

THE USE OF INDUSTRIAL VISITS TO ENHANCE LEARNING AT ENGINEERING COURSES

Marwan Shamel, Edwin Chung, Tirunelveli Narayana Pillai Padmesh, Abdulkareem Sh. Mahdi

School of Engineering, Taylor's University College, Subang Jaya, Malaysia

ABSTRACT

Industrial visits represent important activities in any engineering undergraduate programme that contribute to the achievement of various essential learning outcomes and programme objectives. This paper reports on an attempt to make the industrial visit an integral part of the course. This is achieved through identifying learning outcomes and a suitable industrial site to achieve them. In this case a thermal power plant was identified as a site to be visited by chemical, electrical & electronic and mechanical engineering first year students.

The visit is planned to help the students achieve the following:

1. Recognise the process units – Boiler, Pump, Condenser, Steam turbine, Generator, Electrostatic precipitator, Pulverizer, Reclaimer etc. & generate the process flow diagram.
2. Identify the input and output for different processes.
3. Experience the importance of working safely.
4. Understand the concept of thermal energy conversion & estimate overall efficiency of power plant.
5. Understand how does the product of the plant interfaced to the world.

The industrial visit planning started by contacting the power plant management and obtaining the plant diagram (which is shown in Figure 1) and preparing a series of questions related to the learning outcomes. The students were asked to answer pre visit questions that are related to the plant diagram. Answering these questions prior to the industrial visit was aimed at priming the minds of the students and providing a mental framework to acquire the intended knowledge. After completing the visit, a set of questions, that is related to the visit and the power plant, is served to the students. This set of questions includes questions aimed at gauging the level of satisfaction of the students. The same set of post visit questions is served to the students on the last week of the semester in order to assess the level of retention of knowledge after few weeks of the visit.

Students found this method very useful and they were able to remember a fair bit of information at the end of the semester. Our assessment of this exercise is that it has achieved its objectives.

KEYWORDS

Engineering survey, Learning outcome, Outcome based education, and Industry visit

INTRODUCTION

Outcome Based Education (OBE) is a method of teaching that emphasises what students can actually do after they are trained. Decisions on teaching and learning are made based on how best to facilitate the desired outcome which in turns leads to planning process that is different from traditional educational planning. In OBE, the desired outcome is first identified before the curriculum is created to support the intended outcome [1, 2].

Several universities routinely conduct industrial visit as a part of their curriculum. The validity of visit as an instrument to measure program effectiveness depends on several factors. Since 2001, School of Engineering, Taylor's University College, Malaysia has conducted a course "Engineering Design & communication" for 1 year 1 semester students for all disciplines which includes B. Eng & M. Eng degree programs in Chemical (CE), Electrical and Electronics (EE) and Mechanical Engineering (ME). The aim of this course is to introduce the concept of Project based Learning in the Engineering. The concept of learning outcomes in Engineering is to include or improve the student's technical ability and knowledge, ability for life long learning, leadership and team work ability and communication skills for sustainable development (ESD) [3].

Taylor's purpose is to educate the youth of the world to take their productive place as leaders in the global community

Therefore, all programs in the school have developed and implemented ongoing Program Learning Outcomes Assessment to ensure that curricular objectives are aligned with the educational institution purpose with achieving learning outcomes.

Student centered learning whereby students learn from the theories and project based learning (PBL) which it is emphasizes on the hands-on approach that educators use to approach and solve an engineering problem.

Under this subject module as an integral part, we planned to experience the industrial environment as a visit. Through the learning outcomes of this industrial trip, one cohort (about 60 students) were guided to power plant, about 90 km away from campus where students can improve their knowledge and skills based upon the learning outcomes. For our visit we had chosen the coal based Jimah coal fired thermal power plant in Port Dickson-Malaysia. To achieve the learning outcomes of this industrial visit we planned to assess the student's technical learning capacity and remembrance by conducting three technical surveys (Pre visit, after visit survey and Post visit survey) at different stages.

LEARNING OUTCOMES

The visit generally consists of lectures about the company, the site being visited and a range of topics specific to learning outcomes.

1. Recognize the process units – Boiler, Pump, Condenser, Steam turbine, Generator, Electrostatic precipitator, Pulveriser, Reclaimer. Generate the process flow diagram.
2. Identify input and output for the process.
3. Experience the importance of working safety.

4. Understand the concept of thermal energy conversion & estimate overall thermal efficiency of power plant.
5. Understand how does the product of the power plant is interfaced to the world.

PRE, AFTER AND POST SURVEYS

Pre Visit Survey

As the start of the industrial visit, the process flow diagram (Figure 1) of visiting plant had been described to students. Then students were asked to complete the pre visit survey containing questions related to the learning outcomes. By answering these questions, students can frame some sort of knowledge about the process, safety aspects, marketing of products, environmental pollution etc. of the industry they visited.

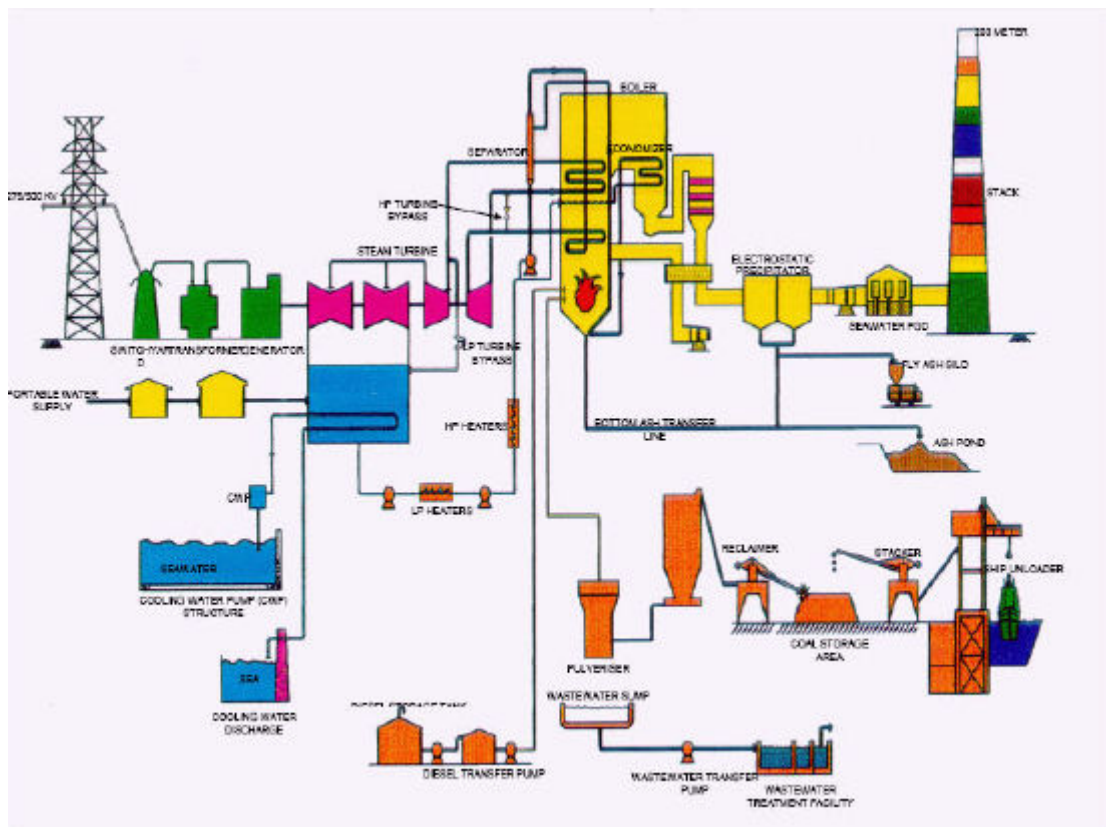


Figure 1: Process diagram of power plant

After Visit Survey

After visiting industry, some set of question had been given to the students, in order to assess their understanding from what they learned. This after visit survey motivated the students to learn and ask more question related with their survey which is based on their learning outcomes.

Post Visit Survey

Post visit survey was done after 3 months of their industrial visit in order to test student's retaining knowledge about the learning from the trip based on learning outcomes. Some set of question had been given to the students, to evaluate students understanding from the industrial trip education.

RESULTS AND DISCUSSION

Pre Visit Survey

From the result of pre visit survey illustrated in Figure 2, it has been found that the students from all disciplines (CE, EE, and ME) gained some information from the initial briefing as approximately 48%. This indicated that the students are still required a knowledge about the activity. This was due to first stage first semester students were in the early stages of learning about the thermal power plant process. Therefore the purpose of pre visit survey was to stimulate the students to learn more about their subjects based upon the industrial visit learning outcomes and look for answers from the industry experts.

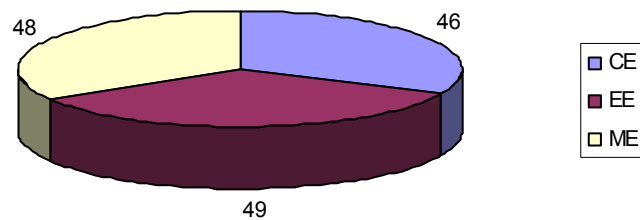


Figure 2: Pre visit survey results for all disciplines

After Visit Survey

After performing the industry visit, a modified version of the pre-visit survey had been given to the students to assess their understanding from what they learned. The results indicated some increase in the student knowledge from the one compared with that before the visit. In addition to that, the survey motivated students to learn in detail about their subjects. Figure 3 illustrate the results of after visit survey for all disciplines students.

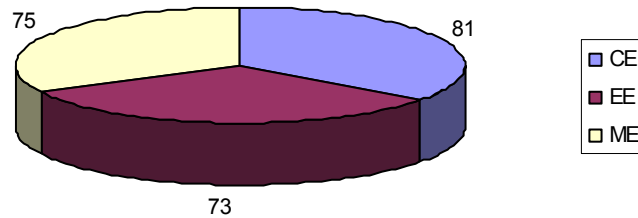


Figure 3: After visit survey results for all disciplines

Post Visit Survey

The results obtained from post visit survey (Figure 4) shows; most of the students still retain their knowledge (approximately more than 50%) about the process of thermal power plant from the learning outcome based survey approximately after 3 months. This results show that students can retain the subject knowledge forever when they learned their subjects based upon the learning outcomes.

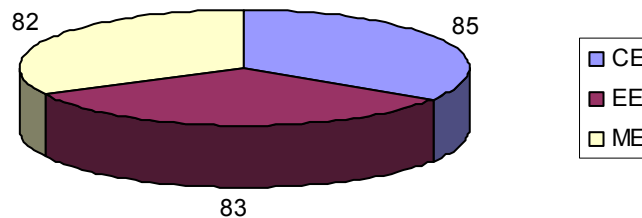


Figure 4: Post visit survey results for all disciplines

OVER ALL RESULTS FOR INDIVIDUAL DISCIPLINES

From the results (Figure 5), students overall gained some knowledge from their pre visit survey to post visit survey based on the industrial visit learning outcome. From the Figure 5, we can conclude that the purpose of learning outcome had been achieved.

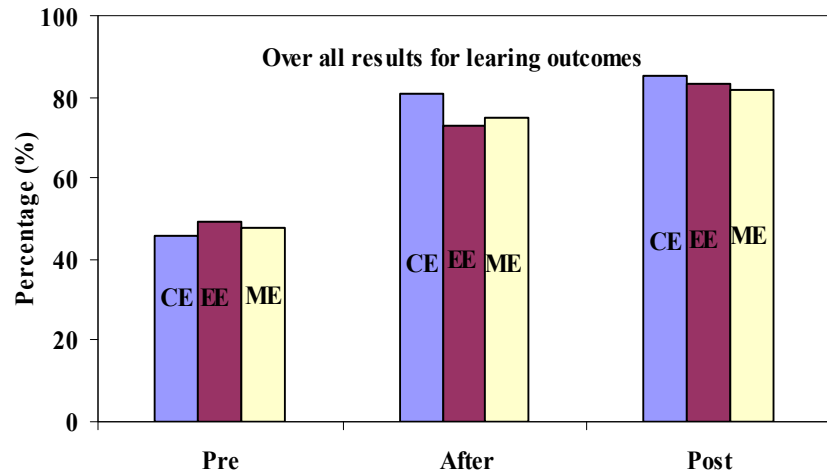


Figure 5: Over all survey results for individual disciplines

OVER ALL RESULTS FOR INDIVIDUAL LEARNING OUTCOMES

The Figure 6 shows that the students more or less achieved their individual learning outcomes through the industrial visit from their pre visit (beginner) to post visit survey (knowledge retaining).

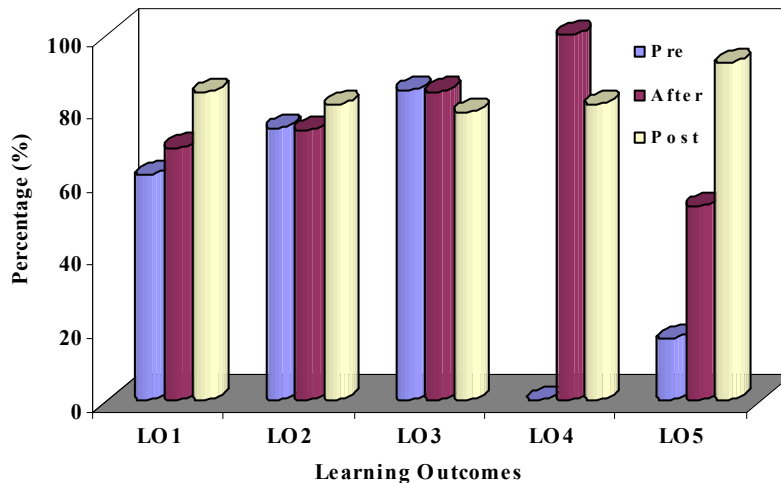


Figure 6: Over all results for individual learning outcomes

CONCLUSION

Industrial visit survey provides the students and programs with “dynamic” real time feedback that is very useful in the program learning outcomes process. It enables educational institutions to build close ties with industrial experts and also to achieve the learning outcomes to students. Several broader educational partnerships have emerged as a result of these visits. These include student’s internships, funded research projects, curriculum development, student career opportunities. More over students will gain the subject learning outcome by means of pre, after and post industrial visit survey. This has resulted in enhanced visibility for the students among their learning outcomes and their portfolio.

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