



Students' Competence Based on BSMT Competency Mapping Towards the Development of an Intervention Program

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ARTICLE INFO

Article history:

Received 11 Dec 2023;
in revised from 18 Jan 2024;
accepted 28 Mar 2024.

Keywords:

Students' Competence, BSMT
Competency Mapping, BSMT
Functions.

ABSTRACT

Education plays a vital role in graduates' capability to gain, maintain, and remain competitive, considering the increasing global maritime demands (Kabir, 2014; Ramirez, 2001). Consequently, maritime educational institutions continuously improve their approaches to train cadets to be competitive in the labor market and quickly adopt the maritime industry's rapid evolution. Thus, this descriptive investigation aimed at determining the competence level developed among the BSMT students; specifically, to find out the students' competence level developed based on BSMT competency mapping in terms of navigation, cargo handling and stowage, and controlling the operation of the ship and care for persons on board. Ninety-four BSMT students from two maritime schools in Bacolod City participated in this study. Findings revealed that BSMT students were partially competent in the various competencies representing the three functions of a BSMT graduate as per the STCW 2010 Manila Amendments. t-test for independent samples revealed a significant difference in the students' level of competence developed between the two schools. An intervention program was formulated to address the gap.

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1. Introduction.

The rapid growth of the maritime industry, ship technical equipment, and consistent strengthening of criteria for shipowners in the environmental protection and cybersecurity fields are some of the explicit demands of the maritime industry that maritime higher education institutions (MHEIs) have to address in order for Filipino seafarers to keep afloat.

The joint CHED-MARINA memorandum circular 01 series of 2019 (JCMMC 01 s. 2019) mandates MHEIs to continuously improve their approaches, quality of graduates equipped with a high level of knowledge, skills that are responsive to the industry's needs, as well as Filipino sailors acting as Officers in Charge of a Watch for international shipping who are globally competitive.

The study conducted by Ching (2017) revealed that BSMT students' competence falls below the group average of ship-board competence at the Operational Level in Cargo Handling and Stowage, Navigation, and Controlling the Operation of the Ship and Care for Persons on board. The results are alarming since the Philippines has been recognized as the world's manning capital, supplying over 25% of the world's maritime fleet over the years (Gonzales, 2019). Furthermore, Ronda (2013) expressed in the Philippine Star that maritime schools have failed to build up quality education despite the risk of the European Union banning Filipino seafarers from boarding EU-enlisted ocean vessels.

Emad (2017) and Ghosh, et al. (2020) pointed out that the assessment system currently enacted does not allow an authentic evaluation of the cadets' competency. The students in this manner engage in defensive learning, acquiring what they need to be successful on the examinations regardless of whether what they learn is useful on-the-job or not. There is no indication that a graduate is competent for a targeted job. This causes the education and training system to perform in a way that makes the students better at taking tests rather than to be competent in

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performing the required tasks on ships. The assessment system needs to be redesigned. Students should be more engaged in and exposed to authentic learning where they may learn a wide range of practices they have available to address problematic situations on board the ship.

In March 2017, the European Maritime Safety Agency (EMSA) conducted an audit on maritime administrations and maritime education and training institutions to ensure that the system is in place (Seafarers, 2020). The Philippines' failure to pass the audit could have seen a long-threatened ban on some 30,000 Filipino officers serving European-flagged ships. Perhaps, it suffices to say that MHEIs and even the government should look for the right framework to help enhance students' competence. It is challenging since most of the MHEIs have been struggling to formulate the right framework for their organization.

Ender (2014) recommends the pyramid model conceptualized by Miller to assess competence. This model had four different levels (1) knows (knowledge)—the recall of basic facts, principles, and theories; (2) knows how (applied knowledge)—the ability to solve problems, make decisions, and describe procedures; (3) shows how (performance)—demonstration of skills in a controlled setting; and (4) does (action)—behavior in real practice.

Maheshwari (2015) suggests a Ralph Tyler Curriculum Development Model to develop an enhancement program to augment student competence. This model comprised four questions that must be answered in developing any curriculum plan of instruction. These questions may be formulated into a four-step process: (1) stating the purpose or objectives; (2) the content; (3) the learning experience; and (4) evaluating the curriculum. He also believed that the structure of the curriculum has to be responsive to three central factors, which are the main elements of educational experience: (1) the nature of the learner; (2) the values and aims of the society, and (3) knowledge of the subject matter. It is necessary to be flexible enough to cope with the market's competing demands yet reliable enough to produce consistent quality learning outcomes.

In line with the abovementioned facts, the present study focused on the assessment of the three (3) functions of the BS Marine Transportation graduates as stipulated in Table A-II/2 of the Standards for Training and Certification for Watchkeeping (STCW '78) as amended that specifies that it is under the operation level that establishes a minimum standard of competence for masters and chief on ships having a gross tonnage of at least 500 tons. There are 19 competencies under the three functions, including the STCW 2010 Manila Amendments.

Function 1 - Navigation at the operation level specifies the following nine competencies: (1) Plan and conduct a passage and determine position; (2) Maintain a safe navigational watch; (3) Use ARPA to maintain the safety of Navigation; (4) Use of ECDIS to maintain the safety of Navigation; (5) Respond to emergencies; (6) Respond to a distress signal at sea; (7) Use the IMO Standard Marine Communication Phrases and use English in both written and oral form; (8) Transmit and receive information by visual signaling; and (9) Maneuver the ship.

Function 2 - Cargo Handling and Storage at the operation level specifies the following two competencies: (1) Monitor

the loading, stowage, securing, and care during the voyage and the unloading of cargoes; and (2) Inspect and report defects to cargo spaces, hatch covers, and ballast tanks.

Furthermore, Function 3 - Controlling the Operation of the Ship and care for persons on board at the operation level specifies the following eight competencies: (1) Ensure compliance with pollution prevention requirements; (2) Maintain seaworthiness of the ship; (3) Prevent, control, and fight fires on board; (4) Operate life-saving appliances; (5) Apply medical first aid on board; (6) Monitor compliance with legislative requirements; (7) Apply of leadership and teamwork skills; and (8) Contribute to the safety of personnel and ship.

Under the STCW competencies, MHEIs are required to establish a structured assessment system to evaluate the students' learning and acquisition of knowledge, understanding, and skills in the form of assessment of both written and practical tests (JCMC-No.-1-s.-2019).

As a result, the goal of this research was to evaluate the degree of competency of third-year BSMT students using the BSMT skills listed in Table A-II/2 of the STCW code, as well as the 2010 Manila amendment of the two MHEIs in Bacolod, Negros Occidental. An intervention program was developed based on the findings and competency mapping.

2. Methodology.

2.1. Purpose of the Study and Research Design.

This study intended at defining the level of competence developed among the BSMT students in two maritime schools in Bacolod City. Specifically, this study sought answers to the following questions:

(1) What is the level of students' academic competence developed on the basis of BSMT competency mapping in terms of (a) Navigation, (b) Cargo handling and stowage; and (c) Controlling the operation of the ship and care for persons on board?

(2) Is there a significant difference in the students' level of academic competence in terms of functions when grouped according to school and taken as a whole?

(3) What intervention program can be developed on the basis of the results?

This investigation employed the descriptive research design utilizing a quantitative research approach. A survey questionnaire was administered personally.

2.2. Participants.

The participants in this study were the 134 third-year BSMT students of two (2) maritime higher education institutions in Bacolod City, Negros Occidental. Of the 134 third-year BSMT students, a sample size of 94 computed using the Raosoft sample size calculator at a 95% level of confidence available online was attained. Stratified random sampling was applied to ensure an accurate picture of the population.

The researcher used a researcher-made instrument to gather the data needed for this investigation.

The items were taken from the list of validated questions for each competency provided by the Maritime Administration.

As defined by the STCW convention, there are three functions supported by competencies needed to complete a BSMT Program. It is composed of (1) Navigation, (2) Cargo Handling and Stowage, and (3) Controlling the operation of the ship and care for persons on board.

There were nine (9) competencies under Navigation, two (2) competencies under Cargo Handling and Stowage, and eight (8) competencies under Controlling the operation of the ship and taking care of persons on board. The competency mapping for BSMT shows a total of 19 competencies under the three functions (STCW, including the 2010 Manila Amendments).

2.3. Procedure.

Permission was requested from the school administrator or president concerned to allow this researcher to gather data for this study. Upon their approval, the researcher collected essential information for the conduct of the research. The assessment was personally conducted in both schools.

2.4. Statistical Treatment of Data.

After gathering all the data, the researcher collected, tallied, and processed the data using appropriate statistical treatments. The data were processed using a Windows-based 17.0 version Statistical Package for the Social Science (SPSS) software with a qualified statistician's help and expertise.

Mean Score	Interpretation	Description
3.60-5.00	Competent	At least 71% of the items were answered correctly to consider the learner as competent
1.60-3.50	Partially Competent	At least 31-70% of the items were answered correctly to consider the learner as partly competent
0.00-1.50	Not Competent	30% of the items or below were answered correctly. The learner is considered not competent

To determine the students' level of competence, the researcher employed the mean. The mean scores were interpreted as follows.

To determine if a significant difference would exist in the students' competence when grouped according to school, the researcher used t-test for independent sample. Alpha level of significance was set at 0.05.

3. Results and Discussion.

3.1. Students' Competence Based on BSMT Competency Mapping When Grouped According to School.

The results revealed that the BSMT students of School A and B were partly competent in the following competency: (a) Function - Navigation, (b) Function 2 – Cargo Handling and Stowage, (c) Function 3 – Controlling the Operation of the

Ship, and Care of Persons. This means that the schools should emphasize the development of the mentioned skills, and their students should work an extra mile to improve their academic performance to uplift their performances in the different competencies.

Torres, et al. (2018) pointed out that competency-based education is intended to meet the students' needs through mastery of content and skills rather than based on the learners' amount of time spent in instruction; also, to meet students' needs more effectively by demanding student mastery of rigorous content and skills rather than measuring student learning by the amount of time a student has received instruction.

Table 1: Students' Competence Based on BSMT Competency When Grouped According to School.

Competency in	School A		School B	
	Mean	Interpretation	Mean	Interpretation
Function 1: Navigation	2.02	Partly Competent	2.28	Partly Competent
Function 2: Cargo handling and stowage	1.65	Partly Competent	2.34	Partly Competent
Function 3: Controlling the operation of the ship and care for persons on board	1.79	Partly Competent	2.30	Partly Competent
As a whole	1.87	Partly Competent	2.29	Partly Competent

Source: Author.

3.2. Students' Level of Competence in Function 1: Navigation When Grouped According to School.

On Function 1: Navigation both groups of students from School A and School B were partly competent. It also reveals that School B has a higher competency level compared to School A in Navigation. Furthermore, School A students were not competent in Function 1 – Competency 3, which is the *Use of ARPA to maintain Safety of Navigation*.

This implied that the students need to master the content and develop the skills to achieve the desired competencies rather than increase the amount of time they spend in class discussion. Students show proficiency in a group of standard competencies to move forward towards graduation rather than based on time spent withing the classroom. However, a comprehensive assessment, specifically on the use of ARPA to maintain safety, may be enhanced.

According to Solmaz et al. (2020), a more in-depth assessment of watchkeeping officers should be taken into account to ensure navigation safety. They are subjected to various evaluation procedures of companies before they get to practice their licenses. Moreover, Le, et al. (2014) stated that assessment requiring the application of their acquire knowledge and the demonstration of mastery regarding the subject matter would

be used to measure students' progress. Torres, et al. (2018) echoed the same sentiments.

Table 2: Students' Level of Competence in Function 1: Navigation When Grouped According to School.

Competencies	School A		School B	
	Mean	Int	Mean	Int
<i>Competence 1: Plan and conduct a passage and determine position</i>	2.56	Partly Competent	2.53	Partly Competent
<i>Competence 2: Maintain a safe navigational watch</i>	2.59	Partly Competent	3.15	Partly Competent
<i>Competence 3: Use ARPA to maintain safety of Navigation</i>	1.05	Not Competent	1.96	Partly Competent
<i>Competence 4: Use of ECDIS to maintain the safety of navigation</i>	2.15	Partly Competent	2.23	Partly Competent
<i>Competence 5: Respond to emergencies</i>	2.00	Partly Competent	2.06	Partly Competent
<i>Competence 6: Respond to a distress signal at sea</i>	1.90	Partly Competent	1.85	Partly Competent
<i>Competence 7: Use the IMO Standard Marine Communication Phrases and use English in written and oral form</i>	2.22	Partly Competent	2.72	Partly Competent
<i>Competence 8: Transmit and receive information by visual signaling</i>	1.68	Partly Competent	1.74	Partly Competent
<i>Competence 9: Maneuver the ship</i>	2.56	Partly Competent	2.53	Partly Competent
Total	2.02	Partly Competent	2.28	Partly Competent

Source: Authors.

3.3. Students' Level of Competence in Function 2: Cargo handling and Stowage When Grouped According to School.

Results showed that in functions 2, there is a contrasting outcome between school A (lowest of the three functions) and school B (highest of the three functions). This implies that school A needs to enhance the content of instruction and their approach in order for the students to develop competence in cargo handling and stowage, specifically on the monitoring of loading, stowage, securing, care during the voyage and the unloading of cargoes as well as inspect and report defects to cargo spaces, hatch covers, and ballast tanks.

Since competence and skills are the bases of the activities onboard the ships, maritime training systems should be responsible for creating a competent workforce in the maritime field (Stan and Buzbuchi, 2012) cited by Semjonovs et al. (2015). According to Curl (2014), competency seeks to emphasize meta-cognitive and self-regulation skills that will enable students to

evaluate their progress, reflect on the things they have learned, and look at learning difficulties as avenues for learning growth mindset.

Table 3: Students' Level of Competence in Function 2: Cargo handling and Stowage When Grouped According to School.

Function 2: Cargo handling and stowage	School A		School B	
	Mean	Int	Mean	Int
<i>Competence 10: Monitor the loading, stowage, securing, care during the voyage and the unloading of cargoes</i>	1.73	Partly Competent	2.28	Partly Competent
<i>Competence 11: Inspect and report defects to cargo spaces, hatch covers, and ballast tanks</i>	1.56	Partly Competent	2.40	Partly Competent
Total	1.65	Partly Competent	2.34	Partly Competent

Source: Authors.

3.4. Students' Level of Competence in Function 3 when Grouped According to School.

On function 3: Controlling the operation of the ship and acre for persons on board, the BSMT students of school B has higher competency level than those in School A. Moreover, the students of school A were not competent in the following competencies: *competence 12 – ensure compliance with pollution prevention requirements; competence 13 – maintain the seaworthiness of the ship; competence 14 – prevent, control, and fight fires on board; and competence 15 – operate life-saving appliances.*

This implies that the schools need to maximize their efforts on troubleshooting and repairing declining students' performance on specific competencies such as competencies 12, 13, 14, and 15. As Moynihan et al. (2015) mentioned, core competencies are a robust minimal set of a mixture of attributes such as attitudes, applied knowledge, and skills that allows a person to do a group of tasks to proper standard efficiently and effectively.

3.5. Difference in the Students' Level of Competence When Grouped According to School.

The t-test for independent sample means shows a significant difference in the students' level of competence with a t-value of 3.01 and p-value of 0.003 when grouped according to school. The result implies that student's level of competence differs per school. The data indicated that the students in School B had a higher level of competence than the students in School A.

Table 4: Students' Level of Competence in Function 3 when grouped according to Schools.

Competencies	School A		School B	
	Mean	Int	Mean	Int
Competence 12: Ensure compliance with pollution prevention requirements	0.88	Not Competent	1.77	Partly Competent
Competence 13: Maintain seaworthiness of the ship	1.15	Not Competent	1.92	Partly Competent
Competence 14: Prevent, control, and fight fires onboard	1.41	Not Competent	2.04	Partly Competent
Competence 15: Operate life-saving appliances	0.90	Not Competent	1.75	Partly Competent
Competence 16: Apply medical first aid on board	2.80	Partly Competent	2.77	Partly Competent
Competence 17: Monitor compliance with legislative requirements	2.27	Partly Competent	3.00	Partly Competent
Competence 18: Application of leadership and team working skills	1.76	Partly Competent	2.11	Partly Competent
Competence 19: Contribute to the safety of personnel and ship	2.39	Partly Competent	2.57	Partly Competent
Total	1.79	Partly Competent	2.30	Partly Competent

Source: Authors.

According to Hanzu-Pazara et al (2010), maritime universities play an essential role in maritime activities and encompass training and serve as the development ground for maritime officers in their personality and sense of responsibility for their actions. Barison and Santos (2011) added that apart from having the technical competencies, they need to have a high level of logical and critical thinking, high level of professionalism and ethical behavior, human relationship skills, emotional intelligence, multicultural sensitivity, and be environmentally conscious, have an excellent grasp of contemporary issues and to adjust to new developments, have leadership skills, and can work in a team.

Furthermore, table 8 reveals that in Function 1: Navigation, there was no significant difference in the students' level of competence between School A and School B, with a t-value of 2.26 and p-value of 0.26. This means that statistically, students of both school A and school B had the same competence level in Function 1: Navigation.

It appears that students' competence levels between two maritime schools differ in Function 2: Cargo handling and stowage

and in function 3: Controlling the operation of the ship and care for persons on board. This indicated that school B had a higher competence level than school A in function 2: Cargo handling and stowage. Likewise in function 3: controlling the operation of the ship and care for persons on board.

Maritime Higher Educational Institutions are expected to address the present needs for quality education and training by translating attitudes, skills, and knowledge that adhere to internationally accepted standards. STCW'95 requires maritime academe to ensure competent seafarers' production for the industry (Doromal, 2010).

Ghosh, et al. (2014) suggest that using an accurate assessment method requires students to construct responses through the critical analysis of information presented in real-world contexts. Hence, the findings of their study reveal the difference in students' academic achievement (measured through scores obtained in assessment) in authentic evaluations compared with the traditional evaluation. Analysis of student scores revealed that the authentically assessed students were guided towards significantly higher academic achievement.

Table 5: The Difference in the Students' Level of Competence in 3 Functions when grouped according to Schools.

Competence	School	Mean	df	t	p
Function 1: Navigation	A	1.9864	92	2.26	0.26
	B	2.2788			
Function 2: Cargo handling and stowage	A	1.2195	92	5.66	0.00*
	B	2.0849			
Function 3: Controlling the operation of the ship and care for persons on board	A	1.9085	92	2.47	0.02*
	B	2.3608			

Source: Authors.

4. Summary of the Problem and Findings .

The primary purpose of this study was to determine the level of competence developed among the BSMT students who graduated in April 2020 from two Maritime Schools in Bacolod City, Negros Occidental. Specifically, this investigation attempted to find answers to the following questions:

(1) What is the level of students' competence developed on the basis of BSMT competency mapping in terms of (a) Navigation; (b) Cargo handling and stowage; and (c) Controlling the operation of the ship and care for persons on board?;

(2) Is there a significant difference in the students' level of competence when grouped according to school?;

(3) What intervention program can be developed on the basis of the results? Means and t-test for independent samples were used to analyze the data.

The findings of this research are as follows:

(1) The level of students' competence developed on the basis of BSMT Competency Mapping in terms of Navigation, Cargo Handling, and Stowage, as well as Controlling the Operation of the Ship and Care of Persons On Board are Partly Competent for both Schools;

(2) There was a significant difference in the level of students' competence between School A and B;

(3) There was no significant difference between School A and B students' competence in Function 1: Navigation;

(4) There was a significant difference between School A and B students' competence in Function 2: Cargo Handling and Stowage; and

(5) There was a significant difference between School A and B students' competence in Function 3: Controlling the Operation of the Ship and Care of Persons On Board.

5. Conclusions.

The two maritime schools involved in the investigation seem to have delivered instructional sessions, as shown in the results of their level of competence; however, some competencies need more reinforcement to make them competent.

The level of competence of the two schools is significantly different; hence, their delivery of instructional segments needs to give more emphasis on some aspects that were found out to be not at competent levels, as far as students' level of competence is concerned.

6. Implication and Proposed Program.

Results seem to reveal that instructors should emphasize the teaching of the skills mentioned. Also, students should work an extra mile to improve their academic performance and uplift their performance in the different competencies.

Most significantly, few competencies are shown as not competent, a level which is quite alarming and pressing thus, the need for prompt attention by both instructors and students. Intervention program activities are deemed pertinent to address this concern.

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Table 6: Maritime Students' excellence in Academic Program Design.

Title of the program	Maritime Students' Excellence in Academics Program (MarSEA Program)
Rationale	While the Maritime Industry is the lifeblood of different economies around the world; seafarers are the lifeblood of the Maritime Industry. They are the ones working hard for smooth operations. Though simple it may seem, seafaring is a very challenging job that requires adequate knowledge and skills. To produce quality seafarers, academic institutions need to develop an intervention program that could help further develop the education of Maritime students by equipping them to be ready with the required skills, knowledge, performance, and values that would make them excellent seafarers in the future, especially to those who are performing behind as compared to others. The MarSEA Program is a tool to attain this goal.
Objectives	After the implementation of the MarSEA Program, the students must have: 1. Acquired the required knowledge, skills, performance, and values that would make them perform excellently as seafarers in the future; and 2. Shown preparedness for the real world of the Maritime Industry
Participants	Maritime Students (Through the help of the Maritime Instructors and the Institution)
Duration	14 months
Phase I: Instructional Materials Development and Procurement of Equipment as Per Minimum Requirement	
A. Course Syllabus	
B. Module	
C. Performance-based Assessment Task/ 21 st Century Assessment	
D. State-of-the-Art Teaching Approach	
Method of Teaching	
(a) Blended Learning	
(b) Pedagogy Wheel	
E. Equipment Procurement	
(a) Carrying Capacity	
(b) Utilization Plan	
Phase II: Series of Seaman Workshops	
Topic 1: Developing Study Skills	
Topic 2: Developing Comprehension and Critical Analysis	
Phase III:	
A. Conduct of Pre-assessment	
1. Navigation	
2. Cargo handling and storage	
3. Controlling the operation of the Ship and care for persons on board	
B. Conduct of Post-assessment	
C. Simulation (Board Examination)	
Phase IV: Academic Counseling and Peer Mentoring	
A. Monitoring Student Performance	
B. Conduct of Special Classes	
C. Peer Mentoring Activities by Specific Areas	
D. Remedial through Peer Mentoring	

Source: Authors.