Satisfaction of Nigerian Marine Engineering Students on Machine Shop

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Abstract *- This study aimed to determine the Level of Satisfaction of Marine Engineering Students in using the LIMA Machine Workshop and the problems encountered with regards to service provided by the Machine Workshop. Descriptive type of research was employed in the study. Results show that students are satisfied with using LIMA Marine Engineering Workshop provided by the school administration while the ratio of machine to students does not satisfy the students. The quality of equipment used during workshop affects students' performance. The students' knowledge on the use of equipment in the Machine Workshop is limited in compliance with Section A-III/1 STCW 1978 amended.*

Keywords: *Marine Engineering Students, LIMA Machine Workshop, Level of satisfaction*

INTRODUCTION

Satisfaction characterizes the quality of products and services that the organization delivers to its customers that serves as the basis for continuous improvement (Buted et al., 2014). To establish as a baseline standard of performance and a possible standard of excellence, LIMA should put the interests of the students at the forefront (Dacuray et al., 2014). Satisfaction of clients is an important element of success for any organization and any sector of the economy (Bay, An & Laguador, 2014).

Physical plant and facilities are major considerations in developing the proficiency of the students to handle equipment and machines needed for their respective fields of specialization (Maristela et al., 2015). Marine Engineering workshops include extensive facilities for bench/hand fitting and the use of machine tools, welding, marine power plant and electrical maintenance, laboratories for Thermodynamics, mechanical and control engineering experiments, a specialized control laboratory for electronic navigational systems operations and control systems. Training in the Global Maritime Education of Marine Engineering cadets covers all marine engineering workshop skills elements, including use and care of hand tools, measuring equipment, drilling machines, centre lathes, vertical milling machines, off-hand grinding machines and welding equipment. The training then advances to cover maintenance skills, assembly skills and electrical/electronic practice (Engineering Workshop, 2014).

Learning is an interactive process that occurs in a specific environment (Velasco et al., 2015). Furthermore, a marine engineering workshop is working environment where industrial materials are cut, fabricated, and finished to prepare them for use. Machine shops are employed in the creation of new parts, as well as repairs to existing equipment and parts. Marine engineering cadets may have specialized training, depending on the type of work done at the marine engineering workshop, as some machining tasks require a unique skill set, as well as a deep understanding of the kind of work the finished parts will be (Heavy equipment like lathes and drill presses is commonly installed) in a marine engineering workshop. The facility is well ventilated to address concerns about particulates and can have rasps, files, and other smaller supplies for finishing tasks available as well as painting booths for painting or coating finished products.

Based on the requirements of STCW, all marine engineering cadets in LIMA before completion of their three years in college should be acquainted with the necessary machinery to conform to the STCW code. Accident and casualty both at sea and in port were dogging the international shipping industry during the shipping crisis in the 1980's. It is a well-established fact that the seafarers' competence is among the most critical factors in safe and efficient ship operation. Therefore, the international maritime organization (IMO) adopted in July 1995 substantial amendments to the international convention on standards of training and watchkeeping for seafarers of 1978 as amended (STCW78).

This event is still considered as the most significant development for improving maritime skills and safety for over a decade. The changes to the convention constitute a comprehensive package of measures designed to improve standards of competence globally, in conformity with the STCW code 1978 in providing and developing the competence in the use and operation of machine tools and equipment and safe working practices for officer-in-charge of Engineering watch. The Commission on Higher Education (CHED) Policies, Standards and Guidelines(PSG) in collaboration with the Philippines Foundation for Maritime Teaching Aids (MARTA) define three syllabus for marine engineering department for all maritime schools in the Philippines in conformity with the "STCW 1978" standard.

In relation, the researchers chose this study to measure the level of satisfaction of marine engineering cadets who have been using the marine engineering machine workshop. Laguador, De Castro and Portugal (2014) emphasized that educational institutions especially those belong to private sectors are very much particular with the customer satisfaction as part of the continuous improvement to retain the students. It is a part of the mission of LPU to provide the students with an equal growth and opportunity more than what the other universities and colleges can offer to their students (Orence & Laguador, 2013).

In order to facilitate Lyceum International Maritime Academy (LIMA) in line with the approved qualification that includes workshop skills or practical experience as specified with STCW Code Table A-III/1 column 1, The researchers believe that through assessment, the institution will be made avail facts about the services offered cadets to ascertain their approval, if it measures up as required, perhaps a need of improvement of the marine engineering workshop to boost its quality in view of meeting the Global Maritime Educational Competency. The researcher believed that this study would develop and sharpen the students engineering self –knowledge, skills and talents in the future if being considered.

OBJECTIVES OF THE STUDY

This research work evaluated the level of satisfaction of Marine Engineering Cadets on LIMA Marine Engineering Workshop. Specifically, it sought to determine the level of satisfaction of Marine Engineering students in the area of Safety, Supervision, tools and equipment, and organization of the Marine Engineering Machine Shop; to identify problem encountered within the Machine shop and to propose a plan of action to address problem faced in the Machine Shop.

REVIEW OF LITERATURE

Assessment of customer satisfaction serves as a strong basis for future revenues and action plans to improve quality service (Mendoza, 2014). It is fundamental to the notion of satisfying the needs and wants of consumers (Bencito, 2014). Making the customer satisfied is the ultimate goal of every business organization, and it's their responsibility to meet client's expectations to ensure loyalty (Devicais, 2014).

The Marine Engineering workshop is one of the major facility built in Lyceum International Maritime Academy and it has been in operation since 1975 at the LPU-B Main Campus, formerly known as Lyceum Merchant Maritime Academy (LMMA) and was later moved to LIMA campus in 1995.

Machine shop; it is one of the most important of a workshop, which is used not only for repair work but also for manufacturing of parts and other fabrication work. Lathes, milling machine, drilling machine, grinders, etc. are house in the shop. Other facilities such as tool room, smithy, welding, forging, and carpentry are also provided in the machine shop. Electrical repair shop; repair and maintains of electrical equipment can be carried out here. The testing facilities for all types of electrical equipment must be also provided (Pathak, n.d.).

In the existing times of minimum manning on board vessels, with increasing challenges to maintain all the equipment under the tight schedules; a skilled engineer has to enhance continuously his technological skills, with an appropriate assessment and evaluation process to guide him. This workshop based, practical oriented course, is designed to improve the participant's skills in following the procedures and safe practices required during

overhauling. It allows him to gain confidence, estimate time and manpower requirements in the maintenance of equipment commonly placed under his care ("Engine Equipment Maintenance", 2015).
The practical electrical knowledge of marine engineering workshop advanced aspects of shipboard electrical knowledge, this workshop, conducted in a dedicated laboratory, provides theoretical information, intensive hands-on training and group discussions leading to improvement in competence and confidence in handling and troubleshooting electrical equipment. Practice on a fully equipped and functional Boiler control panel further develops his ability to trace circuits, locate and rectify faults induced therein ("Practical Marine Electrical Workshop", 2015).

The maritime industry persists based on human element and, in this way, the necessity to invest in human factor must be a high priority. To have personnel qualified according to technological standards is a request that can prove difficult if adequate background training does not exist. The future of shipping is ultimately not dependent on state of art technology, but rather on the quality and expertise of the person handling that technology (Arsernie et al., 2010; Saiedi et al., 2012).

The Engine Department is made up of licensed and unlicensed personnel who have a broad background in marine engineering knowledge and skills. The watch standing engineers and oilers on duty monitor the power generating plant and all auxiliary machinery and "hotel" systems like Heating Ventilation Air Conditioning (HVAC) Systems and Potable Water Systems (fresh water for sinks, showers, cooking, etc). There is a sewage treatment plant aboard known as a Marine Sanitation Device (MSD)—a vacuum collection system for toilets and many other systems ("Engine Control Room & Engine Room", 2015).

The Don Bosco Maritime Academy scores over other engineering colleges by providing sufficient number of machines in spacious workshops, excellent trainer/trainee ratio and motivating the student to do his/her best. Marine Engineers in our faculty have rich experience in supervising the training process itself. Our courses are designed for interactive sessions with the client company's technical manpower and imitate actual conditions and requirements on board. Money spent on such training is recompensed through the reduced number of jobs for onshore workshops and reduced downtime of the plant (Workshop Skills, 2004).

METHODS

Research Design

This study used the descriptive method of research. Descriptive research is a scientific method that involves observing and describing the behavior of a subject without influencing it in any way, it is often used as a pre-cursor to quantitative research designs, the general overview giving some valuable pointers as to what variables are worth testing quantitatively (Research Designs, 2015).

Many scientific disciplines, especially social science and psychology, use this method to obtain a general overview of the subject. Some subjects cannot be observed in any other way; for example, the case study of the level of satisfaction in LIMA Marine Engineering workshop subject is a descriptive research design and allows observation without affecting normal behavior.

Participants

The respondents in this study were the 42 Senior Nigerian Marine Engineering students who have utilized the LIMA Marine Engineering Machine Shop. The researchers believed that they could give their evaluation based on their experiences with respect to Machine Shop training over the years in LIMA Marine Engineering Workshop.

Instrument

The researchers used the primary data collection system in the form of a questionnaire that is filled in by all Senior Nigerian Marine Engineering students. The researchers also used different references to look for data that serve as the basis for making the questionnaire. The questionnaire was divided into two parts. Part I include the questions to determine Level of Satisfaction of Marine Students on the areas of the Machine Shop in terms of Safety, Supervision, Tools and Equipment, Organization. Part II includes the problems encountered by Marine Engineering Students in the machine workshop during training.

Procedure

The researchers begin with gathering of information related to the subject matter for the preparation of the project ahead. Upon accumulating ample information about the topic, the researchers quickly began the task of preparing the data gathering tool, books, journals, and internet. The process of constructing checklist and questionnaire was also consulted by the researchers to see that they bring out

the best of the questionnaire that correspond to the data gathering of the subject matter.

Upon completion of the first draft of the data gathering tool, it was submitted to the research adviser and Machine Workshop professor for comments and suggestions. After integrating the comments and suggestion by the research adviser and Machine Workshop professor, the researchers constructed the final draft for the instrument that was validated by the research adviser and Machine Workshop professor.

The researchers facilitated the process of answering the questionnaire to ensure honest and authentic answer.

Data Analysis

The following statistics were used in treating the responses of the forty-two Marine Engineering students regarding LIMA Marine Engineering Machine Workshop. Weighted mean was used to determine the level of satisfaction and the problem encountered by Marine Students on the different areas of the Machine Shop. Ranking was used to determine the order of items.

The given scale was used to interpret the result of the level of satisfaction of Marine Engineering: 3.50 - 4.00: Highly Satisfied (HS); 2.50 -3.49: Moderately Satisfied (MS); 1.50 -2.49: Satisfied (S); 1.00 -1.49: Dissatisfied (D). The given scale was used to analyze the result of data gathered in problems encountered by the respondents: 4.50 - 5.00: Very Often (VO); 3.50 - 4.49: Often (O); 2.50 -3.49: Seldom (S); 1.50 -2.49: Rarely (R); 1.00 -1.49: Never (N)

RESULTS AND DISCUSSION

This part include the presentation, analysis and interpretation of the data gathered in terms of level of satisfaction of Marine Engineering Students and the level of agreement with the problem encountered in the Marine Machine workshop during the training.

Table 1 presents that the overall rating on the safety of Marine Engineering Machine Workshop. It was rated as moderately satisfied in so far as the results of the respondents are concerned, as shown by the composite mean of 2.84 and a range of weighted mean from 2.43 to 3.02. The result shows that Safety stickers in the shop are present and legible for the users in the Machine workshop got the highest rank with a weighted mean of 3.02 and interpreted as "Moderately Satisfied". This means most of the respondents appreciate the present and eligibility of safety stickers in the Machine shop.

Table 1. Satisfaction of Marine Engineering Machine Students in the Machine Workshop in terms of Safety

Safety	**WM**	**VI**	**Rank**
1. There is the presence of required personal protective equipment	2.93	MS	3
2.There are clear standard operating procedures in the shop	2.88	MS	4
3. The machinery and equipment are placed accordingly	2.98	MS	2
4. Workshop personnel monitor the safe working practices inside the shop	2.43	S	6
5. Safety stickers in the shop are present and legible for the users	3.02	MS	1
6. There are an adequate ventilation space in the workshop	2.81	MS	5
Composite Mean	**2.84**	**MS**	

The Machinery followed it, and Equipment are placed accordingly as interpreted as "Moderately Satisfied" with a weighted mean of 2.98 as the second in rank.

On the other hand, although the responses to the present of "adequate ventilation spaces in the workshop" were moderately satisfied, this result, with a weighted mean of 2.81, ranked fifth while "Workshop personnel monitor the safe working practices inside the shop", with a weighted mean of 2.43, ranked the sixth among the six indicators. This is because the Workshop personnel monitor the safe working practices inside the shop of LIMA Marine Engineering Machine Workshop are not very active in comparison with the Workshop personnel monitor the safe working practices inside the shop of other Marine Engineering Machine Workshops, and as a result, did not established a high rank of moderately satisfaction. This means effective and proper Workshop personnel monitor the safe working practices inside the shop should be an engineer to meet the demands of students.

Table 2 illustrates the mean score of the Supervision in the LIMA Marine Engineering Machine Workshop. It can be observed from the table that the respondents are satisfied with the supervision of the Marine Engineering Machine Workshop having a composite mean of 2.47. Exemption of Instructors provides professional guidance to students, and all the items yield a high to satisfaction mean ranging from 2.38 to 2.64 interpreted as "Satisfied" to "Moderately Satisfied".

Table 2. Satisfaction Level in the Machine Shop in terms of Supervision

Supervision	WM	VI	Rank
1. Technical assistance is provided to cadet in the workshop	2.45	S	2.5
2. There is an effective monitoring of cadet on machine operation	2.45	S	2.5
3.Instructors provide professional guidance to students	2.64	MS	1
4. Workshop personnel assist the student-users	2.40	S	4
5. Instructors closely monitor the students while working in the machine shop	2.38	S	5
Composite Mean	**2.47**	**S**	

The table shows that among the supervisions, Instructors provide professional guidance to students with a weighted mean of 2.64, got the highest mean. It is followed by "Technical assistance is provided to cadet in the workshop" and "There is an effective monitoring of cadet on machine operation" simultaneously are of the same rank having a weighted mean of 2.45. However, the lowest two in the rank of supervision are Workshop personnel assist the student users with a weighted mean of 2.40 and Instructors carefully monitor the students while working in the machine shop with a weighted mean of 2.38. This means that although the satisfaction level of the respondents is satisfied, all other items apart from "Instructors provides professional guidance to students" are viable areas for improvement to correspond to the expectations and preferences of the respondents.

Table 3. Satisfaction Level in the Machine Shop in terms of Tools and Equipment

Tools and Equipment	WM	VI	Rank
1. Different machine tools are appropriately labeled and are put in their respective places	3.05	MS	1
2. Different machines in the shop function properly	2.36	S	3
3. Upgrading and maintenance of tools and equipment in the shop are regularly done	2.10	S	5
4. Machinery service is of good quality	2.26	S	4
5. There is a clear, hands-on knowledge in operating machinery	2.50	MS	2
Composite Mean	**2.45**	**S**	

Table 3 presents that in the area of Tools and Equipment, the general result of the level of satisfaction reflects on the composite mean of 2.45 or verbally interpreted as satisfied, and with a range of weighted mean from 2.10 to 3.05. Most of the respondents were Moderately Satisfied with Different machine tools are properly labeled and are put in their respective places in the Marine Engineering Machine Workshop as first rank with a weighted mean of 3.05. This means that most of the respondent appreciated Different machine tools and the way they were installed in the shop.

Most of the respondents were also moderately satisfied with "there is a clear, hands-on knowledge in operating machinery" that ranked second with a weighted mean of 2.50. This means that the respondents appreciated the impact on operational machinery knowledge to meet the students' needs and desire in the Machine Workshop. On the other hand, the same results reveal that "Machinery service is of good quality" ranked fourth, with a weighted mean of 2.26, while "Upgrading and maintenance of tools and equipment in the shop are regularly done" ranked fifth with a weighted mean of 2.10. This means that although the satisfaction level of the respondents is moderate, the Machinery services are of good quality and Upgrading and maintenance of tools and equipment in the shop are regularly done are feasible for improvement to correspond to the expectation and preferences of the respondents.

Table 4. Satisfaction Level in the Machine Shop in terms of Organization

Organization	WM	VI	Rank
1. There is an established arrangement of equipment in the workshop	2.79	MS	1
2. Instructors are well experienced	2.74	MS	3
3. There are first-aids provided in case of emergency	2.43	S	6
4. Noise is controlled and or managed properly in the shop	2.52	MS	5
5. There is a visible workshop schedule posted in the shop	2.19	S	7
6. The shop is clean and regularly maintained	2.69	MS	4
7. There is an availability workshop personnel to attend students' concerns	2.76	MS	2
Composite Mean	**2.59**	**MS**	

Table 4 presents the general level of satisfaction of the respondents in organization of machine shop is moderate as denoted by the composite mean score of 2.59. Most of the respondents are Moderately

Satisfied with the "established arrangement of equipment in the workshop" as first rank with a weighted mean of 2.79. This implies that location and positioning of equipment in the subject matter plays the most important role in acquiring a moderate level of satisfaction. Most of the respondents also moderately satisfied with "an availability workshop personnel to attend students' concerns" as second rank with a weighted mean of 2.76. This means that the appraisal of students on the availability of workshop personnel is moderate to the expectations of the students in the Machine Workshop. Interpersonal relationships of teachers with the students also play a significant role in achieving a high level of satisfaction rate (Dacuray, 2015).

However, "first-aids provided in case of emergency", ranked sixth among the variables with a weighted mean of 2.43. This means that the LIMA Marine Engineering Machine Workshop needs to provide more first-aids materials and personnel to meet the respondents' expectations. The item "There is a visible workshop schedule posted in the shop" as seventh rank with a weighted mean of 2.19. This suggests that there is a need for periodic workshop schedule for all Marine Engineering students to avoid overpopulation in the Machine Workshop. Curriculum and instruction must be supported by activities which are in the forms of actual experiences outside the classroom that could provide better learning and understanding of the difference between principles and practice (Laguador & Chavez, 2013).

Table 5. Problems Encountered in the Machine Shop

Problems Encountered	WM	VI	Rank
1. There is no shop personnel to attend to student's needs	2.57	S	5
2. There is lacking of teaching materials in the shop	2.93	S	4
3. Quality of equipment (machines) used during workshop affects students'' performance in different activities	3.50	O	2
4. The shop is not well-ventilated, and noise from the outside affects the activities inside the shop	2.38	R	6
5. Students' knowledge on the use of equipment. Machinery are very limited	3.17	S	3
6. The ratio of machines to students is not proportion	3.74	O	1
Composite Mean	**3.05**	**S**	

Table 5 presents the problems encountered by Marine Engineering students in the Machine Shop. The respondents agreed that there are problems encountered with students in the machine workshop during training as indicated by the composite mean of 3.05, and a range of weighted mean from 2.38 to 3.74. The majority of the respondents are often with the problem "The ratio of machines to students at is not proportion" as the first rank with a weighted means of 3.74. This implies that the proportionality between the students and the machines in the subject matter plays the most important role developing a high level of satisfaction. Most of the respondents are also often with the problem "Quality of equipment (machines) used during workshop affects students" performance in different activities" as the second ranked with a weighted mean of 3.50. This proposed that there must be enough quality equipment (machines) to enhance the performance of Marine Engineering students in LIMA to compete with their counterpart in the maritime profession.

Nevertheless, the problem "There is no shop personnel to attend to student's needs" ranked fifth with a weighted mean of 2.57. This means that the respondents did not experience problems in terms the attention of shop personnel while working in the workshop. The item "The shop is not well-ventilated, and noise from the outside affects the activities inside the shop" ranked last with a weighted mean of 2.38. This signifies that the shop in good condition and placement in terms of ventilation and noise free as it ought to be in the circular Maritime institute.

In compliance with Section A-III/1 of STCW Code, Mandatory minimum requirements for certification of officers in charge of an engineering watch in a manned engine room or designated duty engineers in a periodically unmanned engine-room which include The education and training required by paragraph 2.3 of Regulation III/1 shall include training in mechanical and electrical workshop skills relevant to the duties of an engineer officer (Standard Regarding the Engine Department to STCW, 1978).

The marine engineer needs to be equipped with practical skills and able to take care of any repairs that are required on board with the limited resources at hand. The usual resources available for a shipboard engineer are a lathe machine, a gas welding and cutting set, and an electrical arc welding set for shielded metal arc welding (SMAW). A skilled operator can produce wonders with the lathe machine that is known as the 'mother of all machines'. Similarly, the gas and electrical welding sets are essential tools for any regular repairs like joining and cutting on steel, copper and brass in any form.

Table 6. Proposed Action Plan to address Problems on Machine Workshop

Key result area	Strategies	Persons involved
The ratio of machines to students is not proportion	Avail, sufficient number of machines, to accommodate the number of students working in the workshops, for an excellent trainer/trainee ratio and motivating the student to do his/her best, and proper scheduling In the use of Engineering machine Workshop	Administration/Instructors/ Technicians
Quality of equipment (machines) used during workshop affects students'' performance in different activities	Replace outdated and defective equipment, improve storage and maintenance of equipment	Administration and Workshop Technicians
Students' knowledge on the use of equipment. Machinery are very limited	Conducting and formulating new teaching techniques and strategies	Professors and Workshop Technicians

CONCLUSIONS AND RECOMMENDATIONS

The Marine Engineering cadets were satisfied with the LIMA Marine Engineering Workshop. The ratio of machines to students was identified as the main problem in LIMA Marine Engineering Machine Workshop. An action plan was proposed to address problems encountered by the respondents in the Marine Engineering Machine Workshop.

LIMA management may implement new programs that advance the maintenance skills, assembly skills and electrical/electronic practice, use and care of hand tools, measuring equipment, drilling machines, centre lathes, vertical milling machines, off-hand grinding machines and welding equipment.

In the area of Instruction, LIMA Marine Machine Workshop instructors may have to be more effective in selecting and using training/instructional methods and procedures, appropriate Knowledge of machines and tools, including their designs, uses, repair, and maintenance when learning or teaching new things. Scheduling of the machine shop may also be taken into consideration. Provide and continually improve the appropriate learning environment for the students to enhance academic instrumentality (Magtibay et al., 2015).

LIMA administration has to take further action training of Machine Shop instructors and personnel to improve their skills and knowledge on Marine Engineering Machine Workshop to meet the international standard of this profession. Student-centered teaching and learning is the recommended approach to modern day pedagogy especially in the Outcomes-based Education where the teachers served as the facilitator of learning activities rather than performing the traditional lecture method (Laguador, 2014).

Continuous growth and expansion of local and international industry linkages will provide more possibilities to acquire the universal knowledge, live the core values and apply the valuable skills of first world countries in the delivery of instruction inside the university through adapting the outcomes-based curriculum towards ASEAN integration (Laguador, Villas & Delgado, 2014).

The proposed action plan may be conducted for utilization. A similar study may be carried out by future researchers using a different set of variables. LIMA administration may take further action training of Machine Shop instructors and personnel to improve their skills and knowledge on Marine Engineering Machine Workshop to meet the international standard of this profession.

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