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Benchmark of Teaching Competencies of an "Appropriately Qualified" Maritime Instructor: Basis for a Development Matrix

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Abstract
The MET system is composed of four distinct elements: students, academic staff, programs, and facilities. Research has shown that the most critical factor in the quality of maritime education lies in its human resources: the academic staff. However, focus has predominantly been allocated on the development of competences of students rather than instructors.
Likewise, the main purpose of this mixed-methods study was to determine the teaching competencies of an "appropriately qualified" maritime instructor in order to establish a Competency Development Matrix. Based on the review of literature on teaching competencies and STCW standards, an online survey and semi-structured interview was conducted to analyze and interpret data through statistical and thematic analysis gathered from maritime instructors across the country.
Results revealed the highest ranked teaching competencies under the domains of teaching skills, attitude towards work, and technical knowledge were utilized to define the Benchmark of an "appropriately qualified" maritime instructor, with teaching skills holding the highest value. It is also noteworthy that one significant competence that deserves immediate attention is the lack of pedagogical competence of maritime instructors, mainly attributed to lack of training and familiarity due to the technical nature of seafaring.
On this basis, it is recommended that MET institutions should implement the proposed Competency Development Matrix to help determine instructors' deficiencies in order to facilitate competency-based training programs to effectively ensure quality in maritime education.

Keywords: Benchmark, "Appropriately Qualified" Instructor, Development Matrix, STCW A-I/6, Competency-Based Learning Theory, Maritime Education & Training (MET)

Introduction

The quality of Maritime Education and Training (MET) is critical in shaping effective seafarer development, especially as nations strive to enhance their maritime sectors. The MET system consists of four essential components: students, academic staff, programs, and facilities. The success of this system is closely linked to the synergy among these components, with a significant emphasis placed on human resources, particularly the academic staff, who serve as the primary providers of the knowledge and skills essential for the maritime industry (Umut, 2022) [15].
Despite the recognized importance of the MET, a significant gap exists in the literature concerning the qualifications and competencies of MET instructors. While studies have predominantly focused on the competencies of seafarers, there is a scarcity of comprehensive frameworks that address the necessary qualifications for instructors (Vujičić, *et al*., 2022; Pijaca, *et al*., 2021) [16, 12].
In the Maritime Education and Training (MET) context, the set goals are explicitly outlined by the Standards of Training, Certification, and Watchkeeping for Seafarers (STCW) Convention, placing instructors in a crucial role of ensuring the achievement of prescribed learning outcomes.
In accordance with the STCW Code, Table A-I/6, the qualification standards for individuals serving on board ships, including seafarers, instructors, supervisors, and assessors, are emphasized. This lack of standardization leads to variations in the quality of education and training across institutions, as highlighted by the International Maritime Organization (IMO, 2017) [9], which mandates that all instructors involved in maritime education be "appropriately qualified". However, the implementation of these standards is left to the discretion of individual administrations (IMO member states), resulting in inconsistencies that can

adversely affect educational outcomes for maritime education.

Moreover, the dynamic nature of the maritime industry, characterized by rapid technological advancements, necessitates that MET institutions continuously evaluate and update the qualifications of their instructors (Estimo, 2020) [3]. The interconnection among education, competence, and maritime safety is underscored by Ananchenkova (2023) [1], who emphasizes that well-educated seafarers make a significant contribution to maritime safety. This highlights the urgent need for a unified set of competencies for MET instructors to ensure a high-quality educational foundation that can adapt to evolving industry standards.

The study by Lušić, *et al*. (2019) [11], involving multinational seafarers, concluded that the increased demand for officers might lead to a decline in the quality of education and training, as future officers might struggle to keep pace with constant technical and technological developments. Although the STCW Convention provides a standardized framework for seafarer education, schools and training centers adopt diverse approaches, leading to discrepancies in the quality of education and training provided.

In light of these challenges, this study is grounded in the Competency-based Learning Theory, which posits that education should focus on mastering competencies rather than merely accumulating knowledge. This theory, first introduced by R.W. White, emphasizes the importance of observable characteristics and abilities that enhance job performance and effectiveness. Competency is directly related to job performance, and the only way to ensure competence in the workforce is by acquiring the necessary skills and knowledge. Competency-based learning is a learning approach that emphasizes the mastery of job-specific competencies (Das, S. 2020) [2].

Additionally, the influence of Benjamin Bloom's Taxonomy of Educational Objectives reinforces the need to develop competencies across cognitive, psychomotor and affective domains (Ruhl, 2021) [13]. In the context of this study, competencies are framed as technical knowledge, teaching skills, and attitudes towards work reflecting the holistic mastery essential for effective maritime instruction.

This study aimed at addressing the identified gaps and issues within MET by proposing a Competency Development Matrix. The proposed matrix aims to provide a systematic approach based on the multifaceted elements presented in the background, such as the pivotal role of academic staff, the global emphasis on MET quality, and the lack of uniform competencies for MET instructors. It endeavors to identify the required competencies for maritime instructors, thereby addressing existing problems and formulating solutions.

The Competency Development Matrix would act as a comprehensive framework, integrating technical knowledge, teaching skills, and attitudes towards work, as highlighted by the Competency-based Learning Theory. By doing so, it seeks to establish a standardized set of competencies for an "appropriately qualified" instructors, thus ensuring that they are well-versed in their subject matter and possess the pedagogical skills and necessary attitudes essential for effective teaching.

This proposed matrix would serve as a strategic tool for MET institutions to evaluate and enhance the competence of their instructors. As instructors enhance their competencies, they contribute directly to cultivating a more proficient and capable maritime workforce that aligns with the industry's evolving demands and with the broader goal of enhancing the quality of MET graduates, thus addressing the global demand for competent seafarers, and ultimately leading to improvements in the maritime industry's safety, efficiency, and overall performance.

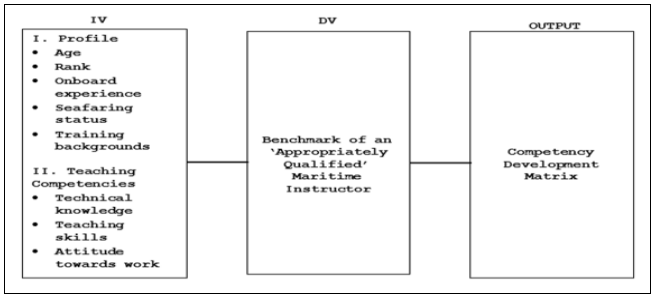

Fig 1: The Research paradigm

This study aimed at determining the teaching competencies required to establish a Competency Development Matrix for maritime instructors.

Specifically, it sought answers to the following questions:

1. What teaching competencies need to be acquired to be considered an "appropriately qualified" maritime instructor in terms of (a) Technical knowledge, (b) Teaching skills, and (c) Attitude toward work?
2. What challenges are encountered by maritime instructors with regard to their teaching competencies?
3. What are the recommendations to address these problems?
4. Is there a significant difference in teaching competencies when respondents are classified according to profile?
5. Is there a significant relationship between teaching competencies and the benchmark of an "appropriately qualified" maritime instructor?
6. Which among the teaching competencies (technical knowledge, teaching skills, and attitude towards work) could significantly predict the benchmark of an "appropriately qualified" maritime instructor?
7. What Competency Development Matrix should be developed in order to produce "appropriately qualified" seafarers to serve as maritime instructors?

Method

Research design

This study employed a mixed-method research design, utilizing both quantitative and qualitative methods. Mixed method is a research methodology that involves collecting, analyzing, and integrating both quantitative and qualitative data. The quantitative method utilized a descriptive-correlational approach, thus using a self-made survey questionnaire as its primary data-gathering tool.

Descriptive research involves collecting data to test hypotheses or answer questions concerning the current work status of the subjects in the study. It determines and reports the way things are. Correlation research, meanwhile, attempts to determine whether, and to what degree, a relationship exists between two or more quantifiable variables. The purpose of correlation research may be to establish a relationship (or lack thereof) or to utilize relationships in making predictions. Relationship investigations typically examine several variables believed

to be related to a significant and complex phenomenon. In this study, the independent variables were teaching competencies and the profile of respondents. The dependent variable, on the other hand, was the benchmark of an "appropriately qualified" maritime instructor.

Participants

To attain the objectives of the Quantitative data, the respondents were comprised of 152 maritime instructors, both deck and engine officers, who are currently employed in accredited maritime higher education institutions (MHEIs) across the country. A simple random sampling using a table of random numbers was utilized to select the final number of respondents.

For the Qualitative data, the researcher involved respondents comprising of five (5) maritime instructors with supervisory functions, which included function heads, supervisors, program heads, department heads/chairs and deans. They were selected through purposive or convenience sampling from the same participants in the survey to ensure diverse perspectives and experiences from a management perspective.

Research instrument

The research instrument was a self-made survey questionnaire. To achieve validity and reliability, the questionnaires were pilot-tested on 25 maritime instructors who were not included in the study to assess content validity, relevance, English construction, and the use of correct grammar. All items in the questionnaires underwent validation to ensure their inclusion in the final form of the questionnaire. For reliability, the test was evaluated using Cronbach's alpha, yielding a result of 0.985.

The questionnaire is divided into two parts. Part I consists of the respondents' Profiles, including name (optional), age, rank, onboard experience, seafaring status, and training backgrounds. Part II involves rating teaching competencies based on their importance. Teaching competencies are divided into three domains: technical knowledge, teaching skills and Attitude towards work. Each domain will have its corresponding questions.

The Qualitative part was conducted through a semi-structured interview using open-ended guide questions based on the research questions.

Procedures

Letters of communication were sent to selected Maritime Higher Education Institutions (MHEIs) to inform them of the researcher's intention to gather data relevant to the study. Upon approval, the researcher administered the questionnaires among the participating maritime instructors. Due to the scope of the study (nationwide), an online survey using Google Forms was utilized to gather data. Participants/respondents were requested to fill out a Data privacy consent form regarding the collection and processing of their data, which were handled confidentially. The data gathered from the respondents were tallied, classified, and tabulated and then subjected to the appropriate statistical analysis using the Statistical Package for the Social Sciences (SPSS) software.

For the Qualitative data, five (5) selected participants with supervisory function were personally interviewed using both face-to-face and online interviews via Zoom.

Data analysis

Descriptive Statistics

-Percentages and frequencies were used to determine the profile of the maritime instructors.

-Mean. Means were used to determine the Maritime instructor's level of importance of each competence under the domains of teaching competency.

-Standard deviation. Standard deviation was used to determine whether the data were homogeneous or heterogeneous.

-Rank. Rank was used to determine the order of the five highest competencies of each domain that will be selected to be used in the Benchmark.

Inferential Statistics

-t-test is used to compare the means of two groups to see if the difference between them is statistically significant. It was used to determine differences when classified according to rank and seafaring status.

-One-way Analysis of Variance (ANOVA) is used to compare the means of three or more groups to see if at least one group is significantly different from the others. It was used to determine differences when classified according to age and onboard experience.

-Pearson's Product Moment Coefficient of Correlation (Pearson's r) was used to determine the significance of the relationships between teaching competencies and the benchmark of an "appropriately qualified" maritime instructor.

-Multiple Linear Regression Analysis was used to determine which of the teaching competencies (technical knowledge, teaching skills, and attitude towards work) could predict the benchmark of an "appropriately qualified" maritime instructor.

Thematic analysis

Thematic analysis was employed as the primary method for analyzing gathered qualitative data. This approach aims to identify and explore patterns, themes, and underlying meanings within the data. It also seeks to supplement or counter-validate data results gathered from the quantitative data.

Results and Discussion

The findings of the study were:

1. The top five (5) ranked competencies under each of the three (3) domains were selected to represent the benchmark of an "appropriately qualified" maritime instructor.

Table 1 presents the means, standard deviations, and ranks of the respondents' levels of importance regarding the three domains of teaching competencies: technical knowledge, teaching skills, and attitude towards work.

Table 1: Means and Standard Deviations of Teaching Competencies and the Benchmark in Technical Knowledge, Teaching Skills and Attitude towards Work (Top 5)

S. No	A. Technical Knowledge	Mean	SD	Rank
1	Demonstrates an appropriate level of knowledge in their specialization (either deck or engine)	4.51	.71	1
2	Displays extensive practical knowledge in the operation of various machinery and equipment	4.39	.69	2
3	Possesses adequate knowledge in the use of maritime laboratories	4.37	.74	3
4	Stays well-informed on updates regarding IMO Conventions such as SOLAS, STCW, MARPOL, and MLC	4.37	.77	4
5	Effectively applies his knowledge of IMO Model courses (6.09 & 3.12) in teaching and conducting assessments	4.35	.71	5
	B. Teaching Skills	**Mean**	**SD**	**Rank**
1	Communicates complex technical information in a clear and understandable manner	4.33	.78	1
2	Engages students through interactive and participatory teaching methods	4.32	.79	2
3	Recognize appropriate learning outcomes and produce a subject-related lesson plan	4.32	.82	3
4	Adopts a student-centered learning and outcomes-based approach	4.30	.73	4
5	Provide constructive feedback to enhance student performance	4.30	.73	5
	C. Attitude Towards Work	**Mean**	**SD**	**Rank**
1	Demonstrates a genuine passion for imparting knowledge to students	4.40	.77	1
2	Inspires and motivates students to excel in their maritime careers.	4.39	.77	2
3	Adheres to high ethical standards in teaching and other activities.	4.38	.76	3
4	Exhibits leadership qualities to guide students and contribute to the institution's goals.	4.36	.77	4
5	Exhibits professionalism in all aspects of work and interactions	4.36	.80	5

2. Challenges encountered by maritime instructors about their teaching competencies include the following:

- Diverse Teaching Styles
- Limited Pedagogical Skills
- Outdated Knowledge and Skills
- Difficulty with Digital Teaching Methods
- Balancing Multiple Responsibilities
- Lack of Classroom Management Skills

3. Recommendations to address these problems involve the following:

- Institutional Initiatives
- Customized Training Programs
- Raising Qualification Standards
- Establishing Uniform Teaching Standards
- Structured Feedback Systems
- Performance Assessments for Competency

4. T-test results on the differences in teaching competencies when respondents are grouped by rank and status. As shown in the results, when grouped by rank, the results were comparable, as supported by the p-value (0.576), which was higher than the significance level $\alpha = 0.05$. When grouped according to status, similar results were shown with a p-value of (0.156), which is higher than the significance level $\alpha = 0.05$.

This indicates that there is no significant difference in teaching competencies when respondents are classified according to rank and status. This result contradicts earlier research by Gunawan (2024), which suggested that, in terms of rank, management-level instructors often bring more strategic insights and a broader understanding of maritime operations.

Table 2: T-test results for Differences in Teaching Competencies When Classified According to Rank and Status

Category		N	Mean	SD	t	df	Sig.
Rank	Operational	81	4.21	.65	-	150	.576
	Management	71	4.26	.61	.560		
Status	Active	53	4.33	.67	1.42	150	.156
	Retired	99	4.18	.61	5		

Table 3 presents the One-way ANOVA results on the differences in teaching competencies when grouped as to experience and age. As shown in the results, when respondents are grouped as to experience, the results were relatively similar, as supported by the p-value (0.148), which is higher than the significance level $\alpha = 0.05$, indicating it is not statistically significant.

However, results on the differences when grouped according to age yielded a p-value of 0.023, which is lower than the significance level $\alpha = 0.05$. This indicates a significant difference in teaching competencies when classified by age. This result supports the broader argument proposed by Suherman, *et al*., (2024) [14] that younger instructors are often more adaptable to new technologies and educational trends.

Table 3: One-way ANOVA Results for the Differences in Teaching Competencies When Classified According to Experience & Age

Category		Sum of Squares	df	Mean Square	F	Sig.
Experience	Between Groups	1.519	2	.759	1.937	.148
	Within Groups	58.414	149	.392		
	Total	59.933	151			
Age	Between Groups	3.730	3	1.243	3.274	.023
	Within Groups	56.203	148	.380		
	Total	59.933	151			

5. There was a positive correlation between teaching competencies and the benchmark of an "appropriately qualified" maritime instructor. The results showed that correlations were significant at $p<.01$.

Table 4: Correlation of Teaching Competency and Benchmark of an 'appropriately qualified' maritime instructor

Model		Benchmark	Teaching Competency
A. Benchmark	Pearson's Correlation	1	.977**
	Sig. (2-tailed)		.000
	N		152
B. Teaching Competency	Pearson's Correlation	.977**	1
	Sig. (2-tailed)	.000	
	N	152	152

*Correlation is significant at the 0.01 level (2-tailed)

6. The results of the Multiple Linear Regression showed which of the 3 domains could predict the benchmark of an

"appropriately qualified" maritime instructor. Teaching skills had the largest beta value (0.459), suggesting it is the strongest predictor of the benchmark for an appropriately qualified maritime instructor. On the other hand, attitude towards work is also a significant predictor, with a Beta value of 0.406. This suggests that it has a strong, positive influence on meeting the benchmark. Lastly, technical knowledge had the smallest beta (0.213), but with a p-value of 0.000, it could still be a significant predictor of the benchmark. With all three predictors included, the model explained 96.1% of the variance in the benchmark, indicating a very strong model fit.

Table 5: Multiple Linear Regression Results for the Significant Predictors of the Benchmark of an "Appropriately Qualified" Maritime Instructor

Model	R	R Square	B	Std. Error	Beta	t	Sig.
Teaching skills	.838[a]	.702	.401	.025	.459	16.3	.000
Attitude towards work	.943[b]	.889	.347	.021	.406	16.52	.000
Technical knowledge	.980[c]	.961	.205	.025	.213	8.213	.000

(a) Predictors: (Constant), Skills
(b) Predictors: (Constant), Skills, Attitude
(c) Predictors: (Constant), Skills, Attitude, Knowledge
(d) Dependent Variable: Benchmark of an "*appropriately qualified*" maritime instructor

7. Based on the study's results, the top five (5) ranked competencies from each of the three (3) domains were collated to establish the **Benchmark of an "appropriately qualified" maritime instructor**.

Objectives

- To guide the professional development of maritime instructors by identifying key areas for training, mentorship, and capacity-building.
- To align teaching competencies with international standards such as STCW, IMO Model Courses (6.09 and 3.12), and CHED guidelines for maritime education.
- To support quality assurance in maritime education through clear performance indicators and evaluation tools for instructor effectiveness.

Figure 2: Proposed Competency Development Matrix

Competency Area	Key Competencies	Development Strategies	Persons Involved	Key Performance Indicators	Evaluation metrics
Technical Knowledge	- Demonstrates expertise in specialization (deck/engine)	- Advanced technical training workshops	- Instructors, Training facilitators, SMEs	% of instructors certified within the year; Practical test pass rates	Pre and Post training assessment
	- Extensive practical knowledge of machinery and equipment	- Simulation-based practice sessions.	- Instructors, Laboratory Technicians, SMEs	- % improvement in simulation task accuracy and completion time	Simulation observation checklists; Peer review or video analysis
	- Adequate knowledge of maritime laboratories	- Regular laboratory-based practical exercises and use of equipment.	- Instructors, Laboratory Technicians,	Number of sessions conducted; Equipment usage efficiency rate	End-of-semester report, Laboratory performance rubrics
	- Knowledge of IMO updates (SOLAS, STCW, MARPOL, MLC)	- Reflect IMO updates in Course revisions and learning materials	- Instructors, Course developers, Program head	% of the course syllabus and other learning materials updated	Annual syllabus review, Document audits
	- Effectively applies IMO Model Courses (6.09, 3.12) in teaching and assessments	- Faculty development Refresher courses in 6.09/3.12	- Faculty, Supervisors	% alignment of teaching strategies with 6.09/3.12	Faculty evaluation every semester
Teaching skills	- Communicates complex technical concepts clearly	- Workshops on communication and teaching methods.	- Instructors, Faculty development officer, Supervisors	- High student comprehension and feedback scores.	Classroom observation by supervisors
	- Engages students through interactive methods	- Workshops on active and participatory teaching strategies.	- Instructors, Faculty development officer, Supervisor	- Engagement rates and positive student feedback.	Classroom observation by supervisors
	- Produces subject-related lesson plans aligned with outcomes	- Mentorship programs with experienced instructors for lesson planning.	- Senior faculty, Supervisors	- % of lesson plans approved and lesson consistency score	Supervisor rubrics; Peer-reviewed lesson plans
	- Adopts student-centered learning approaches	- Training on outcomes-based education and learner-centered methods.	-Dean, External experts	% improvement in student grades; Reduction in remedial intervention	Before-and-after intervention analysis
	- Adapts teaching methods to accommodate diverse learning styles and address individual student needs	- Seminars on differentiated instruction and inclusive strategies	- Instructors, External experts	- % of students meeting learning outcomes across varied styles	Classroom observation rubrics
Attitude Towards Work	- Demonstrates a passion for teaching	- Recognition and incentives for dedicated instructors	-Administration, Management	- # of nominations for teaching awards; Participation in voluntary initiatives	Faculty evaluation (student, peer, Supervisor)
	- Inspires and motivates students	- Soft skills training for instructors.	- Instructors, Supervisors,	- Student retention and progression rates	Exit surveys, Annual Student Retention Report

	- Adheres to high ethical standards	- Workshops on ethical teaching practices.	- Instructors, Human Resources	- Zero ethics violations and high compliance rates.	Scenario-based evaluations; HR audits
	- Exhibits leadership qualities	- Team-building and leadership development programs.	- Department Heads, HR	- Peer/supervisor ratings	- Peer feedback forms
	- Exhibits professionalism in all aspects of work and interactions	- Workshops on Professional conduct and mentoring	- Instructors, Supervisors, HR	- Peer/supervisor ratings	Peer and student feedback forms

Implementation timeline:

- Short-term (6-12 months)
  - Pilot phase in one department (deck or engine)
  - Initially, apply it to one domain (e.g. teaching skills)
- Mid-term (1-3 years)
  - Full implementation across all departments
  - Institutionalize select development strategies, such as mentorship and feedback system
- Long-term (3-5 years)
  - Continuous improvement based on KPI data.
  - Integration into faculty evaluation and promotion systems.

Conclusion

Given the aforementioned research findings, the following conclusions are advanced:

1. The top five (5) ranked competencies under each of the three (3) domains could be selected to comprise the benchmark of an "appropriately qualified" maritime instructor.
2. Maritime instructors face challenges primarily related to pedagogical competence, integrating technology, and managing workload. These challenges stem from limited formal training in teaching and evolving industry standards.
3. Training undertaken by instructors is very limited. Apart from the mandatory IMO model courses, training to improve teaching skills and pedagogies is only rated at 25%, and soft skills training is even lower at 22%, thereby indicating low rates of institutional interventions to improve teaching competencies.
4. The effectiveness of maritime instructors is directly linked to their teaching competencies. Those who meet the benchmark demonstrate stronger instructional abilities, providing a higher quality of maritime education.
5. Age-related differences suggest that younger instructors may be more adaptable to modern teaching technologies and methods, hence emphasizing the need for training updates for older instructors.
6. Teaching competencies, including teaching skills, attitude towards work, and technical knowledge, collectively define the benchmark of an "appropriately qualified" maritime instructor, with the combined model indicating a very strong model fit.

Recommendations

In connection with the obtained findings and given conclusions, the following recommendations are proposed:

1. Maritime institutions should implement the proposed Competency Development Matrix, which integrates competency-based training programs, evaluation metrics, and competency benchmarks.
2. MHEIs should regularly evaluate their instructors' teaching effectiveness and performance using an assessment tool with key performance indicators.
3. Regulatory bodies, such as the IMO and MARINA, may consider incorporating teaching competencies as qualifications for maritime instructors, similar to STCW standards and the GMP Initiative, to ensure alignment with industry needs and global standards.
4. Instructors should embrace the "lifelong learning" mantra to regularly participate in workshops, industry training, and research activities to maintain and continuously enhance their teaching competencies.
5. Individual "training needs analysis" for instructors at different career stages should be conducted. MHEIs should also establish mentorship initiatives, where senior instructors share pedagogical expertise while younger instructors help integrate digital tools and current trends in the maritime industry.
6. The CHED, in coordination with MARINA, may help formulate standards for continuous professional development (CPD) designed explicitly for maritime instructors, including competency training programs, refresher courses, or postgraduate studies.
7. The CHED, in partnership with MARINA, should offer scholarship grants to qualified instructors to encourage them to pursue postgraduate studies.
8. Future studies should be conducted to track the long-term impact and effectiveness of competency development programs on maritime education outcomes.

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