International Journal of Asian Social Science, 2014, 4(2): 202-207

International Journal of Asian Social Science
ISSN(e): 2224-4441/ISSN(p): 2226-5139

Special Issue: International Conference on Teaching and Learning in Education, 2013

journal homepage: http://www.aessweb.com/journals/5007

AN APPROACH ON STUDENT'S PERFORMANCE AND SKILLS IN IMPLEMENTING THEORIES TO CONDUCT LAB EXPERIMENTS

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ABSTRACT

Student's ability to express in terms of knowledge, skills and principles upon completion of course are one of the important aspects that contribute to Program Outcome (PO). Comprehensible articulation of course outcomes provides good foundation in evaluating the effectiveness of teaching and learning process. This paper will be presented on the evaluation of student's performance outcome on lab experiment course which has been designed to support the theory studied in Electrical Machines and Drives (EMD) course. Students should prove theories that have been learned in EMD, examined the machine's characteristics using approximate analytical methods and demonstrated basic practical testing techniques. Machines used in the experiments are the AC synchronous and induction machine, and DC machine whereby they will function as motors and generators. This experimentation done by selected Electrical Power students. The result shows the performance of student in implementing the theories that have been learned towards the lab experiments which are sufficient to analyse the results which achieve the PO requirements.

Keywords: Implement, Analyze, Observation, Evaluate, Demonstrated, Experiment.

1. INTRODUCTION

Lab experiments are deliberated in such way where it is to study student's ability and skills which express their understanding of theories that have been learned. The experiments in this lab course have been designed to support the theories studied in Electrical Machines and Drives (EMD) course. Laboratory activities supplement the theories with suitable practical experiments and simulation. Students will prove some theories, examine the machine's characteristics using

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ISSN(e): 2224-4441/ISSN(p): 2226-5139

approximate analytical methods, demonstrate basic practical testing techniques and provide application analysis. Machines used in the experiments are AC synchronous machines, AC induction machine, and DC machine which can operate as motors or generators. Throughout the lab course, students will be provided with basic knowledge and understanding of electrical machinery and exposed to skills in doing measurement using measurement equipment on electrical quantity. Besides that, students are also able to underlying theories, characteristics and operation of Direct current (DC) and Alternative current (AC) machines such as transformers, synchronous machines and induction motors. All over, soft skills are also integrated and enhanced in this course through communication and leadership skills. The outcomes relating to knowledge, understanding and to intellectual skills contributes to the PO and CO.

1.1. Course Outcomes and Assessment Methods

Avoid There are few course outcomes that have been developed accordingly which helps the students to build their skills align with the theories that have been thought in the previous semester. Description of the concept, operation and characteristics of each machines are one of the main aspect which have been considered. Next, construction and utilization of the equivalent circuits of each machine will be measured. However, safe practices and procedures are of utmost importance in this course. Students are required to read, acknowledge and at all times obey by all safety procedures within the lab.

One of the most challenging steps aligns to teaching responsibilities and programs outcome is the evaluation of student performance. It can be tested by assessments with considering three main purposes. Firstly, assessment has to be done to establish on what the students already know (pre-lab). Secondly, measurement needs to be recorded by evaluating student's feedback on their understanding. It can be done by observations and data taken during the experiments which used to produce a report. Team work, leadership skills and soft skills are also evaluated since the pre-labs and reports are done in group. Finally, tests are done individually to examine the student's progress and performance. This assessment helps to study the students' performance and progress on their knowledge and skills which towards the program outcomes. Therefore, the assessments will be tested for AC synchronous machines, AC induction machines and DC machines. It can be divided into three main categories as stated below:

- Pre-Labs
- Lab Reports
- Tests

1.2. AC and DC Machines

In the first quarter of the semester, students will be exposed to AC synchronous machines which will be divided to the synchronous generator and synchronous motor. Open and short circuit characteristic, load characteristic, and V-Curve characteristic will be covered (Chapman, 2005). Constructing the generator aligns with the concept and operation, starting the motor, measuring the model parameters, plotting the characteristic will be carried on. This lab consists of 3 experiments.

The second quarter of the semester will be on the three-phase induction motor which also divided into two parts. The students will be exposed to the load characteristic and also the pullout torque characteristic of the induction motor. Identifying and constructing, recording and interpreting the concept and characteristic mainly will be carried on in this lab. It consists of two experiments. Lastly, the students will be exposed to the DC machines at the last half semester where the DC machines are also divided to the shunt-wound generator and motor (Chapman, 2005). Recognizing, operating, recording, interpreting and constructing the circuits will be mainly focused on this lab. It consists of four experiments. The lab experiments that been done are on the theories which have been thought to the students on the previous semester.

2. PRE-LABS

Pre-lab assignments are assigned weekly where the students have to complete it in group and to be submitted before the start of the weekly experiment. Pre-labs are questions are based on the experiment that will be done by the students on that week itself. It is to prepare the students on overview and the prediction of the result of the lab. This prediction is based on the consideration of the concept of the lab which towards to the practical of theories. That understanding shapes the students to formulate the prediction of how the lab experiment will turn out, the relationship among variables that the students will anticipate. Table one shows the average of students marks on pre-lab assignment. The average marks of 10 marks are taken from five lab sections with 13 groups consisting of four to five students in a group.

Table-1. Pre-Lab Average Marks for Five Sections

Sections	Ac Machines	Induction Motor	Dc Machines
1	7.21	7.61	7.3
2	7.64	7.55	9.27
3	6.67	7	7.54
4	8.37	8.67	8.33
5	7.41	7.6	8.1
Total Average	7.46	7.69	8.11

3. LAB REPORTS

The laboratory report classifies the experiment which have been undertaken, the objectives of the experiment is accomplished, realizing the significance of the experiment, understanding the overall conditions of the experimentation, and summarizing the theories which related to the experiment. The report is crucially important to identify whether the objectives of the experiment have met state because these successes of the objectives are usually evaluated at the conclusion. The purpose of writing lab report is not only to contribute to the knowledge of related topics, it also provides the opportunity for learning, hence developing and interpreting the lab skills. An excellent lab report does include the data, observations, demonstrates the comprehension concepts behind the data, clarify factors that affected the experiments, and also considerate the principles of the experiment that was designed to examine. Soft skills are also integrated while the students constructing and taking measurements in group. This will indirectly provide 'human touch' such as communication and leadership skills. Table two shows the average of students marks of 20 marks

on lab reports. The average marks are taken from five lab sections with 13 groups consisting of four to five students in a group.

Table-2. Lab Reports Average Marks for Five Sections

Sections	Ac Machines	Induction Motor	Dc Machines
1	14.26	17.17	11.88
2	15.67	14.28	16.96
3	17.22	14.67	11.05
4	13.89	16.67	15.17
5	14.17	18.28	13.12
Total Average	15.04	16.21	13.64

4. INDİVİDUAL PRACTİCAL TEST

Lastly, the students will be examined individually. The test is intended to measure the knowledge and skills that have been gained throughout the lab course. The results of the test can identify the students' learning and understanding person. During the test, students are required to draw the wiring circuit, wire-up the circuit, conduct the test, take the readings and may require doing some calculations. At the end of the test result, we can review the progress and performance of each student. Table three shows the average of students marks of 60 marks on test for each topic. The average marks are taken from five lab sections consisting of 40 students.

Table-3. Test Marks for Five Sections

Sections	Ac Machines	Induction Motor	Dc Machines
1	41.08	46	53.69
2	44.56	48.33	57.15
3	38.02	36.05	56.67
4	45.57	48.67	53.48
5	46.67	53.33	58.89
Total Average	43.18	46.48	55.98

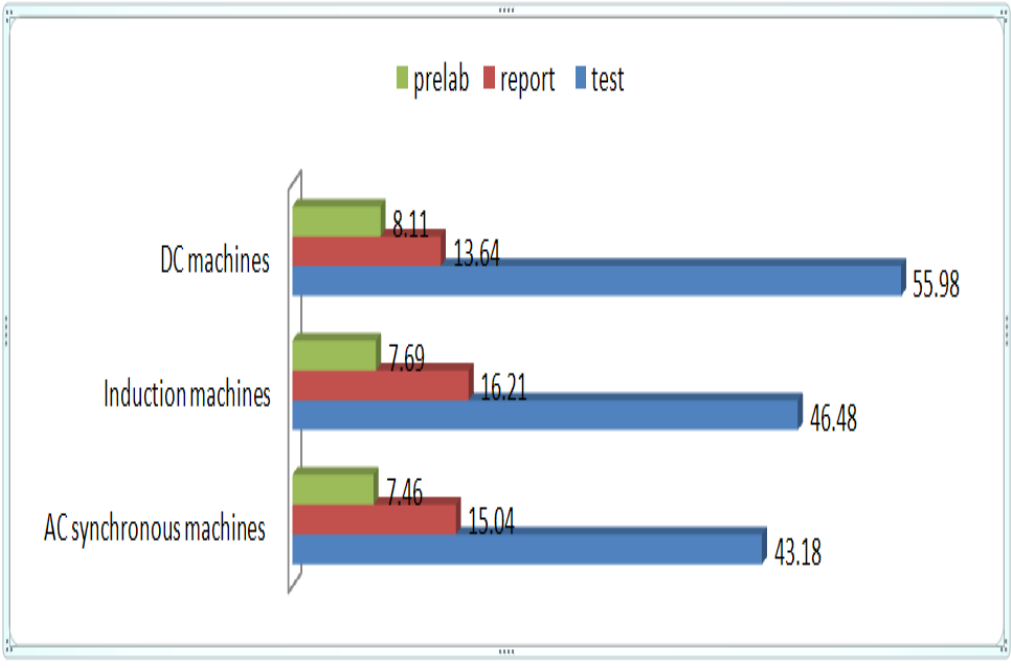
5. RESULT AND ANALYİS

Grades or test scores from standardized test is used to determine if a student‘s performance based on skills and understanding of knowledge. The results and observation that have been discussed here are based on the main three topics i.e AC synchronous machines, AC induction machines and DC machines. The table four describes the overall marks distribution for the selected electrical power students. Figure one shows the difference of student’s performance according to the assessments.

Table-4. Overall Marks Distribution

Assessments	Ac Machines	Induction Motor
TEST	43.18	46.48
LAB REPORT	15.04	16.21
Pre-Lab	7.46	7.69

Figure-1. Overall Student's Progress



There are few factors that contribute to the results that shown in overall tables and figure. Firstly, students in section three, produce low marks compared to the other sections. It is due to the time of the lab is conducted. Early morning labs students produce low marks due to 'morning fever' and they tend not to concentrate during the experiments. Secondly, students perform well and produce good quality work when they do their assessment in groups compared to individual. Average marks upon groups are high and constant compared to assess which done individually. Lastly, students tend to progress and score more and at the end of the semester compared to the beginning. They are more familiar with the way the lab conducted as the lab experiments increases. Therefore it shows that as the number of experiment increases, the mark also increases proportionally.

6. CONCLUSION

In education, student's capability tin expressing their understanding, skills, and principles upon completion of a course are one of the crucial portion that donates to Program Outcome (PO. In such evidence, it can be obtained and evaluated through assessment where the result are typically based on information that gathered from observing their students' skills, behavior and progress. With those results, it is very easy to recognize the performance of students learning and on the clear instructions deliberation. Moreover, individual student's strengths and weaknesses can be diagnosed. Therefore, having assessments and evaluating it for future classes' shows how effective is the courses assessments. By this, learning and instruction to state the principles and concepts can be focused.

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