

The Development Status of Marine Science Education in China Under the Strategy of Maritime Power

Weidong Duan, Ariunaa Shajinbat

Graduate University of Mongolia, Ulaanbaatar 999097, Mongolia

Abstract

The strategy of building a strong maritime nation is a significant strategic task for achieving the great rejuvenation of the Chinese nation. Marine science popularization education, as an important avenue for enhancing public awareness of the ocean and cultivating marine talent, plays a crucial role in the construction of a strong maritime nation. This paper delves into the current status of marine science popularization education in China under the strategy of building a strong maritime nation. It employs a comprehensive approach using literature review, case analysis, and questionnaire surveys to study various dimensions such as policy support for science popularization education, distribution of science popularization resources, forms of science popularization education, and evaluation systems for the effectiveness of science popularization education. The research finds that although China's marine science popularization education has made significant progress under policy impetus, it still faces issues such as uneven distribution of science popularization resources, insufficient innovation in educational formats, a shortage of professional talent, and an incomplete evaluation system for the effectiveness of science popularization education. In response to these issues, the paper proposes strategies and suggestions, including strengthening policy guidance and resource integration, innovating forms of science popularization education, increasing efforts in talent cultivation, and improving the evaluation system for effectiveness. The aim is to provide theoretical support and practical references for promoting high-quality development of marine science popularization education in China and contributing to the construction of a strong maritime nation [1].

Keywords

Marine power strategy; Marine science education; Development status; Countermeasures and suggestions.

1. Introduction

1.1. Research Background and Significance

The ocean, as the cradle of life on Earth and a vital resource for sustainable human development, is playing an increasingly prominent role in global economics, politics, and culture. The 21st century is the century of the ocean, and countries around the world have elevated marine development and utilization to a national strategic level, actively vying for dominance in marine technology, economy, and military affairs. China boasts a long coastline and vast maritime territory, with abundant marine resources, making the marine economy a significant growth driver for the national economy. Building a strong maritime nation is a major strategic task for achieving the great rejuvenation of the Chinese nation, and it holds profound significance for safeguarding national sovereignty, security, and development interests, as well as promoting sustainable socio-economic development [2].

Marine science education, as an essential component of building a strong maritime nation, bears the significant mission of popularizing marine scientific knowledge, spreading marine

culture, enhancing public awareness of the ocean, and nurturing future marine talent. Under the impetus of the strategy to build a strong maritime nation, China has made certain achievements in marine science education. However, compared with the strategic needs of building a strong maritime nation, there are still many shortcomings. A thorough study of the current status of marine science education in China under the strategy to build a strong maritime nation, identifying problems, and proposing targeted countermeasures is of great practical significance for promoting the high-quality development of Chinas marine science education and supporting the construction of a strong maritime nation.

Theoretical Significance: Enrich and improve the research system in marine science education, providing a theoretical foundation and empirical basis for subsequent related studies. Through in-depth research on various aspects such as policies, resources, forms, and effectiveness evaluations of marine science education, reveal the intrinsic laws and influencing factors of its development. This will provide theoretical support for formulating scientific and reasonable policies and plans for marine science education.

Practical Significance: It helps identify issues and shortcomings in the development of marine science education in our country. It provides decision-making references for government departments, educational institutions, research institutes, and science museums. This initiative promotes the optimal allocation of marine science education resources and innovation in educational formats, enhancing the quality and effectiveness of marine science education. It aims to cultivate more talents with a strong sense of ocean awareness and marine literacy, providing talent support and intellectual assurance for building a strong maritime nation.

1.2. Research Status At Home and Abroad

Marine science education abroad started earlier and has accumulated rich experience in theoretical research and practical exploration. Developed countries such as the United States, the United Kingdom, and Japan place great emphasis on marine science education, integrating it into their national marine development strategies. The U.S. has established a comprehensive marine science education system, offering systematic courses from kindergarten through primary and secondary schools, and even higher education. It also conducts diverse educational activities through marine museums, aquariums, and marine research institutions. The UK focuses on the integration and utilization of marine science educational resources, with collaboration among the government, educational institutions, non-governmental organizations, museums, and media to jointly promote marine science education. Japan ensures the implementation of marine science education through legislation, reinforcing marine awareness in primary and secondary education, integrating marine education into multiple subjects, and actively conducting marine science communication campaigns.

In terms of research content, foreign scholars mainly focus on the objectives, content, methods, and evaluation of marine science education. The research suggests that marine science education should emphasize cultivating students marine scientific literacy, awareness of ocean conservation, and global perspective. It employs diverse teaching methods and means, such as inquiry-based learning, project-based learning, and virtual reality technology, to enhance the effectiveness of science education. At the same time, a scientifically sound evaluation system should be established to comprehensively and objectively assess the outcomes of marine science education, continuously improving and refining the work of science education [3].

In recent years, with the implementation of Chinas maritime power strategy, research on marine science education has gradually increased domestically. Scholars have mainly focused on the current status, issues, countermeasures, and innovative models of marine science education. Studies show that under policy support, Chinas marine science education has made some progress, with the emergence of more science museums, activities, and works. However, problems such as uneven distribution of educational resources, monotonous forms of

education, a shortage of science educators, and low public participation still exist. In response to these issues, scholars have proposed suggestions for strengthening policy guidance, integrating educational resources, innovating educational formats, and enhancing the cultivation of science educators. In the innovation of marine science education models, domestic scholars have made active explorations, proposing cross-sector integration models such as "marine science education + education," "marine science education + cultural tourism," and "marine science education + research and study." These initiatives aim to expand the channels and spaces for marine science education, enhancing its appeal and influence. At the same time, leveraging new media technologies, they have launched online marine science education programs, creating digital platforms for marine science education to provide the public with more convenient and diverse educational resources.

1.3. Research Methods and Innovations

Literature research method: Collect and sort out relevant literature and data on Marine science education at home and abroad, including academic papers, research reports, policy documents, etc., to understand the current situation and development trend of Marine science education research, so as to provide theoretical basis and reference for this paper. Case analysis method: Select representative Marine science education cases, such as the construction of Qingdao Marine Science City and the popularization of Marine education in Fujian, to deeply analyze their successful experiences and existing problems, and summarize the modes and practices that can be promoted. Questionnaire survey method: Design a questionnaire for Marine science education, and investigate different groups such as the public, students and science popularizers to understand their cognition, needs and participation in Marine science education, so as to obtain first-hand data and provide data support for research. Innovative Research Perspective: From the perspective of building a strong maritime country, this study comprehensively and systematically examines the current status of marine science education in China. It closely integrates marine science education with the strategic goal of building a strong maritime country, analyzes the role and status of marine science education in this construction, and provides new ideas and directions for its development. Innovation in research content: It not only focuses on the traditional research contents such as policy support, resource distribution and educational forms of Marine science education, but also deeply discusses the construction of the evaluation system of the effect of Marine science education, as well as the relationship between Marine science education and the inheritance of Marine culture and the training of Marine talents, enriching the research content of Marine science education [4].

Innovative research methods: a variety of research methods are comprehensively used, and the literature research method, case analysis method and questionnaire survey method are organically combined to realize the mutual complementation of qualitative research and quantitative research, so that the research results are more comprehensive, objective and accurate. Second, the importance of Marine science education under the strategy of maritime power

2. Enhance Public Awareness of the Ocean

Ocean awareness refers to peoples understanding and recognition of the importance of the ocean in national economic and social development, national security, and ecological protection. For a long time, influenced by traditional land-based thinking, the publics awareness of the ocean in China has been relatively weak, with insufficient understanding and attention to it. Strengthening marine science education through methods such as popularizing marine scientific knowledge, spreading marine culture, and telling marine stories can help the public gain a deeper understanding of the mysteries and value of the ocean, recognize its close

relationship with human survival and development, thereby enhancing ocean awareness and fostering a correct view of the ocean.

A nation with a strong sense of the ocean is more proactive in paying attention to ocean affairs, supporting the implementation of national Marine policies, and participating in activities for the protection, development and utilization of the ocean. Enhancing the public's awareness of the ocean is the ideological foundation for building a maritime power, and it is of great significance for rallying the strength of the whole society to jointly promote the construction of a maritime power.

2.1. Cultivating Marine Reserve Talents

Building a strong maritime nation cannot do without the support of high-quality marine talents. Marine science education, as a foundational component in nurturing marine professionals, can ignite young people's interest and passion for marine science, guiding them to aspire to careers in the ocean. By organizing activities such as marine science experiments, lectures on marine science, and educational trips to the ocean, young people can gain firsthand experience in marine research and practice, developing their observational skills, thinking abilities, practical skills, and innovative capabilities, laying a solid foundation for future studies and careers in marine-related fields.

At the same time, Marine science education can also broaden the channels for cultivating Marine talents, attract more people with non-marine professional background to pay attention to and participate in Marine undertakings, cultivate compound Marine talents with interdisciplinary knowledge and comprehensive quality, and meet the demand for diversified talents for building a strong maritime country [5].

2.2. Promoting the Inheritance and Innovation of Marine Culture

Marine culture is the sum total of material and spiritual wealth created by humans in the process of recognizing, developing, and utilizing the ocean, rich in connotations and unique charm. Marine science education serves as a vital medium for the inheritance and innovation of marine culture. Through educational activities, it can convey elements such as the spirit of navigation, maritime folklore, and marine art embedded in marine culture to the public, ensuring the continuation and development of marine culture. On the basis of inheriting maritime culture, marine science education can also inspire public innovation awareness, encouraging them to integrate modern technology and social needs to innovate and transform maritime culture. This will lead to the creation of more contemporary marine cultural products and services, enriching the connotations and forms of expression of maritime culture, thus promoting its prosperity and development. The flourishing of maritime culture can further enhance national cohesion and cultural identity, providing strong spiritual impetus for building a maritime power.

2.3. Promoting Sustainable Development of Marine Economy

The marine economy is a crucial support for building a strong maritime nation. Achieving sustainable development of the marine economy requires the participation and support of the entire society. Marine science education can enhance public awareness and conservation consciousness regarding marine resources, guiding the public to adopt scientific and rational concepts of resource development and utilization. This reduces over-exploitation and destruction of marine resources, promoting their sustainable use. At the same time, marine science education can cultivate high-quality workers and innovative talents for the development of the marine economy, promoting marine technological innovation and industrial upgrading. By popularizing marine science knowledge, more people can understand the latest achievements and application prospects of marine technology, inspiring their enthusiasm to engage in marine technological innovation and industrial development,

providing intellectual support and talent guarantees for the sustainable development of the marine economy.

3. Current Situation of Marine Science Education in China

3.1. Policy Support and Guarantee

Since the proposal of the Marine Power Strategy, the Chinese government has attached great importance to marine science popularization education, issuing a series of policy documents that provide strong policy support and guarantees for its development. The "National Action Plan for Public Scientific Literacy (2021-2035)" clearly states the need to "improve the level of marine science popularization education, conduct marine science popularization activities, and enhance public awareness of the ocean." The Ministry of Natural Resources, the China Association for Science and Technology, and other departments have also actively promoted marine science popularization education, formulating relevant action plans and implementation schemes, increasing investment in marine science popularization education, and encouraging social forces to participate in this cause.

Under policy guidance, various regions have introduced local marine science education policies and measures, enhancing the overall planning and implementation of marine science education. For example, Qingdao City has formulated the "Work Plan for Building Qingdao into a Marine Science Education City," aiming to elevate the branding, coordination, and comprehensive coverage of marine science education, striving to create a top-tier marine science education city both domestically and internationally. The issuance of these policy documents has fostered a favorable policy environment for the development of marine science education, promoting its orderly progress.

3.2. Distribution of Popular Science Resources

Science museums are crucial platforms for marine science education. China boasts a number of marine-themed science museums, such as the China Maritime Museum, Qingdao Marine Science and Technology Museum, Shanghai Ocean Aquarium, and Dalian Shengya Marine World. These museums educate the public about marine science through exhibitions, lectures, and interactive experiences, promoting marine culture.

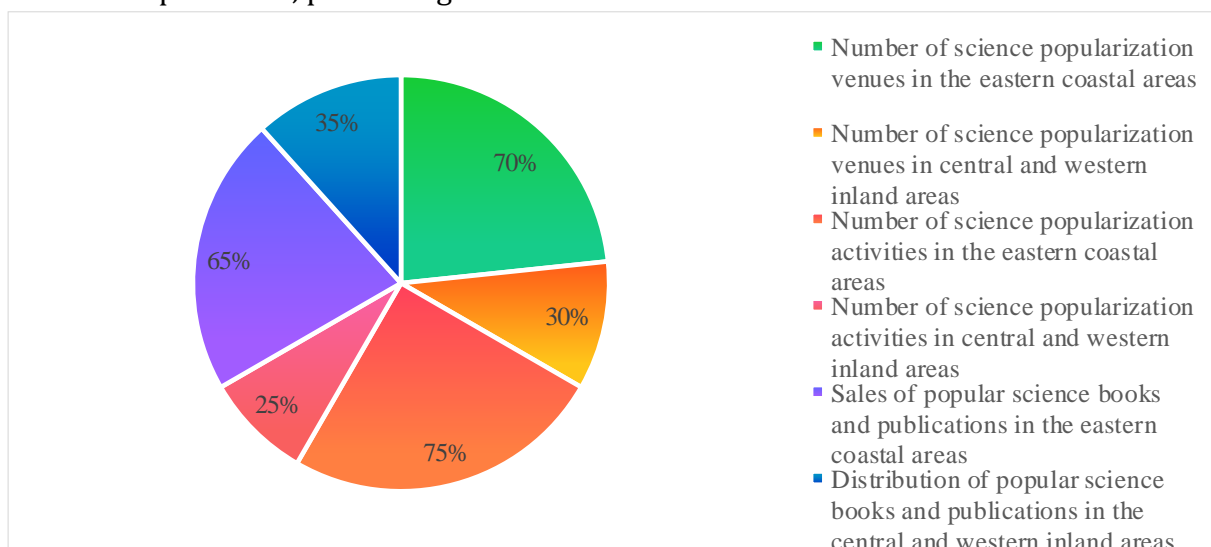


Figure 1. Uneven distribution of science popularization resources in different regions

However, the distribution of marine science popularization venues in our country is uneven, mainly concentrated in the eastern coastal areas, while the number of such venues in the central and western inland regions is relatively low. At the same time, some venues have slow updates

to their exhibits, with monotonous display formats lacking interactivity and appeal, making it difficult to meet the growing public demand for science education. In recent years, the number of marine science books and publications in our country has been increasing, covering multiple fields such as marine scientific knowledge, marine culture, and marine ecological protection. Some excellent marine science books, like "Twenty Thousand Leagues Under the Sea," "Love and Sex in the Ocean," and "Blue Planet: The Earth's Oceans," have received widespread acclaim from readers. At the same time, some professional marine science journals, such as "Ocean World" and "Science Fairy Tales: Exploring the Ocean," also provide important platforms for the dissemination of marine science knowledge. However, the quality of Marine science books and publications in China varies greatly, with some books having outdated content, weak scientific basis and poor readability. In addition, Marine science books and publications still face certain difficulties in market promotion and distribution, making it difficult to reach a wider readership.

With the development of Internet technology, science popularization websites and new media platforms have become emerging forces in marine science education. Various government departments, research institutions, and science museums have established their own marine science websites to publish content such as marine science knowledge and information about science popularization activities. At the same time, they use new media platforms like WeChat official accounts, Weibo, and TikTok to conduct diverse marine science popularization campaigns, including short videos, live streams, and interactive Q&A sessions, attracting a large number of public attention and participation. However, the development of marine science popularization websites and new media platforms also faces some challenges, such as uneven information quality, non-standard platform operation and management, and homogenization of popular science content. In addition, some members of the public have low awareness and usage rates for marine science popularization websites and new media platforms, which requires further promotion and publicity [6].

3.3. Forms of Science Education

Schools are important venues for marine science education. Some primary and secondary schools in our country have incorporated marine science knowledge into their curriculum systems, conducting marine science education through classroom teaching, school-based courses, and extracurricular activities. For example, Fujian Province is actively promoting the popularization of marine education, making marine knowledge an essential part of the curriculum for primary and secondary schools, ensuring that every student can be exposed to a rich world of the ocean in class. At the same time, students are organized to participate in marine study tours, marine science competitions, and the creation of marine biological specimens, allowing them to experience the charm of marine science through practice. However, there are still some problems in China's school Marine science education, such as the non-uniform curriculum standards, imperfect textbook content, weak teachers and so on. Some schools do not pay enough attention to Marine science education, lack of effective teaching methods and means, resulting in the unsatisfactory effect of Marine science education.

Science popularization activities are an important form of marine science education. Various regions in our country have organized a wide range of marine science events, such as World Oceans Day activities, National Marine Science Popularization Day events, marine science exhibitions, and marine science lectures. These activities promote marine scientific knowledge and spread marine culture to the public through exhibitions, explanations, interactive experiences, and more, enhancing public awareness of the ocean. However, there is still room for improvement in the participation and impact of science popularization activities. Some activities lack sufficient promotion, leading to low public awareness; the content and format of these activities are not innovative enough to capture public interest; and the organization and

management of these activities are not standardized, posing potential safety risks. Study tours, as a new form of education, combine research-based learning with travel experiences, offering a new avenue for marine science education. Some coastal regions in our country have fully leveraged their marine resource advantages to develop a series of marine study tour bases and courses, organizing students to participate in marine study tours. By visiting marine science museums, oceanographic museums, marine research institutions, and marine ranches, students can closely engage with marine scientific research and practice, broadening their horizons and increasing their knowledge. However, marine study tours also face some problems in their development, such as inadequate construction of study tour bases, lack of scientific and systematic course design, insufficient professional instructors, and inadequate safety measures. These issues constrain the healthy development of marine study tours and require further strengthening of regulation and management.

3.4. Evaluation of Science Education Effect

Currently, the evaluation system for marine science education in our country is not yet well-established, lacking scientific and unified standards and methods. Some marine science education institutions and organizations do conduct certain effectiveness assessments after organizing educational activities, but these assessments mainly focus on the number of participants and satisfaction levels. There is a lack of in-depth research and evaluation on the long-term impact of such education on enhancing public awareness of the ocean and improving scientific literacy.

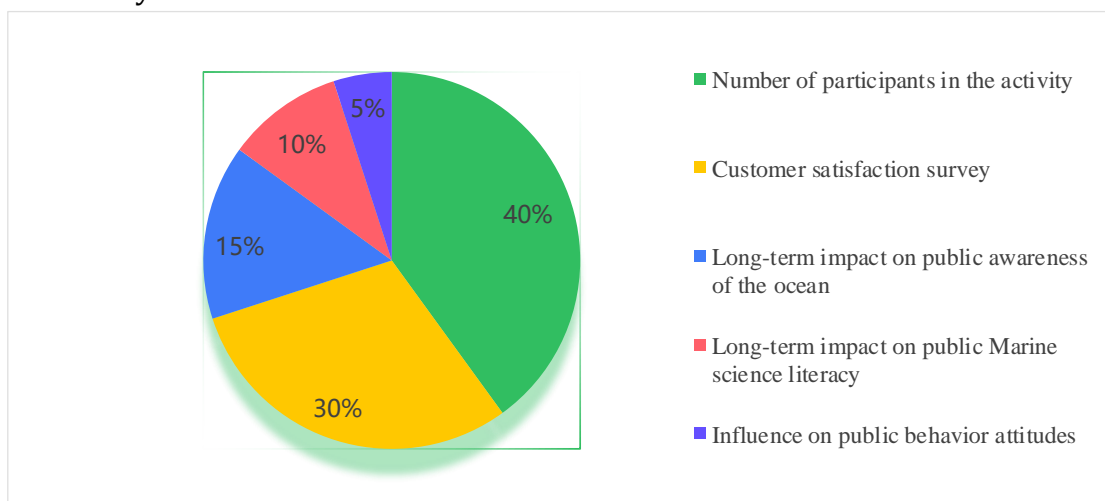


Figure 2. Proportion of evaluation content for the effectiveness of science popularization education

In addition, due to the lack of effective data collection and analysis mechanisms, it is difficult to conduct a comprehensive and objective evaluation of the effectiveness of marine science education. This results in an inability to accurately understand public needs and feedback in marine science education efforts, making it hard to timely adjust and improve the content and format of educational programs. Consequently, this affects the quality and effectiveness of marine science education [7].

4. Problems existing in the development of Marine science education in China

4.1. Uneven Distribution of Popular Science Resources

The distribution of marine science popularization resources in our country is significantly uneven. The eastern coastal regions, with their abundant marine resources and economic advantages, boast a greater number of marine science popularization venues, bases, and

research institutions, enabling them to conduct diverse marine science education activities. In contrast, the central and western inland areas, being far from the sea, have relatively scarce marine science popularization resources, with few venues and infrequent activities, leaving the public with limited opportunities to access marine science knowledge. This geographical disparity leads to significant differences in public awareness of the ocean and scientific literacy across different regions, hindering the comprehensive popularization and balanced development of marine science education [8].

4.2. Lack of Innovation in Educational Forms

Currently, while the forms of marine science education in our country are diverse, there is still a lack of innovation. Some popular science activities and educational methods still rely heavily on traditional explanations and exhibitions, lacking interactivity and appeal, making it difficult to attract public participation, especially from young people. In the era of new media, although some popular science institutions and organizations have started to use the internet and new media platforms for education, the content and format of popular science have not fully integrated the characteristics and advantages of new media. There is a tendency to simply transplant traditional popular science content, leading to poor educational outcomes. Moreover, the integration of marine science education with other fields is insufficient, and the development of the "marine popular science +" cross-sector integration model is still in its early stages, failing to fully leverage the comprehensive benefits of popular science education.

4.3. Shortage of Professional Personnel

Marine science education requires a professional team that possesses both solid knowledge of marine science and the methods and skills for popularizing scientific education. However, there is currently a shortage of specialized talent in marine science education in China, making it difficult to meet the growing demand for marine science education. On one hand, most professionals in marine science are engaged in research and teaching, showing little enthusiasm for participating in marine science education. On the other hand, those specializing in popularizing science have relatively limited knowledge of marine science, leading to insufficient knowledge reserves when conducting marine science education. Furthermore, the system for cultivating talent in marine science education is not well-established, with few relevant programs offered, and a lack of systematic training and continuing education mechanisms, which also hinders the development and expansion of the professional talent pool in marine science education [9].

4.4. The Evaluation System of Science Education Effect is Not Perfect

As mentioned earlier, the evaluation system for marine science education in our country is still not well-established, which poses challenges to improving and enhancing such educational efforts. Due to the lack of scientifically sound assessment criteria and methods, it is difficult to accurately measure the impact of marine science education on public awareness of the ocean, scientific literacy, and behavioral attitudes. At the same time, the assessment process often overlooks the characteristics and needs of different audience groups, leading to results that lack relevance and effectiveness. Current evaluations often rely on simple questionnaires and interviews, lacking long-term follow-up studies on the effects of science education. For example, after an event at a marine science museum, feedback is only collected through on-site questionnaires, making it difficult to understand how much public memory retention, conceptual change, and behavioral modification occur months or even years after the event. Moreover, various evaluators (government, institutions, schools, etc.) lack unified coordination, preventing data sharing, which results in fragmented evaluation outcomes. This hinders the precise optimization and sustainable development of marine science education efforts [10].

5. Summary

Under the backdrop of China's maritime power strategy, marine science education has made certain achievements, but it also faces numerous challenges. Research on policy support, resource distribution, educational formats, and effectiveness evaluation of marine science education reveals that issues such as uneven distribution of educational resources, insufficient innovation in educational formats, a shortage of specialized talent, and an incomplete system for evaluating the effectiveness of marine science education are constraining the high-quality development of marine science education in China. The proposed measures to strengthen policy guidance and resource integration, innovate science education formats, increase talent cultivation efforts, and improve the evaluation system for effectiveness have significant practical implications for promoting the development of marine science education in our country. In the future, we should further reinforce the strategic position of marine science education in building a strong maritime nation. All parties should collaborate to continuously optimize the development environment for marine science education, enhance the quality and effectiveness of science education, and lay a solid foundation for cultivating high-quality talents with a strong sense of ocean awareness and marine literacy, thereby achieving the strategic goal of becoming a maritime power. At the same time, there are still many issues in the field of marine science education that warrant in-depth research and exploration. Subsequent studies can build upon this foundation to conduct more detailed analyses of specific practical cases and emerging technologies, providing more targeted solutions for the development of marine science education.

References

- [1] Baldwin, C., Smith, K., & Taylor, L. (2020). Indigenous knowledge integration in marine science education: A case study of New Zealand's coastal communities. *Journal of Marine Education*, 18(3), 45–62.
- [2] Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
- [3] Chen, Y., & Huang, Z. (2020). Teacher training needs in interdisciplinary marine science education: Evidence from coastal and inland China. *Education Research Frontiers*, 10(2), 78–95.
- [4] Clark, D., & Miller, F. (2021). Assessing the effectiveness of marine education programs: A longitudinal study of student outcomes. *Educational Evaluation and Policy Analysis*, 43(2), 289–310.
- [5] Creswell, J. W., & Plano Clark, V. L. (2017). *Designing and conducting mixed methods research* (3rd ed.). Sage Publications.
- [6] García-Corrales, M., López, J., & Martínez, A. (2021). Transnational collaboration in marine education: Addressing shared Mediterranean marine challenges. *Marine Policy*, 129, 104689.
- [7] Hair, J. F., Black, W. C., & Babin, B. J. (2010). *Multivariate data analysis* (7th ed.). Pearson Prentice Hall.
- [8] Jensen, L., & Olsen, J. (2018). National frameworks for marine education: A comparative study of Norway, Australia, and the United States. *Marine Policy*, 97, 123–131.
- [9] Jiang, Z., & Chen, L. (2020). Funding disparities in marine education: A comparative analysis of coastal and inland provinces. *Educational Finance and Policy*, 15(3), 389–412.
- [10] Kim, H., & Park, J. (2022). Pre-service teacher training in marine science: A case study of South Korea's program. *Journal of Teacher Education*, 73(4), 512–528.

- [11] Li, M., Wang, Q., & Zhang, Y. (2021). Policy implementation gaps in inland marine education: Challenges and solutions. *Chinese Education and Society*, 54(3), 210–228.