Competency-Based Learning in Maritime Vocational Higher Education: A Systematic Literature Review

Nur Rohmah
Politeknik Ilmu Pelayaran Semarang, Indonesia
Email: nur_rohmah@pip-semarang.ac.id

Abstract. Maritime vocational higher education plays a strategic role in preparing human resources capable of meeting the needs of the ever-growing and increasingly competitive maritime sector. The dynamics of the maritime industry, characterized by technological developments, increasingly stringent work standards, and the need for a ready-to-work workforce, demand learning that is oriented towards achieving students' true capabilities. However, in practice, there is still a gap between the learning process in maritime vocational higher education and the real needs of the workplace, both in terms of learning orientation, the role of educators, and integration with industry. This study aims to examine in depth the implementation of competency-based learning in maritime vocational higher education and its commitment to graduate readiness and competitiveness. This study uses a qualitative approach through the review and analysis of various literature sources and previous research results relevant to competency-based learning and maritime vocational education. The results indicate that the direction and orientation of learning that align with the needs of the maritime industry play a crucial role in shaping graduates' work readiness. The role of educators, practical instructors, and an integrated learning environment also supports the achievement of students' professional skills and attitudes. Furthermore, integrating learning with the needs of the maritime industry, despite facing various challenges, opens up opportunities for continuous learning innovation to improve the quality and competitiveness of maritime vocational higher education graduates.

Keywords: Competency-Based Learning, Maritime Vocational Education, Graduate Job Readiness, Industry Integration, Maritime Human Resource Competitiveness.

A.   INTRODUCTION

Maritime vocational higher education plays a strategic role in supporting the development of the increasingly complex and dynamic maritime sector. Indonesia, as an archipelagic nation with significant maritime potential, requires human resources who possess not only theoretical knowledge but also practical skills aligned with the demands of the workplace (Yuen et al., 2022). In this context, maritime vocational higher education institutions face the challenge of producing graduates who are truly prepared to enter the field, able to adapt to technological developments, and who are competitive both nationally and internationally. However, the reality shows that a gap between learning outcomes at vocational higher education institutions and the actual needs of the maritime industry remains frequently found, both in terms of technical skills, job readiness, and professional attitudes of graduates (Simanjuntak et al., 2024).

The development of the global maritime industry, characterized by increasing safety standards, operational efficiency, and the use of cutting-edge technology, demands continuous renewal of the learning process in vocational education. The business world and the maritime industry are moving at a rapid pace, while the learning system in higher education institutions often faces limitations in adapting quickly and comprehensively (Zhang & Yu, 2025). This situation has resulted in criticism of the relevance of the learning provided, particularly when graduates are deemed not to fully meet the expectations of employers. Therefore, strengthening the learning orientation, focusing on real student outcomes, is an unavoidable necessity (Zhang et al., 2024).

In addition to industry demands, the dynamics of national education policy are also driving a paradigm shift in the implementation of vocational higher education. Various policies emphasize the importance of linking education and the workplace, improving graduate quality, and ensuring the accountability of educational institutions in producing productive human resources (Yenugu, 2022). Maritime vocational higher education is required to focus not only on the learning process but also on measurable outcomes, measured through graduate performance in the workplace. This pressure is intensifying with increasing competition among graduates, both in the domestic and international job markets (Autsadee & Phanphichit, 2025).

On the other hand, the characteristics of maritime vocational education, which emphasize field practice, simulations, and experiential learning, require a mature and integrated learning design. Learning that lacks clear direction has the potential to result in fragmented learning experiences, making it difficult for students to connect what they learn in class with real-world situations. This can impact graduates' self-confidence when entering the workforce and diminish the image of maritime vocational education institutions in the eyes of stakeholders (Kim et al., 2023).

Another equally significant challenge is the diverse backgrounds of maritime vocational education students. Differences in initial abilities, experiences, and learning motivations require a learning approach that accommodates these variations without compromising graduate quality standards (Karahalil et al., 2024). In practice, learning often focuses on delivering material, while achieving students' actual skills has not been a consistent priority. This situation has the potential to create an imbalance between vocational education goals and outcomes (Soubra et al., 2022).

Furthermore, the demands of professionalism in the maritime sector are not solely related to technical skills, but also encompass discipline, teamwork, adherence to procedures, and emergency preparedness. These aspects require a structured, continuous learning process oriented toward mastering real-world skills. If learning isn't designed to guide students toward these goals, graduates risk struggling to meet the work standards applicable in the maritime industry (Lopes et al., 2025).

In the context of globalization, maritime vocational higher education also faces international competition, both in terms of graduate quality and competency recognition. The mobility of the maritime workforce across borders demands graduates who are competitive and widely recognized (Isbah et al., 2025). This places maritime vocational education institutions in a strategic and challenging position, as the quality of the learning provided will determine their competitiveness globally. Unpreparedness to respond to this challenge can lead to limited employment opportunities for graduates and a decline in trust in educational institutions (Newisar et al., 2024).

Based on the various challenges in implementing learning in maritime vocational higher education, this study aims to examine in depth how competency-based learning is implemented and the extent to which it is directed towards achieving real student skills that align with the needs of the maritime workforce. This research specifically aims to obtain a comprehensive overview of the relationship between learning planning, implementation, and evaluation with industry demands, while also identifying factors that influence learning effectiveness, including resource limitations, educator preparedness, and the gap between the curriculum and field practice.

B.   LITERATURE REVIEW

Competence is a combination of knowledge, skills, values, and attitudes reflected in habits of thought and action. McAshan argues that competence: "is the knowledge, skills, and abilities or capabilities that a person achieves, which become part of their being to the extent

that they can satisfactorily perform particular cognitive, affective, and psychomotor behaviors." In this context, competence is defined as the knowledge, skills, and abilities mastered by a person, which have become part of their being, enabling them to perform cognitive, affective, and psychomotor behaviors optimally (Oinonen et al., 2024).

According to Syaodih, competence, in its broader sense, encompasses all the skills, abilities, and knowledge needed by a person in their life, whether as an individual, a member of society, a student, or an employee. In a general sense, competence is the ability or skill within oneself that relates to social, intellectual, affective, and physical-biological aspects (Abina et al., 2024).

There are several competencies applied in competency-based learning, as follows:

1. Basic Competencies
   Basic competencies are the skills, habits, or essential competency elements that students must master to master higher-level competencies. Examples include reading, writing, and arithmetic (Ahmad et al., 2023).
2. General Competencies
   General competencies are the mastery of skills and abilities necessary for everyday life, including family, school, community, and work environments. Examples include skills such as turning a radio or TV on and off, riding a public bus, etc (Löfgren et al., 2023).
3. Academic Competencies
   Academic competencies are the abilities, skills, and knowledge to apply theories, concepts, rules, principles, and models in everyday life. Academic competencies also relate to the application and development of higher-order thinking skills and abilities, namely analytical, synthetic, evaluative, problem-solving, and creativity (Chiu et al., 2024).
4. Vocational Competencies
   Vocational competencies relate to the development of practical skills and abilities in a particular field of work. Vocational competency can relate to mastery of work skills and abilities at the practical, vocational, and professional levels (Inderanata & Sukardi, 2023).
5. Professional Competency
   Professional competency is the mastery of high-level academic and vocational skills, habits, and abilities. This competency refers to the application of basic competencies to high-level vocational competencies (Schönau, 2023).

Based on the definition of competence above, it can be interpreted as all abilities, a combination of skills and knowledge, reflected in the ways of acting and thinking that a person needs to live in society. Competency-Based Education (CBE) is widely implemented in vocational and vocational educational institutions such as vocational high schools (SMK) and polytechnics. This educational model is designed to educate or train employees in specific vocational or professional fields (Tuomi, 2022).

Competency-based learning has been implemented since the Dutch colonial era. This is evidenced by the establishment of vocational schools in several cities in Indonesia. One such school is the Ambacht School van Soerabaia in Surabaya, founded by the Dutch government in 1853 for Indonesian and Dutch children. Current learning practices, which tend to focus solely on mastery of material without addressing its life application, or stop at the knowing stage, without reaching the loving, doing, or acting stages, have led to the reappearance of competency-based learning (Winget & Persky, 2022).

C. METHOD

This research uses a qualitative approach, emphasizing the exploration and analysis of data sourced from various relevant scientific studies, including the results of previous research and studies related to competency-based learning and maritime vocational education. The collected data are then systematically analyzed to identify patterns, trends, and key issues related to the implementation of learning within the context of maritime vocational higher education. The data processing process is carried out in stages and in-depth to produce research findings that can explain the actual conditions of learning and provide scientific contributions to the development of maritime vocational education practices.

D. RESULT AND DISCUSSION

1. Direction and Orientation of Learning in Maritime Vocational Higher Education

The capacity of maritime vocational higher education to respond to the evolving demands of the maritime industry is largely shaped by how learning objectives and orientations are conceptualized and implemented. Learning can no longer be positioned solely as an academic activity detached from the realities of the workplace, but must be clearly directed to support professional demands in the maritime sector. The alignment of learning direction with the needs of the maritime sector is reflected in the educational institution's ability to respond to industry dynamics, including technological changes, operational standards, and increasingly complex job characteristics. When learning direction is not aligned with these needs, the educational process has the potential to produce graduates with a gap between the skills acquired during their studies and the demands of the workplace.

The integration of learning objectives and student outcomes is a crucial aspect in ensuring that the learning direction is effectively implemented. Clearly formulated learning objectives must be reflected in the learning activities experienced by students, so that the resulting achievements are not abstract but observable through student performance in various forms of academic and practical activities (Barthakur et al., 2022). The misalignment between learning objectives and student outcomes often creates problems in evaluation, where students are deemed administratively successful but have not demonstrated adequate skills to meet the demands of work in the maritime sector. Therefore, this integration requires systematic and consistent learning planning, from goal formulation to implementation and assessment.

In the context of maritime vocational education, the emphasis on mastering real-world work skills is a key indicator of the success of the learning direction and orientation. The learning process must provide adequate space for students to develop skills relevant to real-world work situations, so that the learning experience does not stop at understanding the material but continues to the ability to apply knowledge in practical contexts. When learning focuses too much on theoretical aspects without balancing it with strengthening work skills, students can potentially experience difficulties adapting to a work environment that demands precision, speed, and resilience in facing various operational conditions in the maritime sector.

Consistency between theoretical and practical learning is also a determining factor in establishing an effective learning orientation. Theory and practice should be viewed as two complementary and inseparable aspects. Theoretical learning plays a role in building students' basic understanding and frameworks of thinking, while practical learning serves as a means to test and strengthen that understanding in real-world situations or situations close to field conditions. Inconsistencies between the two can make it difficult for students to connect what they learn in class with what they need to do in the field, thereby losing the relevance of the learning process to the needs of the maritime workforce.

A focused and consistent learning orientation ultimately has a significant impact on graduates' readiness to enter the workforce. Graduates equipped with learning aligned with the

needs of the maritime sector tend to have a higher level of adaptability, both in facing technical demands and in adjusting to the maritime work culture. Conversely, an unclear or inconsistent learning orientation has the potential to produce graduates who require a longer adaptation period, even requiring additional training before being able to contribute optimally in the workplace.

Furthermore, the direction and orientation of learning also influence stakeholders' perceptions of the quality of maritime vocational education. The industry tends to assess the quality of graduates based on their ability to carry out tasks and responsibilities professionally. When learning at vocational colleges produce work-ready graduates, industry trust in the educational institution will increase, thereby opening up broader collaboration opportunities. Thus, learning orientation not only impacts individual students but also the strategic position of maritime vocational education institutions within the education and industry ecosystem.

2. **The Role of Educators and the Learning Environment in Supporting Competency Achievement**

Student competency development in maritime vocational higher education is strongly influenced by the effectiveness of educators and the quality of the learning environment in facilitating the learning process. Educators serve not only as transmitters of material but also as managers of the learning process, capable of guiding students toward achieving skills relevant to the demands of the maritime workforce. The educator's readiness to manage learning is a primary factor influencing the quality of the learning process, particularly in a vocational context that demands a balance between academic understanding and mastery of practical skills. Educators are required to have an adequate understanding of the characteristics of the maritime sector, the dynamics of the workplace, and the pedagogical skills to manage applicable and contextual learning.

In maritime vocational education, the role of internship instructors becomes increasingly crucial because student skill development is highly dependent on the quality of guidance provided during the internship process. Internship instructors play a direct role in guiding students in work situations that demand precision, procedural accuracy, and adherence to operational standards. Through intensive and ongoing mentoring, internship instructors help students understand the connection between the theory learned and its application in practical activities. The unpreparedness or limitations of practical instructors in carrying out this role can have an impact on the low quality of student skills, so that the objectives of maritime vocational learning are difficult to achieve optimally.

Learning management in the classroom, laboratory, and practical facilities is also a crucial aspect influencing learning effectiveness. Each learning environment has different characteristics and demands, requiring a tailored management approach. Classroom learning plays a role in building students' fundamental understanding and frameworks of thinking, while learning in the laboratory and practical facilities serves as a space for developing technical and professional skills (Yeganeh et al., 2025). When learning management across these three environments is not well integrated, students can potentially struggle to connect acquired knowledge to practical experiences, resulting in fragmented learning.

The interaction between educators and students during the learning process also determines the success of competency achievement. Open, dialogic, and mentoring-oriented interactions enable students to be more active in the learning process, while also providing educators with the opportunity to understand their needs and development. In the context of maritime vocational education, this interaction occurs not only in academic discussions but also through direct guidance during practical activities. The quality of these interactions can

influence students' motivation to learn, their confidence in developing skills, and their readiness to face complex learning challenges.

The overall learning environment also has a significant influence on the development of students' discipline and work attitudes. A supportive, orderly environment that reflects maritime work culture can help students internalize professional values from an early age. Discipline in following procedures, adherence to safety regulations, and responsibility in completing assignments are integral aspects of the maritime vocational learning process. When the learning environment consistently fosters these work attitudes, students will be better prepared to adapt to the demands of the workplace after graduation.

Furthermore, synergy between educators, practical instructors, and the learning environment is a key foundation for supporting the sustainable achievement of student competencies. Educators and practical instructors need to work collaboratively in designing and implementing learning so that students receive a comprehensive and continuous learning experience. A well-managed learning environment will strengthen the role of educators and instructors in shaping students' work skills and attitudes. Thus, achieving competency is not solely the responsibility of individual students but is the result of an integrated and directed learning system.

3. Integrating Learning with the Needs of the Maritime Industry

Ensuring the relevance and employability of graduates in maritime vocational higher education depends heavily on the extent to which educational practices are systematically aligned with the operational requirements of the maritime industry. Learning provided at vocational higher education institutions needs to be designed to align with the characteristics of maritime sector jobs, which demand precision, safety, and adaptability to dynamic working conditions. The alignment between learning activities and maritime industry work demands is reflected in the extent to which students are involved in learning processes that mimic real-world work situations, whether through practical work, simulations, or other learning activities that require direct application of skills. When learning activities do not reflect fieldwork needs, graduates potentially experience a gap between their skills and the demands of the job.

With the rapid development of technology in the maritime sector, learning in vocational higher education institutions is required to continually adapt to remain relevant. Synchronizing learning with maritime technology presents both a challenge and an opportunity for educational institutions to update their approaches and learning materials. Technological changes impact not only equipment and operational systems, but also work methods, communication patterns, and safety standards in the maritime environment. If learning fails to keep pace with these developments, graduates will be left behind and require a longer adaptation period when entering the workforce. Therefore, integrating technology into learning is a crucial part of aligning maritime vocational education with industry needs.

Partnerships between educational institutions and the maritime industry play a strategic role in strengthening the integration of learning with the needs of the workplace. Through ongoing collaboration, educational institutions receive input on industry developments, workforce needs, and applicable work standards. Meanwhile, the industry can contribute to supporting the learning process by providing facilities, practical opportunities, and sharing professional experiences. This mutually beneficial relationship allows learning at maritime vocational colleges not to operate in isolation from industry realities but to become part of an ecosystem that supports the development of maritime human resources.

However, maintaining the relevance of learning to changes in the maritime industry is not easy. The maritime industry is experiencing rapid change, driven by technological developments, regulations, and global market dynamics. This situation requires educational

institutions to have flexibility and adaptability in designing and updating learning (Autsadee et al., 2024). Limited resources, rigid academic procedures, and conflicting interests between the educational world and industry often hinder efforts to maintain this relevance. These challenges need to be systematically managed so that the integration of learning with industry needs is not temporary but sustainable.

Integrating learning with the needs of the maritime industry has direct implications for graduate competitiveness. Graduates equipped with learning experiences aligned with industry demands tend to have advantages in terms of job readiness, adaptability, and self-confidence. They are not only able to meet established work standards but also have the potential to thrive in line with changes in the work environment. Conversely, graduates who come from an education system that is poorly integrated with industry needs risk facing difficulties competing in the job market, both nationally and internationally.

Furthermore, graduate competitiveness is determined not only by technical skills but also by an understanding of the work culture and dynamics of the maritime industry. Good learning integration allows students to become familiar with work patterns, professional ethics, and performance requirements from the start of their studies. Such learning experiences will help graduates adapt to the work environment more quickly and effectively. In the long term, this can enhance the reputation of maritime vocational education institutions as providers of a qualified workforce relevant to industry needs.

4. Challenges and Opportunities in Developing Competency-Based Learning

The development of competency-based learning in maritime vocational higher education faces various structural and operational challenges that impact its effective implementation. One of the main challenges relates to limited facilities, infrastructure, and learning support resources. Maritime vocational education requires adequate facilities, both for theoretical and practical learning, so that students can gain learning experiences that approximate real-world work conditions. When available facilities do not align with learning needs, the process of developing students' skills is suboptimal, making it difficult to achieve learning objectives comprehensively.

In addition to limited facilities, the variation in student abilities and readiness to participate in learning also poses a challenge that requires attention. Maritime vocational education students come from diverse backgrounds, differing in academic ability, practical experience, and motivation to learn (Koh et al., 2023). These differences require an adaptive learning approach to ensure all students can effectively participate in the learning process. The unpreparedness of some students to meet the demands of competency-based learning has the potential to hinder the achievement of expected learning outcomes, especially when learning requires mastery of specific and measurable work skills.

Another equally important challenge relates to the implementation of learning outcome evaluation. Evaluation in competency-based learning requires assessment instruments that can objectively and comprehensively reflect students' actual abilities. In practice, evaluation implementation often faces challenges, both in planning, implementation, and consistency of assessment. When evaluations fail to accurately reflect learning outcomes, the results risk not providing a true picture of student abilities, making them difficult to use as a basis for improving learning.

Amidst these challenges, opportunities exist to develop competency-based learning in maritime vocational education. Opportunities for learning innovation are increasingly open, along with technological advancements and growing awareness of the importance of education's relevance to the needs of the workplace. Innovations in learning methods, the use of supporting technology, and the strengthening of experiential learning can be strategies to

improve learning quality. These opportunities enable educational institutions to develop learning approaches that are more flexible and responsive to the changing needs of the maritime sector.

The development of competency-based learning also opens up opportunities for continuous improvement in learning quality. The learning process needs to be continuously evaluated and improved to remain relevant and effective. These efforts include increasing educator capacity, updating learning resources, and strengthening a more accountable evaluation system. With a sustainable approach, challenges faced in learning development can be systematically managed, thus optimally exploiting opportunities to improve the quality of maritime vocational education.

E. CONCLUSION

Competency-based learning plays a strategic role in enhancing the relevance and quality of maritime vocational higher education. The direction and orientation of learning aligned with the needs of the maritime sector, supported by the integration of learning objectives and student outcomes, serve as an important foundation in shaping graduates' readiness to face the world of work. Consistency between theoretical and practical learning, as well as an emphasis on mastering real-world work skills, has proven to be decisive factors in producing graduates capable of adapting to professional demands in the maritime sector. Furthermore, the role of educators, practical instructors, and the overall learning environment is crucial to the successful implementation of competency-based learning. The readiness of educators to manage learning, the quality of interactions with students, and the management of learning in the classroom, laboratories, and practical facilities contribute directly to the achievement of students' skills and the development of work attitudes. Integrating learning with the needs of the maritime industry, through the alignment of learning activities, synchronization with technological developments, and strengthening partnerships with industry, further strengthens graduates' competitiveness and increases stakeholder trust in maritime vocational education. Amidst various challenges, such as limited resources, varying student readiness, and the complexity of evaluating learning outcomes, there is a significant opportunity for innovation and continuous improvement of learning quality. With adaptive management and a commitment to developing competency-oriented learning, maritime vocational higher education can play an optimal role in producing professional maritime human resources, relevant to industry needs, and able to compete at the national and international levels.

REFERENCES

Abina, A., Temeljotov Salaj, A., Cestnik, B., Karalič, A., Ogrinc, M., Kovačič Lukman, R., & Zidanšek, A. (2024). Challenging 21st-century competencies for STEM students: companies' vision in Slovenia and Norway in the light of global initiatives for competencies development. *Sustainability*, *16*(3), 1295.

Ahmad, A., Akhsani, L., & Mohamed, Z. (2023). The profile of students' mathematical representation competence, self-confidence, and habits of mind through problem-based learning models. *Infinity Journal*, *12*(2), 323-338.

Autsadee, Y., & Phanphichit, T. (2025). Exploring the maritime frontier: unveiling the transformative power of work-based learning (WBL) in maritime education and training (MET). *Higher Education, Skills and Work-Based Learning*, *15*(2), 306-318.

Autsadee, Y., Jeevan, J., Mohd Salleh, N. H., & Othman, M. R. (2024). Digital wind of changes: navigating competitiveness in the maritime sector through the transformation in human resource development. *Maritime Business Review*, *9*(3), 204-228.

Barthakur, A., Joksimovic, S., Kovanovic, V., Richey, M., & Pardo, A. (2022). Aligning objectives with assessment in online courses: Integrating learning analytics and measurement theory. *Computers & Education*, *190*, 104603.

Chiu, T. K., Ahmad, Z., Ismailov, M., & Sanusi, I. T. (2024). What are artificial intelligence literacy and competency? A comprehensive framework to support them. *Computers and Education Open*, *6*, 100171.

Inderanata, R. N., & Sukardi, T. (2023). Investigation study of integrated vocational guidance on work readiness of mechanical engineering vocational school students. *Heliyon*, *9*(2).

Isbah, M. F., Indonesia, A. B. P. E. N., Suwandi, M. A., Rahmawati, D., Fitramadhana, R., Savitri, R., ... & Listanto, V. (2025). Vocational education and skills development for new economies in Indonesia: uneasy parallel challenges. *Asian Education and Development Studies*, 1-14.

Karahalil, M., Lützhöft, M., & Scanlan, J. (2024). Factors impacting curricula in maritime simulator-based education. *WMU Journal of Maritime Affairs*, 1-29.

Kim, J., Lee, C., Jeong, M., Cho, E., & Lee, Y. (2023). Identifying optimal approaches for sustainable maritime education and training: Addressing technological, environmental, and epidemiological challenges. *Sustainability*, *15*(10), 8092.

Koh, L. Y., Li, K., Chia, Y. Y., & Yuen, K. F. (2023). Quality design for maritime studies programme in the digital era. *Maritime Policy & Management*, *50*(3), 301-320.

Löfgren, S., Ilomäki, L., Lipsanen, J., & Toom, A. (2023). How does the learning environment support vocational student learning of domain-general competencies?. *Vocations and Learning*, *16*(2), 343-369.

Lopes, L. S., Nabais, J. L., Pinto, C., Caldeirinha, V., & Pinho, T. (2025). Essential Competencies in Maritime and Port Logistics: A Study on the Current Needs of the Sector. *Sustainability*, *17*(6), 2378.

Newisar, M., Selim, G., & Li, M. (2024). Place-based perspectives on understanding the value of sustainable heritage-inspired arts and crafts in Jordan. *Sustainability*, *16*(17), 7547.

Oinonen, I., Seppälä, T., & Paloniemi, R. (2024). How does action competence explain young people's sustainability action?. *Environmental Education Research*, *30*(4), 499-518.

Schönau, D. (2023). Toward a Definition of Competency in Art Education. *Journal of Aesthetic Education*, *57*(4), 76-97.

Simanjuntak, M. B., Rafli, Z., & Utami, S. R. (2024). Enhancing Global Maritime Education: A Qualitative Exploration of Post-Internship Perspectives and Preparedness among Cadets. *Journal of Education and Learning (EduLearn)*, *18*(4), 1134-1146.

Soubra, L., Al-Ghouti, M. A., Abu-Dieyeh, M., Crovella, S., & Abou-Saleh, H. (2022). Impacts on student learning and skills and implementation challenges of two student-centered learning methods applied in online education. *Sustainability*, *14*(15), 9625.

Tuomi, I. (2022). Artificial intelligence, 21st century competences, and socio-emotional learning in education: More than high-risk?. *European Journal of Education*, *57*(4), 601-619.

Winget, M., & Persky, A. M. (2022). A practical review of mastery learning. *American journal of pharmaceutical education*, *86*(10), ajpe8906.

Yeganeh, L. N., Fenty, N. S., Chen, Y., Simpson, A., & Hatami, M. (2025). The future of education: A multi-layered metaverse classroom model for immersive and inclusive learning. *Future Internet*, *17*(2), 63.

Yenugu, S. (2022). The new National Education Policy (NEP) of India: will it be a paradigm shift in Indian higher education?. *Perspectives: Policy and Practice in Higher Education*, *26*(4), 121-129.

Yuen, K. F., Tan, L., & Loh, H. S. (2022). Core competencies for maritime business educators in the Digital Era. *Frontiers in Psychology*, *13*, 915980.

Zhang, C., Xu, C., Wang, R., Han, X., Yang, G., & Liu, Y. (2024). The learning experiences and career development expectations of Chinese nursing master's degree students: A qualitative investigation. *Nurse Education in Practice*, *77*, 103996.

Zhang, M., & Yu, S. (2025). A Review on the Preparedness of Chinese Maritime Law Education for Emerging Industry and Technology Trends: Sustainable Net-Zero Shipping, Maritime Digitalization, and Application of Artificial Intelligence Technologies. *Sustainable Futures*, 100752.