P Effectiveness of Simulation and Computer Assisted Instruction (CAI) on the Performance of Students under Regimental Training on Selected Topics in Physics II

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***Abstract*—This study investigated the effectiveness of simulation and computer assisted instructions (CAI) on the performance of students under regimental training on multiple choice question and problem solving on selected topics in Physics II. Experimental research design was employed to determine the effectiveness of simulation and CAI on the performance of the learner. Computer assisted instruction's module was made based on the subject manual prescribed by the Maritime Academy of Asia and the Pacific (MAAP). The contents of the module were validated by Physics instructors and subject matter experts of MAAP from the College of Marine Engineering. It was validated in terms of specific learning outcomes and objectives, contents in terms of discussions, example problems, activities and user friendly factor of the software. A pretest and posttest assessment was used to determine the effectiveness of the program. Ten (10) intact sections, one hundred thirteen (113) for traditional group and one hundred twenty six (126) for the experimental group, taking Physics II (Engineering Physics) during the second semester were used as the respondents to the study. Two groups were compared on the study: (1) the experimental group or those midshipmen who utilized the simulation and CAI during classroom instruction and the (2) control group, those undergone the traditional - face to face lecture method of teaching. 20-item multiple choice questions and 2 – problem solving was administered to both groups to compare the performance of the respondents in different types of assessments. The mean, gain score analysis, t-test and standard deviations were analyzed using the computer software Statistical Package for Social Sciences (SPSS). Based on the results of the study, the performance of both groups, students' scores increased significantly from the pretest to the posttest, in both multiple-choice questions and problem solving regardless of methods used. Hence, both traditional and experimental method, individually, are effective in teaching the students.**

***Index Terms*—Computer assisted instruction, maritime academy of asia and the pacific, regimental training, simulation.**

I. Introduction

The Maritime Academy of Asia and the Pacific (MAAP) was founded last January 1998 out of ideals and dreams that will create and provide educational maritime environment that is responsive to the national and international goals of the global maritime community. The primary objective is to meet the ever increasing demand from both local and foreign shipping companies with well disciplined, ably trained, competent and qualified deck officers and marine engineers who are readily at hand in a global competitive maritime trade and industry.

To achieve the said objective, it is necessary to develop teaching strategies and methodologies that will help teachers perform their tasks more efficiently and effectively and provide each student sufficient time to maximize learning at the same time. One of those techniques is to individualize instruction such as computer assisted instruction (CAI) and simulation wherein individual differences of the students with respect to their learning capacities and capabilities will be considered. Students will be given ample time to criticize, learn the topics and at the same time answer all their questions and queries on their point of view. Moreover, students receiving CAI also retain their learning better [1]. The purpose of initiating the CAI is to increase the capacity of the students to learn and study on their own self-paced mode of learning. It may also be accounted the fact that every student has their own exceptional capacity when it comes to learning, unique as they say in their own way. Distinct with his own potential, physical, emotional and mental development, styles in studying and learning techniques, interests and needs. Thus, it is said that no two different students can learn physics at the same rate [2] in the same manner; one may learn faster while other may not, another can easily recognizes concepts while some tend to relax and wait for the consequences of their actions, and others tend to become more mature as compared to others of the same age. In the study of Abante (2006) on the effectiveness of CAI instructional materials in the tertiary level it found out those students performed better in the posttest than in the pre-test based on the increase of the mean of the study. Abante concluded that CAI as teaching methodology is indeed effective as an alternative approach [3]. Also, Cadangonan (2004) conducted a study on the Computer-Assisted Students Instruction on the selected topics in Symbolic Logic [4]. Students viewed CAI as infinitely patient, never get tired, never get frustrated or angry, allow students to work privately, never forget to correct or praise, are fun and entertaining, individualized learning, are self paced, do not embarrass students who make mistakes, make it possible to experiment different options and build proficiency in computer use which will be valuable later in life. Parallel to the above studies, the present endeavor was designed to find out the effectiveness of CAI and Simulation to the performance of the students. The only difference is that the respondents of the latter are under regimental training.

In addition to the challenging and rigorous academic life,

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students enrolled in the maritime educational institution that practiced regimental training need to follow certain rules and procedures which other institutions does not have such as wearing daily uniform, follow a demanding schedule and daily routine of activities and seniority among classes. The regimental training is a lifestyle that embodies four important concepts inside and outside of the classroom: (1) years of leadership and management, (2) a structured training environment, (3) a time management program, and (4) personal development program. It is also a program that increases accountability and responsibility, as well as privileges, as the student moves up the leadership ladder. It provides each student the opportunity to practice and experience some degree of hands on management. Yet it provides those students who want to develop their skills beyond the standard training program, challenging and demanding top leadership positions, which tax their managerial abilities.

This study focused on the development, validation and assessment of computer assisted instructions on the performance of the students in selected topics in Physics II specifically Ohm's Law. It involved discussions of the topics designed to supplement the needs of the students in learning the specific topic by means of illustrations, diagrams, animations, simulations, problem solving and guided step-by-step solutions. The main objective of the study is to develop the discipline and critical thinking of the students in learning physics and to guide them specially in problem solving. This methodology will offer each student the avenue to learn at their own pace independently with their own style of learning.

The main focused of the research study is to investigate the effectiveness of the computer assisted instructions and simulation in the performance of midshipmen under regimental training during the second semester.

II. Methodology

The respondents used in the study were the two hundred thirty nine (239) or fifty percent (50%) of the first year midshipmen from the Maritime Academy of Asia and the Pacific for Academic Year 2011-2012, second semester. Selecting groups entailed assigning subjects in the groups of an experiment in such a way that the treatment of the experimental and control groups are comparable in all aspects except the application of the treatment.

TABLE I: Title Needed

Group	No. of Respondents
Traditional Group	113
Experimental Group	126
Total	239

Table I shows the distribution of respondents. The researchers were not able to balance the number of the respondents for the traditional and experimental group since MAAP has blocked sectioning. The two groups were exposed to different treatments. The experimental group used the computer assisted instruction and simulation, while the control group used the traditional lecture method. Students on the experimental group were given six (6) hours to finish the topic. Students were allowed to browse, learn and maximize the full utilization of the software. In the traditional lecture method, teachers were given six (6) contact hours to finish the prescribed topics.

The content of the computer assisted instruction was designed based on the subject manual prescribed by MAAP. The contents of the software were validated by Physics instructors of MAAP from the College of Marine Engineering. It was validated in terms of specific learning outcomes and objectives, contents in terms of discussions, example problems, activities and user friendly factor of the software.

Respondents who undergone the experimental method were given orientation on how to use the software. Step by step procedures and directions were discussed during the orientation. They were also given 30 minutes to familiarize themselves to the software before the conduct of the study.

To check the significance of computer assisted instruction to the performance of the midshipmen, a pre and post assessment was given to both groups. The examination was content and face validated by the Physics instructors and Subject Matter Experts and was item analyzed by the Micro Analysis (Test Checker and Item Analyzer with Statistics) to obtain its reliability. Before the conduct of the study, a pretest was administered to the experimental and to the control groups. They were both given 1.5 hours to finish the examination. During the study, the experimental group utilized the computer assisted instruction within the time schedule given to finish the lecture class. The same time was allotted to the traditional teaching method. The traditional teaching method used power point presentation with the same content and discussion as the computer assisted instructions have. The results of the posttest examination were examined to determine the achievement of both experimental and control groups.

Paired T-test was used to determine the significant difference between pretest and posttest mean scores in multiple choice questions and problem solving type of questions of students under the traditional method and experimental method; that is, exposure in CAI and Simulation. Independent Sample T-test was used to determine the significant difference between the mean scores of students in the traditional method and those exposed in CAI and Simulation. Likewise, Gain Score Analysis was used to determine the effectiveness of the two methods under study.

III. Research Paradigm

The dependent variables used in the study are the results of the pretest which were given before the start of the study and posttest examination given after employing different techniques in teaching. Likewise, the traditional teaching and the Computer Assisted Instructions (CAI) and Simulation were used as the independent variables.

A. Hypotheses

The following hypotheses were tested:

1) There is no significant difference between the pretest

and posttest mean scores in multiple choice questions and problem solving type of questions of the midshipmen exposed in CAI and Simulation.

2) There is no significant difference between the pretest and posttest mean scores in multiple choice questions and problem solving type of questions of the midshipmen exposed in traditional teaching method.

3) There is no significant difference between the posttest mean scores in multiple choice questions and problem solving type of questions of the students exposed in CAI and Simulation and those students exposed to traditional teaching method.

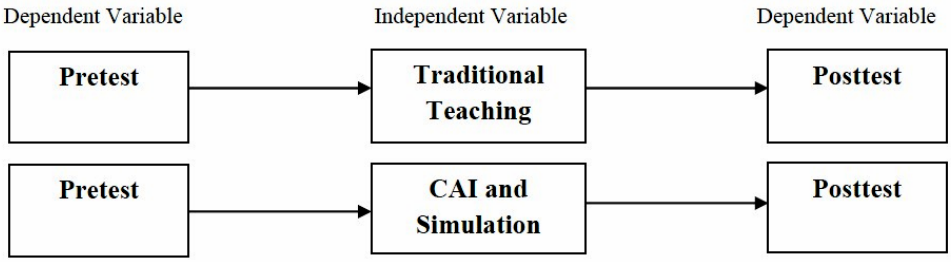

Fig. 1. Title needed

IV. Results and Discussion

Table II shows the comparison of pretest and posttest mean scores of the two groups both on multiple choice questions and problem solving. On multiple-choice questions of students in the traditional group, the mean score of 8.93 during the pretest increased by 5.11 to 14.04 in the posttest. The absolute t-test value of 18.17 with significance level less than 0.05 indicate that there is a significant difference between the pretest and posttest means in multiple-choice questions of the students taught using the traditional method.

On the performance of the students in experimental group in both types of examinations, the study shows that there is a significant difference on the performance from the pretest to posttest.

This study implies that in of both groups, regardless of method used, students' scores increased significantly from the pretest to the posttest, in both multiple-choice questions and problem solving. Hence, both traditional and experimental method, individually, are effective in teaching the students.

TABLE II: Comparison of Pretest and Posttest Mean Scores

Method	Test	Mean	Std. Deviation	Mean Difference	t-test value	Sig.	Remarks
Traditional (n=113)	Pretest -MC	8.93	2.28	5.11	-18.17	.000	Significant
	Post test - MC	14.04	2.41				
	Pre-test - PS	.00	.00	4.88	-13.72	.000	Significant
	Post-test - PS	4.88	3.78				
Experimental (n = 126)	Pretest -MC	8.78	2.15	5.37	-20.52	.000	Significant
	Post test - MC	14.15	2.81				
	Pre-test - PS	.12	.99	4.80	-13.53	.000	Significant
	Post-test - PS	4.92	3.96				
Overall	Pretest -MC	8.85	2.21	5.25	-27.42	.000	Significant
	Post test - MC	14.10	2.62				
	Pre-test - PS	.06	.72	4.84	-19.27	.000	Significant
	Post-test - PS	4.90	3.87				

TABLE III : Comparison of Student Scores between Traditional and Experimental Methods

Test	Method	N	Mean	Std. Deviation	Mean Difference	t-test value	Sig. (2-tailed)	Remarks
MCQ - Pretest	Traditional	113	8.93	2.28	0.15	0.53	0.60	Not Significant
	Experimental	126	8.78	2.15				
PS – Pretest	Traditional	113	.00	.00	0.12	-1.27	0.20	Not Significant
	Experimental	126	.12	.99				
MCQ - Posttest	Traditional	113	14.04	2.41	0.11	-0.34	0.74	Not Significant
	Experimental	126	14.15	2.81				
PS - Posttest	Traditional	113	4.88	3.78	0.11	-0.07	0.94	Not Significant
	Experimental	126	4.92	3.96				
MCQ – Gain Score	Traditional	113	5.11	2.99	0.26	-0.70	0.49	Not Significant
	Experimental	126	5.37	2.94				
PS – Gain Score	Traditional	113	4.88	3.78	0.08	0.17	0.90	Not Significant
	Experimental	126	4.80	3.98				

TABLE IV: Comparison of Students' Overall Scores between Traditional and Experimental Methods

Overall Pretest	Traditional	113	8.93	2.28	0.03	0.10	0.92	Not Significant
	Experimental	126	8.90	2.66				
Overall Posttest	Traditional	113	18.92	5.01	0.15	-0.22	0.83	Not Significant
	Experimental	126	19.07	5.74				
Overall Gain Score	Traditional	113	9.99	4.94	0.18	-0.27	0.79	Not Significant
	Experimental	126	10.17	5.53				

Table III shows the comparison of students' scores between the traditional and experimental methods. On pretest results, direct inspection of the means in multiple choice questions (MCQ) indicates that the mean of students in the traditional group of 8.93 is not different from that of the experimental group with 8.78. The t-value of 0.53 with significance level at 0.60 implies that that there is no significant difference between the means of students under the traditional and experimental groups in the pretest. This suggests that students in the traditional and experimental groups are of the same level prior to the implementation of traditional, and CAI and Simulation methods. The t-value of 1.27 significant at 0.20 reveals that there is no significant difference between the performance in problem solving of students under the traditional and experimental groups. This implies that students are equal in terms of problem solving before the implementation of traditional, and CAI and Simulation methods.

While on posttest result, it shows that there is no significant difference between the posttest scores of students in the traditional group and those in the experimental group with regards to multiple choice questions. Likewise, there is no significant difference between the posttest scores of students in the traditional group and those in the experimental group in terms of problem solving.

On the Gain Score Analysis, the traditional group obtained a mean gain score of 5.11 in MCQ while that of the experimental group was 5.37. These mean scores are not significantly different as manifested by the absolute t-value of 0.70 significant at 0.49. While on problem solving, the mean gain score of 4.88 by the traditional group is not significantly different from that of Experimental group with 4.80. Hence, the data is not sufficient to prove that one method is better than the other in terms of MCQ and problem solving.

Table IV shows the comparison of students' overall scores between the traditional and experimental methods. On pretest results, the t-value of 0.10 significant at 0.92 implies that the hypothesis of no significant difference between the mean pretest scores of students under the Traditional method and those exposed to the CAI and Simulation is accepted. Students under both methods of teaching are of equal level prior to the implementation of respective techniques. After the exposure of students under respective method/treatment, data shows that there is no significant difference between their posttest scores having a t-value of .22 which is greater than 0.05 level on the posttest result.

The Gain Score Analysis as shown in Table 4, there is no significant difference in the mean gain of the students in the experimental group and that of the traditional group. Hence, the hypothesis of no significant difference between the performance of the students in the traditional method compared to those in exposed in CAI and Simulation is accepted. The data does not provide sufficient evidence to show that use of CAI and Simulation is better than the traditional method.

This study only shows that the performance of the two groups, in both assessments, whether MCQ and problem solving, does not differ whether traditional teaching or the face to face lecture to the experimental group or the Computer Assisted Instruction methodology. Regardless whether the midshipmen are under regimental training, they can perform well during classroom instructions. In spite of their rigorous regimental training, they can still manage to cope with their studies.

CAI was developed not to replace the human element in teaching: the teacher. Rather, it offers assistance to make learning more effective since it is another material which the students can use individually [5]. CAI are tools that can enhance a well-designed curriculum and the efforts of a good teacher, but they cannot replace them. They must still be part of an overall instructional design and rely on the timely guidance of a teacher [6].

V. Conclusions

1) The hypothesis that there is no significant difference between the pretest and posttest means scores in multiple choice questions and problem solving type of questions of the midshipmen exposed in CAI and Simulation is rejected.
2) The hypothesis that there is no significant difference between the pretest and posttest means scores in multiple choice questions and problem solving type of questions of the midshipmen exposed in traditional teaching method is rejected.
3) The hypothesis that there is no significant difference between the posttest mean scores in multiple choice questions and problem solving type of questions of the students exposed in CAI and Simulation and those students exposed to traditional teaching method is accepted.

VI. Recommendations

1) Simulation and computer assisted instructions may be used to augment the teaching styles during classroom instructions. It may also be used as an alternative methodology to change the atmosphere in the classroom.
2) To test the validity and reliability of the findings, a longer time and broader topics in conducting the topic is recommended.
3) Studies on other variables that may affect the achievement of the students in physics may be conducted.

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