

Navigating Challenges: Exploring Cadets' Perspectives on Maritime Cyber Resilience in STIP Jakarta's Semester 3 Program

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Abstract. *This qualitative study investigates the perspectives of 240 Semester 3 cadets at the Maritime Institute Jakarta (STIP Jakarta) regarding An Operational Approach to Maritime Cyber Resilience. Over three semesters, the research scrutinizes cadets' academic self-checked intelligence, perceived professional competences, motivations, and the interplay between language development and preparedness for global roles. The demographic diversity of the cadet sample, representing majors in Nautical, Technical, and Port and Shipping Management, ensures a comprehensive exploration of maritime education. The findings reveal a positive evolution in cadets' understanding of maritime cyber resilience, with a notable increase in academic self-checked intelligence. The curriculum's effectiveness in cultivating a nuanced comprehension of cyber threats is underscored by the enhanced professional competences perceived by cadets, indicating preparedness for the practical challenges in the maritime industry. Motivations and engagement exhibit a positive trajectory, from initial challenges to sustained interest, indicating the subject's growing relevance over time. The interconnected development of English language proficiency and subject mastery emphasizes the need for targeted language support within maritime education. The positive correlation between improved language fluency and a deeper understanding of maritime cyber resilience suggests the symbiotic relationship between linguistic and technical competence. The study's implications extend beyond STIP Jakarta, offering insights for refining maritime education globally. Recommendations encompass dynamic pedagogical approaches, continual curriculum evaluation, industry collaboration, and language enhancement initiatives. By embracing these recommendations, maritime education programmes can foster a resilient cadre of professionals adept at navigating the complexities of the modern maritime industry.*

Keywords: *Cadet Perspectives, Language Development, Maritime Cyber Resilience, Maritime Education, Professional Competences*

INTRODUCTION

Maritime education, with its unique blend of theoretical knowledge and practical skills, plays a pivotal role in shaping individuals into competent professionals ready to navigate the challenges of the maritime industry (de la Peña Zarzuelo et al., 2020). Among the multifaceted aspects of maritime education, the integration of contemporary subjects is crucial to meet the evolving demands of the sector. This research focuses on the perspectives of Semester 3 cadets at the Maritime Institute Jakarta (STIP Jakarta), delving into their experiences and insights into the study of An Operational Approach to Maritime Cyber Resilience over a period of three semesters. STIP Jakarta, as a renowned maritime institute, has a commendable legacy in producing highly qualified seamen, deck officers, and engine officers. The institute, rooted in an international program, is dedicated to preparing cadets to become global officers equipped with the necessary skills and knowledge to excel in the international maritime domain (Ferritto, 2016; Manuel, 2017). This preparation extends beyond traditional academic aspects to include

mental, vocational, and professional dimensions (Manuel, 2017). The significance of this preparation becomes evident as cadets progress to undertake internships in the shipping, cargo, or international delivery industry, aligning with their majors in Nautical, Technical, or Port and Shipping Management.

In the contemporary maritime landscape, the emergence of cyber threats poses a new set of challenges that demand attention and proactive measures. The integration of An Operational Approach to Maritime Cyber Resilience into the curriculum for Semester 3 cadets becomes particularly relevant in this context. As the maritime industry becomes increasingly digitized and reliant on technology, the vulnerability to cyber threats grows. Therefore, a nuanced understanding of cyber resilience becomes imperative for the cadets who are on the trajectory to become future maritime leaders. The urgency of understanding cadets' perspectives on maritime cyber resilience stems from the critical role technology plays in modern maritime operations (Christodoulou-Varotsi & Pentsov, 2008). The integration of digital systems and communication technologies has undeniably enhanced efficiency but has concurrently exposed the industry to cyber risks. The need for a comprehensive approach to cyber resilience is accentuated by the potential consequences of cyber-attacks on maritime operations, including disruptions to navigation systems, compromise of sensitive information, and threats to overall maritime security (Balkin, 2006).

Cadets, as the future workforce of the maritime industry, need to be equipped with not only technical skills but also a heightened awareness of the cyber threats that may confront them in their professional journeys (House & Saeed, 2016; Sharma et al., 2019). The three-semester duration of this study allows for a longitudinal exploration of how cadets' perspectives evolve as they engage with the subject over time. This research aims to uncover not only their initial perceptions but also the impact of sustained exposure to the topic on their academic self-checked intelligence, professional competences, and motivations (Lebeničnik & Starčič, 2020). Furthermore, the urgency is underscored by the international nature of the maritime programs at STIP Jakarta. As cadets come from diverse regions of Indonesia, where Bahasa Indonesia and various traditional languages are integral to daily life, the transition to mastering English communication is a crucial aspect of their preparation as global officers. English proficiency, specifically in line with International Maritime education standards mandated by the International Maritime Organization (IMO) and STCW, is non-negotiable for effective communication and collaboration in the global maritime arena (IMO, 2018; Young, 1995).

A cursory examination of the existing literature reveals a growing recognition of the significance of maritime cyber resilience in contemporary discourse. The maritime industry's increasing reliance on interconnected systems and digital technologies has brought about a paradigm shift in the nature of threats it faces (Comtois & Slack, 2017). The need for a proactive and adaptive approach to cyber resilience is evident across various sectors, including shipping, ports, and international delivery. As cyber threats evolve in sophistication and frequency, the importance of incorporating cyber resilience into maritime education becomes apparent (Albayrak & Ziarati, 2012). However, the literature also highlights the challenges in bridging the gap between theoretical knowledge and practical application. Effective cyber resilience requires not only technical expertise but also a holistic understanding of the maritime context, regulations, and the human factor. Therefore, this research seeks to contribute to the existing body of knowledge by exploring how cadets, as the future workforce, perceive and integrate the operational aspects of maritime cyber resilience into their overall maritime education (Erdogan & Demirel, 2017).

The international dimension adds another layer to the literature, emphasising the necessity for English proficiency among cadets (Organization, 2009; Trenkner, 2009). English serves as the *lingua franca* of the maritime industry, facilitating communication and collaboration among professionals from diverse linguistic backgrounds. Therefore, investigating how cadets, who hail from various regions of Indonesia with distinct linguistic traditions, navigate the transition to mastering English communication within the context of maritime education is a pertinent area of exploration (Albayrak & Ziarati, 2012). The synthesis of maritime cyber resilience and English proficiency in the curriculum for Semester 3 cadets at STIP Jakarta reflects a proactive response to the evolving landscape of the maritime industry. This research, through qualitative exploration and descriptive analysis, aims to provide valuable insights into the cadets' perspectives, contributing to the ongoing discourse on enhancing maritime education to meet contemporary challenges.

RESEARCH METHOD

This study adopts a qualitative descriptive approach to comprehensively explore the perspectives of Semester 3 cadets at the Maritime Institute Jakarta (STIP Jakarta) regarding the study of *An Operational Approach to Maritime Cyber Resilience*. The qualitative methodology is chosen to capture the nuanced and multifaceted nature of the cadets' experiences without imposing predefined categories, allowing for a rich and in-depth understanding of their viewpoints (Saldana, 2014). A sample size of 240 cadets is randomly selected from the

Semester 3 cohort at STIP Jakarta, representing the diverse backgrounds and majors of Nautical, Technical, and Port and Shipping Management. The randomness of the selection ensures a representative cross-section of the cadet population, enhancing the generalizability of the findings. Given the nature of qualitative research and the logistical considerations of the study, data collection is conducted through a thoughtful combination of self-reporting and structured data gathering (“Analysing Data and Interpreting Findings,” 2013). Cadets are provided with a questionnaire designed by the researcher, containing open-ended questions and prompts that encourage them to reflect on their experiences studying maritime cyber resilience over three semesters. The questionnaire is carefully crafted to cover various dimensions, including academic self-checked intelligence, professional competences, motivations, and other relevant factors (Bailey & Ngwenyama, 2009).

The questionnaire serves as a tool to guide cadets in articulating their perspectives and insights without direct interviews. This approach is chosen to respect the constraints of the cadets' busy schedules, ensuring that the data collection process is minimally intrusive while still eliciting valuable responses. The open-ended nature of the questions allows for the exploration of emergent themes and ensures that the cadets have the flexibility to express their thoughts in their own words.

To uphold ethical standards, cadets are informed about the research purpose, the voluntary nature of their participation, and the confidential treatment of their responses. Informed consent is obtained from each participant, emphasizing their right to withdraw from the study at any point without consequences. The collected data undergoes a rigorous process of qualitative analysis (Lee et al., 1999; Willig, 2014). The researcher employs thematic analysis to identify recurring patterns, themes, and connections within the responses. This analytical approach allows for a systematic exploration of the cadets' perspectives, enabling the extraction of meaningful insights. The identified themes are then categorised and organised, contributing to the overall understanding of how the study of maritime cyber resilience influences various aspects of the cadets' academic and professional development. To enhance the validity of the findings, a triangulation approach is employed, cross-referencing responses with academic records and relevant contextual information (Tohara et al., 2021). The reliability of the study is ensured through the transparent documentation of the research process, providing a clear trail for potential future replication. The qualitative descriptive approach, coupled with a carefully designed questionnaire, allows for an in-depth exploration of Semester 3 cadets' perspectives on maritime cyber resilience at STIP Jakarta. This methodological choice aligns with the research goals, offering valuable insights into the integration of contemporary

subjects within maritime education while respecting the practical constraints of the cadet population.

RESULTS AND DISCUSSIONS

Results

This section presents the results and findings of the qualitative descriptive research conducted among Semester 3 cadets at the Maritime Institute Jakarta (STIP Jakarta) regarding their perspectives on An Operational Approach to Maritime Cyber Resilience. The study aimed to explore how the cadets perceive and integrate the subject into their academic, mental, vocational, and professional development over a three-semester duration.

Demographic Overview

Before delving into the specific findings, it is essential to provide a demographic overview of the cadet participants. The 240 cadets included in the study represent a diverse range of backgrounds, majors, and geographic origins within Indonesia. The sample includes cadets from Nautical, Technical, and Port and Shipping Management majors, reflecting the comprehensive nature of STIP Jakarta's maritime education programme.

Academic Self-Checked Intelligence

One of the central themes emerging from the responses is the cadets' growing awareness of the importance of cyber resilience in the maritime sector. Initially, many cadets admitted limited exposure to the intricacies of maritime cyber resilience. However, over the three semesters, a discernible shift is observed. As depicted in Table 1, the majority of cadets (68%) expressed an increased understanding of cyber threats and resilience strategies, attributing this to the structured curriculum and practical applications introduced in their courses.

Table 1: Cadets' Perception of Academic Self-Checked Intelligence on Maritime Cyber Resilience

| Semester | Limited Understanding (%) | Increased Understanding (%) |
|----------|---------------------------|-----------------------------|
| 1 | 82 | 18 |
| 2 | 38 | 62 |
| 3 | 32 | 68 |

The data indicates a notable enhancement in cadets' academic self-checked intelligence, aligning with the research's objectives. The structured exposure to the subject over successive semesters appears to contribute significantly to their evolving comprehension.

Professional Competences

The research also explored how the study of maritime cyber resilience influences the development of professional competences among cadets. Table 2 illustrates cadets' self-perception of their competences in dealing with cyber threats in a maritime context.

Table 2: Cadets' Self-Perception of Professional Competences in Maritime Cyber Resilience

| Semester | Limited Competence (%) | Improved Competence (%) |
|-----------------|-------------------------------|--------------------------------|
| 1 | 74 | 26 |
| 2 | 29 | 71 |
| 3 | 18 | 82 |

The findings suggest a significant improvement in cadets' perceived professional competences related to maritime cyber resilience. The shift towards enhanced competence becomes more pronounced with each successive semester, indicating a positive correlation between academic exposure and practical proficiency.

Motivations and Engagement

Understanding the factors influencing cadets' motivations and engagement with the subject is crucial for evaluating the effectiveness of the curriculum. Table 3 outlines cadets' responses regarding their motivations and engagement levels over the three semesters.

Table 3: Cadets' Motivations and Engagement in Studying Maritime Cyber Resilience

| Semester | Initial Motivation (%) | Sustained Motivation (%) | High Engagement (%) |
|-----------------|-------------------------------|---------------------------------|----------------------------|
| 1 | 68 | 32 | 22 |
| 2 | 47 | 53 | 38 |
| 3 | 41 | 59 | 46 |

The data reflects a positive trend, with cadets displaying sustained motivation and increasing engagement as they progress through the semesters. While initial motivation may vary, the structured curriculum and practical applications contribute to a growing appreciation for the relevance of maritime cyber resilience in their future careers.

Other Factors Impacting Perspectives

The qualitative analysis also uncovered additional factors influencing cadets' perspectives on maritime cyber resilience. The international nature of the programme at STIP Jakarta introduces the challenge of mastering English communication. Many cadets (56%) acknowledged the dual challenge of adapting to the subject matter and developing fluency in English. This aspect is crucial for their preparedness as global officers conforming to International Maritime education standards.

Table 4: Cadets' Perception of English Fluency Development

| Semester | Limited Fluency Development (%) | Improved Fluency Development (%) |
|-----------------|--|---|
| 1 | 56 | 44 |
| 2 | 33 | 67 |
| 3 | 22 | 78 |

Table 4 illustrates a positive trajectory in the development of English fluency among the cadets. The concurrent improvement in fluency and understanding of maritime cyber resilience suggests a symbiotic relationship between language acquisition and subject mastery.

The results offer valuable insights into the evolving perspectives of Semester 3 cadets at STIP Jakarta regarding maritime cyber resilience. The notable improvement in academic self-checked intelligence, perceived professional competences, and sustained motivation aligns with the objectives of the study. The structured curriculum and practical applications contribute significantly to the cadets' development in these areas. The positive correlation between academic exposure and practical proficiency indicates the efficacy of the curriculum in preparing cadets for the challenges of the maritime industry. The findings also underscore the importance of sustained engagement and motivation, highlighting the need for dynamic and relevant pedagogical approaches in maritime education.

Furthermore, the impact of English language development on cadets' overall preparedness cannot be understated. The dual challenge of mastering both the subject matter and English communication skills emphasises the need for targeted language support within maritime education programmes. The research provides a nuanced understanding of how Semester 3 cadets at STIP Jakarta perceive and integrate the study of maritime cyber resilience into their maritime education. The positive trends observed in academic self-checked intelligence, professional competences, and motivation underscore the effectiveness of the curriculum in addressing contemporary challenges.

The findings have implications for curriculum design, emphasising the importance of practical applications and sustained engagement to enhance cadets' preparedness for the maritime industry. Additionally, the research highlights the intertwined development of English language proficiency and subject mastery, calling for targeted language support initiatives within maritime education programmes. The study contributes valuable insights to the discourse on maritime education and cyber resilience, offering a foundation for further research and potential enhancements to existing programmes. As the maritime industry continues to evolve in the digital age, understanding and addressing the perspectives of future professionals is essential for fostering a resilient and competent workforce.

Discussions

The findings of this research shed light on the evolving perspectives of Semester 3 cadets at the Maritime Institute Jakarta (STIP Jakarta) regarding the study of An Operational Approach to Maritime Cyber Resilience. The discussion will delve into the implications of the results, their broader significance for maritime education, and provide recommendations for enhancing the effectiveness of educational programmes in preparing cadets for the challenges of the maritime industry.

Academic and Professional Development

The positive trajectory observed in cadets' academic self-checked intelligence and perceived professional competences highlights the effectiveness of the curriculum in addressing the complexities of maritime cyber resilience. The structured exposure to the subject matter over three semesters has led to an enhanced understanding among cadets, aligning with the objectives of preparing them for the digital challenges in the maritime industry.

The implications of this trend extend beyond the immediate academic context. As future leaders in the maritime sector, the cadets' evolving competences in dealing with cyber threats bode well for the industry's overall resilience. A workforce that is not only technically adept but also cognizant of cyber risks is essential in safeguarding maritime operations against evolving threats.

Motivations and Engagement

The sustained motivation and increasing engagement observed among cadets over successive semesters indicate the relevance and resonance of the subject matter. The initial challenges faced by some cadets in grasping the importance of maritime cyber resilience diminish over time, giving way to a more profound understanding and commitment.

This shift in motivation is crucial for long-term retention of knowledge and skills. The sustained engagement reflects not only the effectiveness of the curriculum but also the cadets' recognition of the subject's practical importance in their future careers. Educators can leverage these insights to refine teaching methodologies and emphasize real-world applications to enhance motivation from the outset.

Language Proficiency and Subject Mastery

The intertwined development of English language proficiency and subject mastery among cadets introduces a noteworthy dimension to the discussion. The positive correlation between improved fluency and a deeper understanding of maritime cyber resilience suggests a symbiotic relationship between language acquisition and technical competence.

This finding underscores the importance of incorporating targeted language support within maritime education programmes. While the curriculum addresses the technical aspects of cyber resilience, ensuring that cadets master the lingua franca of the maritime industry is equally crucial. Language enhancement initiatives could include specialised language courses, communication workshops, and immersive language experiences to bridge the language gap effectively.

Implications

The implications of this research extend beyond the immediate context of STIP Jakarta to broader considerations for maritime education and industry preparedness:

1. **Curriculum Enhancement:** The positive outcomes observed in this study suggest the importance of integrating practical applications and real-world scenarios into maritime education curricula. Educators can use these findings to enhance existing programmes, ensuring that they align with industry demands and effectively prepare cadets for their future roles.
2. **Continuous Engagement:** Sustained engagement and motivation are crucial components of effective learning. The research highlights the need for dynamic and engaging pedagogical approaches that maintain cadets' interest throughout their maritime education. This could involve incorporating case studies, interactive simulations, and industry collaborations to enhance the practical relevance of the curriculum.
3. **Language Support Initiatives:** Recognising the dual challenge faced by cadets in mastering both subject matter and English communication, maritime education institutions should consider implementing targeted language support initiatives. These could include language courses, communication workshops, and immersive language experiences to ensure that cadets are well-equipped for international communication in the maritime domain.
4. **Industry Collaboration:** The positive correlation between academic exposure and professional competences suggests the importance of collaboration between educational institutions and the maritime industry. Establishing partnerships with industry stakeholders can facilitate the integration of real-world challenges and best practices into the curriculum, ensuring that cadets are well-prepared for the complexities of their future roles.

Recommendations

Building on the implications, the following recommendations are proposed for enhancing the effectiveness of maritime education programmes:

1. **Integrate Practical Scenarios:** Enhance the curriculum by incorporating practical scenarios and case studies related to maritime cyber resilience. This could involve simulated exercises, guest lectures from industry experts, and collaborative projects that expose cadets to real-world challenges.
2. **Dynamic Pedagogical Approaches:** Implement dynamic and interactive pedagogical approaches that maintain cadets' engagement throughout their maritime education. This could include flipped classrooms, team-based projects, and experiential learning opportunities that foster a deeper understanding of the subject matter.
3. **Language Enhancement Programs:** Develop and implement language enhancement programs specifically tailored to the needs of maritime cadets. These programs should focus on improving English communication skills and technical vocabulary relevant to the maritime industry, ensuring that cadets can effectively communicate in international settings.
4. **Industry-Embedded Internships:** Strengthen ties with the maritime industry to facilitate industry-embedded internships for cadets. This practical exposure will not only reinforce academic learning but also provide invaluable insights into the real-world application of maritime cyber resilience measures.
5. **Continual Curriculum Evaluation:** Establish a framework for continual evaluation and adaptation of the curriculum to align with evolving industry trends. Regular input from industry professionals, alumni feedback, and ongoing research can inform updates to the curriculum, ensuring its ongoing relevance and effectiveness.

The research findings provide valuable insights into the perspectives of Semester 3 cadets at STIP Jakarta on maritime cyber resilience. The implications and recommendations outlined above aim to contribute to the ongoing improvement of maritime education programmes, fostering a workforce that is not only technically proficient but also resilient and well-prepared for the challenges of the modern maritime industry.

CONCLUSION

This research, centred on the perspectives of Semester 3 cadets at the Maritime Institute Jakarta (STIP Jakarta) regarding An Operational Approach to Maritime Cyber Resilience, has provided valuable insights into the evolving landscape of maritime education. The study spanned three semesters, examining cadets' academic self-checked intelligence, perceived professional competences, motivations, and the impact of language development on their preparedness as global officers. The findings reveal a positive trajectory in the cadets' understanding of maritime cyber resilience, with a notable enhancement in academic self-checked intelligence over successive semesters. This underscores the effectiveness of the curriculum in cultivating a nuanced appreciation for the complexities of cyber threats in the maritime domain. The improvement in perceived professional competences suggests that the structured curriculum contributes significantly to preparing cadets for the practical challenges they may encounter in the maritime industry.

Moreover, sustained motivation and increasing engagement among cadets reflect the relevance of the subject matter to their future careers. The transition from initial challenges to a deeper understanding indicates the effectiveness of the educational approach in fostering a lasting commitment to the importance of maritime cyber resilience. The intertwined development of English language proficiency and subject mastery introduces a multifaceted dimension to the conclusions. The positive correlation between improved language fluency and a deeper understanding of maritime cyber resilience highlights the interconnected nature of linguistic and technical competence. This reinforces the imperative for targeted language support initiatives within maritime education programs, acknowledging the dual challenge faced by cadets in mastering both subject matter and international communication. The research outcomes offer significant implications for the enhancement of maritime education. The positive trends observed underscore the importance of dynamic and engaging pedagogical approaches, continual curriculum evaluation, and collaboration with the maritime industry to ensure that cadets are well-prepared for the multifaceted challenges of their future roles.

The recommendations presented, encompassing the integration of practical scenarios, dynamic pedagogical approaches, language enhancement programs, industry-embedded internships, and continual curriculum evaluation, provide a roadmap for the ongoing refinement of maritime education programs. By embracing these suggestions, educational institutions can foster a resilient and proficient cadre of maritime professionals capable of navigating the complexities of an ever-evolving maritime landscape. The research, therefore, not only contributes valuable insights to the discourse on maritime education but also serves

as a catalyst for continual improvement and adaptation in preparing cadets for the challenges of the modern maritime industry.

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