

Open Distance Learning (ODL): Observe the Students' Impression of the Introduction Electric Circuit Course during Pandemic in Malaysia

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Abstract

A new cohort of Electric Circuits course with the Engineering Technology Accreditation Council (ETAC) is facing a sudden teaching and learning challenge due to the Covid-19 pandemic. Therefore, most lecturers are embracing the new norm and moving from the physical method to open distance learning (ODL) as universities resume the semester after a long break. This paper highlights students' impression of ODL practices among electrical engineering students for this course at the Faculty of Electrical Engineering of Universiti Teknologi MARA, Malaysia during the COVID-19 outbreak. Their impressions will be observed and analyzed so that the lecturers can develop another effective online and software-related approach as the goal of this study. Students in the second semester of electrical engineering who took the course on electric circuit were given a survey with two (2) stages, at the beginning and end of the semester using Google Form to gather first and last impressions and provide more effective data for investigation, including their understanding of all nine topics within the course. Based on the finding results, majority of students initially opposed to the ODL concept, especially since this course is the most demanding course in electrical engineering majors and a prerequisite for many subjects. The main difficulties in the ODL sessions are internet connection and understanding of technical issues. To overcome internet limitations throughout the ODL session, the asynchronized (recording) teaching and learning methods can be employed. Conducting hands-on work with electronic ODL toolkits enhanced students' technical and practical understanding. The significant improvement was also evident at the end of the semester compared to the beginning of the semester in understanding all nine topics as the lecturers are always willing and available to be contacted and discussed for further explanation. Nevertheless, positive and gratifying results correlating the students' overall satisfaction with the ODL teaching and learning activities and the professionalism of the lecturers at the end of the semester. For the future researches, we plan to use the results of these analyses to link students' final outcomes results on the efficacy of ODL approaches. It's crucial that this is recorded so that researchers can examine the benefits and drawbacks of online education.

Keywords: Open Distance Learning, Electric Circuit, ODL Approach, ETAC Course.

Introduction

Electric circuit is basically a method of performing how an electrical devices works by receiving power such as flashlights, electric motors and drives, generators, power distribution systems, integrated circuits, transistors, smart phones, computers and many more. There are also non-electrical devices that can also use the electrical circuit equivalents such as sensors, fuel cells, batteries, heat transfer systems and electromechanical systems (de Almeida et al., 2020; Izadian, 2019; Zubi et al., 2018). Moreover, the renewable energy systems also convert the earth's natural and abundant sources into electrical energy by applying these electrical circuits to their systems. For example solar energy from the sun, geothermal energy from heat inside the earth, wind energy, biomass and hydropower from flowing water (Abdul Rahman et al., 2020; Anaba & Olubusoye, 2021).

Since this course is important in our daily life, it is also a crucial course for electrical engineering, electronics engineering, and computer engineering students. This course is designed to provide a comprehensive introduction of the electrical circuit analysis techniques used in electrical and electronics engineering. Electric circuit analysis is typically the first course taught in university in electrical, electronics, and computer engineering programmes, as basically related to electrical, electronics, and computer engineering stems from electric circuit analysis. The fundamental ideas of electrical circuit theory have been established for a long period of time, various new elements must be considered when optimising information transfer is desired (Fino, 2018).

The Covid-19 pandemic that has rocked in the whole world for more than a year and altered the country's previous order of life, including the mechanism of providing education (Fauzi & Khusuma, 2020). According to the Malaysia Ministry of Higher Education and Ministry of Education on the Prevention and Management of Corona Virus Disease (Covid-19), learning is conducted online and from home. This learning is called the Open and Distance Learning (ODL) approach. This approach aims to prevent and contain the spread of Covid-19. This condition necessitates the responsiveness of several educational institutions at the basic, secondary, and university levels to this phenomena (Gaur et al., 2015).

A significant effort has been made to promote the use of ODL approaches as a means of overcoming the challenges inherent in the requirement to support in the transfer of knowledge to students especially during Pandemic Covid-19. However (Islam & Azad, 2015) I and (Yakubu & Dasuki, 2019) suggested that ODL should not be viewed as a substitute for traditional learning, but rather as a platform for promoting and improving the learning environment. ODL tools improve students' access to educational and instructional resources.

Although online learning has been introduced for a long time, education institution have not placed a full emphasis on its implementation (Rahim et al., 2020). This increases lecturers' and students' comfort with traditional teaching approaches. ODL had a new capabilities on lecturers and students, transitioning them from traditional face-to-face teaching and learning in a lecture class or laboratory to a new norm based on a fully online classroom (Markom et al., 2021). Paul & Jefferson (2019) concluded that by implementing ODL, learning activities become more adaptable. Distance education has made significant strides in transforming the conventional learning environment. Schneider and Council (Schneider & Council, 2021) asserted that open learning enhances the new educational standard and will continue to spread education in the coming decade. Due to this new norm, the analysis shows that the increase of Internet traffic was about 15-20 % within a couple of weeks, an increase that is typically spread over multiple months under typical operation (Feldmann et al., 2021).

The new norm of education requires that all lecturers and students of Faculty of Electrical Engineering, Universiti Teknologi MARA, Malaysia participate actively in the implementation of online learning via this ODL approach. Although the effectiveness of online learning has been highly discussed, few studies have been undertaken to examine students' impressions of online learning across a variety of academic areas. As such, the goal of this study was to ascertain students perspectives on online learning using the ODL approach of the Introduction Electric Circuit course during the COVID-19 pandemic in Malaysia.

Learning Outcomes of the Course Design

As learning outcomes for this course, students should be able to explain the fundamental principles and methods for solving resistive, magnetic, and reactive circuits in direct current, as well as basic design electrical circuits using electronic components (Electronics Tools Kit) and National Instruments Multisim modeling software. In terms of simulation software, NI Multisim is viewed as an ideal choice for achieving learning objectives and improving students' simulation hands-on simulation skills rather than practical exercises using electronic components due to its open-source, ease of use, and capability to be used online without downloading the software. The course and program learning outcomes for Electrical Circuit Course are depicted in Figure 1.

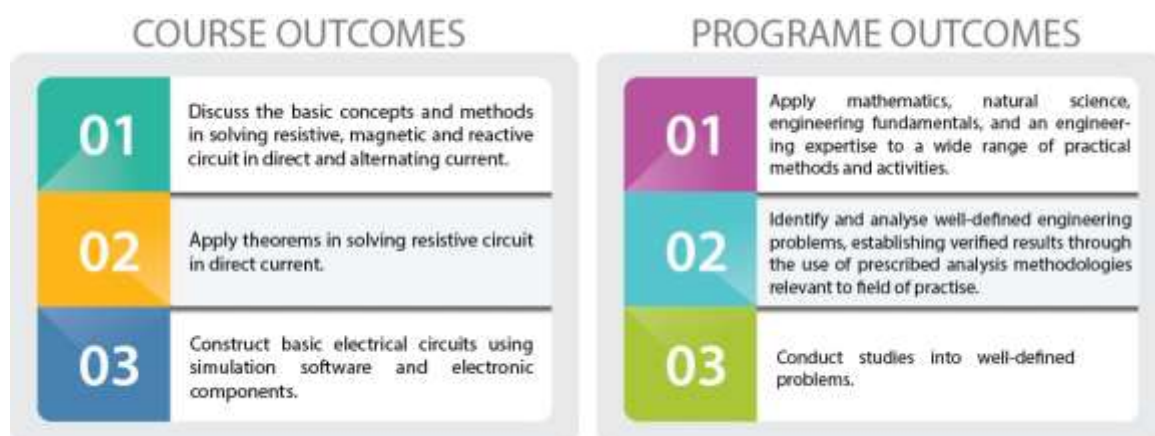


Figure 1: Electric Circuit Course Programme and Course Outcomes

ODL Teaching Strategies

The Electric Circuit Course covers four topics. The course deals with the introduction to electrical quantities in electrical circuits, the circuit theorem, and its application to direct current circuits, magnetic circuits, capacitors, and inductors. This course is designed for 75% lecture and 25% laboratory activity. During the ODL, the lecture was held via an online platform such as Microsoft Teams, Google Meet and WhatsApp. However, to standardize the implementation of teaching and learning, Microsoft Teams is being used as a one-stop center that provides online streaming lectures, assignments, lab reports and test submission, and teaching material storage. The fascinating element is that by utilising Microsoft Teams, lecturers may sync it with Microsoft OneNote and share the teaching notes with other students, allowing them to collaborate in near real-time via peer collaboration. Electric Circuits is a difficult subject to conduct a lecture because 95% of the content consists of computation and circuit drawings work. Thus, a variety of teaching aids are employed, including a tablet pen, that also known as stylus to demonstrate mathematical concepts, a

graphical circuit to demonstrate circuit concepts, and video explanations from online sources such as YouTube.

For laboratory work and practical tests, which contribute for 30% of the course assessment, the lecturers encourage student to buy their electronics tool kits. The purpose of providing students with their own Electronics Tools Kit is to empower them with practical skills notwithstanding their participation in ODL. The lecturer provides the contents of the Electronics Tool Kits, as well as the list of components required to complete each experiment as specified in the lab handbook. However, lecturers are also concerned when there are students who cannot afford the lab Electronics Tool Kits as many parents have been affected by the pandemic. Thus, the survey was conducted as shown in Figure 4 and Figure 5.

Methodology

A. Sample

A total of 95 Electrical Engineering students from five classes were carried out as responders in this study. The subject name of Electric Circuit is the common subject that must be taken for the student majoring in power and electronics engineering in the second semester of diploma studies. Not only as a common subject this subject is also a pre-requisite other subjects.

B. Instruments

A survey instrument was utilised to analyse the ODL response towards Electric Circuit course throughout the early semester and at the end of the semester. Suggestion: The survey was conducted during the early semester to determine the acceptance of the ODL concept, the level of difficulty, the students' ability to purchase electronics toolkits, and the early impression of understanding the subject. At the end of the semester, survey has been performed to know the feedback on their understanding of each topic and performance, including impression of course, lecturer professionalism, teaching and learning activities. The survey has been conducted by using Google Form Tool and one of the university survey platforms for the semester Mac 2021 to October 2021.

C. Research Procedures

The Mac 2021 semester through October 2021 is the first batch of students who's introduced the Electric Circuit course as a new cohort with the Engineering Technology Accreditation Council (ETAC). ETAC is the recognized accreditation body for engineering programs offered in Malaysia. This new accreditation introduces further elements of practical and technical work into the diploma program. However, due to the pandemic, a new course assessment plan needs to be revised that is compatible with the current situation and constraints. In this regard, a new course assessment plan has been established that increases the percentage of two (2) tests as a replacement for the final exam contribution. Nevertheless, the practical session which includes laboratory work and practical test for this course, remains with the idea initiative by using Electronics Tool Kits and implementing lab work from ODL as shown in Figure 6. Table 1 shows the comparison of the previous assessment design accreditation by Malaysia Qualification Register (MQA), the current assessment design accreditation by ETAC (face to face) and during ODL.

Table 1

Comparison of MQA, ETAC (face to face) and ETAC (ODL) Course Assessment Plan

ASSESSMENT	MQA	ETAC(F2F)	ETAC(ODL)
Tests	20 %	20 %	70 %
Practical Work	-	20 %	20 %
Practical Test	10 %	10 %	10 %
Assignment	10 %	-	-
Final Exam	60 %	50 %	-

Analysis and Results

The survey for the Electric Circuits course was conducted in two stages. The first stage occurs at the beginning of the semester, while the second stage occurs at the end of the semester. Figure 2 shows the outcome of the feedback on the acceptance of the ODL concept by the students for their understanding of the course topic. 63 % disagree that this course should be delivered via ODL. This is because the students feel more comfortable with face-to-face learning sessions, particularly lectures, which are supposed to be active and interactive. Other than that, students also having difficulties by implementing ODL. The outcome of the measurement of the student's difficulty factor during the deployment of ODL is depicted in Figure 3. According to the results, internet connection is the biggest challenge which is 38% of the difficulty, followed by the difficulty of understanding the topic, 28%, the interaction with the lecturer which is 19%, the lack of focus which is 10%, and an inconducive environment that accounts for 5%.

The survey of the students' acceptance and ability to purchase electronics toolkits is shown in Figure 4 and 5 respectively. Almost all student with 98.9% agreed that the use of the Electronics Tool Kit can help to improve the understanding of Electric Circuit Course and 95.8% of the student able to purchase that Electronics Tool Kit. Figure 6 shows student implementing lab work through ODL by using their own that Electronics Tool Kit.

Figure 7 illustrates the students' comprehension of each topic. The survey was conducted in the early and at the end of the semester. Throughout the first semester, the majority of their knowledge is below 1.5 on a 5-point scale. By the end of the semester, their comprehension had grown to a level more than 4, with the highest scale being 4.3 for the fundamental concept, 4.2 for Kirchhoff's law and the divider rule, and 4.1 for mesh, nodal analysis, source transformation, and capacitor inductor. However, according to the study, the Thevenin/Norton theorem and Magnetic Circuit topic receive the lowest rating of 4, respectively. In general, their understanding is on a good scale which is 4 out of 5.

The lecturer professionalism survey was also conducted at the end of the semester for five lecturers who taught this course as shown in Figure 8.: It shows that all lecturers achieve very good results of over 80%. Guidance and accessibility are the student's excellent performance rate, which is over 90%. However, the English delivery is on the lowest scale, but still in the very good delivery performance.

Figure 9 depicts the end-of-semester survey of teaching activities. The survey covers feedback on course content, course outcomes, teaching planning, active learning, feedback on each assessment and enjoyable teaching activities. According to the student evaluations, all lecturers convey the course content with an excellent 90% as well as the course outcomes with 89.7%. Students rated the explanation method of assessment, teaching planning, feedback of assessment and, student active involvement in teaching and learning at 88% and above. The enjoyment during ODL is rated at 87.3%. Overall, all the performance of the teaching activities are at a very good level.

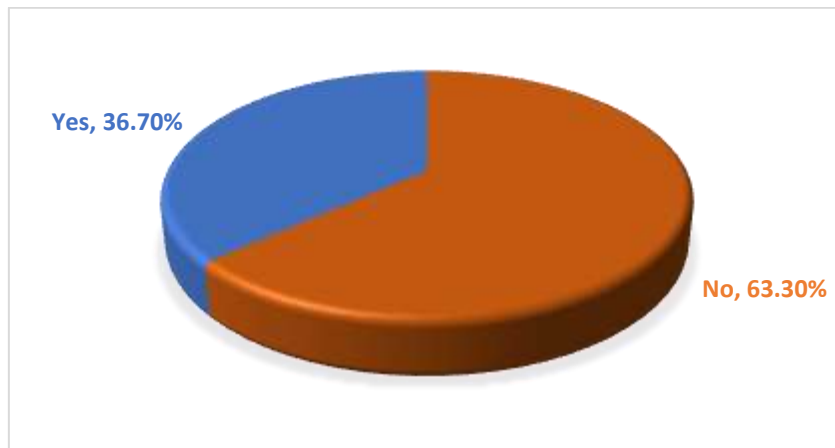


Figure 2: Is this ODL concept effective for you to understand the topics in the Electric Course?

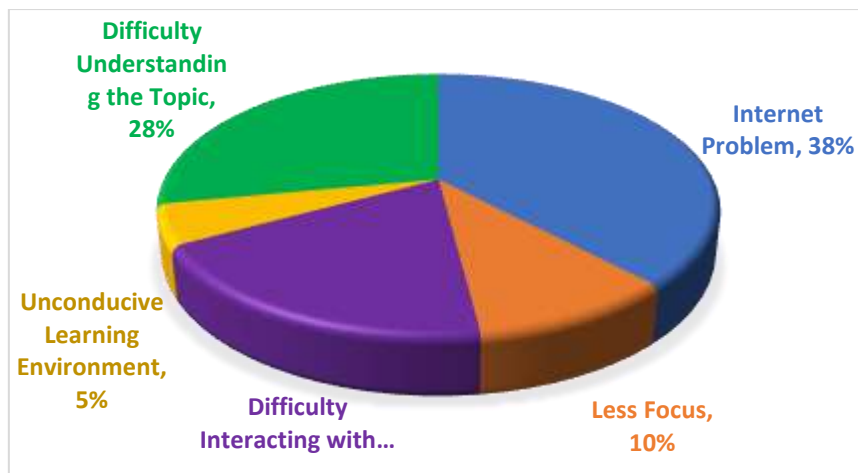


Figure 3: State your difficulties on this ODL session

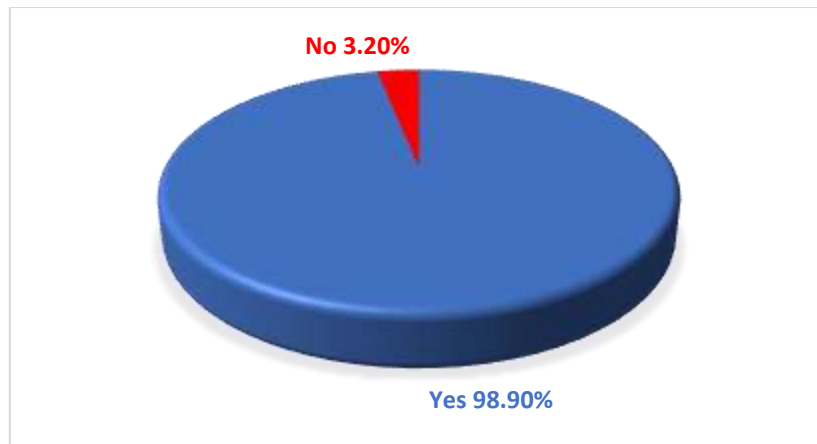


Figure 4: Do you agree that the use of the Electronics Tool Kit can help to improve the understanding of Electric Circuit Course by ODL?

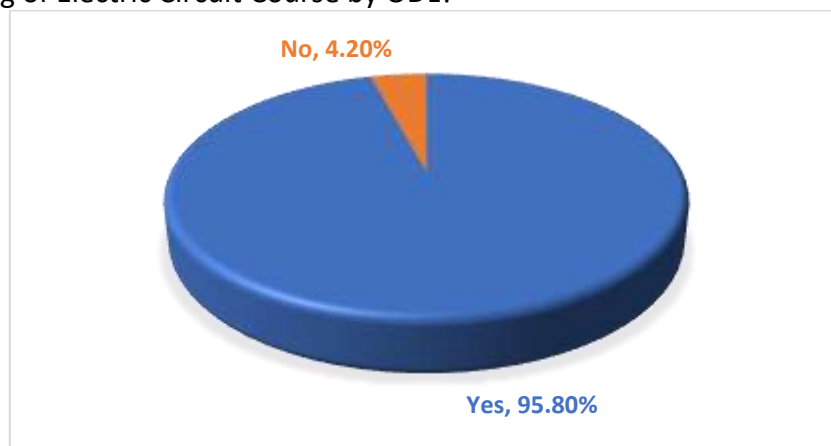


Figure 5: Can you afford the cost of purchasing an Electronics Tool Kit?



Figure 6: Student doing practical work through ODL

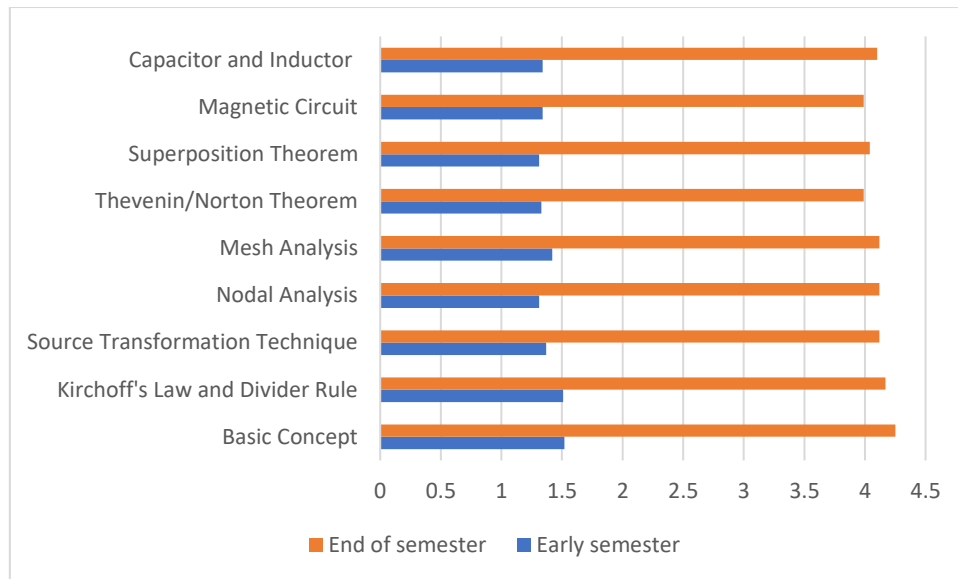


Figure 7: Understanding of Topics

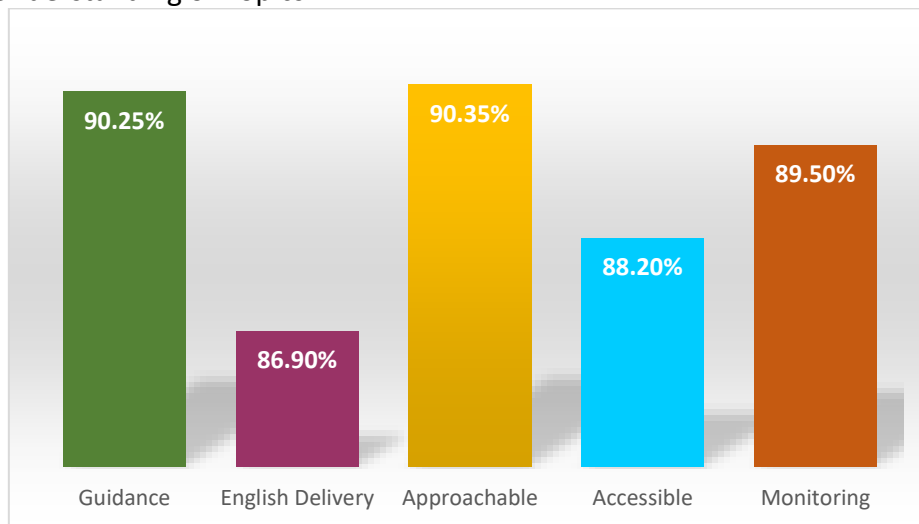


Figure 8: Lecturer Professionalism

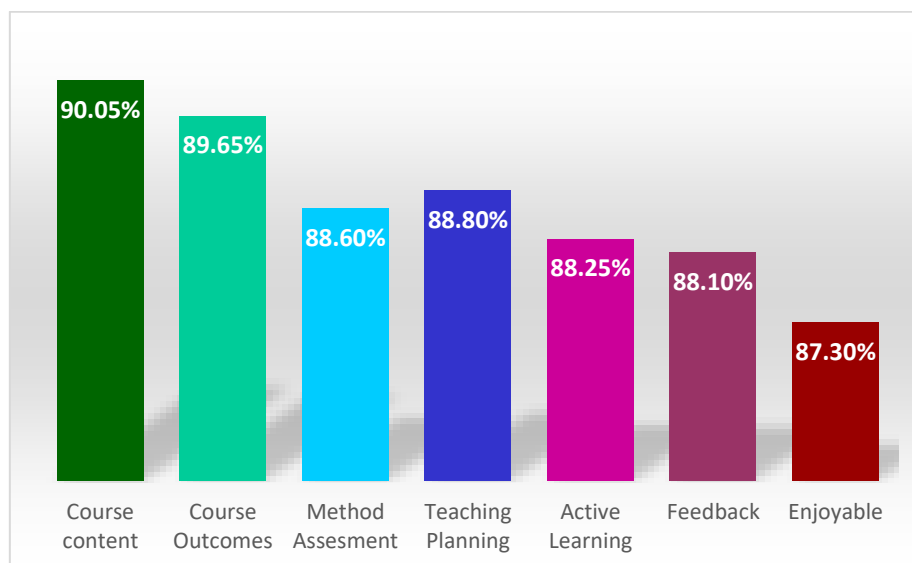


Figure 9: Teaching and Learning Activities

Discussion

The sudden transition from the traditional to the ODL approach raised concerns among students and lecturers. Additionally, this batch of students is experiencing their first semester of ODL learning. Thus, a survey instrument was used to examine the ODL perspectives toward the Electric Circuit course in the early and end of the semester. The first instrument was designed to ascertain the effectiveness of the ODL idea in comprehension the Electric Circuit course. It is demonstrated that the students are initially oppose the ODL concept, particularly because this course is the toughest course in the Electrical Engineering course and a prerequisite to many subjects. More than half of the students are looking forward to learning this course through the ODL process with a positive feeling. The students began to understand the new norm of the teaching and learning, which we could not escape due to the current pandemic situation.

On the list of issues encountered during the ODL, the highest problem is an internet connection. During the synchronous session which is a live lecture of presentation, the information is lagging and sometimes the connection is disconnected. As a result, the lecturers are taking an initiative to prepare recordings of lectures that can make available to the student. Besides, due to the limited communication in the online session, the students also have difficulty understanding the topic. Students also have a problem with focus, as most of the family stays in the house during the Covid-19 pandemic and some of them fall into the B40 category (lower income group) which not having a proper study area for them to focus on the teaching and learning session.

In order to improve their technical and practical understanding, as well as their learning outcome, the students agreed to implement practical work using ODL rather than simulation work. They acknowledge by practical work; they will more understand the concept of the electric. For students experiencing financial difficulties, the lecturer has taken the effort to provide them with an Electronics Tool Kit. Figure 6 shows the students' real practical ODL concepts at home using the Electronics Tool Kit to improve their understanding and skills of this course. Overall, the practical works are successfully implemented, and the student enjoys the learning activities.

The survey for the understanding of the topic in this course has been implemented at early of the semester and at the end of the semester. At the early of the semester, most of the students rated themselves on a scale below 1.5 for each topic. They failed to determine the concept of every method and theorem for solving resistive, magnetic and reactive circuits in direct and alternating current. This is because all the students have no basic in electrical engineering. Meanwhile, at the end of the semester, the individual student understanding of all topics is rated with a minimum of 4 out of 5. The best understanding of the topics applies to the basic concept, Kirchhoff's law and divider rule. Students can define the basic concept of charge, current, voltage, circuit elements, power and energy as well as define Kirchhoff's Laws and analyze the electric circuit very well using the laws. However, the Thevenin / Norton Theorem and the topic Magnetic Circuit received the lowest ratings. This rating reflects the Test 2 results which most of the students were not very good at answering the question on the subject.

For the professionalism of the lecturer, the feedback from the students towards lecturer guidance and approachability is the highest percentage with 90.3% and 90.4%. These proven lecturers are always ready to offer the students academic and approachable. Typically, students will contact the lecturer via WhatsApp, either individually or through the course group, to ask a question. Lecturer were also available for discussion, and were ready to give

an additional class to assist the student. In terms of monitoring, the lecturers also monitor the performance and achievement of the students for each test. Students who do poorly on Test 1 are guided by the lecturer and inspired to improve on Test 2. The student feedback on English usage during ODL lectures is 86.9 %. This is because some explanations are given in Malay during the lecture on ODL to help the students to better understand.

Beside the teaching activities, others activities has been conducted in this course. The survey has been implemented to know the delivery of the course content, outcomes of the course, method of the assessment, the involvement of student in learning process. Based on the survey, mostly student satisfied with more than 87%. Overall, student enjoyed the teaching style of the lectures and interested to this course. This is proven that 93% of the student passed on this course and balance 7% is failed.

As ODL is expected to be performed next semester, in order to improve performance in this topic and attain a 100% pass rate, a hybrid class will be proposed for next semester. A hybrid class combines traditional face-to-face learning in the classroom with online learning that students complete outside of the classroom. With the implementation of hybrid mode, students will attend the class to conduct practical sessions and lectures on selected topics in which the majority of students are weak and others lectures will be conducting through ODL. This implementation will accomplish learning outcomes while adhering to the Ministry of Higher Education's guidelines in limiting the presence of students on campus at one time.

Conclusion

This paper examined the impressions of students faced with the ODL approach when a new course with ETAC requirement was first introduced at Faculty of Electrical Engineering of Universiti Teknologi MARA, Malaysia. The survey was conducted at the early of the semester to observe their first impressions and the results were expected as they reject the ODL approach and expect the lowest level of understanding of all topics, knowing that Electric Circuit is a tough course. However, the survey at the end of the semester shows a significant improvement for each topic of the course as they are enjoyed with different approaches from the lecturers who are well prepared to ensure their students have a better understanding. The implementation of hands-on work with electronic ODL toolkits and excellent communications between students and lecturers improve the technical and practical understanding. Finally, the analysis obtained in this study will be linked to the decision-making performance of the students in future studies on the effectiveness of the ODL method.

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