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PERCEPTION STUDY ON MULTIPLE ACTIVE LEARNING TECHNIQUES FOR TELECOMMUNICATION COURSES IN UNIVERSITI KEBANGSAAN MALAYSIA

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Abstract

Active learning is a 3-ways approach of teaching-learning in which lecturers and students engage in learning activities by using alternative methods such as writing exercises, educational games, problem-solving, reaction-viewing systems, debates, class discussions, and electronic media use. Although there is evidence to support the effectiveness of active learning strategies, the implementation of different techniques in higher learning programs is minimal. This study aimed to evaluate the perception of active learning from students exposed to the designed activities in three courses at the Department of Electrical, Electronics and Systems, Faculty of Engineering and Architecture, UKM. The three courses were KKKT3243 (Communication Devices), KKKT4133 (Communication Data and Computer Networks), and KKKT4193 (Radio and Satellite Communication). Evaluation using a questionnaire involved 27 student respondents from Years 3 and 4. In these courses, a number of complex topics were presented using various active learning techniques involving teaching materials based on the needs of the current telecommunications industry. The design also includes collaborative learning using media such as Google Drive and iFolio, a UKM learning management system. Questionnaire studies reported that students think they learn better and can relate theory and practice easily and quickly. Students, however, reckoned that the main obstacle to active learning was that lecturers needed more preparation and a lack of adequate infrastructure.

Key Words: Active learning; Innovative teaching; Telecommunication engineering; Electronic media; Industry-based approach

1.0 INTRODUCTION

Since the introduction of higher education, the main teaching method used is the conventional lecture (Lujan, 2006). This method sets the classroom environment focused on lecturers and students becoming passive listeners (Lom, 2012). Passive learning does not use open-ended student interaction and instead focuses on delivering course material to students (Wilke, 2003). Although many argued that traditional lecturing methods were sufficient to educate students, the assessment of the teaching itself was also based on a passive learning approach, involving theoretical comprehension on examination paper. Evidence suggests that alternative teaching methods can enhance students' performance and qualitative experience (Lujan, 2006 & Felder, 2016). Evidently, there were alternating methods in the assessment (Chen, 2018 & Jadhav, 2018).

Active learning has become known as a teaching approach that involves dynamic student participation in lectures. It is also known as the three-ways teaching-learning approach involving interaction between lecturer with student, student with lecturer, and student with student. Students are responsible for their learning process through activities such as writing exercises, educational games, problem-solving, audience-response systems, debates, class discussions, and electronic media use (Cavanagh, 2011). In contrast to the focus of memorizing facts, active learning encourages students to achieve higher learning levels using Bloom's taxonomic cognitive domains such as analysis, synthesis, and assessment (Bates, 2012). Studies (Michael, 2006 & Freeman, 2014) have shown that active information processing improves students' physiological understanding, solve complex problems, and critical thinking skills, especially in science, engineering, and mathematics.

Specifically, in Malaysia in the last three years, many studies have reported the application of active learning (Jamali, 2018, Hadibarata, 2019 & Ngadiman, 2019) and the redesign of learning space (Raja-Yusof, 2018 & Raihanah, 2019) in the undergraduate and post-graduate engineering courses. However, none has applied explicitly to telecommunication engineering. Students in the Electrical, Electronics and Systems Engineering department in Universiti Kebangsaan Malaysia (UKM) were exposed to this approach. The objective of this paper is to evaluate the students' perspectives on three of the active learning techniques that were designed and implemented in the three courses of the Bachelor of Telecommunications Engineering Program, namely KKKT3243 (Communication Devices), KKKT4133 (Data Communication and Computer Networks) and KKKT4193 (Radio and Satellite Communication).

2.0 METHODOLOGY

2.1 Applied Active Learning Techniques

Three active learning techniques have been introduced for the first time in the three courses of Bachelor of Telecommunications Engineering Program. The purpose of this study is to study the students' perception of the new techniques.

a. Cisco CCNA CyberOps-based laboratory

The laboratory sessions were designed following the Cisco CCNA CyberOps professional certification curriculum. Some complex modules in KKKT4133 courses such as ARP (Address Resolution Protocol), ICMP (Internet Control Message Protocol), and TCP handshaking mechanism were delivered via interactive videos in lectures. Subsequently, laboratory sessions using Linux software, Virtual Machine, and Wireshark network analyser were conducted to enhance the understanding of the overall concept of data communication and computer networks. In addition to this lab activity, PBL (problem-based learning) tasks using these softwares have been carried out as teamwork to analyse TCP package behaviour for Youtube and Facebook applications.

b. Exposure to industrial scenario

Assignments were given in the class to relate with the industrial scenario. For example, in the first class of KKKT4193, students were asked to identify mobile network engineer tasks. Students were given examples of telecommunications industry scenarios throughout class, specifically Malaysian's Maxis / Axiata / Digi / UMobile. The telecommunications industry's real-time hardware implementation scenario has been shared with students, such as the concept of antenna Multiple Input Multiple Output (MIMO), channel coding, reconfigurable Software Defined Radio.

c. Collaborative learning

This technique involves students for group discussion followed by real-time sharing using electronic media that is accessible at any time. This technique encourages the use of cloud-based software such as Google Drive and iFolio (a UKM Learning management system). In addition, the discussion and question-and-answer sessions were also conducted in the lecture using an audience response system in active learning.

2.2 Questionnaire and Sample study

The questionnaire consists of 10 questions which are further derived into smaller Likert scale questions, multiple-choice, objective, and subjective questions. The summary of the questions can be referred to in Table 1. The total number of students for these courses is 27. All students were involved in the questionnaire.

Table 1: The questionnaire questions and answers.

Nb.	Question	Type of question	Derived questions	Answer options
1	Why did you choose this course?	Objective	Degree, Essential for future career, Interest	
2	Level of effort on active learning for these subjects	Likert scale	2.1 KKKT4133: Data communication & computer network 2.2 KKKT4193: Radio & Satellite Communication 2.3 KKKT3243: Communication devices	Poor, Fair, Satisfactory, Very good, Excellent and Not applicable
3	Contribution to your learning progress	Likert scale	3.1 Level of skill/knowledge at start of course 3.2 Level of skill/knowledge at end of course 3.3 Contribution of course to your skill/knowledge	Poor, Fair, Satisfactory, Very Good, and Excellent
4	Course content	Likert scale	4.1 Learning objectives were clear 4.2 Course content was organized and well planned 4.3 Course workload was appropriate	Strongly disagree, disagree, Neutral, Agree, Strongly agree

			4.4 Course organized to allow all students to participate fully	
5	Which active learning activity do you most prefer?	Multiple choice	Exercises, Group discussion, Lab activity, Educational games, Debate session, Student presentation, Assignment/self-study at home	
6	Your opinion on telecomm industry-related activities contribution to active learning?	Likert scale	6.1 Lab: Cisco CCNA CyberOps 6.2 Examples: Mobile operator scenario (Maxis/Axiata/Digi/UMobile 6.3 Collaborative learning: Google drive/iFolio	Strongly disagree, disagree, Neutral, Agree, Strongly agree
7	Tick if you agree with these benefits/barriers of active learning	Multiple choice	More interesting, More effective for long-term memory retention, More effort needed from students, Activity takes a lot of time, Infrastructure (classroom/WiFi, etc) conditions are not suitable	
8	In your opinion, why do you think active learning is not popular in today's learning programmes?	Multiple choice	Lecturers are more comfortable with traditional teaching method, More preparatory effort needed from lecturers, Allocated class time is not sufficient, Insufficient infrastructure	
9	How much percentage do you think is required using active learning vs. conventional learning?	Objective	10:90, 20:80, 30:70, 40:60, 50:50, 60:40, 70:30, 80:20, 90:10	
10	Any other suggestions/comments?	Subjective		

3.0 RESULTS AND DISCUSSION

A total of 27 students responded to this questionnaire. Out of these, 47% (13 of them) were Year 4 students, while 52% (14 of them) were Year 3 students. KKKT3243 and KKKT4133 were compulsory courses for the students in this program, while KKKT4193 was an elective course for this programme. Out of 13 Year 4 students, 7 of them took the elective course. From Question 1, the majority of students chose these courses because of interest (52%) compared to 33% who thought it was a future career requirement. The remaining 15% saw the courses as only a part of their degree requirement.

In terms of effort in active learning (Question 2), the students' perceived the lecturers' effort as excellent varies from 33% in KKKT4133, 41% in KKT3243, and 86% in KKK4193. The lower score in KKKT4133 and KKT3243 are arguably not representative enough as five students from KKKT4133 and 6 in KKKT3243 chose the not applicable answer, which was not a valid choice for them. The choice was initially been for the elective KKKT413 students only.

The derived questions under Question 3 focused on the active-learning approach's contribution to the students' learning progress. The questions rated the level of skill/knowledge of students at the start and the end of the course, followed by an evaluation of the contribution of active-learning based courses to their knowledge. In general, the results are a positive increase and illustrated as in Figure 1.

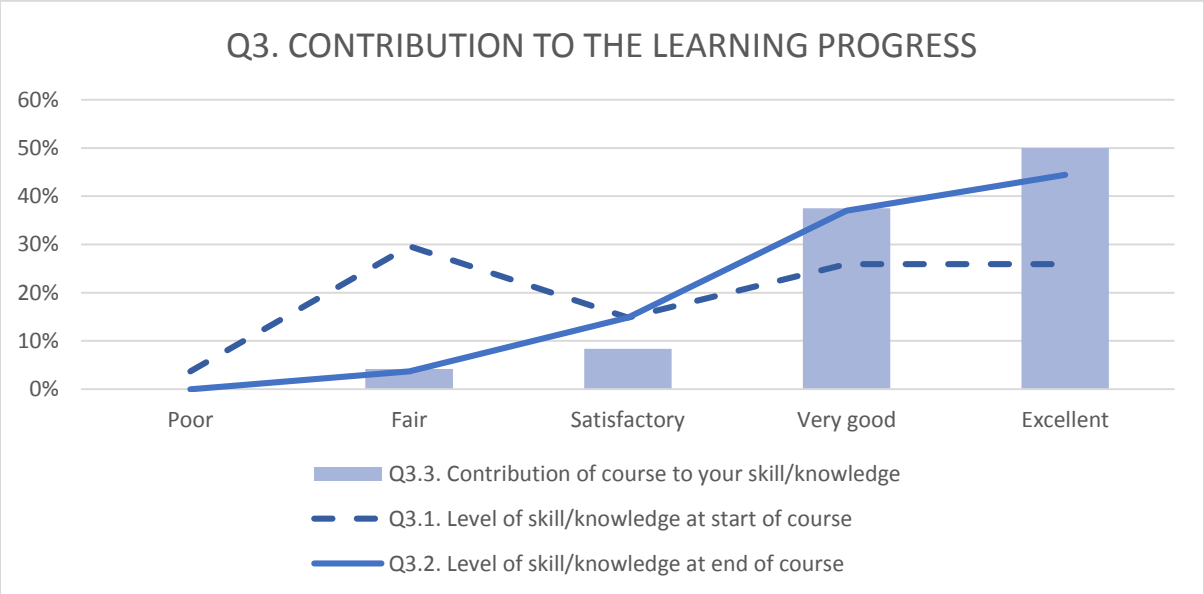

Figure 1: Student feedback on the contribution of active learning towards their learning progress.

Results from Questions 4.1 - 4.4 show that the majority of students strongly agreed that the course enabled the full engagement of all students in the course (63%), learning objectives were clear (52%), course workload was appropriate (52%), and the course content was well organized and planned (48%). Figure 2 shows the overall student response to the content of these courses based on different precision.

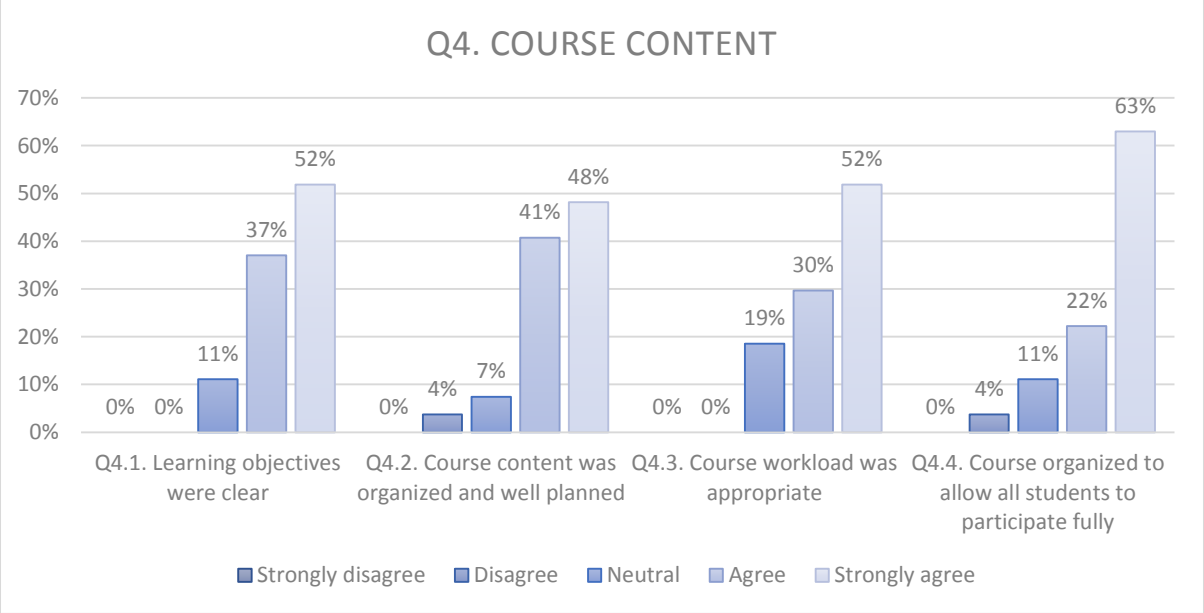

Figure 2 : Student feedback on course content by different precision.

For multiple-choice Question 5 on preferred activities, 70 choices were recorded. The percentage of choice to the number of recorded choices showed that the most popular active learning techniques were exercises (24%), laboratory activities (24%), educational games (17%), and homework/learning at home (13%). The least favoured techniques, however, were student presentation (11%), debate session (6%), and group discussion (4%). However, in terms of choice to the number of students, 61%, equivalent to 17 students, ticked the exercises and lab activities. 11%, three students ticked the least favourite activity, the student presentation.

In terms of contribution based on the telecommunications industry activities (Question 6), more than 90% of students agree or strongly agree that this activity contributes to their active learning process in all three activities. Figure 3 shows the overall response to the questionnaire based on these activities. None chose the option to disagree or non-disagree. Meanwhile, for Question 7 on benefits/barriers of active learning, 75% of students agreed on the techniques to make learning more interesting and 57% more effective for long-term

memory retention. However, 36% felt that the techniques require more effort from students, takes much time, and 25% felt they were in need of a better infrastructure to be implemented.

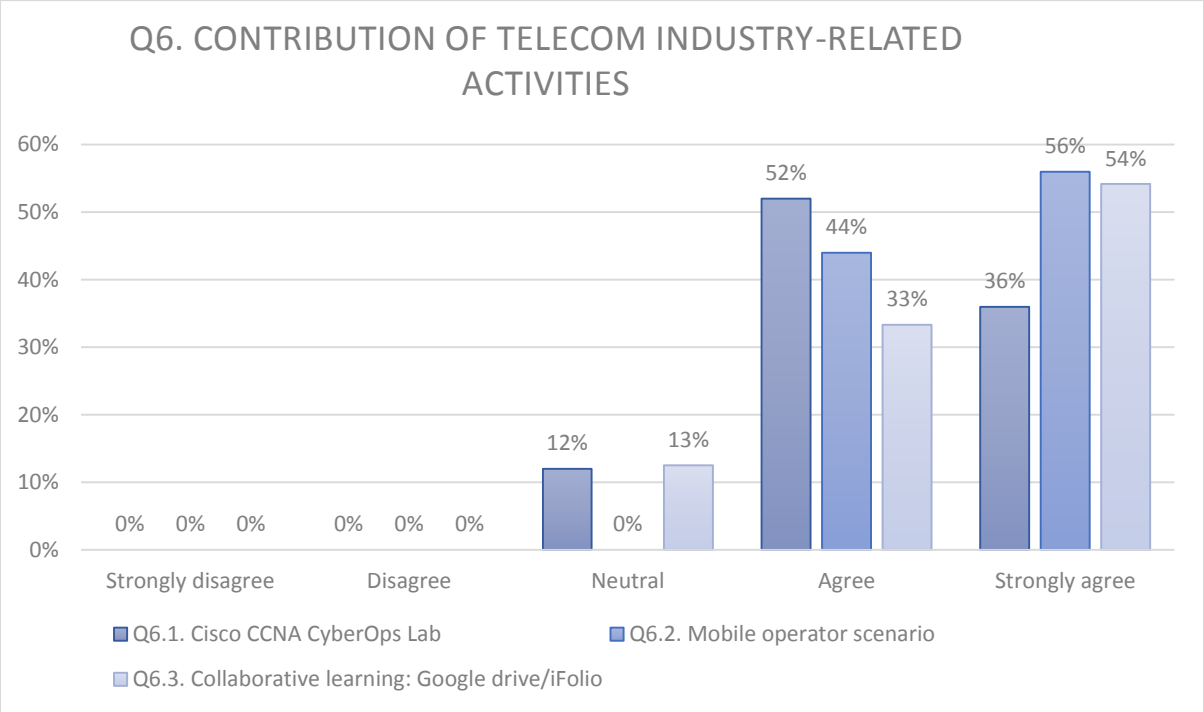

Figure 3: Student feedback on telecommunications industry-based activities in active learning.

In the opinion of the students as in Question 8, the main causes for active learning to be less practiced as the current teaching techniques are due to more preparation effort needed from lecturers (57%), inadequate infrastructure (46%), insufficient class time (39%) and because lecturers are more comfortable with conventional teaching method (21%). Finally, Figure 4 shows students' recommendations on active learning ratio to traditional learning (Question 9). The figure shows that 88% (22%, 44%, 11%, and 11%) of students think active learning should be practiced within the 40% to 70% range of lecture delivery.

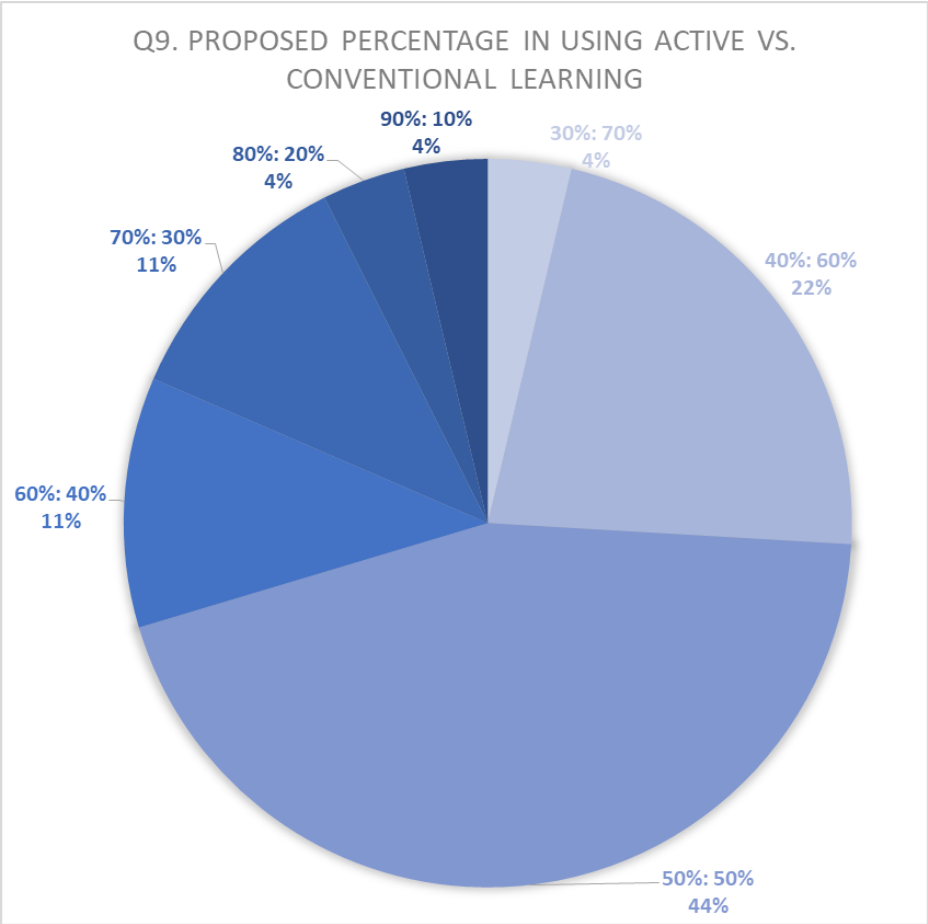

Figure 4 : Student feed on proposed percentage suitable in applying both active and conventional learning (Ratio of active:conventional).

In the final Question 10, students were asked for suggestions and comments to improve the whole active learning blending process. The six recorded answers were; i) More fieldwork, ii) Exercises or pre-exam questions are preferred, iii) More lab activity, iv) More individual than grouping activities, v) Hunger to learn more, and vi) More exercises to understand better the topics, with more examples than theories.

3.1 Discussion

The questionnaire was done to evaluate several directions in applying the active learning approach towards students in higher education. Based on Question 3.3, 50% and 38% of the students agreed on the excellent and very good contribution respectively, of the applied techniques towards their skill/knowledge. Additionally, the majority were satisfied with the organised contents. However, when we look at the follow-up questions, some interesting results were discovered. For example, in Question 5, 61% of the students chose the exercise activity. While exercise is an excellent activity adapted to suit the active-learning criteria, it existed already in the conventional method. The results indicate two possibilities: either

students were comfortable and appreciate exercises as they were already used to, or they see it as the most beneficial, or they see it as the most beneficial for obtaining good marks in the written examination. To date, the current assessment put a significant weight on the written assessment. The latter tendency can be said based on Question 10, where two students mentioned more exercises and examples to understand a topic better, and pre-exam questions and exercises are preferred.

Secondly, in multiple-choice Question 7, students recorded some active learning barriers, such as activity taking much time and more effort from students. The design of active learning is supposed to direct the students to achieve more things but within the same students-lecturer contact hour and students learning time (SLT). If students think the activity takes more time, it can either be the design of activities were not optimized or students were not aware of SLT existence in the current credit-hour-based system. In conventional SLT, students either get a 'straight-forward' exercise as homework, or they are expected to self-study by themselves. In the most practical transition towards active learning, lecturers are supposed to give students directional activities to self-explore but within class contact hour plus their SLT.

The third finding can be related to the point where students think more effort are needed from students. Despite the majority appreciation towards the active learning approach, based on Question 9, 66% of the students voted for 50:50 and 40:60 ratio of active:conventional learning allocation. The remaining students had divided opinions on the greater ratio of active over the conventional approach. Apart from improving current techniques, a question on active-learning concept understanding needs to be added to verify the students understanding on top of all the other perceptions before they take the questionnaire.

4.0 CONCLUSION

This study shows students' perception towards the content of the telecommunications industry-based courses and the new learning techniques conducted in Year 3 and 4 student courses from the degree of telecommunications engineering in the Bachelor of Electronics Engineering. The techniques introduction received very encouraging response from students and lecturers are opened for improvement in several direction based on the results to ensure full benefits of active learning, such as the improvement in teaching and their assessment. In terms of questionnaire design, one of the directions to be pursued in our future assessment is to prelude it with measurement of students' awareness of active learning and conventional

concepts to derive the answers pattern based on understanding. Second is to add more questions on conventional teaching directly so a better conclusion over the advantage of one over another can be drawn.

5.0 ACKNOWLEDGEMENTS

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