Bulletin of Pedagogical Research

Open Access

Vol. 5, No. 3, December 2025
https://attractivejournal.com/index.php/bpr/

Empowering Maritime Generation Z Students to Develop a Digital Entrepreneurial Mindset through Self-Efficacy & Cognitive Flexibility

Riki Wanda Putra [1*], Bambang Hermanto[1], Elfira Wirza[1], Nazarwin[1], Hasri Devin[1]
[1] *Politeknik Pelayaran Sumatera Barat, Indonesia*

rikiii126@gmail.com*

ARTICLE INFO
Article history:
Received
August 29, 2025
Revised
November 03, 2025
Accepted
November 24, 2025

Abstract

This study examines an empowerment program designed to develop a digital entrepreneurial mindset among Generation Z maritime students by strengthening self-efficacy and cognitive flexibility. Responding to the accelerating digitalization of the maritime sector, the program aimed to shift student perspectives from traditional seafaring roles toward innovation-driven, technology-based entrepreneurship. Adopting a Participatory Action Research (PAR) model, the intervention involved 118 second-semester students at Politeknik Pelayaran Sumatera Barat and comprised stages of preliminary assessment, socialization and motivational seminars, two-day training workshops using Creative Problem Solving and Design Thinking, digital business idea simulations, mentoring, and reflective evaluation. Data collection included pre–post surveys, direct observation, written student reflections, facilitator notes, and triangulation across sources; qualitative descriptive analysis identified thematic changes in self-efficacy, cognitive flexibility, and entrepreneurial orientation. Post-intervention findings show notable increases in students' confidence to express ideas, make decisions, and assume leadership roles, alongside enhanced cognitive flexibility manifested in multi-perspective problem solving and creative solution generation. Participants produced viable digital maritime business concepts (e.g., vessel-tracking applications, online seafarer training platforms, and logistics services), and demonstrated improved communication, teamwork, and pitching skills. The study recommends curriculum integration, establishment of a campus digital maritime incubator, stakeholder engagement for industry linkage, and longitudinal evaluation to sustain and scale outcomes. Overall, the intervention advances a replicable model for preparing adaptive, innovative maritime graduates capable of contributing to Indonesia's digital maritime economy.

Keywords: Gen-Z, Digital Entrepreneurship, Entrepreneurial Mindset, Self-Efficacy, Cognitive Flexibility

Published by CV. Creative Tugu Pena
Website https:/attractivejournal.com/index.php/bpr
ISSN 2775-2305

INTRODUCTION

The maritime sector serves as the backbone of the global economy, playing a vital role in facilitating international trade, transportation, and logistics. For Indonesia a nation recognized as an archipelagic state his sector not only drives economic growth but also embodies the nation's maritime identity. However, the emergence of Industry 4.0 and the rapid expansion of the digital economy have significantly transformed the competency requirements for human resources in the maritime field. Maritime vocational education, which has traditionally emphasized technical and operational skills, now faces increasing pressure to integrate digital literacy, innovation, and entrepreneurial thinking into its curriculum.

Politeknik Pelayaran Sumatera Barat (Poltekpel Sumbar), a maritime vocational institution under the supervision of the Ministry of Transportation, is dedicated to producing professional and competent seafarers through practice-oriented education (Abduh et al., 2022). Nonetheless, the current wave of digital transformation necessitates a paradigm shift in its educational approach. The emergence of concepts such as smart shipping, digital marine logistics, and maritime-based startups illustrates that future seafarers must not only excel in technical expertise but also demonstrate the capacity to become innovators and entrepreneurs capable of adapting to digital technologies (Nazarwin et al., 2025). This transformation underscores the need for maritime education institutions to develop adaptive curricula that balance technical proficiency with digital competence and creative problem-solving (Mashartanto et al., 2024; Kurniawan et al., 2025). Through this approach, Indonesia's maritime education system can ensure that its graduates remain relevant and competitive in an increasingly digitalized global maritime industry (Bissias et al., 2025).

Generation Z, who predominantly occupy the realm of vocational education today, are characterized by their high proficiency in utilizing digital technologies, their capacity for critical and analytical thinking, and their inclination toward adaptive, flexible, and innovative learning approaches. (Kısaçtutan, 2024). However, the current vocational maritime education system, which continues to emphasize discipline, procedural adherence, and technical proficiency, has not yet fully optimized the creative potential of the younger generation. Consequently, a gap has emerged between the technical competencies of graduates and the evolving needs of the digital maritime industry, which demands innovation, adaptability, and a willingness to take calculated risks. Therefore, it is essential for maritime educational institutions to initiate a paradigm shift toward a learning approach that fosters the development of a digital entrepreneurial mindset, grounded in self-efficacy and cognitive flexibility (Surucu-Balci et al., 2024).

Based on preliminary observations and discussions with lecturers and students at the Sumatera Barat Maritime Polytechnic (Poltekpel Sumbar), several key issues were identified among second-semester students in developing a digital entrepreneurship mindset. First, students demonstrated a relatively low level of self-efficacy in the context of digital entrepreneurship. Many of them still perceive their primary career pathways as being limited to professions such as seafarers or marine technicians, rather than as innovators or entrepreneurs within the digital maritime sector. This lack of confidence in generating business ideas, making strategic decisions, and managing potential risks has contributed to their limited initiative and engagement in entrepreneurial activities (Duong et al., 2024). Secondly, students tend to demonstrate limited cognitive flexibility. Although they possess strong technical skills, their established patterns of thinking often remain routine and procedural. As a result, they face difficulties in adapting to technological changes or modifying their cognitive strategies when confronted with novel problems (Gill et al., 2021). The ability to think flexibly is a vital competency in fostering innovative problem-solving within the context of the digital age. However, students in maritime higher education institutions often experience limited exposure to the digital entrepreneurship ecosystem. This condition arises because maritime education primarily emphasizes technical proficiency and compliance with international seafarer competency frameworks, such as those established by the STCW and IMO conventions. Consequently, opportunities for students to participate in innovation-oriented initiatives or digital entrepreneurship programs remain relatively scarce (Sharma & Nazir, 2021). Fourth, there is still an absence of a structured empowerment program that integrates psychological aspects (self-efficacy) and cognitive dimensions (cognitive flexibility) within the framework of digital entrepreneurship practices. In fact, the integration of these two aspects has been proven to enhance individuals' readiness to make decisions and foster innovation in the technology-driven industrial era (Yu et al., 2023).

These issues highlight a significant gap between the technical competencies of maritime students and the demands of the modern digital shipping industry, which increasingly requires innovation and entrepreneurial skills. Therefore, a structured empowerment model is needed to enhance students' self-confidence and cognitive flexibility through participatory approaches and experiential digital training. Theoretically, the concept of self-efficacy, introduced by Bandura (1997), refers to an individual's belief in their capacity to organize and execute the actions required to achieve specific outcomes. In the context of entrepreneurship, self-efficacy functions as a key psychological determinant influencing one's willingness to take risks, persistence in overcoming challenges, and motivation to innovate. Meanwhile, cognitive flexibility denotes an individual's ability to modify their thought processes, adapt strategies, and approach problems from multiple perspectives. Individuals with high cognitive flexibility tend to exhibit greater creativity, adaptability, and openness to change, which are essential attributes in navigating the dynamic and technology-driven landscape of the maritime industry (Bačnar et al., 2025). The synergy between self-efficacy and cognitive flexibility constitutes a critical foundation for the development of an innovative and competitive digital entrepreneurship mindset. This integration enables individuals to adapt effectively to dynamic technological environments while maintaining confidence in their ability to create and implement novel business solutions.

Practically, the enhancement of these two aspects will enable maritime students to transform from job seekers into job creators. They will not only be prepared to work on ships or within the conventional maritime industry, but also be capable of developing new business opportunities driven by digital technology, such as maritime applications, online logistics systems, or digital-based seafarer training platforms. This initiative aligns with the national blue economy strategy and Indonesia's Digital Economy Roadmap 2030, both of which emphasize the importance of innovation and technological empowerment to ensure the sustainability of the maritime sector (Bhati et al., 2025).

The community service initiative entitled *"Empowering Generation Z Maritime Students to Develop a Digital Entrepreneurial Mindset through Self-Efficacy and Cognitive Flexibility"* represents a tangible manifestation of the institution's commitment to advancing the government's strategic vision of cultivating high-quality maritime human resources who are both competitive and adaptive to technological advancements. This program serves as a strategic effort to bridge academic knowledge with practical application, fostering innovation and entrepreneurial spirit among maritime students. Through this initiative, the institution not only fulfills its educational and social responsibilities but also contributes to the development of a sustainable and technology-oriented maritime sector in Indonesia. This program engages students as the primary subjects of empowerment through interactive training, workshops, digital business idea simulations, and mentoring sessions designed to enhance self-confidence, creativity, and adaptive thinking skills. Consequently, the initiative not only offers academic benefits but also strengthens the role of Poltekpel Sumbar as a leading center for digital maritime empowerment in Indonesia.

The rapid advancement of digital technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), and Big Data Analytics has transformed operational systems within the maritime sector from ship automation to port logistics management. This transformation necessitates the emergence of a new generation of seafarers who possess not only technical proficiency but also mental resilience, adaptability, and an entrepreneurial mindset. Without strategic interventions within vocational education systems, graduates risk falling behind global standards and losing competitiveness in the international labor market. Therefore, empowering maritime students by enhancing their self-efficacy and cognitive flexibility is crucial to preparing them for the demands of the

digital economy era and enabling them to contribute actively to the development of a technology-driven maritime ecosystem.

Prior research concerning maritime vocational education has largely emphasized the development of technical and operational proficiencies, particularly in areas such as navigational skills, maritime safety practices, and vessel management. These studies tend to concentrate on strengthening practical expertise required for professional performance within the maritime industry (Hasan et al., 2024). However, there remains a limited number of studies that examine the psychological and cognitive aspects of students within the context of digital entrepreneurship development. Similarly, community service activities in the maritime sector have predominantly focused on areas such as safety, environmental sustainability, and technical training, rather than on fostering a digital entrepreneurial mindset.

Therefore, this study presents a novel contribution by integrating two essential constructs self-efficacy and cognitive flexibility into a unified approach to fostering a digital entrepreneurial mindset among Generation Z maritime students. This model provides a fresh perspective on the development of vocational education that emphasizes innovation and digital sustainability, offering theoretical and practical implications for future-oriented educational strategies.

METHOD

This study employs a qualitative approach using the Participatory Action Research (PAR) model (Bröer et al., 2023; Timmis et al., 2024). This approach was chosen as it aligns with the study's objective to actively empower students in the learning process and in fostering transformative thinking. The PAR model enables students not merely to serve as research subjects but to act as active participants engaged in every stage of the process from problem identification to the evaluation of outcomes.

The research was conducted at Poltekpel Sumbar, located in Padang Pariaman Regency, West Sumatra. This site was selected because Poltekpel Sumbar is a vocational institution under the Ministry of Transportation, dedicated to developing professional and globally competitive seafarers. The participants of the study were 118 second-semester students enrolled in the maritime study program, who belong to Generation Z. These students were chosen intentionally because they are at an early stage of professional character formation, making them more receptive to guidance and direction in cultivating a digital entrepreneurial mindset (Mini et al., 2023; Syed et al., 2024). In summary, the research setting and participant selection were strategically determined to ensure that the study aligns with the institution's mission and the developmental phase of the student participants, thereby enhancing the relevance and applicability of the research outcomes.

This research was conducted through several sequential and interrelated stages. The initial stage involved preparation and preliminary analysis, beginning with coordination between the research team and the university administration. During this phase, a preliminary survey was administered to explore students' levels of self-efficacy, cognitive flexibility, and their perceptions of the digital entrepreneurship landscape (Mozahem & Adlouni, 2021; Ulfert-blank & Schmidt, 2022). The findings from this initial survey served as the foundation for developing appropriate materials and activity strategies, ensuring that the program was aligned with the students' specific needs and learning contexts (Honra & Monterola, 2024).

The subsequent stage involved digital entrepreneurship socialization and motivation. In this phase, students were introduced to the fundamental concepts of digital entrepreneurship through seminars and interactive discussion sessions. The speakers, consisting of lecturers and practitioners from the digital maritime industry, provided insights into technology-based business opportunities within the maritime sector. This

activity aimed to help students understand the importance of innovation and resilience in adapting to changes in the modern digital work environment (Geaquinto & Alves, 2024; Hasan et al., 2024). The third stage comprised training and workshops, which served as the core component of the empowerment program. Over the course of two days, students engaged in various active learning activities designed to enhance their self-confidence and adaptive thinking skills. During the self-efficacy strengthening session, students were trained to recognize their personal potential, practice decision-making, and develop both individual and group goals. This stage emphasized not only technical competence but also the cultivation of a growth-oriented mindset, preparing students to navigate the challenges and opportunities of the digital maritime entrepreneurship ecosystem effectively.

Meanwhile, in the aspect of cognitive flexibility, students were encouraged to engage in problem-solving activities using the Creative Problem Solving (CPS) and Design Thinking approaches (Tsai et al., 2023; Choi et al., 2024). These methods trained students to adopt an open mindset, explore solutions from multiple perspectives, and develop digital business ideas that align with the maritime sector. The program then continued with simulation sessions and mentoring for digital business idea development. Students were divided into small groups to design and present digital business proposals related to maritime issues, such as marine logistics applications, online sailor education services, or technology-based environmental innovations in the maritime field. Each group received guidance from lecturers and industry mentors, who provided constructive feedback on the feasibility, innovation, and social value of their proposed ideas. Through these activities, students not only enhanced their creative and analytical thinking skills, but also strengthened their communication, teamwork, and leadership competencies key abilities required in the modern digital and maritime industries.

Upon the completion of the entire training and mentoring phases, an evaluation and reflection process was undertaken to comprehensively assess the effectiveness of the implemented activities (Zarestky et al., 2022). The evaluation employed a dual-method approach, consisting of direct observation and written reflections submitted by the participating students. Within these reflections, students were encouraged to critically express the personal transformations they experienced, particularly in terms of enhanced self-confidence, cognitive development, and evolving attitudes toward digital entrepreneurship (Hartmann et al., 2023). In addition, a comparative analysis was conducted between the initial and final survey results to assess the improvement in students' understanding and attitudes toward the training topic. The collected data were analyzed using a qualitative descriptive approach. The analysis involved reading, interpreting, and categorizing the data according to key themes such as the enhancement of self-efficacy, cognitive flexibility, and the development of a digital entrepreneurship mindset. Observational findings, student reflections, and facilitator notes were utilized to draw conclusions regarding the effectiveness of the empowerment activities. To ensure data validity, the researchers employed source triangulation by comparing the results of observations, interviews, and reflective notes. Furthermore, each finding was verified with participants and academic supervisors to confirm that the analysis accurately represented the actual conditions observed in the field.

Overall, this research method emphasizes not only data collection but also the transformational process experienced by the participants. The students, who initially viewed the maritime profession through a conventional lens, began to exhibit a shift in mindset toward greater creativity and innovation (Farrokhnia et al., 2022). Through a participatory approach, the program successfully fostered a collaborative and inspiring learning environment, enabling students to gain confidence in adapting to change and to take initiative in creating new opportunities within the realm of digital maritime entrepreneurship (Jensen et al., 2025). The outcomes of this study will be compiled into a

scientific article and submitted for publication in journals focusing on vocational education or entrepreneurship. Furthermore, the findings and best practices derived from this initiative will be disseminated through campus seminars to encourage the adoption of similar empowerment models in other maritime education institutions.

Accordingly, the research methodology employed in this study extends beyond the mere collection of academic data. It contributes to practical outcomes by enhancing students' and the institution's capacity to cultivate a learning culture grounded in innovation and digital entrepreneurship, particularly within the context of maritime education.

RESULT AND DISCUSSION

The empowerment program for maritime students of Generation Z, aimed at developing a digital entrepreneurship mindset, was conducted at Poltekpel Sumbar over a period of approximately one month. The entire series of activities was successfully implemented, involving 118 second-semester students. The program encompassed several phases, including socialization, training, mentoring, and reflective evaluation. Overall, the outcomes of the program demonstrated a significant improvement in students' self-confidence, cognitive flexibility, and understanding of the importance of digital entrepreneurship within the maritime sector. Moreover, the initiative fostered a more open, active, and collaborative learning atmosphere across the campus environment.

This program thus illustrates the effectiveness of structured empowerment activities in enhancing entrepreneurial awareness and digital adaptability among maritime students, preparing them to face the dynamic challenges of the modern maritime industry.

Figure 1. Digital Entrepreneurship Socialization and Motivation Activity
Source: Personal Documentation

The initial phase of the program commenced with a socialization session and digital entrepreneurship motivation seminar held in the main auditorium of the campus. During this stage, students were introduced to the fundamental concepts of digital entrepreneurship, emphasizing the significance of self-efficacy and cognitive flexibility in the context of the modern maritime industry. One of the photographs included in the report captures the enthusiastic atmosphere of the seminar. The students, dressed in complete uniforms, filled the hall and attentively listened to presentations delivered by lecturers and digital practitioners. Several participants were actively engaged in discussions, posing questions about potential business opportunities within the technology-driven maritime sector.

This activity effectively raised awareness that the maritime world extends beyond ships and ports, encompassing digital innovations such as logistics applications, online training platforms, and data-based maritime information systems. As a result of this session, students began to recognize that creativity and the courage to seize opportunities are essential foundations for pursuing entrepreneurship in the evolving maritime landscape.

Figure 2. Self-Efficacy and Cognitive Flexibility Training
Source: Personal Documentation

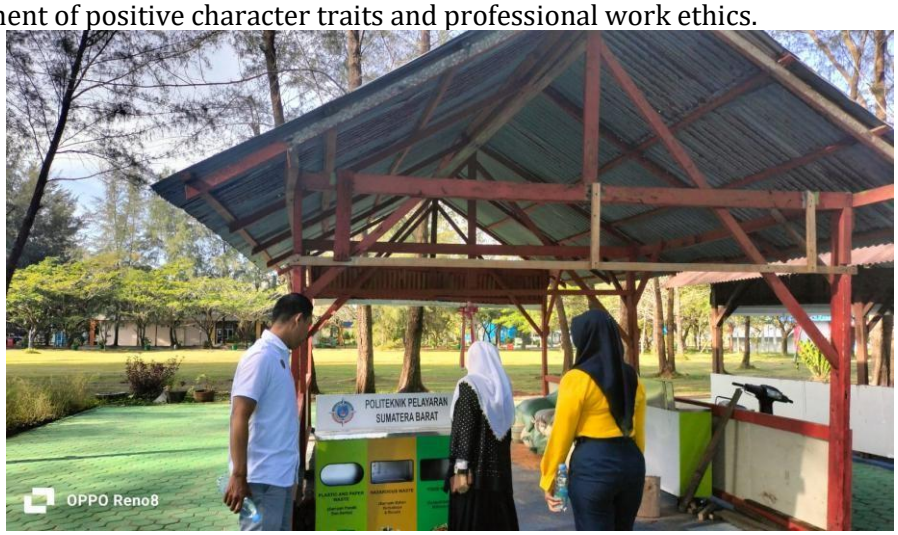
The training and workshop were designed to enhance students' self-efficacy and cognitive flexibility through an interactive and participatory learning environment. The activities took place in laboratory and practical classroom settings, where students engaged in collaborative learning experiences. One of the photographs captures students working in small groups, actively discussing and writing their ideas on a whiteboard. Their expressions reflect a combination of seriousness and enthusiasm, indicating deep engagement in the learning process. During the sessions, participants practiced developing simple business plans, conducted decision-making simulations, and engaged in self-reflective exercises to explore their individual strengths and capabilities. Through these structured activities, students learned to recognize their personal potential, think creatively, and adapt effectively to changing circumstances. Notably, many students who initially lacked confidence began to take initiative in leading discussions and presenting their ideas before their peers. This transformation demonstrates that a participatory, experience-based training approach can successfully foster self-confidence while simultaneously cultivating adaptive and critical thinking skills among students.

During the creative problem-solving session, students were challenged to develop solutions for real-world issues in the maritime sector, such as improving cargo handling efficiency at ports or enhancing work safety monitoring systems. This activity demonstrated a significant improvement in their critical and flexible thinking abilities. Rather than adhering to a single line of reasoning, the students explored innovative and technology-based approaches, integrating diverse ideas to design more effective and digitally oriented solutions.

The subsequent stage involved a simulation activity focused on developing digital business ideas. In the community service report, there is a photograph depicting students delivering pitching presentations before lecturers and mentors. During these sessions, students showcased a variety of innovative maritime-related business concepts, such as vessel tracking applications, online seafarer education platforms, and marine logistics booking systems. This activity provided students with practical experience in designing and presenting business ideas in a professional context. Through the simulation process,

students demonstrated notable improvement in communication skills, teamwork, and innovative thinking. Moreover, they gained valuable insights into transforming conceptual ideas into simple yet applicable business models suitable for real-world implementation.

Furthermore, this activity fostered a spirit of healthy competition among the participants. Some groups strived to present the most creative and feasible ideas, while others demonstrated strong collaboration by supporting one another. This indicates that the program not only enhanced participants' academic abilities but also contributed to the development of positive character traits and professional work ethics.



Source: Personal Documentation

Figure 4. Final Evaluation Activities Conducted by Lecturers and Guest Speakers

At the final stage of the program, an evaluation was conducted through a group reflection session. Based on observations and written reflections, the majority of students reported that the activity was highly beneficial, providing them with new experiences that differed from conventional classroom learning. The report includes a photograph depicting the reflection session, where students sat in a circle to share their experiences and perspectives regarding the program. Many participants expressed that the activity enhanced their confidence and encouraged them to voice their opinions more openly. They also indicated that they became more receptive to new ideas and better prepared to face challenges in the digital era. The results of the reflection demonstrated that the program successfully helped students recognize that being a modern seafarer extends beyond working aboard a ship it also involves playing an active role as innovators in the digital maritime field. This shift in mindset serves as a key indicator of the program's success in empowering participants and fostering the development of forward-thinking maritime professionals.

In addition to benefiting the students, this activity also had a positive impact on the overall learning environment within the campus. Lecturers and supervisors involved in the program acknowledged that experiential and collaborative learning methods proved to be highly effective in enhancing student engagement and participation (Fogg et al., 2022; Findyartini et al., 2023). Several documentation photos captured the close and interactive relationships between lecturers and students throughout the activity, reflecting a dynamic and inspiring learning atmosphere (Feekery, 2024). The lecturers did not merely function as instructors but also assumed the roles of mentors and facilitators, guiding students in developing creative and innovative ideas. This activity serves as a tangible example of how vocational education can be effectively integrated with digital entrepreneurship learning while maintaining the core values of discipline and maritime professionalism. Through such an approach, students are not only prepared to become

competent professionals in their field but are also nurtured as potential entrepreneurs and innovators in the maritime sector.

The findings of this study indicate that the enhancement of self-efficacy and cognitive flexibility plays a crucial role in shaping a digital entrepreneurial mindset among maritime students. Active involvement in the learning process fosters greater confidence, creativity, and adaptability in facing change (Saptono et al., 2021). The participatory approach implemented in this activity aligns with Bandura's (1997) theory, which emphasizes that direct experience and social encouragement are essential factors in building an individual's self-belief (Håkon et al., 2022). Furthermore, design thinking–based training encourages students to think openly and develop creative solutions relevant to the modern maritime context (Ayeh et al., 2023). Consequently, this empowerment initiative not only strengthens the personal competencies of the students but also contributes to the development of a more innovative and adaptive learning culture within the campus environment, responsive to the demands of contemporary advancement (Wibowo et al., 2023).

Based on the results of the activity implementation and the reflections obtained, several recommendations can be proposed. Similar initiatives should be conducted on a continuous basis and integrated into the formal learning programs at the West Sumatra Merchant Marine Polytechnic. Incorporating digital entrepreneurship training into the curriculum can facilitate students' ongoing development of creative thinking skills and self-confidence, better preparing them to navigate challenges in the professional world (Olmos-vega et al., 2023; Honra & Monterola, 2024). Institutional backing is crucial to broaden the reach of these empowerment activities. The campus could establish a digital maritime business incubator to serve as a platform for students to transform their business ideas into tangible projects (Adeel et al., 2023; Herpen et al., 2024). With structured mentoring and guidance, students would have the opportunity to innovate in a more focused and productive manner. Future programs should involve a wider range of external stakeholders, including industry practitioners, maritime startup founders, and relevant government agencies. Such collaborations would enrich students' knowledge and provide potential avenues for partnerships that contribute to the development of Indonesia's digital maritime sector. It is essential to regularly assess the effectiveness of these activities. Through follow-up surveys or longitudinal studies, the institution can monitor the extent to which students' mindset changes persist and evolve after participation in the programs (Rosado-Cuberoa et al., 2024). The implementation of these recommendations is expected to position Poltekpel Sumbar as a leading institution in innovative maritime vocational education with global competitiveness. Additionally, this empowerment initiative is intended to serve as a benchmark for other educational institutions in preparing a new generation of maritime professionals who are not only equipped with workforce-ready competencies but also capable of generating opportunities and contributing substantively to the development of Indonesia's digital economy.

CONCLUSION

The empowerment program for maritime students of Generation Z aimed at developing an entrepreneurial digital mindset through the enhancement of self-efficacy and cognitive flexibility has been successfully implemented at the Politeknik Pelayaran Sumatera Barat. The series of activities including socialization, training, simulation, and reflection produced substantial and observable outcomes in transforming students' mindsets and attitudes. Findings from the program indicate a significant improvement in students' confidence, adaptive thinking skills, and comprehension of the importance of digital entrepreneurship within the maritime sector. Moreover, the participants have begun to perceive the seafaring profession not merely as a technical occupation but also as

a strategic opportunity to innovate and create new technology-based business ventures. The enhancement of self-efficacy was evident through students' increased confidence in expressing opinions, making decisions, and taking leadership roles during the training sessions. Meanwhile, the improvement in cognitive flexibility was reflected in their ability to solve problems using creative and collaborative approaches. The digital business idea simulation activity served as an effective platform for students to refine their critical thinking skills and translate their ideas into practical application. In addition to providing direct benefits for students, this activity also had a positive impact on the overall learning environment within the campus. Lecturers began to adopt more participatory and contextual teaching approaches, creating a learning atmosphere that is more active, open, and collaborative. The program demonstrated that vocational education in the maritime field is not only capable of producing job-ready graduates but also of nurturing a generation of seafarers who are creative, innovative, and possess a digital entrepreneurial spirit. Overall, the initiative successfully achieved its primary objective: fostering a digital entrepreneurial mindset among maritime students by enhancing their self-efficacy and cognitive flexibility. This represents a significant step toward developing high-quality, adaptive, and competitive human resources in Indonesia's maritime sector, capable of thriving amid the ongoing digital transformation era.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the institutional support and facilities provided by Politeknik Pelayaran Sumatera Barat and the assistance of the university administration in coordinating this program. We thank the 118 participating students for their active engagement, and the lecturers, workshop facilitators, industry mentors, and guest speakers whose expertise and guidance were essential to the training, mentoring, and evaluation activities. We also appreciate the contributions of administrative and technical staff who supported logistics, documentation, and data collection. Finally, we are grateful to colleagues who provided constructive feedback during the preparation of this manuscript.

AUTHOR CONTRIBUTION STATEMENT

RP conceived and coordinated the community service program, secured institutional partnerships, and oversaw overall implementation; BH developed the training curriculum and led the seminars and workshop sessions; EW facilitated the design-thinking and Creative Problem Solving activities and mentored student teams during the digital business simulations; NZ managed fieldwork, collected observational and reflective data, and organized documentation; HD performed qualitative data analysis, synthesized findings, and drafted and revised the manuscript. All authors contributed to the program evaluation, reviewed the manuscript, and approved the final version for submission.

REFERENCES

Abduh, M., Hasnur, J., & Siska, S. Y. (2022). The effect of maritime English vocabulary for beginners module on the vocabulary learning outcomes. *Jurnal Pendidikan Vokasi*, *12*(2), 117–129. https://doi.org/10.21831/jpv.v12i2.49033

Adeel, S., Daniel, A. D., & Botelho, A. (2023). The effect of entrepreneurship education on the determinants of entrepreneurial behaviour among higher education students: A multi- group analysis. *Journal of Innovation & Knowledge*, *8*(1), 100324. https://doi.org/10.1016/j.jik.2023.100324

Ayeh, J. K., Bondzi-simpson, A., & Baah, N. G. (2023). Predicting Students ' Response to Entrepreneurship in Hospitality and Tourism Education : An Application of the Theory of Planned Behavior. *Journal of Hospitality & Tourism Education*, *35*(3), 265–276. https://doi.org/10.1080/10963758.2022.2056469

Bačnar, D., Barić, D., & Ogrizović, D. (2025). Charting the Future of Maritime Education and Training: A Technology-Acceptance-Model-Based Pilot Study on Students' Behavioural Intention to Use a Fully Immersive VR Engine Room Simulator. *Applied System Innovation*, *8*(3). https://doi.org/10.3390/asi8030084

Bhati, M., Goerlandt, F., & Pelot, R. (2025). Digital twin development towards integration into blue economy: A bibliometric analysis. *Ocean Engineering*, *317*(December 2024), 119781. https://doi.org/10.1016/j.oceaneng.2024.119781

Bissias, I. G., Pallis, A. A., & Theotokas, I. N. (2025). Gen Zers and the seafaring profession: A generational approach to enrolment in merchant marine academies. *WMU Journal of Maritime Affairs*, *January*. https://doi.org/10.1007/s13437-024-00355-4

Bröer, C., Veltkamp, G., Ayuandini, S., Baillergeau, E., Moerman, G., Sauvage, R. De, Banik, A., Luszczynska, A., Rito, A., Mendes, S., Klepp, K., Helleve, A., Nesrallah, S., Lien, N., & Grewal, N. K. (2023). Negotiating policy ideas : Participatory action research projects across five European countries. *Ethics, Medicine and Public Health*, *28*. https://doi.org/10.1016/j.jemep.2023.100905

Choi, H., Kim, H., & Kim, N. (2024). Enhancing creativity through a problem-based design thinking project in higher education. *Cogent Education*, *11*(1). https://doi.org/10.1080/2331186X.2024.2378272

Duong, C. D., Nga Ngo, T. V., Thu Nguyen, T. P., Tran, N. M., & Pham, H. T. (2024). Digital entrepreneurial education and digital entrepreneurial intention: A moderated mediation model. *Social Sciences and Humanities Open*, *10*(August), 101178. https://doi.org/10.1016/j.ssaho.2024.101178

Farrokhnia, M., Baggen, Y., Biemans, H., & Noroozi, O. (2022). Bridging the fields of entrepreneurship and education : The role of philosophical perspectives in fostering opportunity identification. *The International Journal of Management Education*, *20*(2), 100632. https://doi.org/10.1016/j.ijme.2022.100632

Feekery, A. (2024). The 7 C ' s framework for participatory action research : inducting novice participant- researchers inducting novice participant-researchers. *Educational Action Research*, *32*(3), 332–347. https://doi.org/10.1080/09650792.2023.2234417

Findyartini, A., Syah, N. A., Susilo, A. P., Qomariyah, N., Greviana, N., Ainin, D. Q., Sari, M., & Claramita, M. (2023). Challenges and opportunities in cultivating medical students ' competencies : Participatory action research from a hierarchical cultural setting. *Medical Education Online*, *28*(1). https://doi.org/10.1080/10872981.2023.2185122

Fogg, C., Lanning, E., Shoebridge, J., Longstaff, J., Vos, R. De, Dawson-taylor, K., Glanville-hearson, A., Carpenter, D., Court, S., Brown, T., Heiden, E., & Chauhan, A. (2022). The role of Participatory Action Research in developing new models of healthcare : Perspectives from participants and recommendations for ethical review and governance oversight. *Ethics, Medicine and Public Health*, *24*, 100833. https://doi.org/10.1016/j.jemep.2022.100833

Geaquinto, R., & Alves, H. (2024). Entrepreneurship education for non-business students : A social learning perspective. *The International Journal of Management Education*, *22*(2), 100974. https://doi.org/10.1016/j.ijme.2024.100974

Gill, S. A., Bencheva, N., Karayel, S., & Usman, M. (2021). Does entrepreneurial self-efficacy moderate effects of cognitive flexibility and entrepreneurial alertness on entrepreneurial intentions? *Entrepreneurial Business and Economics Review*, *9*(3), 25–41. https://doi.org/10.15678/EBER.2021.090302

Håkon, D., Aaboen, L., & Williams, K. (2022). Teaching and facilitating action-based entrepreneurship education : Addressing challenges towards a research agenda. *The International Journal of Management Education*, *20*(3), 100711. https://doi.org/10.1016/j.ijme.2022.100711

Hartmann, A., Kruijf, J. V., & Weesep, R. Van. (2023). Asking the right questions : The role of reflection for learning in and between projects. *International Journal of Project*

Management, *41*(5), 102494. https://doi.org/10.1016/j.ijproman.2023.102494
Hasan, M., Tiara Hutamy, E., Supatminingsih, T., Ahmad, M. I. S., Aeni, N., & Dzhelilov, A. A. (2024). The role of entrepreneurship education in the entrepreneurial readiness of generation Z students: why do digital business literacy and financial literacy matter? *Cogent Education*, *11*(1). https://doi.org/10.1080/2331186X.2024.2371178
Herpen, S. G. A. Van, Hilverda, F., & Vollmann, M. (2024). A longitudinal study on the impact of student- teacher and student-peer relationships on academic performance : the mediating effects of study effort and engagement. *European Journal of Higher Education*, *8235*, 1–20. https://doi.org/10.1080/21568235.2024.2414760
Honra, J. R., & Monterola, S. L. C. (2024). Fostering cognitive flexibility of students through design thinking in biology education. *Cogent Education*, *11*(1). https://doi.org/10.1080/2331186X.2024.2415301
Jensen, I. B., Dikilitas, K., & Jensen, I. B. (2025). A scoping review of action research in higher education : implications for research-based teaching implications for research-based teaching. *Teaching in Higher Education*, *2517*, 84–101. https://doi.org/10.1080/13562517.2023.2222066
Kısaçtutan, E. D. (2024). *Digital natives of the labor market : Generation Z as future leaders and their perspectives on leadership*. *May*, 1–12. https://doi.org/10.3389/fpsyg.2024.1378982
Kurniawan, M., Hasnur, J., & Siska, S. Y. (2025). Character Building in University Students: Comprehension of Islamic Value & Discipline. *Edureligia : Jurnal Pendidikan Agama Islam*, *09*(01), 48–67.
Mashartanto, A. A., Pranata, W., & Siska, S. Y. (2024). Development of Learning Media Maritime English Textbook for Ratings Forming. *Journal of Languages and Language Teaching*, *12*(3), 1238. https://doi.org/10.33394/jollt.v12i3.11337
Mini, R., Salim, A., Refolia, M., Aisyah, N., David, D., & Situmorang, B. (2023). The role of career decision self-efficacy as a mediator of peer support on students ' career adaptability. *Heliyon*, *9*(4), e14911. https://doi.org/10.1016/j.heliyon.2023.e14911
Mozahem, N. A., & Adlouni, R. O. (2021). Using Entrepreneurial Self-Efficacy as an Indirect Measure of Entrepreneurial Education. *The International Journal of Management Education*, *19*(1), 100385. https://doi.org/10.1016/j.ijme.2020.100385
Nazarwin, Putra, R. W., Hermanto, B., & Siska, S. Y. (2025). Strategies for Enhancing Job Satisfaction : The Influence of Rewards , Work-Life Balance & Coworker Support. *International Journal of Management, Entrepreneurship, Social Science and Humanities And*, *9*(1), 104–123.
Olmos-vega, F. M., Stalmeijer, R. E., Varpio, L., & Kahlke, R. (2023). A practical guide to reflexivity in qualitative research : AMEE Guide No . 149. *Medical Teacher*, *45*(3), 241–251. https://doi.org/10.1080/0142159X.2022.2057287
Rosado-Cuberoa, A., Hernandezb, A., Blanco-Jimenezc, F. J., & Freire-Rubio, T. (2024). Seeding young entrepreneurs : The role of business incubators. *Journal of Innovation & Knowledge*, *9*. https://doi.org/10.1016/j.jik.2024.100579
Saptono, A., Wibowo, A., Widyastuti, U., Shandy, B., & Yanto, H. (2021). Entrepreneurial self-ef fi cacy among elementary students : the role of entrepreneurship education. *Heliyon*, *7*(9), e07995. https://doi.org/10.1016/j.heliyon.2021.e07995
Sharma, A., & Nazir, S. (2021). Assessing the technology self-efficacy of maritime instructors: An explorative study. *Education Sciences*, *11*(7). https://doi.org/10.3390/educsci11070342
Surucu-Balci, E., Iris, Ç., & Balci, G. (2024). Digital information in maritime supply chains with blockchain and cloud platforms: Supply chain capabilities, barriers, and research opportunities. *Technological Forecasting and Social Change*, *198*(October 2023). https://doi.org/10.1016/j.techfore.2023.122978
Syed, R. T., Alzahmi, R. A., & Tariq, U. (2024). Digital entrepreneurship education in

universities through the lens of educators : evidence from the United Arab Emirates. *Cogent Education*, *11*(1). https://doi.org/10.1080/2331186X.2024.2409472

Timmis, S., Mgqwashu, E., Trahar, S., Naidoo, K., & Muhuro, P. (2024). Students as co-researchers : participatory methods for decolonising research in teaching and learning in higher education education. *Teaching in Higher Education*, *29*(7), 1793–1812. https://doi.org/10.1080/13562517.2024.2359738

Tsai, C., Song, M. W., Lo, Y., & Lo, C. (2023). Design thinking with constructivist learning increases the learning motivation and wicked problem-solving capability — An empirical research in Taiwan. *Thinking Skills and Creativity*, *50*(August 2022), 101385. https://doi.org/10.1016/j.tsc.2023.101385

Ulfert-blank, A., & Schmidt, I. (2022). Assessing digital self-efficacy : Review and scale development. *Computers & Education*, *191*(March), 104626. https://doi.org/10.1016/j.compedu.2022.104626

Wibowo, A., Shandy, B., Dianta, K., Sebayang, A., Mukhtar, S., Hakimi, M., & Shafiai, M. (2023). How does digital entrepreneurship education promote entrepreneurial intention ? The role of social media and entrepreneurial intuition. *Social Sciences & Humanities Open*, *8*(1), 100681. https://doi.org/10.1016/j.ssaho.2023.100681

Yu, X., Zhao, X., & Hou, Y. (2023). Cognitive flexibility and entrepreneurial creativity: the chain mediating effect of entrepreneurial alertness and entrepreneurial self-efficacy. *Frontiers in Psychology*, *14*(November), 1–12. https://doi.org/10.3389/fpsyg.2023.1292797

Zarestky, J., Bigler, M., Brazile, M., Lopes, T., & Bangerth, W. (2022). Reflective Writing Supports Metacognition and Self-regulation in Graduate Computational Science and Engineering. *Computers and Education Open*, *3*(June 2021), 100085. https://doi.org/10.1016/j.caeo.2022.100085