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Aplied Research

Enhancing Seafarers' Self-Awareness and Emergency Decisions through Bridge Simulator Training

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Abstract: This study examines the association between Bridge Simulator training, seafarers' self-awareness, and emergency decision-making performance. A quantitative correlational design was employed involving 105 active seafarers who had participated in certified bridge simulator training. Data were collected using a structured questionnaire measuring perceived training quality, self-awareness, and emergency decision-making performance. Spearman's rho correlation analysis revealed a strong positive association between Bridge Simulator training and self-awareness (ρ = 0.764), as well as between Bridge Simulator training and emergency decision-making performance (ρ = 0.744). These findings indicate that higher perceived quality of simulator training is associated with higher levels of self-awareness and decision-making performance in emergency contexts. The study contributes empirical evidence on the psychological and cognitive dimensions associated with simulator-based maritime training and highlights implications for maritime education and safety training.

Keywords: Impact Analysis; Bridge Simulator; Self Awareness; Seafarer Performance; Decisions, Emergencies

1. Introduction

One of the essential skills that sailors must possess is the ability to make decisions quickly, precisely, and accurately in emergency situations. Mistakes in decision-making not only threaten the safety of ships and crews but can also have far-reaching impacts on the maritime environment and the economy that relies on ocean transportation. Ships need a leader, in this case, a skipper who can make decisions quickly and appropriately [1].

Decision-making in an emergency requires a combination of various abilities, including technical skills, mental resilience, and self-awareness [2]. Self-awareness is an individual's awareness of his or her abilities, emotions, and limitations are important aspects that support effective decision-making [3]. Self-awareness of physical processes and psychological processes has a reciprocal relationship with mental life related to life goals, emotions, and the cognitive processes that follow them [4]. However, many seafarers are not adequately trained in the aspect of self-awareness, making them vulnerable to pressure and mistakes when dealing with critical situations.

In sailing education, the Bridge Simulator has been recognized as one of the effective modern training tools to provide a learning experience close to real situations. Thus, it allows sailors to hone their technical skills while increasing self-awareness. Through simulating complex scenarios and emergency conditions, Bridge Simulator training provides a safe and realistic practical experience, helping mariners evaluate their responses to a variety of situations at sea as outlined in practical scenarios [5].

Previous studies have primarily focused on

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the technical outcomes of bridge simulator training, such as navigational accuracy and operational efficiency. However, empirical evidence linking simulator training with psychological constructs, particularly self-awareness and emergency decision-making, remains limited, especially within the context of Indonesian seafarers. In addition, the international literature in the last five years has highlighted the need for non-technical skills as an integral component of maritime safety management. For example, a study conducted by [6], With the development of navigation technology and the increasing demands of shipping safety, simulators serve not only as a learning tool but also as a medium to improve the cognitive, strategic, and metacognitive competencies needed for critical decision-making. In addition, simulator training is able to improve crew skills in identifying hazard risks, understanding environmental changes, and managing information in a short period of time [7]. This study addresses this gap by empirically examining the correlational relationships among Bridge Simulator training, self-awareness, and emergency decision-making performance, thereby extending existing maritime education research beyond technical competencies.

This study is guided by a conceptual framework in which Bridge Simulator training is hypothesized to be associated with seafarers' self-awareness and emergency decision-making performance. Self-awareness is positioned as a psychological construct that may coexist with decision-making performance in emergency situations. The framework does not assume causal pathways but illustrates theoretically grounded relationships supported by previous maritime and cognitive psychology literature, as illustrated in Figure 1.

Figure 1. Conceptual Framework

Although the effectiveness of Bridge simulators in improving technical capabilities has been widely discussed, the specific relationship between this training and increased self-awareness and its impact on decision-making in emergency situations has not been discussed in depth, especially in the context of Indonesian seafarers. In fact, a study on this matter is very important to be done [8], Given the need to improve the quality of national seafarers in order to compete at the global level while supporting shipping safety. Therefore, this study aims to: (1) evaluate the impact of Bridge Simulator training on increasing seafarers' self-awareness; (2) identify the relationship between increased self-awareness and decision-making ability in emergencies; (3) determine the effectiveness of the Bridge Simulator as a training tool to support maritime operational safety.

This research is relevant and feasible because it is supported by the evolving needs of the global maritime industry. Bridge Simulator has been implemented in various maritime educational institutions with positive results on the technical aspect. Previous research has shown that bridge simulators can improve learning efficiency in various maritime educational institutions [9], [10], [11]. Moreover, [7], [12] emphasizing the importance of self-awareness in carrying out guard duty on ships and especially during critical decision-making. Thus, this research is expected to make a significant contribution to maritime education that is more effective and has an impact on shipping safety, and increases the competitiveness of Indonesian seafarers.

2. Materials and Methods

This research takes place on ships entering

the Port of Tanjung Perak Surabaya. This study uses a quantitative approach with the type of correlational research design, which means the relationship between two or more variables [13] This was done to analyze the effect of training using the Bridge Simulator on increasing self-awareness and seafarers' performance in decision-making in emergency conditions. The data collection technique in this study uses a questionnaire. The research instrument consisted of three constructs: Bridge Simulator training (4 items), self-awareness (4 items), and emergency decision-making performance (4 items). Instrument development was grounded in maritime simulation literature and self-awareness theory. Items were measured using a four-point Likert scale (1 = strongly disagree to 4 = strongly agree). Sample items include:
"The training improved my technical skills in dealing with problems on the ship" (training Bridge Simulator),
"*The training helped me understand how my response could affect the team in an emergency"* (self-awareness), and
"*Simulator training helps me evaluate multiple decision alternatives under pressure"* (decision-making).

A purposive sampling technique was applied with inclusion criteria: active seafarers with a minimum of two years' sea experience and prior participation in certified bridge simulator training. While this approach enabled access to relevant respondents, it limits the generalization of the findings beyond similar maritime training contexts. The population in this study is active seafarers who have participated in training or learning using bridge simulators at maritime universities that have been approved by the Directorate General of maritime transportation. Since the exact number of active seafarers participating in the Bridge Simulator training is not officially available, the determination of the sample count is carried out using a non-probabilistic approach. In this case, the researcher used a purposive sampling technique with inclusion criteria, namely active seafarers who have at least two years of experience and have participated in Bridge Simulator training. The number of respondents who were successfully collected was 105. Although this number is below the ideal recommendation for unknown populations [14] The data have qualified for validity, reliability, and statistical correlation tests. The research flow chart, outlined as Figure 2, follows:

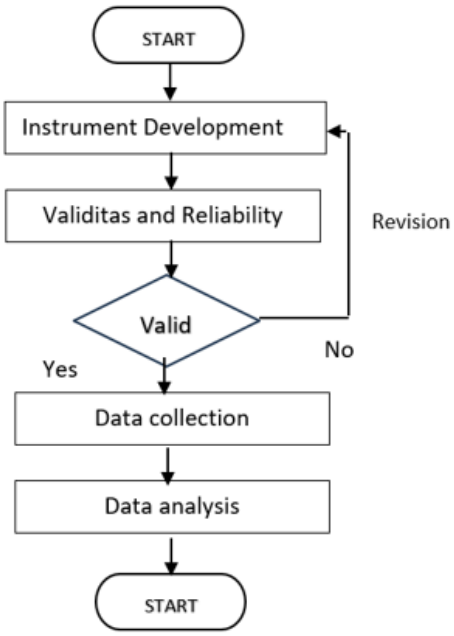

Figure 2. Research Flow Diagram

3. Results

Before being used in the main data collection, the research instrument is first tested for validity and reliability. The trial was carried out on a number of respondents who had similar characteristics to the target population, namely active seafarers who had participated in bridge simulator training, totaling 30 people.

3.1 Validity Test

The validity test was carried out to assess the extent to which the items of statements in the questionnaire were able to measure the aspects that should be measured. The validity of the instrument was tested using the Pearson Product-Moment correlation technique between the calculated r value and the r table. The statement item is declared valid if r counts

> r table. The r-value of the table with 30 respondents, with a significance value of 0.05, is 0.3610. As presented in Table 1, all questionnaire items showed correlation coefficients exceeding the critical value, indicating that all items were valid and suitable for measuring the intended constructs.

Table 1. The results of the validity test of the statement items

Item	r_{xy}	r_{table}	Information
P1	1,000	0,361	Valid
P2	0,699	0,361	Valid
P3	0,689	0,361	Valid
P4	0,868	0,361	Valid
P5	0,652	0,361	Valid
P6	0,754	0,361	Valid
P7	0,670	0,361	Valid
P8	0,575	0,361	Valid
P9	0,699	0,361	Valid
P10	0,769	0,361	Valid
P11	0,799	0,361	Valid
P12	0,799	0,361	Valid

3.2 Reliability Test

Instrument reliability was evaluated using Cronbach's Alpha coefficient, where values of 0.70 or higher indicate acceptable internal consistency. The results, summarized in Table 2, show that all three variables demonstrated high to very high reliability, with Cronbach's Alpha values ranging from 0.898 to 0.980. These findings indicate that the instrument consistently measures the constructs of Bridge Simulator training, self-awareness, and emergency decision-making performance. The results of the reliability test are further described in Table 2 below:

Table 2. Instrument Reliability Test Results

Variable	Cronbach's Alpha	Information
Bridge Simulator Training (X)	0,946	Perfect reliability
Self-awareness (Y_1)	0,898	High reliability
Decision-making performance (Y_2)	0,980	Perfect reliability

3.3 Normality Test

Data normality was examined using the Kolmogorov–Smirnov test. The results revealed that the significance values ($p < 0.05$) for all variables were below the normality threshold, indicating that the data were not normally distributed. Accordingly, non-parametric statistical analysis was deemed appropriate for subsequent hypothesis testing.

3.4 Correlation Test

Spearman's rho correlation analysis was conducted to examine the relationships among the study variables. The results show a correlation coefficient of $\rho = 0.764$ between Bridge Simulator training (X) and self-awareness (Y1), indicating a strong positive association based on conventional effect size interpretation for non-parametric correlations. This magnitude suggests a substantial relationship between perceived simulator training quality and self-awareness among seafarers. Similarly, the correlation between Bridge Simulator training (X) and emergency decision-making performance (Y2) yielded a coefficient of $\rho = 0.744$, which also falls within the category of a strong positive association. This finding indicates that higher perceived quality of simulator training tends to be accompanied by higher levels of reported decision-making performance in emergency situations.

To strengthen statistical interpretation, these correlation coefficients may be considered large effect sizes according to established benchmarks for Spearman's rho. Although confidence intervals were not calculated directly in this study, the consistency and magnitude of the coefficients across variables suggest stable and meaningful relationships within the sampled population.

4. Discussion

The findings of this study indicate a strong association between Bridge Simulator training, self-awareness, and emergency decision-

making performance among seafarers. This suggests that simulator-based training is closely related to the development of non-technical skills that are essential in emergency situations. Similar patterns have been reported in previous studies, which highlight that simulation-based learning environments provide opportunities for reflection, situational awareness development, and cognitive readiness without exposure to real operational risks [6], [15].

The observed association between simulator training and emergency decision-making performance is consistent with earlier research emphasizing the role of realistic scenario-based simulations in supporting cognitive processing and judgment under pressure [16]. This alignment with prior studies reinforces the relevance of bridge simulators as an integral component of maritime training systems [17]. Overall, the results suggest that self-awareness and emergency decision-making performance are closely related competencies within the context of simulator-based maritime training. These competencies appear to complement each other and are widely recognized in the literature as important elements in reducing the likelihood of human error in maritime operations [18].

4.1 Limitations

This study has several methodological and contextual limitations that should be considered when interpreting the findings. First, due to the absence of officially available data on the total population of active seafarers who have participated in Bridge Simulator training, a non-probability sampling approach was employed. A total of 105 respondents were successfully recruited. Although this sample size is below the ideal recommendation for unknown populations, it was sufficient to meet the minimum requirements for validity, reliability, and correlational statistical analysis. Nevertheless, the use of purposive sampling limits the external validity of the findings, and the results should therefore be interpreted within similar maritime training and operational contexts.

Second, the normality test results indicated that all variables had significance values below 0.05, suggesting that the data were not normally distributed. Consequently, Spearman's rho correlation was applied to examine the relationships among variables. While this non-parametric method is appropriate under such conditions, it restricts the use of more advanced parametric analyses that could provide deeper insights into the relationships among variables.

5. Conclusions

Based on the results and discussion, several conclusions can be drawn. First, Bridge Simulator training shows a strong positive association with seafarers' self-awareness ($\rho = 0.764$). This indicates that seafarers who perceive higher-quality simulator training also tend to report higher levels of self-awareness, particularly in recognizing personal strengths, limitations, and emotional states during emergency situations.

Second, self-awareness is closely associated with emergency decision-making performance. The strong positive correlation ($\rho = 0.744$) between Bridge Simulator training and decision-making performance suggests that seafarers with higher perceived training quality and self-awareness also tend to demonstrate better decision-making coordination in critical situations.

Overall, this study provides empirical evidence of meaningful relationships between Bridge Simulator training, self-awareness, and emergency decision-making performance. Nevertheless, the conclusions are subject to several limitations, including the use of non-probability sampling, a relatively limited sample size, non-normal data distribution, and a cross-sectional correlational approach. As a result, the findings may not be generalized beyond similar maritime training and operational contexts, and causal inferences cannot be drawn. Future research is therefore encouraged to employ experimental, longitudinal, or mixed method approaches to further investigate the causal mechanisms and long-term effects of Bridge Simulator training on seafarers' psychological and decision-making competencies.

References

[1] Rini, H. F. A. Setiawati, and H. F. A. Setyawati, "Kepemimpinan di atas Kapal (Leadership on a Ship)," *Jurnal Manajemen Transportasi & Logistik*, vol. 5, no. 3, pp. 237–248, 2018.

[2] D. H. Pasolong, *Teori Pengambilan Keputusan*. Bandung, Indonesia, 2023.

[3] S. A. Puteri and A. Rozana, "Pelatihan berbasis self-awareness untuk meningkatkan kemampuan pengambilan keputusan karir," *Plakat: Jurnal Pelayanan Kepada Masyarakat*, vol. 4, no. 1, p. 121, 2022, doi: 10.30872/plakat.v4i1.7834.

[4] R. Hafizha, "Profil self-awareness remaja," *Journal of Education and Counseling*, vol. 2, no. 1, pp. 159–166, 2022, doi: 10.32627/jeco.v2i1.416.

[5] K. Hjelmervik, S. Nazir, and A. Myhrvold, "Simulator training for maritime complex tasks: An experimental study," *WMU Journal of Maritime Affairs*, vol. 17, no. 1, pp. 17–30, 2018, doi: 10.1007/s13437-017-0133-0.

[6] S. Shanta and J. G. Wells, "T/E design-based learning: Assessing student critical thinking and problem-solving abilities," *International Journal of Technology and Design Education*, 2020, doi: 10.1007/s10798-020-09608-8.

[7] L. G. Evidente, K. Kannan, V. A. Loginovsky, Y. Mori, and A. R. Shoshin, "The effect of preparatory bridge simulator training on development of situation awareness skills of watchkeepers," *Russian Journal of Water Transport*, vol. 73, no. 3, pp. 226–242, 2022, doi: 10.37890/jwt.vi73.325.

[8] Kuncowati, N. A. Listriyawati, E. Febriana, and A. Maulino, "Penggunaan bridge simulator dan komunikasi untuk keselamatan pelayaran di era new normal," *Jurnal Saintek Maritim*, vol. 23, pp. 151–158, 2023.

[9] N. J. S. and R. D. K., "Optimalisasi pemanfaatan full mission ship handling simulator dalam meningkatkan kompetensi bernavigasi taruna," vol. 21, no. 2, pp. 79–85, 2019.

[10] R. Alkadri, B. Mustari, and A. Setiawan, "Pengaruh bridge simulator karya PT LEN sebagai industri pertahanan dalam negeri untuk meningkatkan kompetensi taruna AAL korps pelaut," *Rekayasa*, vol. 15, no. 2, pp. 199–203, 2022, doi: 10.21107/rekayasa.v15i2.14155.

A. Novianto and D. Riana, "Integrative factors of bridge simulator laboratory adaption: Based project model," *Journal TAM (Technology Acceptance Model)*, vol. 14, no. 1, p. 36, 2023, doi: 10.56327/jurnaltam.v14i1.1519.

[11] S. M. Dilawar, D. K. Durrani, X. Li, and M. A. Anjum, "Decision-making in highly stressful emergencies: The interactive effects of trait emotional intelligence," *Current Psychology*, vol. 40, no. 6, pp. 2988–3005, 2021, doi: 10.1007/s12144-019-00231-y.

[12] J. W. Creswell and J. D. Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Los Angeles, CA, USA: SAGE, 2018.

[13] W. G. Cochran, *Sampling Techniques*. New York, NY, USA: John Wiley & Sons, 1977.

[14] A. Kuzu, E. Başar, and Doğru, "Effectiveness of bridge simulator training in improving maritime students' situational awareness," *WMU Journal of Maritime Affairs*, vol. 19, no. 1, pp. 23–45, 2020, doi: 10.1007/s13437-019-00182-9.

[15] C. Chauvin, S. Lardjane, G. Morel, B. Clostermann, and J. P. Langard, "Human and organisational factors in maritime accidents: Analysis of collisions at sea using the HFACS," *Accident Analysis & Prevention*, vol. 59, pp. 26–37, 2013, doi: 10.1016/j.aap.2013.05.006.

[16] A. H. Purwantomo, *Prosedur Darurat dan SAR*. Semarang, Indonesia: PIP Semarang, 2018.

[17] R. P. Sumarta, D. Widarbowo, D. Haryanto, M. Kendek, and I. K. H. P. Adiputra, "Meningkatkan pengetahuan navigasi kapal dengan bridge simulator,"

Jurnal Inovasi Hasil Pengabdian Masyarakat, vol. 7, no. 2, pp. 271–282, 2024, doi: 10.33474/jipemas.v7i2.20710.