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Yaacob, Mohd Rusdy; Velte, Clara Marika

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INCORPORATING TVET EDCUATION ON AN EXPERIMENTAL COURSE: A CASE STUDY AT TECHNICAL UNIVERSITY OF DENMARK (DTU)

Mohd Rusdy Yaacob[1,*], Clara Marika Velte[2]

[1)] Faculty of Electrical Engineering, Universiti Teknikal Malaysia Melaka,
Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia
[2)] Department of Mechanical Engineering, Technical University of Denmark, 2800 Kgs. Lyngby, Denmark

[*]Corresponding e-mail: rusdy@utem.edu.my

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ABSTRACT – Technical and Vocational Education and Training (TVET) education highly promotes the coupling between theory and practice in teaching and learning activity. The most straightforward way of incorporating it is through an experimental course, which is in our case, the Experimental Fluid Mechanics at DTU. This course has been implemented by applying many important pedagogical elements of teaching and learning and is therefore made as a benchmark study for future implementation at Universiti Teknikal Malaysia Melaka (UTeM). The most recent course evaluation shows the effectiveness of TVET implementation in improving the student's level of understanding on different measurement techniques in turbulence.

1. INTRODUCTION

TVET has long been an essential aspect of the lifelong learning process that integrates education with practical training and skills development [1]. Being part of the Malaysian Technical University Network (MTUN), TVET has become the core element of teaching and learning at UTeM [2]. In fact, it is one of the UTeM general education goals to produce graduates who are will equipped with the relevant knowledge, technical competency as well as the soft skills. The aim of this study is to evaluate and benchmark the execution of the Experimental Fluid Mechanics course offered at DTU, which is a university that complies with the Conceive Design Implement Operate (CDIO) standards for their engineering students [3].

This three-week course was also part of the Masters program in turbulence at the Chalmers University of Technology [4][5]. Since more than 15 years ago, it has been yearly offered for the Masters and final year Bachelor students of DTU Mechanical Engineering, with the purpose of giving an introduction to different measurement techniques in turbulent flow [6]. This paper however only focuses on the recent implementation of the course, e.g., during the last winter semester of 2018.

2. COURSE IMPLEMENTATION

The course comprises a series of lectures of basic optical measurement theories, signal processing and data interpretation, followed by experimental works in the laboratory. By applying the team teaching strategy, lectures and instructions were delivered by different teachers/instructors based on their individual strengths/expertise on specific topics/experiments [7]. The knowledge transfer was implemented through the teacher-centered learning (TCL) since the topics covered require comprehensive inputs from the teachers/instructors, especially on the specific measurement techniques. However, students were always welcome to interrupt in asking any questions for creating an interactive discussion in the class [8]. A simple demonstration was also conducted in the class followed by an exercise to test the students understanding on the basic optical principle, while promoting an active learning environment at the same time [9].

Students were obligated to perform and report four different experiments (A, B, C and D) in a group of 4 persons, of which two must submit a separate report for each experiment. Experiment A and B were divided into two and three pre-assigned experiments, respectively, of which each group must choose one to carry out. The execution of Experiments C and D followed an inductive learning approach [10] where students were to think and develop their own experiments. Experiment C must at the end come along with a short report while Experiment D was to be presented in a poster or a short video.

A lab tour was conducted on the very first day during which each experiment was briefly introduced, but just on the surface. Instructions for Experiments A and B were only given on the first day of the experiments, but emphasizing only on the guidelines in operating the related equipment and devices in order to promote an open-ended environment [11]. Less facilitations were given to the students for Experiment C and D to inculcate problem-solving [12] and teamwork skills [13] among themselves.

3. ASSESSMENT AND EVALUATION

Contributing to 5 ECTS points, the course was based on a Pass/Fail evaluation, with an intention to keep the excitement among the students throughout the course. The assessment was holistic based on the students' level of activity, attendance, lab reports and final presentation. Out of 35 students enrolled, 97% received a passing grade. Other than direct interaction in class/laboratory, the course also utilized an e-learning portal for notes and other necessary information sharing, as well as for the assignments' submission. Some of the exercises of multiple-choice questions were also executed online that provide immediate score based on the students' answers (see Figure 1).

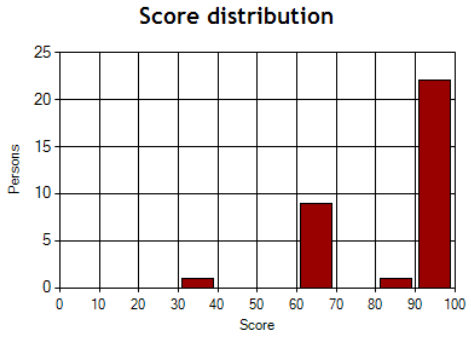

Figure 1 The score retrieved from the e-learning portal for Signal Processing (Introduction) exercise.

Via the same portal, students were also asked to fill in the online evaluation form at the end of the course. Ten questions were asked and responded but only the most significant ones are presented in Figure 2:

Q1: I think I learn a lot in this course
Q2: I think that the course of study lends itself to my active participation
Q3: I think that the teachers create a good connection between the various teaching activities
Q4: Overall, I think the course is good

From the response, more than half of the respondents have at least agreed on the criterion set for each of the questions. Half of them has also ranked the highest Motivation Scale on Q1, which is the important determinant on the effectiveness of experiential learning based on the learning cycle of Kolb [14]. In overall, half of the respondents has also strongly satisfied with the course.

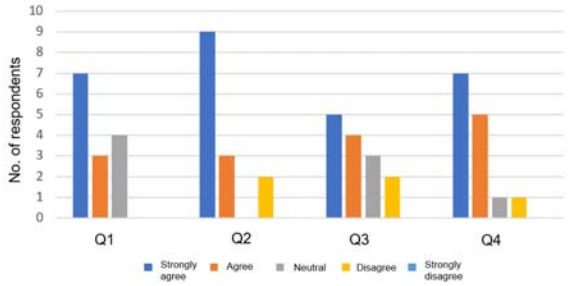

Figure 2 Course evaluation based on 14 respondents

4. CONCLUSIONS

The direct coupling between theory and practice, which is the cornerstone in TVET education, has successfully and effectively attracted students' interest in learning the new knowledge from the course. The authors hope that this study can be a valuable benchmark in conducting any experimental course at UTeM. In future, this course will introduce some small (mobile) setups for students to have more options in customizing their own experiments, as well as video lectures and laboratory instructions to train students to be more independent. A study on the effect of introducing this new implementation will be of a great interest in the future Kolb learning cycle

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