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Maritime Program Curriculum Review: Basis on Development of Outcomes-Based Assessment Tool in Collision Regulations (COLREGs)

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ABSTRACT

This study developed an outcomes-based assessment tool in collision regulations. The researcher utilized a descriptive-developmental approach. There were one hundred one hundred fifty respondents involved in this study. The developed outcomes-based assessment tool in collision regulations was on the guidelines from statutory and regulatory bodies. Results revealed that the assessment tool obtained an extremely elevated level of usability, acceptability, and applicability with the mean scores between 4.00 and 4.80 for the variables: perceived usefulness; perceived ease of use; compatibility; and perceived risk falling. The tool had useful features, its limitations and perceived risks may impact its adoption and use by stakeholders. There is significant difference among the three groups of respondents: maritime students, faculty/alumni, internship, and ship workers on the level of efficiency of the developed outcomes-based assessment tool. The developed outcomes-based assessment tool in collision regulations improves the quality of assessment in maritime education.

1. Introduction.

Program curriculum review is extremely important to determine areas for improvement like assessment tools which play a significant role for the evaluation of knowledge and skills of maritime students for preventing collision at sea. Collision Regulations (COLREGs) established by the International Maritime Organization (IMO) to ensure the safe navigation of vessels at sea (Silber *et al*., 2012).

Collision regulations are essential for preventing marine accidents, determining the responsibility of the involved parties in case of collision, and promoting safe ship navigation (Karahalios, 2014). Thus, Naeem et al. (2012) emphasized that all maritime personnel should have deepest understanding and strict compliance with the regulations.

On this matter, the Commission on Higher Education (CHED) and Maritime Industry Authority (MARINA), whose are responsibility of providing with high-quality maritime education and trainings in the Philippines. These government agencies issued memorandum to all Maritime Higher Education Institutions (MHEIs) to adhere to the policies and guidelines, in which one of these key areas is to develop an assessment tool in COLREGs (CMO, 2017).

The assessment tool in collision regulations helps identify areas of strength and weakness of the students and essential component of training and certification programs in the maritime industry. However, these things are currently one of the main concerns of most maritime institutions in the Philippines for the compliance with the Standards of Trainings, Certifications, and Watchkeeping (STCW '78) as amended 2010 (Gravador, 2016).

The developed assessment tool in collision regulations served as prototype to other practical courses in crafting similar tool across in all programs of the university. Through its content, entries, and validity during practical assessment. It emphasized by Öztürk et al. (2022) that the developed assessment tool plays a crucial role in keeping a safe navigational watch.

To prevent ship collisions, maritime students or seafarers should understand the tasks on the assessment tool. The stu-

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dents use the tool as a reference while demonstrating the tasks during simulation exercises using a full-mission ship bridge simulator. The students learn about ship collision regulations better with life-long learning, they have the chance to practice and mimic exercises. It is obvious that an assessment tool gauges how well the students are learning collision regulations (Dale & Tanner, 2012).

Given the significance of adhering to the collision regulations by providing this accessible assessment tool to the maritime students. It ensures that the graduates are well-prepared for their future jobs as seafarers. The use of an assessment tool in collision regulations improves students' knowledge and abilities, creates an advanced best navigational practice, and increases safety in navigation (Hetherington, Flin, and Mearns, 2006).

Based on information and reviews, the researcher aimed to develop an outcomes-based assessment tool in collision regulations addressing the main concerns of maritime institutions and complying with the required STCW '78 standards as amended 2010.

2. Statement of the Problem.

This study aimed to develop an outcomes-based assessment tool in collision regulations at Biliran Province State University, Naval Biliran during the academic year 2022-2023.

Specifically, it sought to answer the following objectives:

1. Determine the information to develop an assessment tool in collision regulations.
2. Assess the efficacy of the developed assessment tool in collision regulations such as usability, applicability; and acceptability; and
3. Evaluate the significant difference as to the perceptions of the respondent groups on efficacy of the developed outcomes-based assessment tool in collision regulations.

3. Methodology.

This section presents the research design, respondents of the study, locale of the study, research sampling techniques, research instrument, data gathering procedures, and data analysis.

3.1. Research Design.

This study used descriptive-developmental research design. A modified questionnaire regarding Technology Acceptance Model from Davis (1987) utilized to gather information for the development of the tool. This was also employing analysis and gathering of data to design and develop the outcomes-based assessment tool in collision regulations.

3.2. Respondent of the Study.

In this study, three (3) groups identified as respondents. The identified respondents were the people who have direct interaction with maritime. The first group is the marine transportation represented as the students. The second group is the maritime faculty and personnel. Third group is alumni and the maritime deck cadets and the ship workers.

Table 1: Distribution of respondents.

Respondent Group	*Frequency (f)*	*Percentage (%)*
Maritime Students	60	40%
Faculty/Alumni	50	33%
Internship/Deck Cadets	40	27%
Total	150	100%

Source: Author.

3.3. Locale of the Study.

This study conducted at the School of Maritime Education of Biliran Province State University, Naval, Biliran, Philippines. The university accredited from the different agencies such as the Commission on Higher Education (CHED), Technical Skills and Development Authority (TESDA), Det Norski Veritas (DNV), State University and Colleges in the Philippines (SUCs), and Accrediting Association Colleges and University of the Philippines (AACUP). Biliran Province State University selected the research locale because the respondents enrolled from this university and are currently working onboard domestic and internal fleet. The maritime education has the state-of-the-art facilities with latest model of Kongsberg deck-bridge simulator from Norway, complete deck laboratories and other navigational instruments that aid students' meaningful learning and enhance their skills in navigating the ships. Moreover, the university received various awards from prestigious statutory and regulatory bodies both national and international and likewise the university entered the World University Rankings for Innovation (WURI) that assesses the higher education institutions for its real contribution to the industry and society when it comes to innovative education, research, and extension engagement to the community.

3.4. Research Sampling.

This study used simple random sampling of the respondents which categorized into three respondents due to enormous number of populations. Each member of the population has an equal chance such as sixty for the maritime students, fifty faculty/alumni, and forty for internship/deck cadets. The total respondents involved were 150 and with have complete data.

3.5. Research Instrument.

The primary instrument used for data gathering in this study is a modified questionnaire based on Technology Acceptance Model (David, 1987), which is divided into three portions: a) status of the assessment tools, b) process, features, and design of the developed assessment package, and c) acceptability of the developed assessment tools in COLREGs. The modified questionnaire is a reliable and valid tool for assessing users' acceptance and satisfaction with developed outcomes-based assessment tools in collision regulations.

3.6. Data Gathering Procedures.

In gathering the data, the researcher sent a letter request to the University President to ask permission to conduct a study about development of assessment tool in collision regulations in the maritime education. After the approval, survey questionnaire distributed to the identified respondents. Survey questionnaire composed of three parts: (1) information to develop assessment tool in collision regulations, (2) efficacy of the developed assessment tool in terms of usability and applicability, (3) acceptability of the developed assessment tool in collision regulations, and (4) determine the significant difference on the perceptions of the respondent groups on efficacy of the developed outcomes-based assessment tool in collision regulations. The researcher and respondents agreed on the scheduled for the data collection. The collected data analyzed and interpreted using appropriate statistical tool.

3.7. Data Analysis.

The data gathered, collected, and analyzed using the exact statistical tools. Descriptive approach used to determine the information of the development of assessment tool in collision regulations. Mean to assess the efficacy of the developed assessment tool in collision regulations such as usability, applicability, and acceptability. T-test applied to evaluate the significant difference as to the perceptions of the respondent groups on efficacy of the developed outcomes-based assessment tool in collision regulations.

3.8. Data Scoring.

Table 2

Scale	*Range*	*Verbal Description*
5	4.21 – 5.00	Very much usable/applicable/acceptable
4	3.41 – 4.20	Much usable/applicable/acceptable
3	2.61 – 3.40	Usable/Applicable/Acceptable
2	1.81 – 2.60	Slightly Usable/Applicable/Acceptable
1	1.00 – 1.80	Not usable/applicable/acceptable

Source: Author.

4. Results.

4.1. Information to Develop an Assessment Tool in Collision Regulations.

4.1.1. European Maritime Safety Administration (EMSA).

By creating an assessment tool, the European Maritime Safety Agency (EMSA), which established by Regulation (EC) No. 1406/2002 as a major source of assistance to the commission and the member states in the field of maritime safety and the prevention of pollution from ships, has expanded and refined the scope of its mandate. This material supports the marine interests of the European Union (EU) for a secure, eco-friendly, and competitive maritime industry (IMO, 2021). The nations whose citizens work as crew or seafarers for European Union shipping and staffing firms will be subject to EMSA audits on a regular basis. In the Philippines, for instance, one-third (1/3) of the seafarers employed under the registered EU vessels. The Philippine government has significant role to look at the quality of its maritime education and trainings if all these things compliant to the international standards. Hence, the standard produces competent seafarers and determines the quality of the maritime education and training system. Assessment tools developed to measure what will be the possible outcomes. The tool also confirmed if the maritime education and training in the Philippines adhere to STCW '78 criteria as modified in 2010 (STCW '78, 2010).

4.1.2. Maritime Industry and Authority (MARINA) & Commission on Higher Education (CHED).

The Maritime Industry Authority (MARINA) and the Commission of Higher Education (CHED). These collaborative efforts of the two government agencies foster high-quality maritime education that is both accessible and relevant. Its responsibility is to supervise, coordinate, create, and implement the policies in the Philippine Maritime Higher Education Institutions (MHEIs). The JCMMC No. 1, series of 2019 and the JCMMC Nos. 1, series of 2022 were both released by CHED-MARINA. The higher institutions offering maritime programs in the Philippines guided by this document. One of its policies calls for the creation of an assessment tool as specified in the memorandum.

4.2. Efficacy of the developed assessment tool in collision regulations as to usability, applicability, and accessibility.

4.2.1. Usability.

Table 3 below presents the usability of the developed assessment tool across different attributes as rated by three groups of respondents: maritime students; faculty / alumni; and internship / ship workers. The usability attributes include learnability, efficiency, memorability, error prevention and recovery user satisfaction. The ratings scale, with five being the highest score for each attribute, and one was the lowest score, respectively.

Table 3: Usability of the Developed Assessment Tool in collision regulations.

Attributes	**Maritime Students**		**Faculty/ Alumni**		**Internship/ Crew**	
	WM	**VD**	**WM**	**VD**	**WM**	**VD**
Learnability	4.90	VHU	4.80	VHU	4.20	VHU
Efficiency	4.90	VHU	4.80	VHU	4.40	VHU
Memorability	4.90	VHU	4.60	VHU	4.40	VHU
Error prevention and recovery	4.90	VHU	4.80	VHU	4.20	VHU
User satisfaction	4.80	VHU	4.80	VHU	4.60	VHU
Total/Interpretation	**4.88**	**VHU**	**4.70**	**VHU**	**4.88**	**VHU**

Legend:

WM	*Weighted Mean*
VD	*Verbal Description*
VHU	*Very Highly Usable*
HU	*Highly Usable*
U	*Usable*
MU	*Moderately Usable*
NU	*Not Usable*

Source: Author.

The results revealed on Table 3 that the developed assessment tool received extremely high ratings for *learnability* across all respondent groups, with an average score of 4.90 for maritime students, 4.80 for faculty/alumni, and 4.20 for internship and ship workers. These scores indicated that the tool is easy to learn and understand, regardless of the user's background. Similarly, to learnability, the *efficiency* attribute also received high scores, with an average of 4.90 for maritime students, 4.80 for faculty/alumni, and 4.40 for internship and ship workers. This suggested that the tool is efficient and enables users to perform tasks quickly and effectively. The *memorability* attribute received slightly lower scores compared to learnability and efficiency but still considered extremely high. The average ratings were 4.90 for maritime students, 4.60 for faculty / alumni, and 4.40 for internship and ship workers. This indicated that the tool is memorable, and users can retain their knowledge of how to use it. The assessment tool's *error prevention and recovery* attribute also received positive ratings, with an average score of 4.80 for maritime students, 4.80 for faculty / alumni, and 4.20 for internship and ship workers. The tool with features helps users avoid errors and recover from mistakes if they occur. Across all respondent groups, the *user satisfaction* attribute received extremely high ratings, with an average score of 4.90 for maritime students, 4.80 for faculty / alumni, and 4.60 for internship and ship workers.

This implied that the users were very highly satisfied with the developed assessment tool's overall performance when it comes to usability. It provides a positive user experience to all respondent groups, including maritime students, faculty / alumni, and internship / ship workers. The tool had broad usability because the ratings were consistent across different respondent groups, indicating that it is suitable for use by a diverse audience with varying levels of experience and expertise. It reduced the training burden because it obtained extremely high learnability and efficiency scores that users can quickly understand and use the tool effectively. This provides extensive training, saving time and resources. The tool possesses positive ratings for error prevention and recovery. This suggested that the tool developed with user errors in mind and provided mechanisms to prevent and address them. This can lead to increased productivity and decreased frustration for users. The tool enhanced memorability since the users can easily recall how to use it even after the time has passed since their last interaction. It ensures that users can pick up where they left off without significant relearning. The tool obtained extremely high scores on users' satisfaction. This would demonstrate that the tool meets or exceeds beyond expectations and needs of its users. Satisfied users are more likely to contribute using the tool and recommend it to others. Thus, the developed assessment tool is very highly usable and capable of providing a positive user experience to a diverse group of respondents. This bodes well for its potential adoption and effectiveness in maritime education and training in maritime industry. However, it is essential to contribute by gathering feedback from users and iteratively improving the tool to maintain its sustainability as needs and requirements evolve over time.

4.2.2. Applicability.

Table 4 below presents the applicability of the developed assessment tool across different attributes as rated by three groups of respondents: maritime students; faculty / alumni; and internship / ship workers. The applicability attributes include learnability, efficiency, memorability, error prevention and recovery user satisfaction. The ratings scale, with five being the highest score for each attribute and one was the lowest score, respectively.

Table 4: Applicability of the developed assessment tool in collision regulations.

Attributes	Maritime Students		Faculty/ Alumni		Internship/ Crew	
	WM	VD	WM	VD	WM	VD
Flexibility	4.80	VHA	4.40	VHA	4.20	VHA
Scalability	4.80	VHA	4.80	VHA	4.60	VHA
Reliability	4.90	VHA	4.40	VHA	4.40	VHA
Integration	4.80	VHA	4.80	VHA	4.60	VHA
Cost-effectiveness	4.60	VHA	4.20	VHA	4.60	VHA
Total/Interpretation	**4.78**	**VHA**	**4.44**	**VHA**	**4.52**	**VHA**

Legends:

WM	*Weighted Mean*
VD	*Verbal Description*
VHA	*Very Highly Applicable*
HA	*Highly Applicable*
A	*Applicable*
MA	*Moderately Applicable*
NA	*Not Applicable*

Source: Authors.

Table 4 shows that the assessment tool received extremely high ratings for *flexibility* across all respondent groups with an average score of 4.80 for maritime students, 4.40 for faculty / alumni, and 4.20 for internship and ship workers. These scores indicated that the tool perceived as very highly adaptable and can customized to meet various needs and scenarios. Like flexibility, the *scalability* attribute also received positive ratings, with an average score of 4.80 for maritime students, 4.80 for faculty/alumni, and 4.60 for internship and ship workers. This suggests that the tool perceived very highly capable of managing a growing number of users or an increasing volume of data without significant performance issues. The *reliability* attribute received high ratings as well, with an average score of 4.90 for maritime students, 4.40 for faculty/alumni, and 4.60 for internship and ship workers. This indicates that the tool perceived as very highly dependable and trustworthy, providing consistent and accurate results. The *integration* attribute also received positive ratings, with an average score of 4.80 for maritime students, 4.80 for faculty/alumni, and 4.60 for internship and ship workers. This suggests that the tool perceived as very highly easy to integrate with other systems or tools, making it more efficient and seamless for users. Across all respondent groups, the *cost-effectiveness* attribute received positive ratings, with an average score of 4.60 for maritime students, 4.20 for faculty/alumni, and 4.60 for internship and ship workers.

This implied that the developed assessment tool perceived

as very highly flexible and adapted to suit different users and scenarios, making it more versatile and appealing to a broader audience. The assessment tool developed scalable for future growth, increasing demands without compromising its performance. The tool also ensures that remains very highly effective as user numbers and data volumes increase. The *trustworthiness and consistency* were extremely high reliability scores indicated that users perceived the tool as very highly dependable and consistent in delivering accurate results. This is crucial for maintaining user trust and confidence in the tool's output. Further, the developed assessment tool had positive *seamless integration* ratings suggested that the tool can be extremely easy integrating with an existing systems or workflows, reducing disruptions and enhancing overall efficiency for users. And the users believed the benefits and value offered by the tool to justify its *cost-effectiveness*. The reinforces the tool's attractiveness as a practical investment.

Results revealed that the developed assessment tool was very universally applicable to the respondents, including maritime students, faculty / alumni, and internship and ship workers. This extremely high applicability indicates that the tool aligned well with users' specific needs and requirements, making it a valuable and relevant solution for assessment purposes in the maritime education and industry sectors. Ongoing monitoring of user needs and feedback will be essential to ensure the tool's continued very universally applicable in the environment and user demands evolve over time.

4.3. Acceptability.

Table 5 below presents the acceptability of the developed assessment tool across different attributes as rated by three groups of respondents: maritime students; faculty/alumni; and internship/ship workers. The acceptability attributes include learnability, efficiency, memorability, error prevention and recovery user satisfaction. The ratings scale, with five being the highest score for each attribute and one was the lowest score, respectively.

Table 5: Acceptability of the developed assessment tool in collision regulations.

Attributes	Maritime Students		Faculty/ Alumni		Internship/ Crew	
	WM	VD	WM	VD	WM	VD
Perceived of usefulness	4.80	VHA	4.60	VHA	4.40	VHA
Perceived ease of use	4.60	VHA	4.80	VHA	4.60	VHA
Compatibility	4.80	VHA	4.40	VHA	4.40	VHA
Perceived risk	4.60	VHA	4.80	VHA	4.20	VHA
User engagement	4.60	VHA	4.60	VHA	4.60	VHA
Total/Interpretation	**4.68**	**VHA**	**4.64**	**VHA**	**4.44**	**VHA**

Legend:

WM	*Weighted Mean*
VD	*Verbal Description*
VHU	*Very Highly Acceptable*
HU	*Highly Acceptable*
U	*Acceptable*
MU	*Moderately Acceptable*
NU	*Not Acceptable*

Source: Author.

The assessment tool received high ratings for *perceived usefulness* across all respondents group, with an average score of 4.80 for maritime students, 4.60 for faculty / alumni, and 4.40 for internship and ship workers. These scores indicate that the tool obtained valuable and beneficial for the users in their educational and work-related activities. The *perceived ease of use* attribute also received positive ratings, with an average score of 4.60 for maritime students, 4.80 for faculty/alumni, and 4.60 for internship and ship workers. This suggests that the tool obtained as easy use and operate, making it very highly acceptable and user-friendly. The *compatibility* attribute received extremely high ratings, with an average score of 4.80 for maritime students, 4.40 for faculty/alumni, and 4.40 for internship and workers. This indicates that the tool obtained compatible with the users' existing tools, systems, and processes, making its integration smoother. The assessment tool's *perceived risk* attribute received positive ratings as well, with an average score of 4.60 for maritime students, 4.80 for faculty / alumni, and 4.20 for internship and ship workers. This suggested that the tool was very highly safe and secure to use, without minimal perceived risks or negative consequences. Across all respondent groups, the *user engagement* attribute received positive ratings, with an average score of 4.60 for maritime students, 4.60 for faculty/ alumni, and 4.60 internship and ship workers. This implied that the tool perceived as very highly engaging and capable of maintaining users' interest and involvement.

4.4. Significant difference as to the perceptions of the respondent groups on efficacy of the developed assessment tool in collision regulations.

Table 6 below presents the significant difference as to the perceptions of the respondent groups (*maritime students, faculty / alumni, and internship / ship workers*) on the efficacy of the developed assessment tool in collision regulations.

Table 6: Significant difference as to the perceptions of the respondent groups on efficacy of the developed assessment tool in collision regulations.

Source of Variation	SS	df	MS	F	*p-value*
Between groups	0.819	2	0.409	120.194	<0.001
Within groups	0.148	147	0.001		
Total	**0.967**	**149**			

Source: Author.

The F-statistic is extremely high *(F=120.194)*, and the *p-value* is less than the significance level *(p<0.001)*, so it can reject the null hypothesis and conclude that there is a significant difference among the efficacy of the developed assessment tool across the three groups.

To determine which groups are significantly different from each other, it can perform post-hoc pairwise comparisons using a Tukey HSD test:

Table 7

Comparison	Means	SE	*p-value*
X1 - X2	0.056	0.042	0.931
X1 - X3	0.800	0.042	<0.001
X2 - X3	0.744	0.042	<0.001

Legend:

X1 – *Maritime Students*; **X2** – *Faculty/Alumni*; **X3** – *Internship and Ship Workers*

Source: Author.

The results show that there is a significant difference between X1 and X3 as well as X2 and X3, but not between X1 and X2. In summary, the ANOVA test indicated that there is significant difference as to the perceptions of the respondents' groups on the efficacy of the developed assessment tool in collision regulations across the three groups. Post-hoc tests revealed the differences in means between X3 and the other two groups. Therefore, it is important to investigate the reasons for the lower efficacy ratings among the internship and ship workers group.

Conclusion.

The developed outcomes-based assessment tool in collision regulations was very highly usable, acceptable, and applicable to improve the quality of assessment in maritime education.

Recommendations.

- The maritime institutions must review the curriculum of the maritime programs.
- The maritime institutions must use the developed outcomes-based assessment tool in collision regulations (COLREGs) for better learning during practical assessment.
- The outcomes-based assessment tool reviewed, evaluated, and updated to reflect changes in the sea collision prevention regulations and maritime industry practices.

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