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Attitude, Skills Performance, and Implications of Using Simulator Programs among Marine Engineering Students

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Abstract - This study aims to determine the attitude towards, skills performance, and implications of simulator programs among marine engineering students of John B. Lacson Foundation Maritime University-Molo, Iloilo City, Philippines. The participants of this study were the 120 marine engineering students who used simulator programs in their subject, specifically Power Plant 1. This present study employed quantitative-qualitative method of gathering data. Data gathered were obtained through Likert-type data-gathering instrument entitled "Attitude towards Simulator Programs," assessment rating instrument of the professors teaching simulator was used to determine the skills performance of the students, and implications of using simulator programs were determined by using the students'

qualitative inputs on simulator. Appropriate statistical tools were used to analyze the quantitative data. Interviews and comments were used for qualitative analysis of the study. Results of this study were properly disseminated and discussed among faculty members handling simulator programs. Department heads, faculty members, and students were invited to the presentation of the results of this study to discuss the effect as regards their academic performance.

Keywords - Attitude, skills performance, implications, simulator program, Marine Engineering students

INTRODUCTION

Simulation was used to different degrees by different communities such as students, trainees, and instructors. Past experiences and cultural biases influenced the extent to which specific communities used simulator (Roof, 1996; Kapos, 1998; Careta and Dunlop, 1998). According to several studies, transfer of training effectiveness of live training has been augmented by the use of simulator either in flying/navigating/starting engine. However, trainers or instructors should attempt to know the advantages and disadvantages of both live and simulated training. The important role of simulator training in these studies was to lessen the training deficiencies caused by increasing complexity and tasks brought about by nature, event, and work that need analysis of input data but not to replace "live training."

In this context, the researchers conceived to include in this study the role played by other variables that influenced the use of simulator programs -- attitude and skill performance among marine engineering students at a maritime university in the Philippines. The simulator program aims to ensure optimum safety and efficiency at sea, extensive training for marine engineers is essential. The Engine Room Simulator (ERS) is designed to provide the training for marine engineering students, from basic to advanced level, and with special reference to the requirements of the STCW code and IMO Model Course 2.07.

Meanwhile, attitude, in many investigations play an important role in the learning process. In the study of Porras (2004), attitude was defined as "the cognitive and effective evaluation that disposes a person to act in certain way." Alvin (1991, in Porras, 2004) adds that attitude explained the relatively stable evaluation of object, person, work, and issue.

Another variable of the present study is the skill performance in using simulator. Linder and McDevitt (1998) mention proficiency as the state of being skilled in performing tasks -- expertise. The proficiency as a measure increases with practice on scale without an upper bound. Although, in practice, increases in proficiency per practice repetition diminish as one reaches higher levels of proficiency. In this study, live and simulator training is usually focused on increasing skill by giving more practice in a particular skill.

In a study titled "Impact of Simulator Training On Cognition Among Marine Engineering Students," it was underscored that simulation learning decreases extraneous cognitive load and this has enabled the learners to align and focus the cognitive resources for understanding the content of the learning environment (Tumala, 2003; Chen, 2000).It shows that simulator activities had helped the students to have better perspective of learning especially towards the development of the cognitive and psycho-motor aspects of the learners. The researchers additionally mentioned that people do things which are based on varied mental operations. They operate either abstractly or concretely. These mental operations are used to identify analytically the fundamental components of mental life, like attention, developing paradigms to make sense of collected observations. There are general principles which have been uncovered over the years of laboratory research on cognition and some of those principles seem to promise fruitful application to natural situations, especially in education and training. Furthermore, simulation activity offers numerous maritime education providers significant educational tools that meet the needs of today's maritime learners by providing them with interactive, practice-based instructional technologies.

On the other hand, there were other researchers who believed that everything can not be substituted by technology, and this was expressed in the statement of Castillo (2000) below:

It is true that technology has greatly improved people's lives by means of attaining goals that could not possibly be met in any other ways, it must be realized that it is not the end --- all of everything: that it cannot be a substitute for thinking and planning and the effort that those tasks require. If technology would be assumed to be so, then, it would diminish the individual as a human being and weaken the fabric of one's culture. In this study, it was not focused on solely technology or skills development on simulator but rather, the study attempted to explore also other factors like attitude towards simulator and its implication in the learning process of the individual.

FRAMEWORK

The conceptual framework of the study was explained by the model below. The framework showed the relationships of the three (3) variables such as attitude, skill performance, and implications.

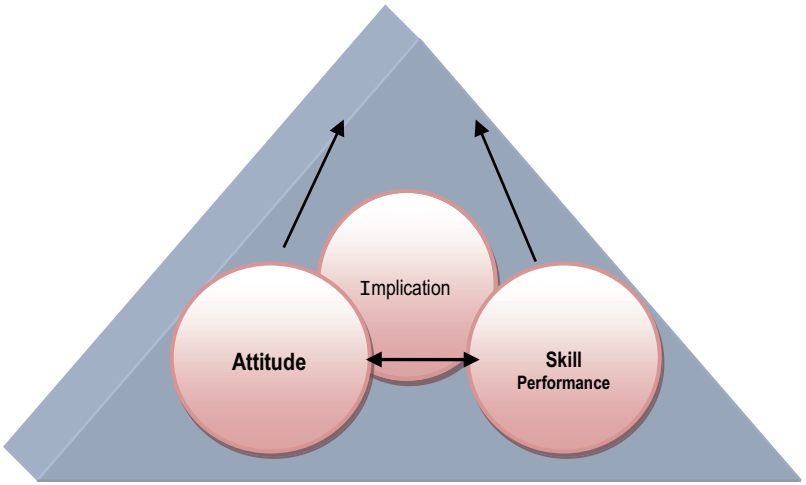

Figure 1. Research conceptual framework of the present study.

OBJECTIVES OF THE STUDY

This study included the following objectives: 1) to describe the marine engineering students' attitude towards the simulator program; 2) to determine the level of the marine engineering students' skill performance in using simulator; 3) to relate the attitude and skills performance among the students in using simulator; and 4) to describe the implications of the simulator program.

MATERIALS AND METHODS

The present study utilized the quantitative-qualitative method to achieve the objectives. The answers to the interview questions, comments, and suggestions given by the respondents were used to further substantiate the quantitative date generated from the study.

The respondents of the study were 118 marine engineering students of John B. Lacson Foundation Maritime University-Molo, Iloilo City, Philippines. The respondents had taken Auxiliary Machinery and Power Plant 1 by using the engine room simulator. The participants of the study were classified according to different categories such as students' classification, parents' occupation, and type of residence. The distribution of the participants was shown in Table 1.

Table 1. The participants of the study

Category	Frequency	Percentage
A. Entire Group	118	100
B. Students' Classification		
*Regular	73	62
*NSA/Polaris	44	38
C. Parents' Occupation		
*Science & Technology (Father & Mother)	20	17
*Science & Technology (Father or Mother Only)	25	21
*Non-Science & Technology	52	44
*Others	21	18
D.Type of Residence		
*Staying at Home	55	47
*Staying in Boarding Houses	42	36
*Others	20	17

The data-gathering instruments used in this study were the following: (1) Attitude Towards Simulator Rating Scale, (2) Auxiliary Machinery 2 (Refrigeration) Activity Evaluation Form and Power Plant 2 (Oil Fire and Exhaust Gas Boiler)) Activity Evaluation Form, and (3) Qualitative Open-Ended Questionnaire.

The Attitude towards Simulator Rating Scale was a 20-item questionnaire about the attitude of the students towards simulator. This instrument was a five point rating scales with corresponding description as shown below:

Response	**Scale**
Strongly Agree	5
Agree	4
Undecided	3
Disagree	2
Strongly Disagree	1

To analyze the gathered data, the following scales and descriptions were used:

Scale	**Description**
4.10 - 5.00	Positive
3.10 - 4.00	Moderately Positive
2.10 - 3.00	Moderately Negative
1.00 – 2.00	Negative

To determine the level of skill of the marine engineering students, two (2) evaluation type of data-gathering instruments were used. The first data-instrument was an evaluation activity form, which was used to determine whether the student was highly competent, competent, and recommended for retake. This instrument used to assess the skills of the respondents on Auxiliary Machinery 2 (Refrigeration) using the engine room simulator (ERS) within 5 minutes. This Activity Evaluation Form contained 15 tasks starting from condenser up to the adjustment of thermostat to high pressure safety of 2 MPA. This Activity Evaluation Form was set to evaluate the level of competence of the respondents. The following are the scores and level of competence:

Grade	Level of Competence
93-100	Highly Competent (HC)
75-92	Competent (C)
60-74	Recommended for Retake (RR)

The other one was the Power Plant 2 (Boiler) Evaluation Form. This instrument was used to evaluate the skills of the respondents on Power Plant 2 (Oil Fire and Exhaust Gas Boiler) using the engine room simulator within 10 minutes. The instrument consisted of 29 tasks to be performed by the participants. It further used to determine the level of competence of the participants with the following scores and levels of competence:

Grade	Level of Competence
93-100	Highly Competent (HC)
75-92	Competent(C)
60-74	Recommended for Retake (RR)

RESULTS AND DISCUSSION

The results of the study are divided into three sections. First, the results about the attitude towards simulator by using the attitude rating scale instrument. Second, is about the level of skill using simulator by using the Evaluation Rating Scale. Third, is the relationship between the variables involved. Last, is the implication/s of simulator by using the qualitative inputs of the respondents of the study. The qualitative inputs are derived from the answers, comments, and discussions given by the respondents through the interview and open-ended questionnaire developed by the researchers.

The results of the study revealed that the attitude towards simulator is "moderately positive" as an entire group and when grouped according to the different categories except for the students whose parents had "Science and Technology Occupation." The indicated mean scores of moderately positive are 3.85, 3.80, 3.68, 3.89, 3.83, 3.17, 3.88, and 3.78 respectively. Data are shown in Table 2.

Table 2. Attitude towards simulator among marine engineering students

Category	Mean	Description
A. Entire Group	3.85	Moderately Positive
B. Students' Classification		
*Regular	3.80	Moderately Positive
*NSA/Polaris	3.68	Moderately Positive
C. Parents' Occupation		
*Science & Technology (Father & Mother)	4.18	Positive
*Science & Technology (Father or Mother Only)	3.89	Moderately Positive
*Non-Science & Technology	3.83	Moderately Positive
*Others	3.17	Moderately Positive
D. Type of Residence		
*Staying at Home	4.28	Positive
*Staying in Boarding	3.88	Moderately Positive
*Others	3.78	Moderately Positive

The results on moderately positive attitude towards simulator are in accordance with the results revealed by the different studies (Baria, 2004; Lobaton, 2003; Porras, 2004; Aquino, 200) conducted in the field that attitude is a consistent manner of thinking, feeling, and reacting on the process of collecting effort to achieve common goals. In this study, moderately positive attitude towards simulator indicates that the marine engineering students' thinking and reacting to simulator had favorable outlook. Simulator learning is considered as a motivating factor in learning machineries and power plant to achieve the necessary performance and skills in doing some tasks on board.

The results of the study revealed that marine engineering students exhibit "competent skill" in performing the different tasks in Auxiliary Machinery 2 (Refrigeration) as an entire group and when grouped according to different categories. The indicated mean grades of the marine engineering students are shown in Table 3.

Table 3. Skill performance in simulator among marine engineering students on auxiliary machinery 2 (refrigeration)

Category	Grade	Description
A. Entire Group	87.88	Competent
B. Students' Classification		
*Regular	88.00	Competent
*NSA/Polaris	90.68	Competent
C. Parents' Occupation		
*Science & Technology (Father & Mother)	86.18	Competent
*Science & Technology (Father or Mother Only)	83.89	Competent
*Non-Science & Technology	84.83	Competent
*Others	83.87	Competent
D. Type of Residence		
*Staying at Home	84.98	Competent
*Staying in Boarding	90.08	Competent
*Others	90.78	Competent

The results of the study reveal that marine engineering students exhibit "competent skill" in performing the different tasks in Power Plant 2 (Oil Fire and Exhaust Gas Boiler) as an entire group and when grouped according to different categories. The indicated mean grades of the marine engineering students are shown in Table 4.

Table 4. Skill performance in simulator among marine engineering students on power plant 2 (oil fire and exhaust gas boiler)

Category	Grade	Description
A. Entire Group	88.18	Competent
B. Students' Classification		
*Regular	88.20	Competent
*NSA/Polaris	89.08	Competent
C. Parents' Occupation		
*Science & Technology (Father & Mother)	88.28	Competent
*Science & Technology (Father or Mother Only)	87.89	Competent
*Non-Science & Technology	88.83	Competent
*Others	88.87	Competent

D. Type of Residence		
*Staying at Home	87.98	Competent
*Staying in Boarding	89.08	Competent
*Others	88.78	Competent

Doyle's (2009) study entitled "Reconstructing a Marine Casualty: The Effectiveness of the full-mission simulator as a casualty analysis tool" posits the important role of simulator in investigating marine casualty and establishing causal factors of the casualty. In his study, he describes that: in the course of very many marine safety investigations, the availability of full-mission bridge simulator is likely to offer a powerful and productive analytical tool. Such a tool affords the opportunity to examine a broad spectrum of environmental conditions and vessel characteristics, as well as equipment failures, human factors and operating procedures. A marine casualty may be reconstructed in a real-time simulated environment, to allow detailed analysis of the incidents. Mariners who have had the benefit of full-mission simulator training will readily appreciate the merits of the debriefing/plyback feature, allowing detailed examination of the exercise or simulated incidents, as the replay unfolds in real-time or short-time segments.

Zalewski (2009) mentioned that "simulation studies give perfect opportunity to record the expert knowledge of pilot commanding vessels in the relevant area." He further added that the "conduct rules (procedural knowledge) and analysis and evaluation of situation (declarative knowledge) can be solved by gaining knowledge directly from electronic records."

To correlate the attitude and skill performance in simulator, the researchers employed the following scales (JBLF Manual) and their equivalent grades respectively:

Equivalent Scale	**Grade**
1.00	97-100
1.25	94-96
1.50	91-93
1.75	88-90
2.00	85-87
2.25	82-84

2.50	80-81
3.00	75-79
5.00	74-below

The scales were used by the researchers to convert the grades into means in order to determine the relation between the two variables – attitude and skill performance.

Employing the Pearson's r, positive and significant correlation was observed between the attitude and skill performance in simulator ($r = .531$, $p < .05$). The correlation of the two variables is shown in Table 5.

Table 5. Correlation between attitude and skill performance in simulator

Variable	Skill Performance in Simulator	
	r	r-prob
Attitude towards Simulator	.531*	.023
$p < .05$		

Implications of the Simulator Program

The researchers have generated the evidence that indeed the simulator program has been successful and effective in its delivery of performance among the students. Based on the students' responses to the open-ended questions as well as the interview from them, both positive and negative responses were generated. Figure 2 has the data.

Students' Observations of the Simulator Program

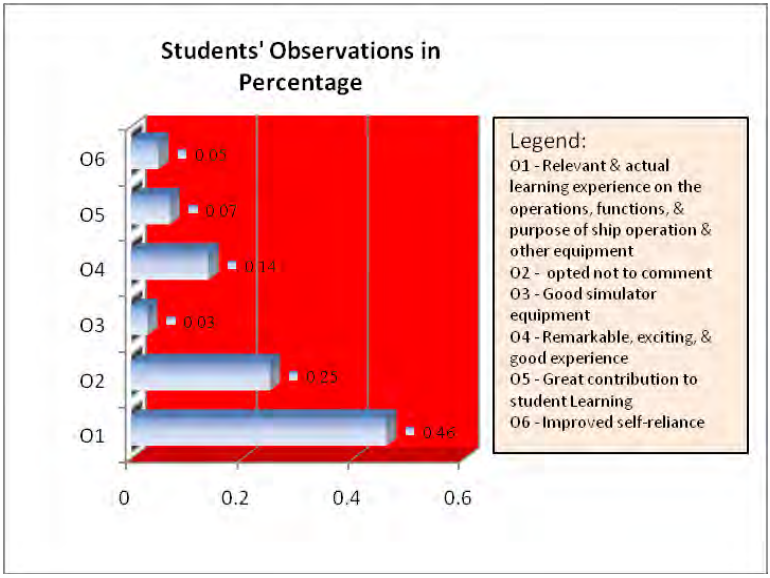

Figure 2. Students' observation of the simulator program

Based on the data in Figure 2, majority of the respondents had indicated that their simulator had enhanced to the relevant and actual learning experience on the operations, functions, and purposes of ship operations and other equipment with 46% of the total observations. Twenty five percent (25%) opted not to comment. Three percent (3%) had observed that the simulator equipment was good. Fourteen percent (14 %) had observed that simulator training was good, remarkable, and exciting. Seven percent (7%) said that it was a great contribution to student learning. While five percent (5%) had indicated that it has improved their self reliance.

However, one observation that was significant was that one respondent wrote "the simulator experience was basically for assessment purposes. That is, what I have learned in the simulator soon fades in my mind. Similarly, this happens in all the simulator experiences that I have encountered. I have performed and got a high assessment but after that no more."

Although, such observation is isolated it cannot be dismissed that simulation must be a kind of training that can sustain the students exposed to it. But this observation is not a problem because periodically these cadets are undergoing simulator assessment. So even if a cadet tends to forget the skills acquired, this can be reassessed before any cadet proceeds to work on board.

Students' Comments of the Simulator Program

Based on the data in Figure 3, majority of the respondents had indicated that the "simulator room lack of computers for students' simulator activities" with 50% of the total responses. Twenty percent (05%) "opted not to comment." Eighteen percent (18%) had suggested that the "simulator room must be improved in terms of equipment." While twelve percent (12%) of the students had indicated "more simulator time." Figure 3 contains the data.

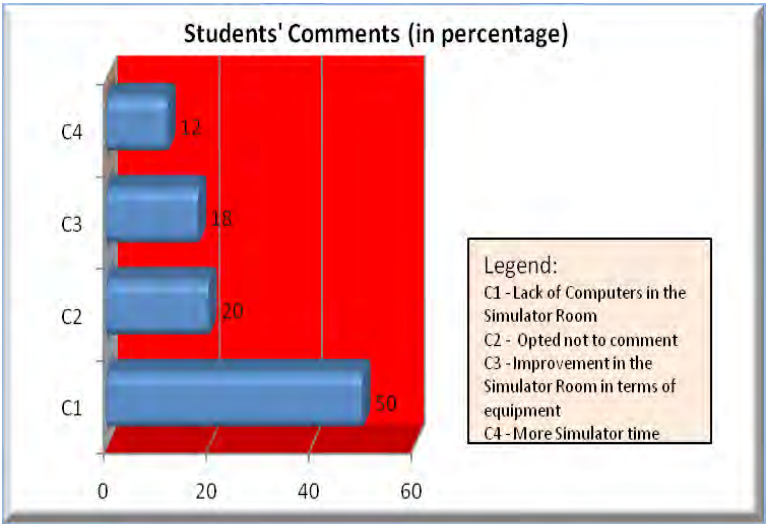

Figure 3. Students' comments of the simulator program

CONCLUSIONS

The key issue in successful application of simulator classes is ensuring that simulation serves its purpose. The primary aim of any simulator experience is to create a certain level of skills performance among students. In summary, this study has the following conclusions:

Qualitative data established the evidence why the students had perceived a "moderately positive attitude" towards simulator. The students' attitude towards simulator was only "moderately positive" as an entire group.

Sustaining the marine engineering students' "competent skill" in performing the different tasks in simulator is needed and likewise be enhanced.

The significant correlation that was observed between the attitude and skill performance in simulator is reinforced by several studies to support the relationship between learner attitude and their performance (The National Academic Council for Online Learning [NACOL], 2006 and recent position statements from the College Board (2004, 2005, 2006a, 2006b) and the NSTA (2005). It is stated also that technology has been apparent in this regard as it has reached a threshold where virtual or simulated approaches can meet or exceed the learning outcomes of expository (teacher-centered) approaches.

The implications found here suggest that simulator should consist of more than anything else a set of updated and upgraded computer software and hardware to address the observations and comments from the students.

RECOMMENDATIONS

In this regard, the following are recommended:

1. The findings of this study reveal that simulated laboratories may not effectively enhance the mastery of desired skills to the maximum although a "moderately positive attitude" and "competent skill" were found out. Studies of this kind must be considered to further validate the results of this investigation.
2. The lack of computers and improvement of the simulator room must be addressed by a careful and periodic assessment of the simulation rooms to be conducted.

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