of the CPC Central Committee and the State Council on Advancing the Comprehensive Development of a Beautiful China and Excerpts on Xi Jinping's Construction of Ecological Civilization of Socialism*. Throughout specific course modules, ideological and political dimensions are concretized through illustrative case studies. For example, students are presented with an adverse scenario wherein a company prioritized economic profit over environmental stewardship during an EIA process, prompting a critical discussion on the real-world implications of the maxim "lucid waters and lush mountains are invaluable assets." Similarly, in the module on Ecological Impact Assessment, the conservation efforts at Baigui Lake Wetland Park serve to demonstrate the operational principles underpinning the "holistic protection and systematic governance of mountain, river, forest, farmland, lake, grassland, and desert ecosystems." This case-based, contextual approach enlivens the integration of ideological education, fostering in students a proactive EIA consciousness, a broader systemic outlook, and a deepened commitment to sustainable development, all of which are integral to their comprehensive formation.

2.2 Restructuring the course content Attention is devoted to ensuring the currency of instructional materials through the assimilation of up-to-date legal statutes, technical directives, and real-world industry cases, alongside the incorporation of emerging knowledge and contemporary issues. Classroom delivery is organized in a scientifically grounded and efficient manner. In alignment with the ongoing evolution of China's EIA regulatory framework, the course is subject to continual refinement, with learning priorities and challenging concepts explicitly highlighted. The organization and synthesis of material across chapters are undertaken to systematically illustrate both the guiding principles and the demonstrated outcomes of EIA development in China.

In the teaching process, close attention is paid to the latest environmental and ecological hotspots in China, including EIA for emerging pollutants and carbon emission impact assessment under the dual-carbon goals. The instruction covers the current status of environmental elements such as water, atmosphere, and ecology in China, models for predicting and evaluating the status of different environmental elements, and the latest advances in new technologies and methods for pollution treatment, thereby underscoring the necessity of EIA. Real-world EIA cases are integrated into classroom instruction, and a sense of immersion and interactivity is enhanced through approaches such as role-playing and simulated re-

view meetings. Furthermore, project-driven practical teaching is adopted to innovate and optimize the course knowledge system. While imparting textbook knowledge, the course uses actual EIA projects as a vehicle for students to work in groups on the preparation of EIA documentation. This approach guides students to explore knowledge independently, enhances their ability to analyze and solve problems autonomously, cultivates their aptitude for innovative scientific research, and strengthens their engineering practice capabilities.

2.3 Comprehensively using teaching methods The course is structured around 22 h of theoretical coursework complemented by 10 h of hands-on practice, following a sequential four-phase instructional framework: theoretical instruction, case deconstruction, project-based practice, and culminating presentation with oral defense. A range of pedagogical strategies is deployed in the classroom setting, encompassing case-driven exploration, heuristic guidance, active participation, and interactive engagement. Collectively, these methods serve to invigorate student motivation and foster the capacity for autonomous problem identification, analysis, and resolution.

2.3.1 Case-based teaching. Case-based teaching, characterized by its experiential, heuristic, and practical nature, has become a pivotal approach in the reform and innovation of the EIA course. To enhance teaching effectiveness and bridge the gap between theory and practice, the course utilizes the "Xuexitong" platform to implement a three-stage progressive instructional process comprising "pre-class preparation—in-class discussion—post-class consolidation and analysis." Before class, typical EIA case materials are released in advance to guide students in independently consulting the latest regulations, standards, and technical methods, thereby enabling them to complete preliminary analyses and scheme designs and fostering their ability to identify problems. During class, group discussions and debates are organized within smart classrooms to stimulate students' enthusiasm for exploration and hone their capacity to solve practical problems. After class, systematic summaries and evaluations are conducted based on the discussion outcomes, with a particular focus on analyzing the strengths and weaknesses of various proposed solutions, thereby enhancing students' dialectical thinking and empirical spirit in addressing complex engineering challenges. Throughout this process, students remain the central focus, and their initiative is fully mobilized, ensuring that each student deeply engages with the case scenarios and, through task-driven learning, gains a profound understanding of the essence of EIA while experiencing the satisfaction of applying knowledge to practice.

2.3.2 Heuristic teaching. The traditional role of a teacher encompasses three pillars: transmitting the Way, imparting knowledge, and resolving perplexities—with "transmitting the Way" (the methodology of inquiry and problem-solving) holding primacy. In this course, the conventional emphasis on mere content delivery will be supplanted by a pedagogy centered on "methodology." Knowledge itself will serve as the medium through which students are initiated into the "Way of scholarship"—equipping them with scientific frameworks for analysis and solution-generation, and thereby establishing a robust foundation for subsequent research and innovation. Students will be actively encouraged and mentored to participate in the instructor's ongoing environmental impact assessment research initiatives. Furthermore, by leveraging applied projects that directly support local economic development, the course will curate a selection of illustrative, research-infused instructional modules. Representative topics include investigative studies on ambient air pollution in the Pingdingshan area and surface water quality assessments within the Baigui Lake National Wetland Park. This deliberate integration cultivates a dynamic interplay between teaching and scholarly inquiry. The derived content not only exemplifies core EIA techniques but also exhibits strong practical relevance, investigative depth, and disciplinary rigor, all of which serve to amplify student engagement and intellectual curiosity.

2.3.3 Participatory teaching. Adhering to the "student-centered" philosophy, this approach enables students to actively engage in the course instruction. By leveraging the "Xuexitong" platform, online teaching resources for the Environmental Impact Assessment course are constructed. For relatively straightforward chapter content, newly promulgated national policies and standards, and issues arising from actual EIA cases, relevant learning tasks are assigned both in the classroom and online. Students are encouraged to engage in autonomous learning, to consult pertinent professional materials, and to compose reflective summaries of their learning experiences. Following group division, a designated group representative delivers a presentation at the podium, after which different groups engage in mutual questioning and exchange of ideas. The instructor then provides evaluative commentary based on the students' responses and the quality of the ensuing discussion. Using this method, the primacy of the student as the subject of learning is fully realized, thereby stimulating their intrinsic motivation and subjective initiative in the exploration and acquisition of knowledge.

2.3.4 Interactive teaching. During the instructional process, interaction with students is facilitated through multiple channels such as classroom questioning and discussion. This approach aims to guide and encourage students to proactively analyze and solve problems, thereby stimulating their enthusiasm for learning. It enables two-way information communication and exchange between teacher and student, as well as among students themselves, thereby cultivating students' thinking skills, expressive abilities, communication competence, innovative spirit, and team spirit.

2.3.5 Instruction combining lectures and self-study. The key points and difficult sections of the course are systematically planned, with portions designated for student self-study clearly identified. During classroom sessions, instruction is concentrated on the pivotal and challenging content of each chapter. Specialized

assignments are subsequently distributed both in class and via the "Xuexitong" platform, requiring students to independently study China's latest environmental laws, regulations, technical guidelines, and related policies and institutional frameworks outside of class in order to derive answers to the assigned tasks. This approach is designed to encourage and supervise students' autonomous learning and active thinking, thereby cultivating their capacity for problem analysis and resolution.

2.4 Improving the course assessment system The course has established a diversified assessment mechanism comprising "process evaluation + practical competency evaluation + final examination evaluation." Assessment components including classroom performance, group reports, and practical projects are incorporated to form a comprehensive, multi-dimensional evaluation system that holistically appraises student learning outcomes. Specifically, process performance accounts for 20% of the total score. Leveraging the "Xuexitong" platform, this component focuses on assessing students' effectiveness in self-directed learning and their ability to analyze and solve problems, with grading based on chapter tests and assignment completion. Practical performance constitutes 40% of the total score, with emphasis on evaluating students' capacity to apply EIA technical guidelines in resolving authentic EIA problems. The final examination contributes the remaining 40% and adopts an open-book format. Grounded in specific environmental impact assessment case scenarios, this examination primarily assesses students' ability to comprehensively apply knowledge to address practical challenges. Following the examination, papers are graded according to established scoring rubrics and reference solutions. The attainment of course objectives is finally calculated and analyzed by integrating students' process performance, practical performance, and final examination results, thereby identifying emergent issues and informing continuous course improvement.

5 Achievements in teaching innovation

5.1 Improvement of students' learning effect Through the detailed analysis of students' examination results, we can clearly see the positive impact of teaching innovation on students' knowledge mastery. For example, when learning the technical methods of environmental impact assessment, students used to memorize mechanically and did not have a deep understanding of its principles and application scenarios. Through the introduction of practical case analysis and project-based learning, students can use these technical methods in practice, deeply understand their principles and applicable conditions, and improve the achievement of course goals. In a class discussion on atmospheric environmental impact assessment, students were able to accurately analyze the advantages and disadvantages of different atmospheric diffusion models in combination with practical cases, and select appropriate models for prediction, analysis and evaluation according to the characteristics of the project, which fully reflects that students' mastery of knowledge has changed from superficial memory to in-depth understanding and flexible application.

5.2 Enhancement of students' practical ability The achievements and performance of students in practical projects strongly prove that teaching innovation has significantly improved their practical ability. In the environmental impact assessment project of the Baigui Lake Wetland Park around the school, students need to carry out pollution source investigation and environmental impact analysis. They used their knowledge to formulate a detailed investigation plan, conducted in-depth field investigation, and collected a large number of first-hand data. Through the analysis and processing of these data, the students accurately identified the main pollution sources and environmental impact factors around the wetland park, and put forward targeted environmental protection measures and suggestions.

5.3 Enhancement of students' innovative ability In course teaching, by introducing teaching methods such as project-based learning and group cooperative learning, students are encouraged to think actively and dare to put forward their own ideas and suggestions. In the group discussion on the environmental impact assessment of a landfill project, in view of the possible environmental risks, students use different big data platforms to assess the environmental impact from the whole process of project construction, operation and closure, and put forward targeted mitigation measures. These innovative ideas not only broaden the thinking of problem solving, but also provide a new perspective and method for environmental impact assessment.

6 Conclusions

The theory-practice integrated Environmental Impact Assessment course distinguishes itself through marked pedagogical innovation, having undertaken a systematic overhaul of the course in terms of learning objectives, content architecture, instructional approaches, and evaluation protocols. This comprehensive reform has effectively mitigated persistent deficiencies observed in conventional EIA teaching. By seamlessly weaving ideological and political dimensions into the fabric of professional instruction, the course fosters the internalization of appropriate ethical and civic values among students. Consistent with a learner-centered ethos, the deployment of diverse teaching modalities, most notably case-based learning and interactive engagement, dismantles the traditional paradigm of passive knowledge reception. In its place, the course propels students toward self-directed inquiry, hones their capacity for critical reasoning, and equips them with the essential competencies to independently discern, scrutinize, and address complex problems. In conclusion, this pedagogical framework provides a firm and enduring groundwork for nurturing a new generation of innovative and practice-ready professionals.

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Table 1 Evaluation of teaching effectiveness using the case library (*n*, %)

Evaluation project	Experimental group (*n* = 30)	Control group (*n* = 26)
Fostering students' interest for learning	27 (90.00)	18 (69.23)
Enhancing the classroom learning environment	26 (86.67)	19 (73.08)
Improving the capability for autonomous learning	26 (86.67)	15 (57.69)
Improving learning efficiency	25 (83.33)	16 (61.54)
Deepening the understanding and mastery of theoretical knowledge	30 (76.67)	21 (80.77)
Expanding students' knowledge	27 (90.00)	15 (57.69)
Training innovative thinking skills and capabilities	25 (83.33)	18 (69.23)
Enhancing the capacity for problem analysis and resolution	26 (86.67)	17 (65.38)
Fostering a spirit of teamwork	24 (80.00)	17 (65.38)
Developing skills in communication and interpersonal exchange	28 (82.35)	20 (76.92)
Developing competencies in the application of theoretical knowledge and practical diagnostic skills	28 (93.33)	16 (53.85)

4 Conclusions

The development and implementation of a case library can assist students in constructing a comprehensive knowledge framework, addressing the deficiencies inherent in traditional teaching materials regarding theory and practice. This approach enhances the practical engagement and critical thinking within postgraduate teaching, thereby significantly improving students' abilities in theoretical application and diagnostic practice. Furthermore, this teaching method reinforces the interdisciplinary integration of molecular pathology and histopathology, fostering the cultivation of postgraduate students' innovative capacities and clinical competencies. Moving forward, it is imperative to further refine the development and utilization of innovative cases, which hold considerable potential for broader application in postgraduate aquaculture curricula.

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