



Ocean Literacy in Vocational Tourism Education: A Conceptual Framework for Blue Curriculum Design

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Abstract. This conceptual review examines the integration of ocean literacy into vocational tourism education through blue curriculum design, addressing the critical gap between marine environmental competencies and tourism professional preparation. The study employs a conceptual review methodology, synthesizing peer-reviewed literature from Web of Science, Scopus, ScienceDirect, and other major databases published between 2015-2025, using thematic analysis to develop a comprehensive framework for ocean literacy integration in vocational contexts. The research proposes an integrated framework comprising three core competency domains: cognitive understanding of marine ecosystems, affective connection to ocean environments, and behavioral skills for sustainable tourism operations operationalized through five pedagogical approaches: place-based experiential learning, work-integrated learning, problem-based learning, interdisciplinary integration, and digital technologies. Implementation requires four critical mechanisms including curriculum architecture with spiral and horizontal integration strategies, authentic assessment designs, educator capacity building through professional development, and strategic partnerships among educational institutions, tourism industry, and marine conservation organizations. The framework identifies six primary challenges including curriculum crowding, educator capacity gaps, and resource constraints, alongside emerging opportunities from UN Ocean Decade policy momentum, industry sustainability demands, and technological enablers. This research contributes theoretical bridging of ocean literacy education and vocational pedagogy while providing practical guidance for curriculum developers, educators, policy makers, and industry stakeholders seeking to develop ocean-literate tourism professionals capable of advancing sustainable coastal and marine destination management in climate-vulnerable environments.

Keywords: blue curriculum design, ocean literacy, vocational tourism education.

1 Introduction

Coastal and marine tourism represents the largest maritime economic sector, accounting for 33% of the blue economy globally, with tourism exports contributing 30-

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L. Animatul Chisbiyah and S. Zahro (eds.), *Proceedings of the International Conference on Innovation in Food Science, Culinary Art, and Fashion Technology (INNOFATEC 2025)*, Advances in Social Science, Education and Humanities Research 973,

https://doi.org/10.2991/978-94-6463-908-7_14

85% of GDP in Small Island Developing States [1]. However, this rapid growth coincides with severe environmental pressures, exemplified by the Mediterranean Sea facing biodiversity loss and overfishing affecting 90% of fish stocks [2]. Despite the UN Decade of Ocean Science (2021-2030) calling for ocean literacy integration in formal education systems globally, national curricula worldwide demonstrate concerning absence of marine content, while vocational tourism education remains constrained by overcrowded curricula, staff resistance to sustainability, and lack of standardized frameworks for ocean literacy competencies [3, 4].

Ocean literacy research has expanded rapidly since 2005, with bibliometric analyses revealing diverse interdisciplinary contributions and 122 studies predominantly focusing on physical ocean understanding [5]. Methodologically, studies have employed cross-cultural comparisons, survey instruments like SOLE for measuring teacher literacy, and structural equation modeling demonstrating that environmental knowledge positively influences pro-environmental behaviors in tourism contexts [6, 7]. Previous research established seven essential ocean literacy principles, demonstrated effectiveness of marine education interventions, and examined the Portuguese Blue School model as a replicable framework, while identifying critical success factors including industry partnerships and student-centered approaches in sustainable tourism education [8, 9].

Critical gaps persist as systematic investigation of ocean literacy in vocational tourism training remains absent, with existing research focusing on university-level programs rather than shorter-duration vocational contexts with distinct pedagogical challenges [10, 11]. The disconnect between ocean literacy frameworks emphasizing scientific understanding and vocational education's competency-based paradigm has not been adequately operationalized, while research has concentrated on curriculum content rather than pedagogical strategies or assessment methodologies specific to apprenticeship and work-integrated learning models [12]. Advancing integration requires bridging marine science education, sustainability pedagogy, and vocational training theory, with urgent needs for translating ocean literacy dimensions into measurable competencies aligned with industry standards, investigating effective pedagogical approaches for vocational contexts, and exploring assessment strategies beyond knowledge-testing to capture attitudinal development and practical application [13].

This conceptual review addresses these gaps by examining theoretical foundations and practical considerations for integrating ocean literacy into vocational tourism education through blue curriculum design, synthesizing knowledge from ocean literacy education, sustainable tourism pedagogy, and vocational training theory to propose a conceptual model for developing ocean-literate tourism professionals [14]. The review systematically analyzes how ocean literacy principles can be operationalized within competency-based frameworks, explores pedagogical approaches suited to vocational contexts including experiential learning and industry partnerships, and identifies implementation considerations including curriculum integration strategies and teacher professional development requirements. This research contributes to education for sustainable development discourse by addressing the marine dimension of environmental literacy in tourism professional preparation, offering guidance for curriculum developers, educators, policy makers, and industry stakeholders enhancing environmental competencies of future tourism professionals in climate-vulnerable coastal destinations.

2 Method

2.1 Research Design and Data Sources

This study employs a conceptual review methodology, a systematic approach to synthesizing and critically analyzing existing theoretical and empirical literature to develop new conceptual frameworks and identify research directions, particularly appropriate for emerging interdisciplinary fields requiring theoretical consolidation [15, 16]. Literature was sourced from multiple academic databases including Web of Science, Scopus, ScienceDirect, Taylor & Francis, Springer, Emerald Insight, and Frontiers, using a combination of keywords organized into three thematic clusters: (1) ocean literacy terms ("ocean literacy," "marine literacy," "blue literacy," "ocean education"); (2) tourism education terms ("tourism education," "vocational tourism," "hospitality education," "tourism training"); and (3) curriculum and sustainability terms ("curriculum design," "sustainable tourism education," "environmental literacy," "blue economy," "competency framework"), with searches limited to English-language peer-reviewed publications from 2015-2025 to capture contemporary developments aligned with the UN Sustainable Development Goals era and the Ocean Decade.

2.2 Data Analysis and Synthesis

Publications were included if they addressed ocean literacy, marine environmental education, or coastal tourism education concepts; discussed vocational education, tourism training, or competency development frameworks; examined curriculum design, pedagogical approaches, or sustainability integration in tourism education; and were published in peer-reviewed journals, conference proceedings, or official reports from recognized organizations between 2015-2025. Data analysis followed a thematic synthesis approach involving three iterative stages: (1) initial coding extracting key concepts, definitions, theoretical frameworks, and empirical findings; (2) descriptive theme development identifying patterns across literature representing conceptual foundations, curriculum design principles, competency frameworks, implementation challenges, and research gaps; and (3) analytical theme construction synthesizing findings across disciplines to develop the conceptual framework for blue curriculum design, integrating ocean literacy principles with vocational education theory, tourism industry requirements, and sustainability pedagogy.

2.3 Framework Development and Validation

The conceptual framework emerged through iterative synthesis drawing on established frameworks including the Ocean Literacy Framework (seven essential principles), Education for Sustainable Development competency models, and vocational qualification frameworks, incorporating: (1) identification of core ocean literacy competency dimensions adapted for vocational contexts; (2) mapping competencies to tourism industry skill requirements in coastal/marine settings; (3) specification of pedagogical approaches aligned with vocational education principles; (4) delineation of curriculum integration strategies; and (5) articulation of assessment methodologies appropriate for competency-based vocational qualifications. Framework validation was achieved

through triangulation with existing successful models such as the Portuguese Blue School program and alignment with international standards including the UN Decade of Ocean Science, SDG 14, and Blue Economy strategies (. Limitations include the focus on English-language publications potentially excluding relevant non-English scholarship, publication lag times affecting inclusion of recent developments, limited empirical validation of the proposed framework necessitating future testing, reliance on logical extension from related fields given nascent research specifically addressing ocean literacy in vocational tourism contexts, and contextual variations requiring local adaptation rather than universal application.

3 Result and Discussion

3.1 Conceptual Framework for Blue Curriculum Design

The synthesis of literature reveals a comprehensive conceptual framework for integrating ocean literacy into vocational tourism education comprising three interconnected dimensions: competency domains, pedagogical approaches, and implementation mechanisms. The competency framework identifies three core domains adapted from ocean literacy principles and vocational education theory as presented in Table 1.

Table 1. Ocean Literacy Competency Framework for Vocational Tourism Education.

Competency Domain	Components	Tourism-Specific Applications	Assessment Indicators
Cognitive Competencies	<ul style="list-style-type: none"> • Seven essential ocean literacy principles • Ocean-Earth system connections • Marine biodiversity understanding • Ocean-climate interactions • Human impacts on marine ecosystems • Sustainable resource management 	<ul style="list-style-type: none"> • Coastal destination carrying capacity analysis • Marine protected area regulations • Sustainable tourism certification standards • Environmental impact assessment • Blue economy principles 	<ul style="list-style-type: none"> • Knowledge tests on marine systems • Case study analysis • Policy interpretation exercises • Destination sustainability audits
	<ul style="list-style-type: none"> • Environmental values • Ocean stewardship attitudes • Emotional connection to marine environments • Commitment to sustainability 	<ul style="list-style-type: none"> • Tourist environmental education • Conservation advocacy • Sustainable practice adoption • Destination pride and protection 	<ul style="list-style-type: none"> • Attitude surveys • Reflective journals • Values clarification exercises • Behavioral intention scales

Behavioral Competencies	<ul style="list-style-type: none"> • Pro-environmental behavioral intentions 	<ul style="list-style-type: none"> • Climate change awareness 	<ul style="list-style-type: none"> • Peer observations
	<ul style="list-style-type: none"> • Sustainable operations implementation 	<ul style="list-style-type: none"> • Waste reduction programs 	<ul style="list-style-type: none"> • Performance assessments
	<ul style="list-style-type: none"> • Stakeholder engagement 	<ul style="list-style-type: none"> • Water conservation practices 	<ul style="list-style-type: none"> • Workplace supervisor evaluations
	<ul style="list-style-type: none"> • Environmental monitoring 	<ul style="list-style-type: none"> • Marine wildlife protection protocols 	<ul style="list-style-type: none"> • Portfolio evidence
	<ul style="list-style-type: none"> • Crisis management 	<ul style="list-style-type: none"> • Tourist behavior management 	<ul style="list-style-type: none"> • Community feedback
	<ul style="list-style-type: none"> • Interpretation and education delivery 	<ul style="list-style-type: none"> • Sustainable supply chain practices 	<ul style="list-style-type: none"> • Industry placement reports

Source: Synthesized from Boubonari et al. (2019); McKinley et al. (2025); Kim et al. (2025); Jonas et al. (2019)

3.2 Implementation Strategies and Enabling Factors

Implementation of blue curriculum design requires systematic attention to four critical mechanisms: curriculum architecture, assessment design, educator capacity building, and partnership development. Curriculum architecture must balance technical tourism competencies with ocean literacy objectives through spiral integration where marine environmental concepts are introduced progressively across program duration with increasing complexity, horizontal integration connecting ocean literacy to multiple concurrent subjects, and capstone projects requiring synthesis of technical tourism skills and environmental stewardship competencies demonstrated through real-world coastal destination challenges [17, 18]. Practical strategies include embedding 15-20% of total curriculum time to ocean literacy content distributed across all program years rather than concentrated modules, developing modular units allowing flexible adaptation to local coastal contexts and tourism sectors, and creating dual-qualification pathways where students earn both tourism vocational credentials and ocean literacy certifications recognized by marine conservation organizations [19].

Table 2. Implementation Strategies and Enabling Factors.

Implementation Area	Strategies	Key Stakeholders	Success Indicators
Curriculum Architecture	<ul style="list-style-type: none"> • 15-20% ocean literacy integration • Spiral progression design 	<ul style="list-style-type: none"> • Curriculum developers • Program coordinators 	<ul style="list-style-type: none"> • Content coverage across years • Student competency progression

Implementation Area	Strategies	Key Stakeholders	Success Indicators
	<ul style="list-style-type: none"> • Horizontal cross-subject linking • Modular flexible units • Capstone synthesis projects 	<ul style="list-style-type: none"> • Subject matter experts • Qualification authorities 	<ul style="list-style-type: none"> • Industry feedback scores • Accreditation approval
Assessment Design	<ul style="list-style-type: none"> • Performance-based evaluation • Portfolio documentation • Workplace supervisor input • Community assessments • Self-assessment tools 	<ul style="list-style-type: none"> • Assessment designers • Industry supervisors • Community partners • External moderators 	<ul style="list-style-type: none"> • Valid competency measurement • Authentic evidence quality • Inter-rater reliability • Graduate employability
Educator Capacity	<ul style="list-style-type: none"> • Immersive ocean literacy training • Collaborative teaching models • Communities of practice • Curated teaching resources • Recognition incentives 	<ul style="list-style-type: none"> • Professional developers • Marine educators • Conservation experts • Institution leaders 	<ul style="list-style-type: none"> • Educator confidence levels • Teaching quality ratings • Resource utilization rates • Innovation adoption
Partnership Development	<ul style="list-style-type: none"> • Industry placement agreements • Collaborative curriculum design • Guest lecturer programs • Joint research projects • Equipment/facility sharing 	<ul style="list-style-type: none"> • Tourism operators • Conservation NGOs • Government agencies • Coastal communities 	<ul style="list-style-type: none"> • Partnership longevity • Mutual benefit realization • Resource contributions • Student opportunities

Source: Synthesized from Freitas et al. (2022); Lund-Durlacher (2015); Gómez et al. (2025); Lin et al. (2025)

Assessment design must move beyond traditional knowledge testing to authentic evaluation of competency development through multiple methods: (1) performance-based assessments evaluating students' practical application of sustainable practices in simulated or actual tourism operations; (2) portfolio assessment documenting competency development through reflective journals, project artifacts, and evidence of pro-environmental behaviors; (3) workplace supervisor evaluations during industry placements assessing integration of ocean literacy in authentic tourism contexts; (4) community-based assessments where local coastal communities and marine conservation organizations evaluate students' contributions to sustainability initiatives; and (5) self-assessment instruments measuring attitudinal development, values clarification, and behavioral intentions regarding ocean stewardship [20].

Educator capacity building emerges as critical enabler requiring multi-faceted professional development strategies including immersive ocean literacy training for tourism educators lacking marine science backgrounds, collaborative teaching models pairing tourism instructors with marine educators or conservation practitioners, communities of practice facilitating ongoing learning and resource sharing among educators implementing blue curricula, access to curated teaching resources including case studies, multimedia materials, and assessment tools specific to vocational tourism contexts, and incentive structures recognizing and rewarding curriculum innovation and sustainability integration efforts [21, 22].

Partnership development between vocational institutions, tourism industry, marine conservation organizations, and coastal communities provides essential infrastructure for authentic ocean literacy integration through industry placements in sustainable tourism operations, collaborative curriculum design ensuring alignment with workforce needs, guest lecturers from marine sectors providing real-world perspectives, joint research projects addressing coastal destination sustainability challenges, equipment and facility sharing enabling access to marine environments and research infrastructure, and funding support for curriculum development and implementation from tourism industry associations, conservation foundations, and government coastal management agencies [23].

3.3 Challenges and Opportunities in Blue Curriculum Integration

Analysis reveals six primary challenges requiring strategic attention: (1) Curriculum crowding in vocational programs already densely packed with technical skill requirements, necessitating creative integration strategies rather than additive approaches, potentially requiring difficult prioritization decisions regarding curriculum content [24, 25]; (2) Educator capacity gaps as many tourism instructors possess limited marine science knowledge or environmental education expertise, requiring substantial professional development investment [26]; (3) Resource constraints particularly for inland institutions lacking coastal proximity, limiting direct marine environment access for experiential learning, though potentially mitigated through digital technologies and periodic intensive coastal study programs [27]; (4) Industry resistance from tourism employers prioritizing immediate operational skills over environmental competencies, requiring evidence demonstrating ocean literacy's contribution to business performance, customer satisfaction, and destination sustainability [28]; (5) Assessment complexity

in evaluating affective and behavioral competencies beyond traditional knowledge testing, demanding innovative authentic assessment approaches [29]; and (6) Systemic inertia in vocational education systems arises from standardized curricula, qualification frameworks, and accreditation requirements that constrain innovation, necessitating policy advocacy and regulatory flexibility [30].

Conversely, emerging opportunities include: (1) Policy momentum from the UN Ocean Decade, SDG 14, and Blue Economy strategies creating favorable policy environment and potential funding for ocean literacy initiatives [31]; (2) Industry demand for sustainability competencies driven by consumer preferences, certification requirements (e.g., Green Globe, EarthCheck), and destination management priorities [32]; (3) Technological enablers including virtual reality, augmented reality, and online platforms democratizing access to marine learning experiences regardless of geographic location [33]; (4) Youth engagement as emerging workforce generations demonstrate stronger environmental values and career preferences for purpose-driven organizations aligning with sustainability principles [34]; (5) Cross-sectoral collaboration potential between tourism, marine conservation, and coastal management sectors recognizing shared interests in sustainable ocean-based economies [35]; and (6) Global networks such as Blue Schools, Ocean Literacy coalitions, and sustainable tourism education forums providing communities of practice, resource sharing, and collective advocacy for curriculum reform [8].

3.4 Theoretical and Practical Contributions

This conceptual framework advances theoretical understanding by bridging previously disconnected domains of ocean literacy education, vocational pedagogy, and sustainable tourism development, offering a coherent model for interdisciplinary integration that respects both marine science principles and vocational education realities. The framework extends ocean literacy concepts beyond K-12 and university contexts into vocational training, demonstrating adaptability across educational sectors while maintaining fidelity to core principles. Integration of competency-based approaches with environmental education theory provides practical operationalization pathway translating abstract ocean literacy principles into measurable vocational qualifications aligned with industry needs and qualification frameworks. Recognition of affective and behavioral dimensions alongside cognitive knowledge addresses limitations of information-deficit models, acknowledging that effective ocean stewardship requires not only understanding but also values, emotional connection, and practical skills [36, 37].

Practically, the framework provides actionable guidance for multiple stakeholder groups: curriculum developers receive structured approach for designing integrated blue curricula balancing technical and environmental competencies; vocational educators gain pedagogical strategies appropriate for work-based learning contexts and diverse learner populations; tourism industry leaders understand workforce competencies supporting sustainable destination management and competitive advantage; policy makers identify leverage points for supporting ocean literacy through qualification frameworks, funding mechanisms, and quality assurance systems; and marine conservation organizations recognize opportunities for workforce development partnerships advancing ocean stewardship through tourism sector engagement [38]. The frame-

work's modular design enables adaptation to diverse contexts including different tourism sectors (coastal resorts, marine recreation, ecotourism), geographic settings (islands, coastal cities, inland regions with seasonal tourism), cultural contexts, and vocational education systems, avoiding prescriptive one-size-fits-all approaches while maintaining coherent conceptual foundation [12].

4 Conclusion

This conceptual review has examined the integration of ocean literacy into vocational tourism education through blue curriculum design, addressing a critical gap in preparing tourism professionals for sustainable coastal and marine destination management. The proposed framework synthesizes three core dimensions cognitive, affective, and behavioral competencies with five pedagogical approaches specifically adapted for vocational contexts including place-based experiential learning, work-integrated learning, problem-based learning, interdisciplinary integration, and digital technologies. Implementation requires systematic attention to curriculum architecture employing spiral and horizontal integration strategies, authentic assessment designs moving beyond traditional knowledge testing, educator capacity building through professional development and collaborative teaching models, and strategic partnership development among vocational institutions, tourism industry, marine conservation organizations, and coastal communities. While significant challenges exist including curriculum crowding, educator capacity gaps, resource constraints, industry resistance, assessment complexity, and systemic inertia, emerging opportunities from policy momentum through the UN Ocean Decade and SDG 14, growing industry demand for sustainability competencies, technological enablers democratizing access to marine learning, youth environmental values, cross-sectoral collaboration potential, and global networks provide favorable conditions for blue curriculum integration. The framework's theoretical contribution bridges ocean literacy education, vocational pedagogy, and sustainable tourism development while offering practical guidance for curriculum developers, educators, industry leaders, policy makers, and conservation organizations. Future research should empirically test the framework's effectiveness across diverse vocational education contexts, develop validated assessment instruments for ocean literacy competencies in tourism settings, investigate the relationship between tourism professionals' ocean literacy levels and workplace sustainability behaviors, examine scalability and adaptation requirements for different cultural and institutional contexts, and explore long-term impacts on destination sustainability outcomes, ultimately contributing to the development of an ocean-literate tourism workforce capable of balancing economic imperatives with environmental stewardship in an era of unprecedented marine ecosystem challenges and expanding coastal tourism demands

Acknowledgments. This study was funded by the Doctoral Dissertation Research Grant from the Ministry of Research, Technology and Higher Education of the Republic of Indonesia (Kementerian Riset, Teknologi dan Pendidikan Tinggi - Kemristekdikti) for the year 2025.

Disclosure of Interests. The authors have no competing interests to declare that are relevant to the content of this article.

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