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Online Distance Learning for Electronic Design Subject at Diploma Level during Pandemic in Malaysia: A Case Study on Student Awareness and Perception

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Abstract
The Covid-19 pandemic outbreak globally had caused huge reformed in teaching and learning methodology. Online distance learning (ODL) had become popularly new norm to deliver knowledge that previously held face to face. However, the efficiency of ODL method on delivering a course that involve practical skill especially for Electronic Design subject is still not commonly understood. Hence, assessing students' feedback throughout the running semester could provide insight to understand the effectiveness of ODL method implemented during the online class. This paper presents the study of students' perception, awareness, and experience of ODL for Electronic Design subjects at Diploma level in Malaysia. The study sample was taken from one class consisting of sixteen students who took the Electronic Design subject. Data was collected through surveys that implement in different stages. The first stage was in the early semester, the second at the end of the semester, and the third was just before the students obtain their final semester results. Additional surveys were also taken in google form throughout the semester to cater to the survey questions other than in the previous three stages. Open feedback was also collected to understand any issues arising from the ODL implementation method for Electronic Design subjects, especially those related to hands-on activities such as lab exercises. This study could provide insight on the skill and competency that students obtained throughout the semester of ODL and improvement required on the methodologies that suit to students' interest. The result of the study is expected to be used for curriculum improvement for this subject. Besides, the study result could be used as the references in future by universities to develop new curriculum that is suitable to be conducted in any form of delivery method and matched with requirement of accredited body as well as industry needs.

Keywords: Online Distance Learning, Electronic Design, Covid-19, Teaching and Learning, Student Feedback

Introduction

The COVID-19 pandemic has caused severe impacts on daily human life locally as well as globally. Many business and services operation has been totally disrupted by the wave of the Covid-19 virus (Abelskamp et al., 2021). The World Health Organization (WHO) declared COVID-19 a pandemic on 11 March 2020 (WHO, 2020). COVID-19 had spread across 217+ countries with almost 17.1 million confirmed cases and 668,073 deaths by 31 July 2020. In Malaysia, the Government has provided many resources to higher education to mitigate the impact, such as collaborating with the telco for a special mobile data package for students and providing more comprehensive coverage of high-speed Internet to facilitate online learning (Noorazah, 2020). During the pandemic, Malaysia has to implement a lockdown period that causes higher learning institutions to switch to online knowledge delivery methods for students entirely. This direction helped to increase the growth of the online education market in Malaysia, which is expected to be about 16.4% annually over the forecast period of 2016–2023 (Umaira, 2020). Hence, lecturers and students need to adapt to the new norm of learning methods through online platforms. This could reflect teaching and learning performance measurement and cause some difficulties for students and lecturers to immediately transform the conventional lecture-based approaches (Markom et al., 2021).

The pandemic also significantly impacts higher education students' practices regarding academic work and life (Aristovnik, 2020). An observation of the student's perception and experiences of Electrical Engineering students through the ODL method during the COVID-19 pandemic outbreak has been conducted by (Ilham et al. 2021). This paper aims to study the effect of online study mode on the student's perception, awareness and experience specifically for Electronic Design subject for Diploma level. The study result could also be used for benchmarking purposes by other campuses that offer the subject as well as a university for curriculum development in terms of teaching and learning concepts and strategies during ODL.

a. Learning Outcomes of the Course Design

The course design for the subject is to provide a clear understanding and practice on the concept of designing amplifier applications using transistors and Op-Amp and also on the printed circuit board (PCB) based design project. By completing this course, students were expected to be able to design amplifiers and produce prototypes based on electronics system design.

b. Organization of the Course Contents

Electronic design subject is a compulsory subject that needs to be taken by students to complete their diploma in electronic engineering. This course has about five chapters in the course outline. Chapter one covered a small signal amplifier design involving Bipolar Junction Transistor (BJT) type and Field Effect Transistor (FET) types. In chapter two, the topics covered were amplifiers with frequency response design that also includes both BJT and FET transistors. Chapter three covers operational amplifier (op-amp) design, while chapters four and five cover design process prototyping and surface mount technology (SMT), respectively. Lab exercise has been embedded based on the topic from chapter one until chapter three.

c. ODL Teaching Strategies

Table 1
Chapter versus number of weeks to accomplish the course.

Chapter	***Week***
1.0 Chapter 1: Small Signal Amplifier Design	*1 to 3*
1.1 Blended Learning	*4*
1.2 Laboratory 1	*5*
2. Chapter 2: Amplifier with Frequency Response Design	*6 to 8*
2.1 Blended Learning	*8*
2.2 Laboratory 2	*9*
3.0 Chapter 3: Operational Amplifier Design	*10 to 11*
3.1 Laboratory 3	*12*
4.0 Chapter 4: Design Process and Prototyping	*13*
5.0 Chapter 5: Surface Mount Technology	*14*

Based on typical teaching strategies for non-online classes, the students will first be exposed to theory and calculation to ensure that their knowledge is good enough before further work on simulation during lab exercise. Lab exercise during non-ODL requires a student to present physically with limited time, usually about two hours. However, the teaching strategies during ODL would implement theory calculation and simulation for each subtopic. The reason is that students have ample time to use simulation on their computers. Besides, a lecturer must ensure they understand one particular topic at a time since all classes were made online and students have limited communication mediums compared to a face-to-face class.

Methodology

A. Sample

The sample was taken from one class of six students studying in the fourth semester of the Diploma in Electronic Engineering. Only one class of students took the Electronic Design subject during that semester which was held between March 2021 to August 2021. During this period, all classes across the faculties and campuses were forced to implement the online distance learning (ODL) method since no students were allowed to stay on campus.

B. Instruments

Most of the data collected for this study is through surveys. There are three types of surveys which were given to the students. The first survey would be the entrance survey collected during the first week of the semester, and the exit survey collected during the last week of the study semester. Another survey was collected before the students' semester results, called student feedback online or SUFO. The surveys were collected through the university's system for students' learning platform, namely UFUTURE. The lecturer also gave an additional survey through google forms to cater for the questions that were not included in the three surveys mentioned.

C. Research Procedures

During first week of the semester study, students were briefed by lecturer of the subject on the course outline, course outcome, topics covered, included lab exercise, assessment method for coursework and mini project. Some other information in the briefing also includes possible mini project topic that has suited to the mark allocated for the project. During first week of semester also, students were given entrance survey which normally covers the question related to the topics in the subject. The information would give a glimpse of the students' knowledge related to the topics that will be covered later on. After that, theory class were continued with calculation exercise before proceeding to the simulation work using software. The learning method continues across all of three chapters which covers on small signal amplifier design in the first chapter, amplifier with frequency response design in second chapter and operational amplifier design in the third chapter. Lab exercise work will cover from all these three chapters. The fourth and fifth chapter covers mainly by theory with no practical work. The lecturer week have until fourteen weeks to complete the course topics. Along the study weeks, students were assessed by two writing test, practical test, lab exercise and mini project. All assessment works have been completed through online method.

Analysis and Results

Figure 1 show student feedback on the overall student experience in online learning. Based on the survey results, students have found that the overall learned topics can be understood through online distance learning. A majority, as much as 77.8% of students has voted for a YES response indicating that they were able to learn the topics successfully using the online platform. The remaining 22.2% of the students responded otherwise, indicating that they found that learning through ODL for Electronic Design topics was challenging to understand.

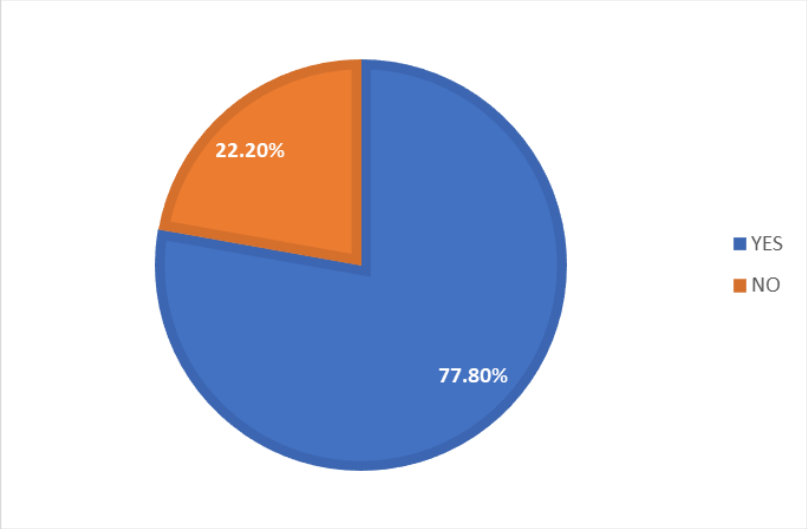

Figure 1: Overall feedback experience by students during the online study.

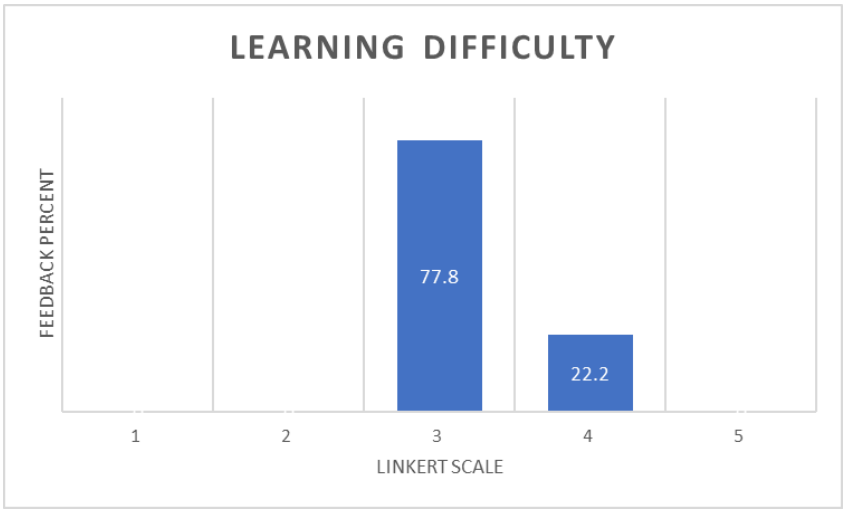

Figure 2: Students feedback based on learning difficulty of the subject.

Figure 2 shows the learning difficulty experienced by students related to the subject of Electronic Design. Learning difficulty level during ODL shows that student's responses are from medium to moderate-high. The survey gave five ratings: one refers to low difficulty, the second was for moderate low, three for medium difficulty, four for moderate-high difficulty and five for high difficulty. 77.8 % of the students find that learning electronic design is still acceptable to conduct online. In contrast, 22.2% of the students voted for moderate difficulty. Perhaps due to the nature of the subject that requires basic theory on calculation and simulation on the software. The difficulty would be more if they could not properly understand during online theory lectures. Hence, this could make it further challenging to do the calculation before performing simulation using the software. The electronic design subject requires the student to obtain correct calculation results before the circuit can be simulated using the appropriate software.

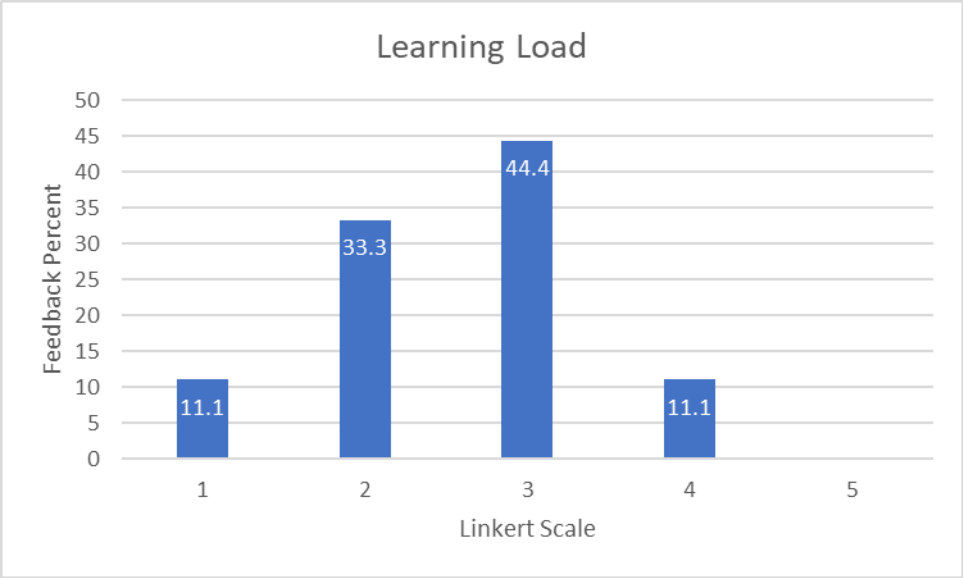

Figure 3: Student's feedback based on the learning load during semester.

Learning load in this survey refers to the overall load that students need to cope with during ODL learning in that semester with respect to the subject taken. Students were given a five Linkert scale rating, one referring to low load while five referring to high load. Based on

the survey feedback from the students, 11.1% have voted for low load, followed by 33.3% for the moderately low load. As much as 44.4% of the students have voted for medium load and moderately high load at 11.1%. Based on the bar chart result, most of the students were able to cope with this subject when it was conducted in online mode. No students have a rate of five or high load, indicating that they could cope with the workload given during the learning of this works.

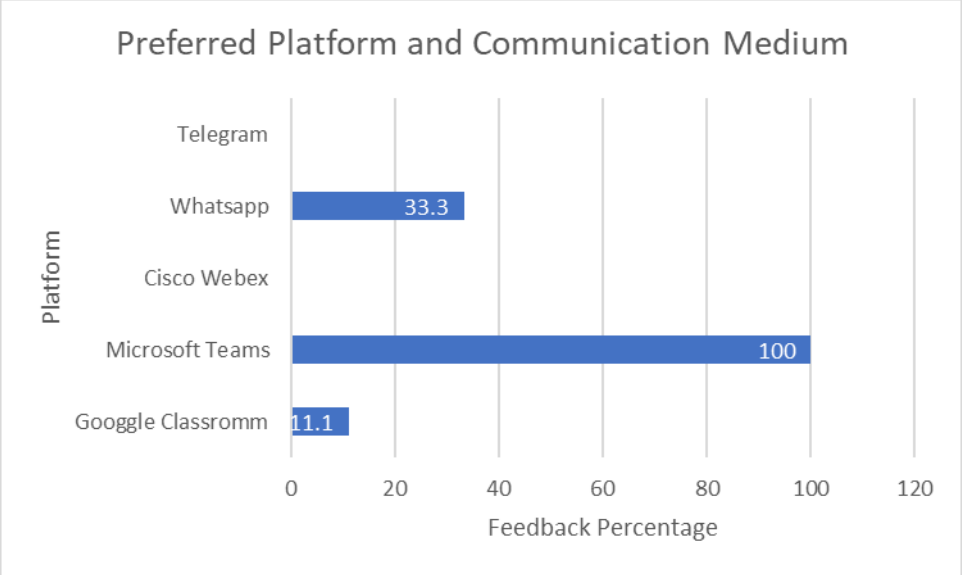

Figure 4: Students feedback on the preferred platform and communication medium.

Figure 4 shows the preferred platform and communication medium of the respondent. Most respondents or students preferred to choose Microsoft Teams compared to Google classrooms as their chosen learning platform. This was possibly due to the features that are available on the Microsoft team that students find more straightforward to use and handle. The university has both Google and Microsoft account for students and academic staff. However, features on Microsoft products were better compared to google concerning the university's licensing subscribed. The features that students favour most include live recording class sessions. The recording feature has been disabled on the current google license; hence, they could not directly record using the google platform if the lecturer used the google meet platform. The recording features are still available on Microsoft teams; hence this was their chosen platform.

Along with the platform, the student also voted to choose WhatsApp as their preferred communication medium between lecturers and students. This could help them engage with the discussion on a specific topic that could involve all of the WhatsApp group participants. The lecturer's response to any topic questions could also help alert quiet students to ask further inquiries that intrigue them and hence could spark valuable discussion for all students.

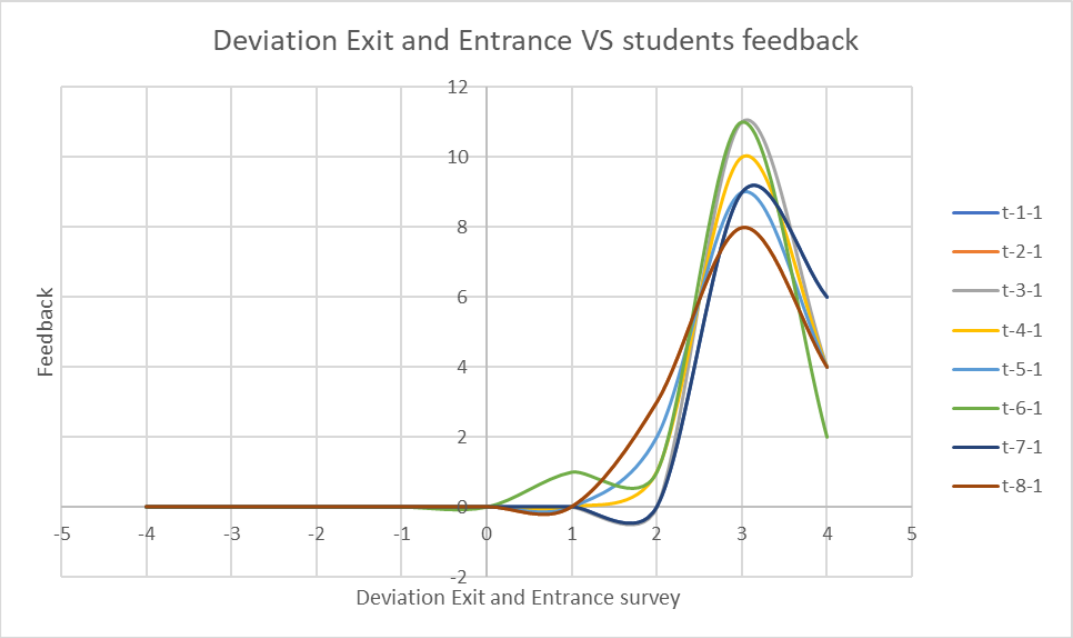

Figure 5: Deviation of Exit and Entrance survey data based on Linkert scale.

Figure 5 shows the deviation of exit and entrance survey results. The survey questions are marked in the legend with the label t-1-1 to indicate the survey question on subtopic one. About eight subtopic survey questions were asked in the exit and entrance survey form. Each survey question has been set on a Linkert scale of one to four. Students were required to submit an entrance survey in the early semester to collect their feedback and assess their knowledge of the subtopic. At the end of the semester, again, the students were required to submit the same survey questions to determine their current knowledge after completing the course. The deviation between exit minus entrance on the Linkert scale value is plotted as in the graph above. When the delta value for exit minus entrance obtains negative values, the data is not correct as it seems that the students become less understanding before taking the course. Hence, the delta value plotted above shows a positive value for all survey questions. This has indicated that student knowledge was increased in all of the subtopics in this Electronic Design subject.

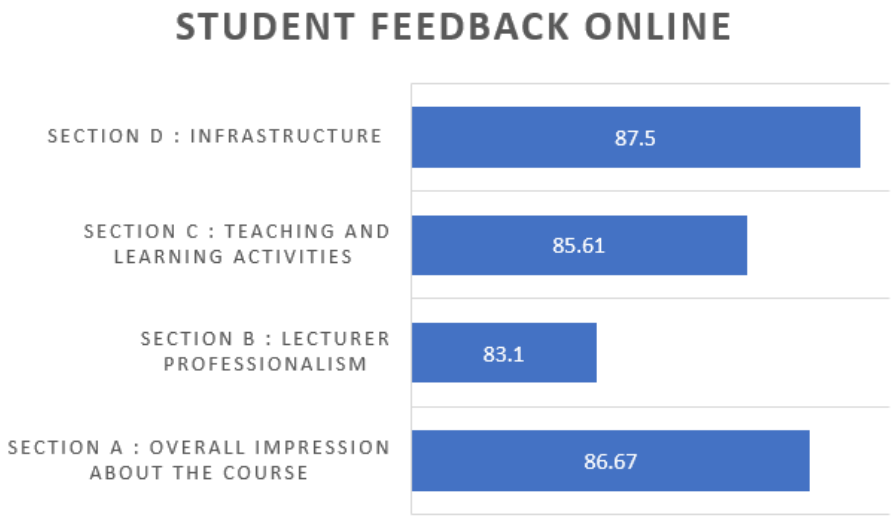

Figure 6: Students feedback based on SUFO system.

Student feedback online, which stands for SUFO is a mechanism used by the university to obtain feedback from students after completing the course subject. The feedback collection is usually taken every semester after the end of the semester or just before they obtain the semester result. The feedback can be divided into several sections in the survey, as shown in Figure 6. The first section would be on the infrastructure of the learning. This section describes the conduciveness of the infrastructure and the equipment's functionality during the learning process. In both points, students have rated 87.5% for this subject.

The second part, which touches on the teaching and learning activities, score overall at 85.61%. This section request students to rate based on several criteria given in the survey. The first criterion would be to assess the lecturer during the first class of lecturing whether they were briefed on the subject's content, outcome and assessment method. Then, students were asked to rate the lecturer's teaching evaluation, which consisted of whether the lecturer followed the course plan accordingly, the study environment that allowed the student to participate in the discussion actively and whether they interestingly delivered the content or not. In this section, students were asked to rate whether the lecturer has given feedback on the assessment and assisting the students to master the content. Another section which assesses the lecturer's professionalism during the class includes whether the lecturer completes the scheduled lecture hours, is ready to give guidance to students, is approachable, and monitors attendance. This section scores 83.1% based on student feedback. The final section would be the overall impression of this course. The rating given by the student during this pandemic class was about 86.67%.

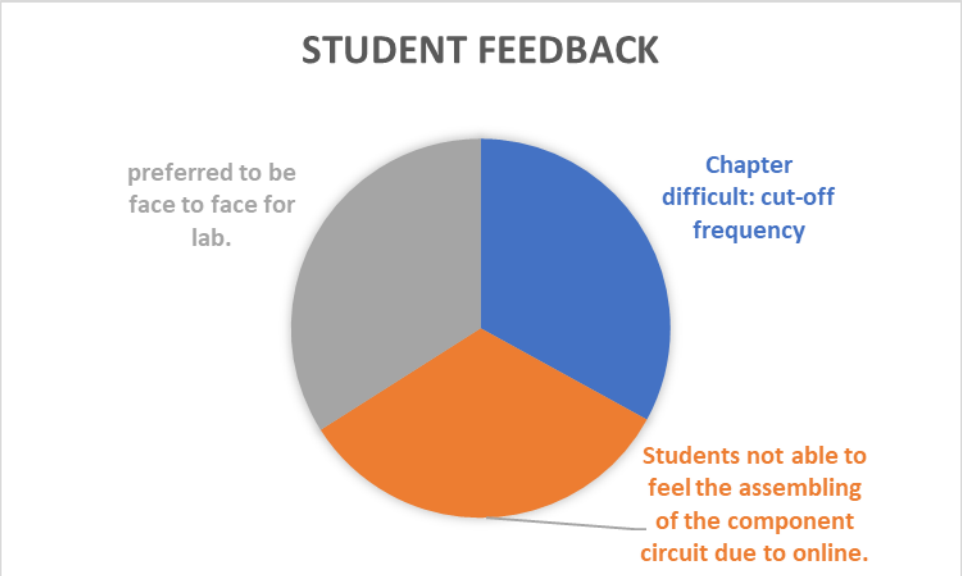

Figure 7: Open feedback on overall online learning course outline and implementation.

Figure 7 shows students' open feedback on the online learning criteria for Electronic Design that they have just gone through. Some students have given feedback on the course's second chapter, which was the frequency cut-off topic that caused them difficult to understand. Other feedback on this subject also includes that students could not feel the assembling of the component as it was compared with conducting on face-to-face basis. Some of them addressed that they preferred to conduct face-to-face laboratory exercises as they could easily inquire about or discuss the matter they did not understand with the lecturer. This could speed up their learning process and accomplishes the lab exercise and experiment.

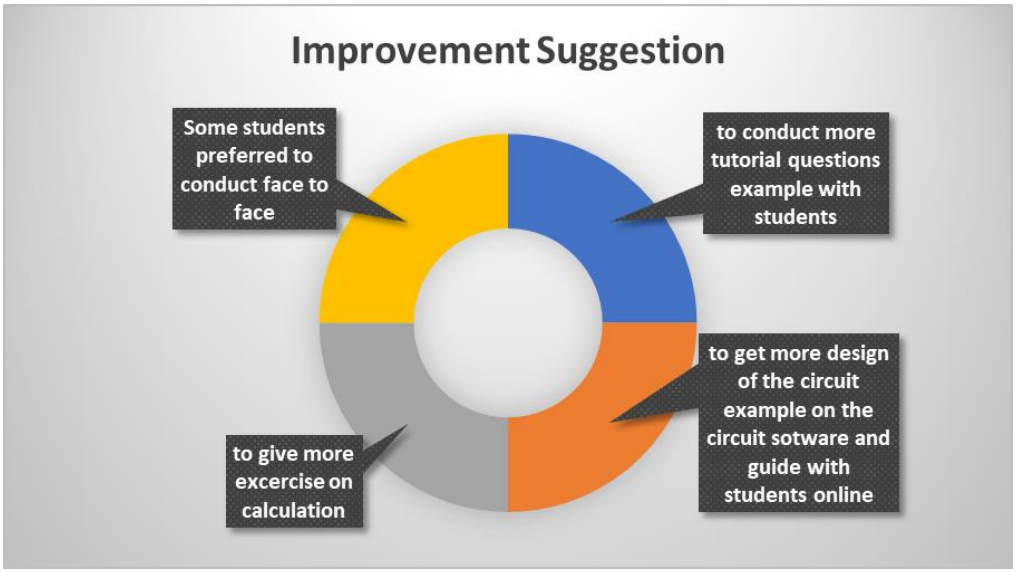

Figure 8: Open feedback on improvement suggestion.

Another open feedback is shown in Figure 8, where students were asked to give suggestions on the improvement that could be applied in the future based on current students learning experiences. Some students suggest conducting more tutorial example questions to better understand for certain topic. Other students gave the opinion that they need more circuit design examples with simulation using the software; hence they could quickly familiarise themselves with the software tools and features to run the circuit simulation. Some of them also suggest that on specific topics, face to face method is more suitable and give deeper insight into the depth and breadth of the topics.

Discussion

Based on the feedback from the students on online distance learning for electronic design subjects at the diploma level, the overall vote collected from students rated above 80%, depending on the criteria covered in the survey. This indicated that students could align and cope with different mediums and study environments compared to traditional face-to-face classes. The student also could quickly adapt to the technological advancement of online learning, giving them a better chance to survive during the online pandemic study. However, on some parts of the topics and course outlines, they still prefer to be conducted in face-to-face mode. This could make them easy to understand further on the topic and the ability to work with hands-on activities, especially in the lab exercise.

As overall survey result, students' awareness and perception along the semester run during pandemic was very well. The flexibility in term of study time given by the lecturer was fully utilized by the students. They were easily adjusted to the new environment and the challenges that they encountered during online learning. The awareness also can be reflected base from the exit and entry survey result. The results shows that students acknowledge that their understanding have increased after they learn Electronic Design subject as compared to before attending the class. This could not be done if the students not aware with the changing on the learning medium, environment as well as learning method during pandemic hence could fail in this subject.

Conclusion

This paper highlights the student's perception, awareness and experiences in learning Electronic Design subject by online distance learning (ODL) approach. Having multiple surveys distributed across multiple time frames could help to capture consistent and non-bias data collection feedback by students of interest. The results found by far have aligned with the study's objective, in which data shows positive results in students' perception and awareness on the use of the online method in this subject. Students' feedback and experience also have been recorded in the surveys and could be used and implemented to improve the teaching and learning of the Electronic Design subject in the future. The study finding also could be used as reference to university during syllabus review to ensure the new syllabus or curriculum matched industry needs regardless students to learn through ODL or face-to-face mode.

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