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INITIAL INVESTIGATION ON THE NEEDS OF LABORATORY IN MICROELECTRONIC SUBJECT

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Abstract

Measuring students' academic performance has received quite considerable attention till today. This study was conducted to evaluate the significance of laboratory practice in "Fabrication Process" as one way of better apprehensive toward theoretical knowledge. The study population was the second last year students whom enrolled in microelectronic course. A questionnaire based on student's perception towards this topic was collected and analyzed. Based on the findings, laboratory practice may improve student's knowledge level thus bettering their apprehension ability making it more relatable to the industry. From this initial investigation, it can be said that majority of the students agree on the needs of laboratory practice in order to improve their understanding about this course.

Keywords: Laboratory practice, microelectronic, fabrication process, experiential learning

1.0 INTRODUCTION / BACKGROUND OF THE STUDY

Conventional teaching refers to a teaching method involving instructors and students to interact in a face-to-face manner where students need to memorize the information given and reiterate them in order to perform well in exams. Generally, the examination itself is a part of teaching process where it acts as a tool to test the students' progress and accomplishment in any course.

Introduction to Microelectronics (ELE245) is one of the majoring courses offered in Faculty of Electrical Engineering, Universiti Teknologi MARA (UiTM) which is compulsory for diploma students whom enrolled in electronic field. One of the topics in this course is "Fabrication Process", which concerned in designing and manufacturing of semiconductor physics and CMOSs' MOSFET fabrication process. Based on previous findings, most of the students find it is difficult to score this topic compared to others. One of the reasons is due to the lack of understanding on this topic caused by having next to no experience on real hands-on laboratory practice, except for memorizing theories only. As advantage, once the laboratory experience is implemented, the knowledge gained through the practice will become handy in completing final year project by fabricating Printed Circuit Board (PCB). Thus, an initial investigation on the needs of laboratory practice in microelectronic subject is conducted among students whom are enrolling this course during May- July 2018 session.

2.0 LITERATURE STUDY

As reported by (Richard M. Felder, 2005; Norhayati Ahmad, 2017), students can be characterized into different learning styles since they have different levels of motivation, different attitudes about teaching and learning and different responses to specific classroom environments and instructional practices. Due to these, numerous studies have been done to investigate the most effective way to improve academic performance in students (J. Dunlosky, 2013; S. Tahir Hijazi, 2006; A. L. L.Rodriguez, 2018; V.R.R. Mendonça, 2013; J. Javier López, 2003).

One of the approaches is the usage of technology in teaching and learning process. To date, online learning system has been reported to facilitate students in a learner-centered learning experience called "learning anytime and anywhere" via the fastest way (Li, 2016). This medium can help students to visualize the equipment's handling especially in engineering education without having the need of laboratory session. However, the disadvantage of this approach is that students do not have a real experience in real life.

As stated by Kolb's theory (Bergsteiner, 2010), the experiential learning (learning by doing) is one of the key features in the learning process. There are four basic stages included in Kolb's theory; i) active experiences, ii) reflective observation, iii) abstract conceptualization, and iv) active experimentation. This was proved by (Mohd Zainizan Sahdan, 2007), where the implementation of this experiential learning approach did improved the learning outcomes of Microelectronic subject in Universiti Tun Hussein Onn Malaysia (UTHM) without overloading the student. Students experiencing the clean room environment and the Integrated Circuit (IC) fabrication equipments (stage one), will give an idea on how the IC is manufactured in industry. Furthermore, (Priscilla J Hill, 2015) had also suggested that integrating laboratory experience did increase student's knowledge level.

Another approach is by employing the pedagogical theory and the Problem-based Learning (PBL) practice into Microelectronics module (Cirstea, 2003). Throughout this method, students are required to determine how they are going to solve problems given by lecturers. This method is believed to enhance the quality of teaching technical disciplines however this could burden the students due to the overload of students learning time (Mohd Zainizan Sahdan, 2007).

Hence, this paper's aim is to study the effectiveness of doing experimentation session (laboratory works) on top of the theoretical knowledge in ELE245's "Fabrication Process" in order to improve learning experience thus upgrading academic performance.

3.0 METHODOLOGY

A survey was conducted on subjects whom are students enrolling the course during May – July 2018 session. The expected sample size of the respondents are 55 students, however due to unanswered questionnaires, the sample size has been reduced to 20. Subjects were asked to answer several questions relating to own perspective on teaching and learning experience throughout the topic. The survey was measured in 5 points of Likert scale (1 for Strongly Disagree, 2 for Disagree, 3 for Neutral, 4 for Agree and 5 for Strongly Agree).

4.0 RESULT AND DISCUSSION

Table 1 addressed the questions in those questionnaires.

Table 1. Overall Impression about the Course

Item	SD (1)	D (2)	N (3)	A (4)	SA (5)
The learning outcomes of this topic were clear to me	0	0	25%	55%	20%
In this topic, I gained insights into research and current thinking in the field	0	0	30%	50%	20%
Learning resources were relevant to subject content and objectives	0	5%	25%	40%	30%

In Table 1, majority of the subjects agreed that the learning outcomes were cleared and able to enhance the learning ability in the field of study. Furthermore, table also indicate that subjects also agreed on the fact that current learning resources were relevant to subject content and objectives. Conventional teaching method which is face-to-face learning process is necessary so that active discussion in class is well experience. Figure 1 below proved that 45% agreed while 30% strongly agreed that the assessment tasks in class does increased the understanding of core concepts. The presence of lecturers in class can help to answer the questions arises regarding to this topic.

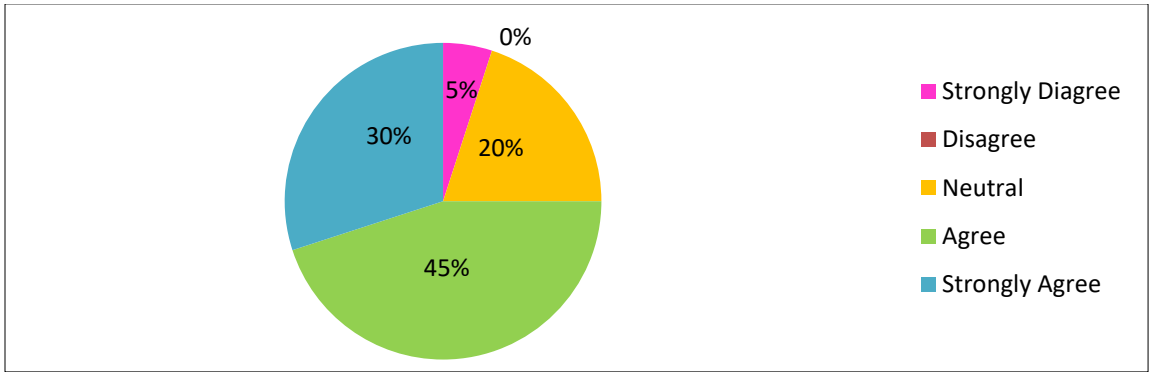

Figure 1. Percent Rate of Subject's Perception towards In-Class Assessments Does Increased Core Concept Apprehension

Then, subjects answered questions regarding few modes of instructional deliveries that are more prevalent to this topic such as; i) flipped classroom learning (lectures/notes online, discussion in class), ii) the usage of technology/online content (Massive Open Online Course (MOOC), blended learning), and iii) lab experience and field trip. The answers are recorded in Figure 2. Figure 2 is plotted according to the subject numerals versus instructional deliveries modes.

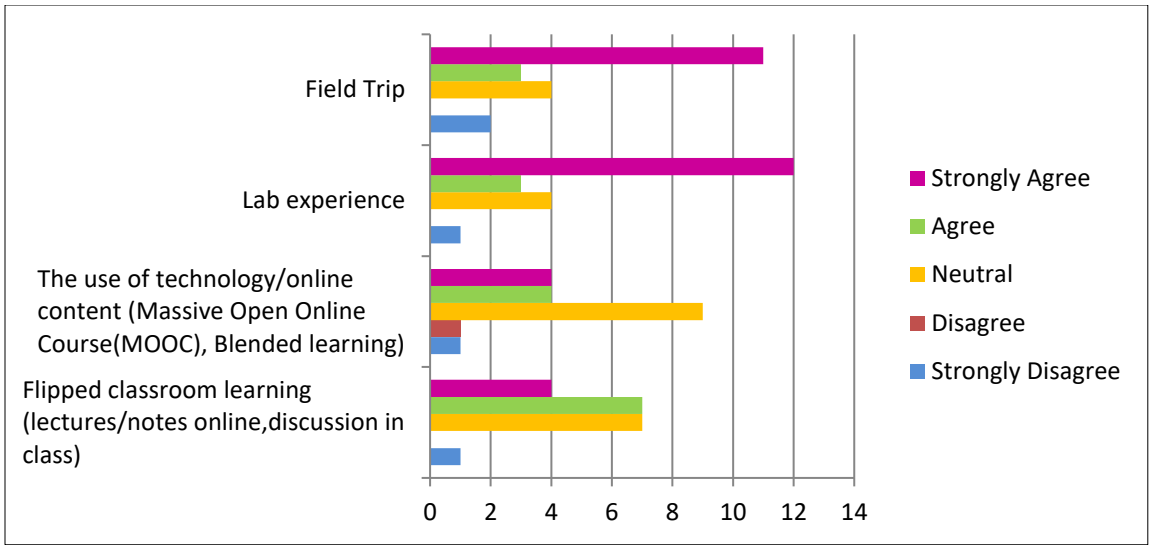

Figure 2. Modes of Instructional Deliveries That Are More Prevalent In Understanding the Topic

Based on the findings, eleven (11) and twelve (12) subjects agree that lab experience and field trip are the most prevalent modes in order to have better understanding on the fabrication process respectively. It is noticeable that most choice favour in lab experience since theoretical concept in class could easily be grasped through practical experience. While field trip or site visit is preferable possibly because it can be one of the particularly helpful ways for those especially in science and engineering education to see it live in the eyes.

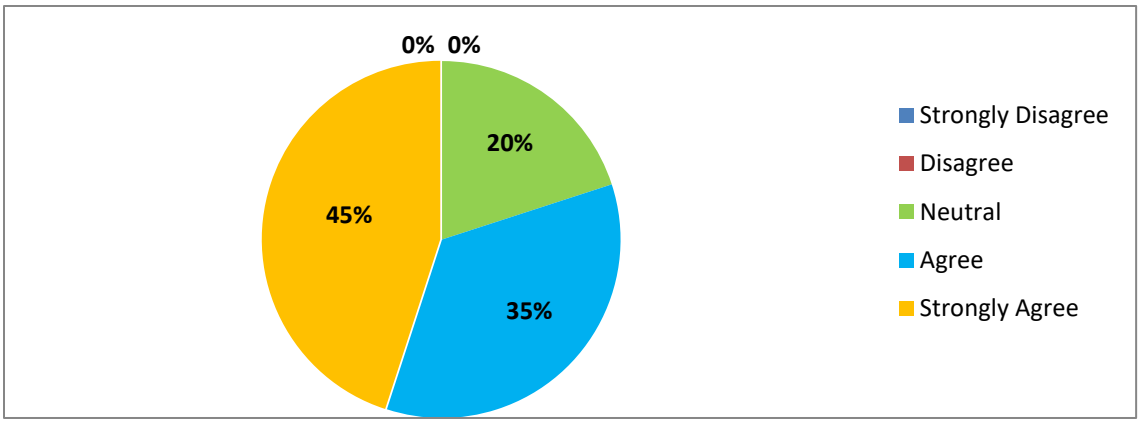

Figure 3. Percent Rate of Student's Perception That Lab Experience Clarified the Lecture Material

Figure 3 exhibits that most (45%) agreed on the idea that lab experience will clarify lecture material. This was proved by (Bergsteiner, Kolb's experiential learning model: Critique from a modelling perspective., 2010; Cirstea, 2003) where they claimed that the abstract conceptualization can be stimulated by lecture sessions, whereas active experimentation, concrete experience and reflective observation can be better addressed in interactive laboratory sessions. Furthermore, this lab experience can be an advantage in completing the final year project at the end of the semester.

5.0 CONCLUSION AND FUTURE WORKS

From the survey, it is proven that most subjects; i.e students believed in experiential learning including lab experiences and field trip. These delivery modes are expected to help in apprehension of fundamental concept. Having to experience the fabrication process in line with the theoretical concept can also help in successfully fabricating Printed Circuit Board (PCB) board for final year project. Since, this is an initial investigation on the needs of laboratory practice in microelectronic subject, thus this appropriate teaching strategy for this course should be taken into consideration.

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