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Students' Perceptions and Performance on ODL Implementation in Computer Programming Course During Covid-19 Pandemic

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Abstract : This paper assesses students' perceptions and performance in Computer Programming (ECE431) course offered in the Universiti Teknologi MARA (UiTM) Malaysia, using Online Distance Learning (ODL) as a new delivery method during Covid-19 pandemic. ODL was conducted beginning Week 5 of the semester, hence there is a need to investigate the students' acceptance and performance. 53 second year Electrical Engineering undergraduates participated in the assessment. The student's acceptance on the ODL approach was evaluated twice through survey while the performance of the students was evaluated based on Course Outcome (COs) attainment and student's grade. Approximately 50% of the students were struggling to adapt to ODL during initial stage. The percentage of students adapting to ODL increased to nearly 80% at the end of the semester as they have familiarized with the delivery method. Average score for COs attainment and students' grade were compared with face-to-face classes. The results showed a 24.1% improvement in CO1, as evaluated from quizzes and assignments, as well as reductions in CO2 by 2.6% and CO3 by 11.7% through miniprojects. This is attributed to the programming skills as they are away from lecturers and classmates, which often guide them on miniproject's codes. This study suggests that the changes of teaching and learning approach to ODL did not affect the students' performance.

Keywords : Computer programming, distance learning, e-learning, ODL, online learning.

1. Introduction

The Malaysian government enacted a Movement Control Order (MCO) on March 18, 2020, as a result of the rising number of Covid-19 cases around the world, particularly in Malaysia. Almost all economic operations were prohibited, with the exception of necessities. On May 4, 2020, the Malaysian government loosened the lockdown regulations by implementing Conditional MCO (CMCO), which permitted some commercial sectors to restart operations. The government made concessions by allowing the majority of the economy to resume operations on May 4, 2020, while universities and colleges remained shut. The Covid-19 epidemic and the ensuing MCO imposed by the Malaysian government have had a significant influence on Malaysia's higher education system. When MCO was

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implemented, universities had to make the transition to online instruction (Choong Pui Yee, 2020), and in less than a month, the conventional classroom environment was replaced with online lectures to ensure the continuation of education (Chung et al., 2020).

Full online learning implementation presents a number of difficulties, particularly for the Information and Communication Technology (ICT) infrastructure. Not all students have easy access to the Internet or the laptops, desktop computers, or tablets that allow enrolling in online classes possible. In addition, the location affects the Internet's coverage and speed. In the end, it's possible that some students, especially those who reside in remote regions, lack access to the Internet and the necessary ICT equipment. These students face a significant possibility of lagging behind if classes are taught solely online. More suffering will be experienced by students from less fortunate homes. Their difficulties include the absence of resources like printers, books, and a comfortable environment for studying, in addition to the ICT facilities. Family obligations may also be a source of distraction for some pupils. For every activity related to learning and instruction during the MCO, Universiti Teknologi MARA implemented the ODL approach as a result of that scenario (Samat et al., 2020). Since all students live in their hometowns and they learn at different times, across various locations, and using various technological devices, lecturers may use a variety of teaching methods in addition to online learning depending on the accessibility of their students (Krull & Duart, 2019). In addition, a survey was conducted to assess the preparedness, participation and needs of student for continuous improvement purpose regarding ODL behavior (Lee & Isa, 2024). However, conducting learning activities using ICT resulted better performance result especially in Computer Programming subjects (Patil & Kale, 2019).

Additionally, even though a blended learning strategy has been used, the quality of teaching is still impaired because the majority of the educational activities were previously carried out face-to-face. Tutorials and laboratory sessions are essential for students to enhance their understanding on subject matters discuss in the lecture earlier through exercises discussion, presentation, sharing of ideas as well as hands-on experience through practical activities. Furthermore, it is the moment when lecturers can accurately assess the performance of their students. However, as students will no longer be able to enjoy the interaction in the classrooms, the level of engagement and freedom that can be achieved in the classrooms will probably be missed (Niemi & Kousa, 2020). Additionally, it can be challenging for students to raise inquiries in an unobtrusive manner while in a face-to-face setting, where everyone can see each other's body language and make eye contact, studying from peers' perspectives is difficult to achieve (Choong Pui Yee, 2020). The challenges discussed earlier not only affected the performance of students. Students might be demotivated and stress with the problems that occur during the semester. According to Koper (2015), not all students are prepared for independent and self-paced learning. While the majority of students would instead learn at their own pace, many others find an organized learning setting more comfortable (Boz & Adnan, 2017; Broadbent & Poon, 2015). Students who study online also need to be distinct, self-contained, self-managed individuals who take accountability for their studies and actively participate in their educational journey. According to Rizvi's study (2020), students were reluctant to venture outside of what they were used to or to explore something new. Even though adaptation is essential, the students are still hesitant to try out new learning environments.

Computer Programming with the course code of ECE431 is a core course taken by the second-year students of the bachelor's degree in Electrical Engineering in the School of Electrical Engineering, Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia. This course focuses on C++ Programming and brief introduction on Object Oriented Programming (OOP). It is conducted in 2 hours lecture and 2 hours laboratory session in a week for 14 weeks. The hands-on experiences during the laboratory session help the students to appreciate the art of writing the program and apply the program to solve certain engineering problems (Paula et al., 2022). However, students have skipped the practical exercise thru face-to-face methods as a result of the MCO and the ODL strategy implemented by the institution. According to Arulogun et al. (2020), ODL students heavily depend on the application of ICT technologies for online assistance and other learning-supporting activities. Thus, before the ODL teaching and learning activities were carried out, an initial survey to evaluate the ICT facilities among the students were done. Based on the survey, it is found that all students have Internet access but some of them have limited bandwidth. When lectures and tutorial

sessions have been recorded for teaching and learning activities, an asynchronous mode is employed (T. Almpanis and P. Joseph-Richard, 2022). All videos were uploaded onto the Internet which did not consume higher bandwidth as compared to real time video conferencing or synchronous mode.

This paper systematically investigates the perceptions of 53 students enrolled in an Online Distance Learning (ODL) course, where the instructor, also the first author, played a pivotal role. The primary objectives are twofold: first, to gauge students' perspectives through a structured online survey, and second, to assess their academic performance by comparing Course Outcomes (COs) and grades with a comparable group from the previous year who underwent traditional face-to-face instruction by the same lecturer. The research aims to clarify the specific challenges and advantages inherent in ODL as perceived by students, providing insights into both the pedagogical and experiential aspects of this mode of education. By systematically analyzing COs and grades, the study also seeks to draw meaningful comparisons between ODL and traditional learning environments, shedding light on potential differences in academic outcomes. The rest of the paper is organized as follows. Section 2 deliberates on ODL while Section 3 dwells on the methodology of the study. Then, the findings of the study are discussed in Section 4. Finally, Section 5 provides the conclusion and recommendation to improve students' adaption to the new teaching method.

2. Open And Distance Learning (odl)

ODL was formed over 30 years early to meet the academic requirements of people who lack the time or accessibility to regularly attend in-person lectures, such as parents, people who are employed or in other paid jobs, and others (Galeon et al., 2019). Postal services were initially used to execute ODL; this was followed by radio and television; it transitioned to digital with computer-assisted practices, and at this point, the Internet and emerging technologies are driving this process' ongoing development (Donmez & Hakan, 2019). No matter where a student lives or works, ODL, especially online learning, has made education more accessible (Kumar et al., 2017; Larmuseau et al., 2019; Zhu et al., 2020). Massive Open Online Courses (MOOCs), an online-based educational tool that makes benefit from the use of internet-based open-access educational materials, have been developed as a result of the growing use of digital learning in modern academic institutions (Ghazali et al., 2020). As of 2018, 81 million students were enrolled in 9,400 MOOCs at more than 800 universities worldwide, pushing the limits of conventional education, according to Shah (2018). Therefore, it can be claimed that ODL is neither a teaching and learning method that spontaneously evolved nor is it a product of improvements in technology for communication and information alone (Donmez & Hakan, 2019). In India, National Education Policy (NEP) 2020 is the latest evolution of the Indian Education System built on the foundational pillars of Access, Equity, Quality, Affordability and Accountability. The NEP focuses on providing quality education to all students, irrespective of their socio-economic background or place of residence, thus cultivating the youths of tomorrow into moral and civil citizens leading to the development of the nation. Dustker et al. (2022) showcase the learning outcomes and scope of service-learning as a pedagogy to accomplish the objectives of NEP 2020.

A study has been carried out to assess the effectiveness of assignments when submitted manually to the teachers as opposed to submission through an E-Learning facility like Google Classroom and the results show overwhelming success when this activity was carried out with the help of technology. By incorporating technology in classroom learning, diverse ways of leveraging it in the classroom, its benefits and a few relevant issues (Bhat et al., 2018).

The surveys conducted by Hung Vuong University in Vietnam implementing e-learning based on the appearance of Covid-19 leads to surprise and unexpected successes. The experimental results conducted by 508 surveys on students and 62 surveys on lecturers includes (1) The interaction of students when using MS Teams; (2) The feedback from students when using HVU LMS; and (3) The habits of the lecturers when using elearning tools verify the reached goal of the e-learning implementation of HVU (Cong & Hung, 2024).

Ilonga et al. (2020) investigated the difficulties that students faced at a chosen remote institution in Namibia when using online and remote learning modes. The issues can be divided into three categories based on the findings: IT-related, lecturer-time-related, and institution-related. Uncertain systems that contain insufficient or false information, such as enrolled courses and grades, are to blame for IT-

related problems. The research also discovered that students had difficulty accessing technology, notably the Internet, especially if they lived in remote or rural locations without electricity.

Statistical analysis was conducted by Alamayrah etal. (2022) to determine the level of satisfaction of students and testify how far the E-learning process was successful as compared with conventional classroom learning. It was concluded that students were not comfortable with this first experience related to online teaching, especially when it comes to specialized technical and practical courses as well as labs. Moreover, they faced serious problems in following up online lectures. This could be attributed to the fact that this is the 1st experience on distance learning and weakness in existing facilities and lack of awareness among students as well as staff members.

The majority of participants stated that inadequate Internet connectivity made it difficult for them to access their portals. Despite the fact that the university provided Internet SIM cards with monthly data loads, the connectivity was unstable, making it difficult for students to post their assignments to the portal. As a result, they frequently missed assessments online or turned in late projects. Since students are unable to make any interventions since they did not receive the marked assessment promptly, lecturer time issues mostly revolve around the delay in marking the assessment, which results in low final coursework grades. Confusion, fear, and irritation were also felt by the students as a result of their lecturer's failure to provide fast and clear feedback. Students also believe that their studies suffered from the lecturer's lack of face-to-face interaction. Finally, the institutional-related challenges are related to inefficiency of the administrative office in dealing with the academic matters such as the students need to get the materials from the campus but the materials are limited thus some of them cannot get the original materials from the institution.

Aydin et al. (2019) conducted research on the causes of ODL student dropout in a Turkish university. It was observed that causes relating to time management were impacted by growing duties in both work and family life. Due to obligations at home and family issues, several students were forced to postpone their studies. As a result, they were unable to set aside sufficient time for studying because they needed to focus more on family issues. System-related factors are another cause of student dropout. Lack of system understanding is one of the most significant factors influencing students' decisions to leave the system. Students admitted that they lacked knowledge about program content, job prospects, course waivers, and educational materials. To enhance the design of online courses, maximize student learning, and maximize the range and complexity of learning on such courses, it is necessary to continuously investigate students' perspectives of online learning (Skordis-Worrall & Haghparast-Bidgoli, 2015). The demands of educating students to become self-regulated students, which is more pertinent to the ODL learning environment, are studied by Garip et al. (2020) in order to attain this.

Kalkhambkar & Gaikwad (2022) conducted an online survey of 150 engineering faculties of various branches in Shivaji University, India about the various issues of e-learning. The work addresses the educational, personal and social impacts of online education on faculties and provides valuable suggestions for the long-term implementation of the offline-online mode. The findings and lessons learned through this work will be useful for the engineering faculties to further enhance the e-learning platform and address the various questions.

The technological challenge of providing multimedia information over diverse wired or wireless networks is in addition to the students' behaviour and impressions of ODL that are being examined. This is a result of various network connectivity in the study areas of the students as well as the need to conform to various platforms and end devices including desktops, laptops, tablets, and smartphones (Megliola M., Sanguini R., 2015). The multimedia content of the teaching materials should be dynamically adapted to varies devices and network connectivity. Two delivery modes can be applied depending on the students' connectivity known as asynchronous mode such as recorded video and synchronous mode such as through video conferencing. For example, video quality should be adaptable to the different Internet bandwidth and device capabilities, keeping a video playing and allowing the students to learn in their own pace. The impact of segmented video on ODL students' cognitive load, satisfaction, engagement, and academic achievement levels was investigated by Altinpulluk et al. (2020). The results of the study suggest that educational videos that have been trimmed and segmented into smaller parts not only lessen the cognitive load on pupils but also boost their

levels of satisfaction. Students that used the split videos appeared to perform better on the test that was given to them. This result suggests that the test group that received videos broken up into smaller segments was more engaged with the videos they were given.

3. Methodology

This study was done to learn more about how undergraduate students perceived and performed during ODL sessions for a computer programming course. It was created as a descriptive case study to comprehend a real-life phenomenon and it accurately reflects 53 second-year electrical engineering students' acceptance and performance on the ODL through self-report. 53 students who took the course with the same lecturer were involved as participants of this study. The study was carried out at the School of Electrical Engineering, College of Engineering, Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia. Due to the Covid-19 pandemic and the MCO beginning 18 March 2020 as announced by the Malaysian Prime Minister, the university has decided to conduct the classes through ODL approach. A survey was initially conducted to identify the ICT facilities that the students are equipped with since students are no longer live in or around the campus with sufficient workstations and Internet connectivity. This survey was conducted to ensure that the ODL teaching and learning materials and activities are accessible by all students regardless of their location since the students are residing in their hometown following the MCO. The course Student Learning Time (SLT) and lesson plan were then redesigned due to the changes in the delivery method where previously the course was conducted in face-to-face manner. Table I provides the outline of the lesson plan for the ODL session which was started at Week 5 of the semester.

During the Open and Distance Learning (ODL) session, the pedagogical approach involved the strategic use of two primary platforms: the ECE431 Online Learning Center and Google Classroom. Fig. 1 provides a visual representation of the ECE431 Online Learning Center, a custom-made learning management system developed in-house by a collaborating lecturer, who is also the second author of this paper. This platform serves as a diverse repository encompassing essential educational components, including lecture notes, diverse exercises, tutorial queries, mini project specifications, and an online testing platform. In addition, Intelligent Tutoring

Table 1 :
Lesson Plan For Online Distance Learning (ODL) Session

Week	Topic	Activity	Platform
5	Revisions	Tutorial	ECE431 Online Learning Center
		Quiz 1 and 2	Google Classroom
		Assignment 1	Google Classroom
	Functions	Notes and Exercises	ECE431 Online Learning Center
6	Functions	Tutorial	ECE431 Online Learning Center
	Functions	Quiz 3	Google Classroom
	Pointers and Alias	Watch Video Lecture on Pointers 1, 2 and 3	Google Classroom
		Notes and Exercises	ECE431 Online Learning Center
		Assignment 2	Google Classroom
7	Pointers and Alias	Tutorial	ECE431 Online Learning Center
		Quiz 4	Google Classroom
	Arrays	Watch Video Lecture on Arrays 1 and 2	Google Classroom
		Notes and Exercises	ECE431 Online Learning Center
		Watch Video Lecture on Arrays 3	Google Classroom

Week	Topic	Activity	Platform
8	Arrays	Notes and Exercises	ECE431 Online Learning Center and Google Classroom
		Tutorial	ECE431 Online Learning Center
		Watch Video Lecture on Arrays 4 and 5	Google Classroom
9		Test	ECE431 Online Learning Center
	Array	Tutorial	ECE431 Online Learning Center
		Release of miniproject question and guideline	ECE431 Online Learning Center
	File Processing	Watch Video Lecture on File Processing	Google Classroom
		Notes, Exercises and Tutorial	ECE431 Online Learning Center
10	Array and File Processing	Quiz 5	Google Classroom
	Structure	Watch Video Lecture on Structure	Google Classroom
		Notes, Exercises, Tutorial	ECE431 Online Learning Center
		Students need to upload Week 10 miniproject progress report	ECE431 Online Learning Center
11	Structure	Tutorial	ECE431 Online Learning Center
		Students need to upload Week 11 miniproject progress report	ECE431 Online Learning Center
12	Structure	Tutorial	ECE431 Online Learning Center
	Object Oriented Programming (OOP)	Watch Video on Object Oriented Programming (OOP) 1	Google Classroom
		Notes and Exercises	ECE431 Online Learning Center
		Students need to upload Week 12 miniproject progress report	ECE431 Online Learning Center
13	Object Oriented Programming (OOP)	Tutorial	ECE431 Online Learning Center
		Watch Video on Object Oriented Programming (OOP) 2 and Polymorphism	Google Classroom
		Students need to upload Week 13 miniproject progress report	ECE431 Online Learning Center
14	Mini Project	Miniproject Coding Submission	ECE431 Online Learning Center
		Miniproject Report Submission	Google Classroom
17	Mini Project	Miniproject demonstration Submission	Google Classroom

Systems (ITSs) can fit according to the necessity of an individual learner. In Kaliwal & Deshpande (2021), their work on an assessment of the knowledge level of a learner, the ITS system has incorporated the uncertainty factors of Success and Failure with the help of Bayes' rule and has found promising results that take into account the possibility of Success or Failure.

The ECE431 Online Learning Center's distinctive feature lies in its randomized assignment mechanism for tutorial questions, mini project prompts, and test items. This approach ensures that each student is presented with a unique set of inquiries, mitigating the possibility of redundancy within the cohort. The platform's capacity for dynamic content delivery, owing to its internally developed nature, allows for a tailored learning experience catering to individualized student needs.

Furthermore, the variety of supplementary course materials, comprising lecture slides, instructional videos, tutorial discussion recordings, specialized exercises, quizzes, and assignments, were meticulously curated by the instructor. These materials were systematically uploaded onto the Google Classroom platform, as depicted in Fig. 2. The Google Classroom integration extends the educational ecosystem by providing a collaborative space for real-time interactions, document sharing, and assignment submissions, thus enhancing the overall pedagogical framework of the ODL session. This dual-platform strategy not only diversifies the learning resources available to students but also encourages an enriched and interactive virtual learning environment.

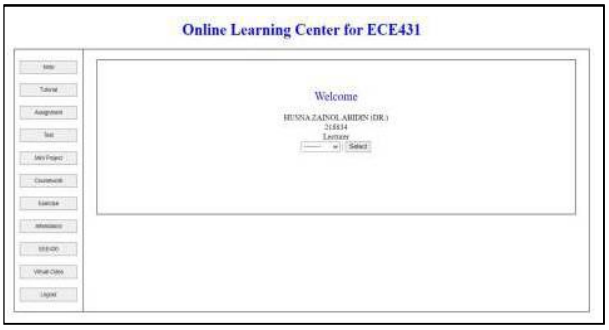

Fig. 1 : Online Learning Center for Main Course Material Platform in ODL Session

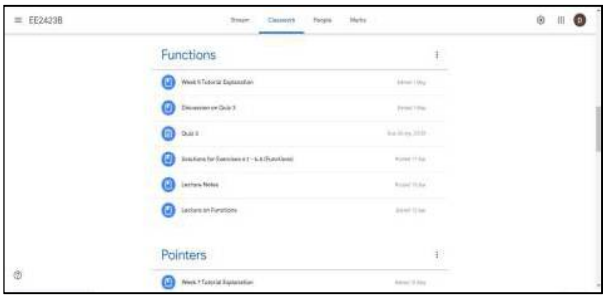

Fig. 2 : Google Classroom for Secondary Course Material Platform in ODL Session

The ODL session for this course was conducted in asynchronous mode where the students are provided with the short videos to accommodate the different Internet connectivity level among the students. The implemented asynchronous mode does not consume higher bandwidth since the videos are chunked into smaller parts as illustrated in Fig. 3. The students can play the videos at their own pace as compared to synchronous mode through video conferencing. Students were able to access the online course content, such as videos, discussions, and others repeatedly. This has benefited the students as it allows them to access the lessons more than once and at any time. However, a video conferencing session was also carried out twice due to the request by the students in order to enhance their understanding on certain topics as shown in Fig. 4. The video conferencing session which was done via Cisco Webex were recorded so that those students who are unable to join the video conferencing session could watch it offline.

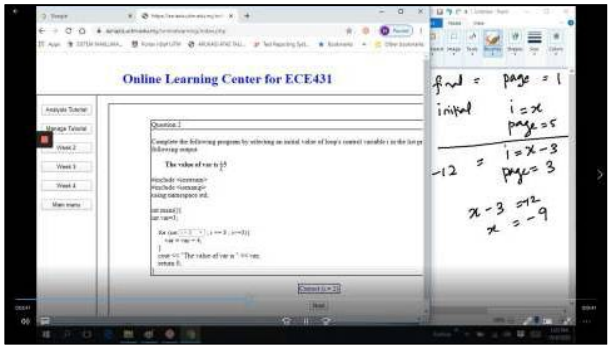

Fig. 3 : Screenshots from the Video Lecturer's Learning Session.

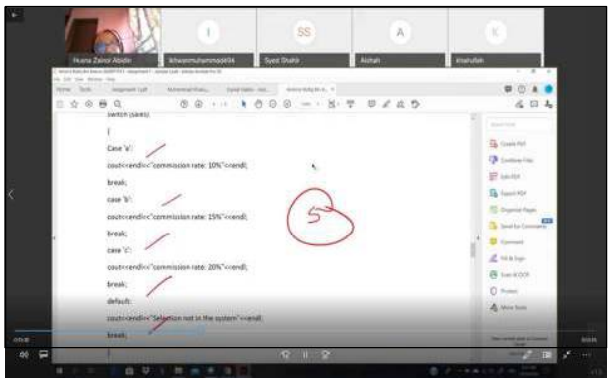

Fig. 4 : Live Video Conferencing through Cisco Webex

This study was participated by 53 second year students enrolling the Computer Programming course or better known ECE431 as part of their four-year Electrical Engineering bachelor's degree program.

These students are taking the course with the same lecturer of which they had gone through the same teaching style. This course introduces students with C++ programming language and fundamental of Object-Oriented Programming. The measurement of this study is divided into two parts; the students' acceptance and students' performance. The students' acceptance on the ODL approach was evaluated twice which is in Week 6 i.e., after 1 week of ODL implementation and in Week 14 which is the final week of the semester. Students' acceptance was evaluated by using an online survey. The same set of survey questions were distributed twice through Google Form in Week 6 and Week 14. The polls used a five-point Likert scale with values ranging from Strongly Disagree (1) to Strongly Agree (5) and multiple-choice questions. The survey also includes two open-ended questions at the end. The survey questions are as follows:

- The ODL approaches applied in this course has enhanced my learning ability;
- The contents of the ODL teaching materials are presented in an organized manner;
- The ODL teaching materials shared are sufficient;
- The assessments provided are suitable for the given duration;
- The ODL method that suits me are: (you may choose more than 1 method);
- ODL material(s) that you like the most: (you may choose more than 1 material);
- Please state the challenges/problems that you faced during the first week of ODL implementation in ECE431; and
- Please suggest any improvement that can be made in order to improve the ODL implementation in ECE431.

The performance of the students was evaluated in terms of the Course Outcomes (COs) attainment and students' grade. COs are statements of what a student should be able to demonstrate upon completion of a course that are measurable and achievable and are based on Bloom's Taxonomy (Kulkarni & Barot, 2019).

4. Results And Discussions

This section begins with the finding on initial study conducted to evaluate the students' ICT facility. The survey results are then discussed in detail to determine how the students feel about the application of ODL in the course, and COs attainment and the students' grade are then shown to demonstrate the students' performance.

A. Initial Study

The study begins with the outcomes of the survey on ICT facilities equipped by the students which is required for the students to answer. 100% respondents of 53 students had answered the survey prior to ODL implementation in the course during the MCO.

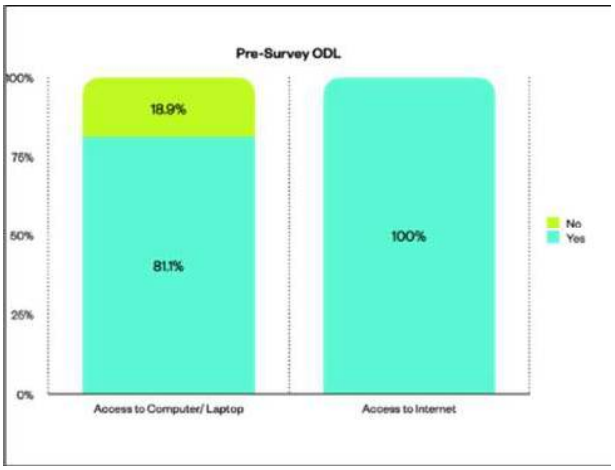

Fig. 5 : Student Access to a Computer / Laptop

Computer or laptop is an essential device in learning Computer Programming. Thus, each student is expected to have access to a computer or laptop for them to write programs for their exercises and assessments. As depicted in Figure 5, a notable 81% of the students enjoy access to a computer or laptop, whether it be their personal device, or one borrowed from family members. This prevalence can be attributed to some students relying on the computers generously provided by the university within the computer laboratory during their tenure on campus. For those students who currently lack direct access to a computer or laptop, a viable alternative involves utilizing their smartphones for programming tasks. The resulting programs can then be executed using online compilers. Looking ahead, it is anticipated that post the upliftment of the Movement Control Order (MCO), students without personal computing

resources will have the option to conveniently access computers, whether it be at nearby cybercafés, libraries, or resource centers. In the contemporary landscape of Open and Distance Learning (ODL), one of the pivotal elements is ensuring reliable internet connections. The guidelines outlined by the university for ODL activities during the MCO underscore that if students find themselves without internet coverage, instructors are expected to adeptly deliver teaching and learning materials through alternative communication mediums. Analyzing the data presented in Figure 5, it is evident that every student in this class enjoys internet access, irrespective of speed and bandwidth limitations. Consequently, all teaching and learning activities are seamlessly conducted online.

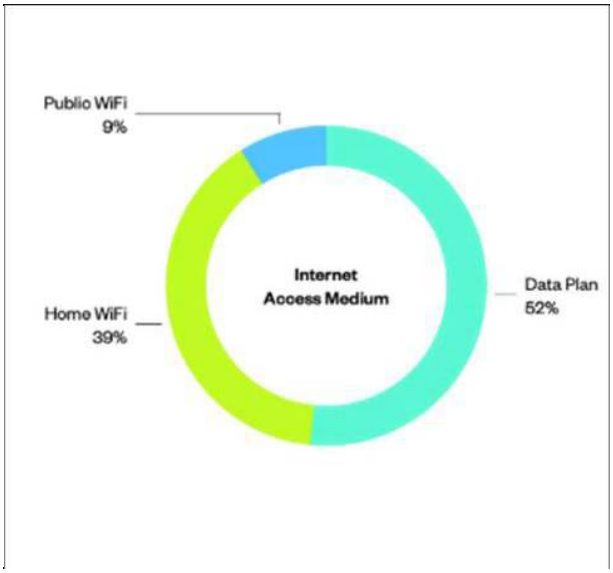

Fig. 6 : Student Access to an Internet

The type of online delivery is heavily influenced by the Internet connections and bandwidth available to the students. Analysis depicted in Figure 6 reveals that the majority of students utilized their mobile telephone data plans for Internet connectivity, followed by home Wi-Fi and public Wi-Fi. In addition, Norin et al. (2022) presented drawbacks of MS Teams in the learning process and solutions on how to eliminate them. Considering these findings, the implementation of Open and Distance Learning (ODL) activities was strategically conducted in an asynchronous mode. This approach minimizes the demand on higher bandwidth, allowing students to participate without incurring additional costs associated with data plans that have limited bandwidth. Typically, Wi-Fi connections offer unlimited downloadable bandwidth, making them favourable for online activities. However, due to restrictions imposed during the Movement Control Order (MCO), students were unable to access public Wi-Fi. Consequently, those without access to home Wi-Fi had to rely solely on their mobile data plans, emphasizing the importance of adopting bandwidth-efficient methods such as asynchronous learning to accommodate varying connectivity scenarios.

B. Comparison of Student's Feedback in Week 6 and 14

Students' perceptions on ODL implementation in Computer Programming course during the MCO is studied by comparing their feedback after one week of ODL which is in Week 6 and during Week 14 which is the final week of the semester. Number of respondents that answered the survey in Week 6 is 48 students representing 90.6% students of the group while in Week 14, 51 students answered the survey which is approximately 96.2% students of the group. The survey was distributed twice to see their perceptions during the early stage of the ODL implementation and the final stage of ODL implementation. It was envisaged that there will be difference in their acceptance since the ODL activities were carried out on ad hoc basis in the beginning which might affect the feedback since they need time to adapt with the new delivery method.

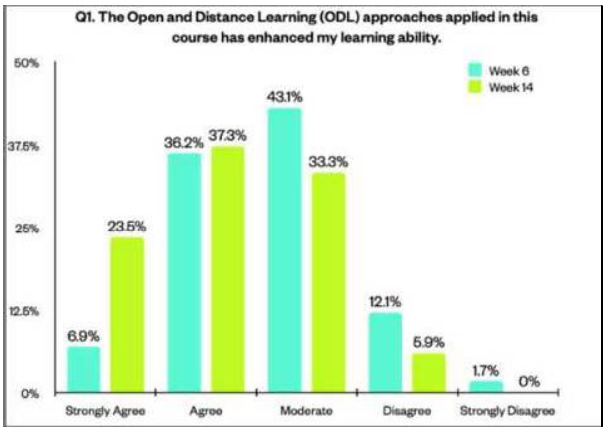

Fig. 7: Descriptive Results on Question 1

Fig. 7 depicts the students' feedback on whether the ODL approaches applied in the course has enhanced their learning ability or not. As can be seen, at the early stage of ODL, majority of students selected Moderate, Disagree and Strongly Disagree with 43.1%, 12.1% and 1.7% of students chose those scales respectively. It shows that the students were not comfortable with the new delivery method since they

must join the class from their hometown without any face-to-face interactions with the lecturer and peers. Only approximately 43% of the students agreed that the ODL approaches have enhanced their learning ability with 6.9% of them chose Strongly Agree and 36.2% chose Agree. The perception of students has changed significantly in Week 14 where 23.5% chose Strongly Agree and 37.3% students chose Agree while the percentage of students that chose Moderate, Disagree and Strongly Disagree has decreased dramatically. It shows that students were still adapting with the new ways of class at the beginning of the ODL implementation as compared to Week 14 where they already familiarized with the delivery methods.

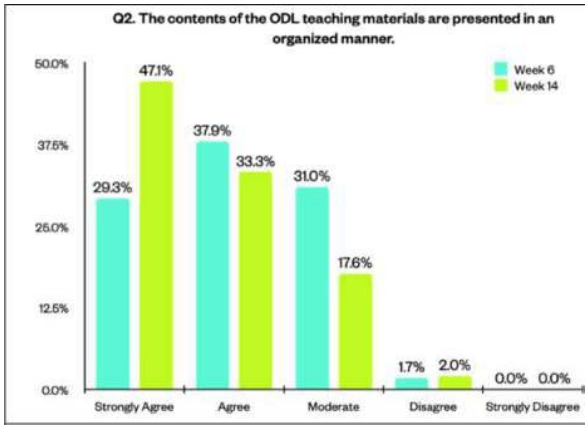

Fig. 8: Descriptive Results on Question 2

Descriptive results on the Question 2 of the survey are illustrated in Fig. 8. This question dwells with the teaching materials shared by the lecturer. In Week 6, 29.3% of students chose Strongly Agree followed by 37.9% students chose Agree. However, the percentage of students who chose Strongly Agree has increased tremendously to 47.1% which shows that there is an improvement in students' acceptance towards the online teaching materials although there is slight increment in the percentage of students who chose Disagree. This is due to the students were already familiarized with the materials and platforms used for ODL at the end of the semester as compared to Week 6 where most students were still trying to understand the different platforms used in the ODL.

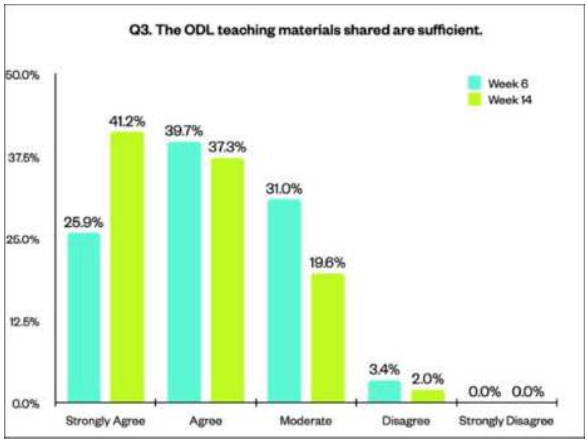

Fig. 9 : Descriptive Results on Question 3

Fig. 9 illustrates the descriptive results on the Question 3 of the survey which investigate the sufficiency of the ODL teaching materials. Based on the figure, in Week 6, 25.9% of students chose Strongly Agree and 39.7% chose Agree. This result shows that the students felt that the online teaching materials shared are sufficient. However, around 31% of students moderately felt that it is sufficient and 3.4% Disagree with that statement. The feedback given by students in Week 14 have shown an improvement where 41.2% of students Strongly Agree with the statement and there is reduction in percentage of students chose Moderate and Disagree which shows that once the students are familiar and comfortable with the delivery method, they felt that the materials shared are adequate for their understanding.

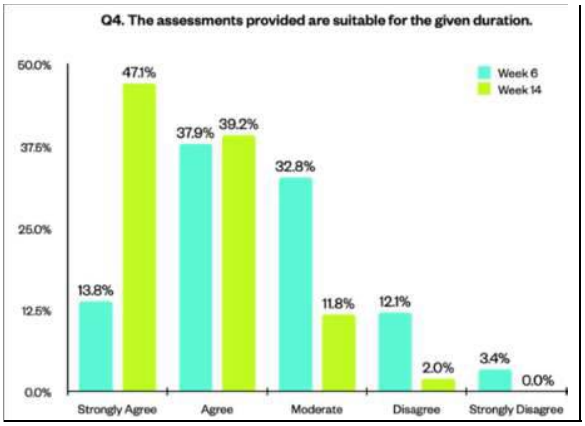

Fig. 10: Descriptive Results on Question 4

One of the challenges in ODL is the time management among the students. Since the students are at their own hometown and attend the classes virtually at their own time, it is important for them to manage the time wisely. Some of them are also helping their family in house chores as well as other responsibility particularly for those who are less-privileged and living in rural areas. As can be seen in Fig. 10, at the beginning of ODL implementation, only 32.8% of students moderately felt that the duration given for them to submit the assessments are sufficient while 12.1% and 3.4% students disagree and strongly disagree respectively. However, at the

end of the semester, it can be concluded that the students were able to manage their time juggling between family responsibilities and ODL classes. This is based on the results where 47.1% of the students strongly agree as compared to Week 6 which only 13.8% students strongly agree with the statement. Percentage of students who chose Agree has also shows slight increment by approximately 1.3% while there is reduction in Moderate, Disagree and Strongly Disagree scales.

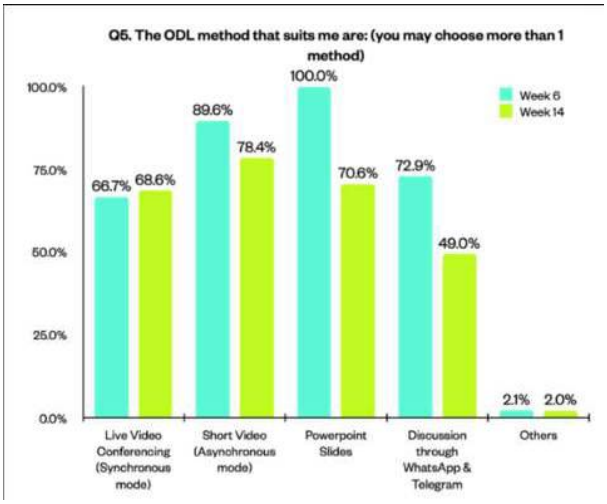

Fig. 11 : Descriptive Results on Question 5

Fig. 11 dwells on the method that the students felt suitable for them with the facilities that they have. In Week 6, the most suitable method for them is PowerPoint followed by short video and discussion through WhatsApp and Telegram applications. This is because most students are having limited data for their Internet connectivity, thus most of them felt that these are methods that are suitable to be used with that connectivity level. However, in Week 14, the top three suitable methods have changed to short video, PowerPoint slides and live video conferencing. It could be due to the students who are already comfortable with ODL delivery approach and able to learn independently thus they do not have to rely on discussion in the groups. This is also may be due to the live video conferencing that have been conducted twice to further discuss on any topics that they need further explanation. The government has loosened the MCO with the Conditional Movement Control Order (CMCO), which takes effect on May 4, 2020. Under the CMCO, the majority of economic sectors and activities are permitted to operate while adhering to a number of strict business standard operating procedures, such as social distancing and others (BERNAMA, 2020). Students believe that using live video conferencing in Week 14 is appropriate because they can get better internet coverage.

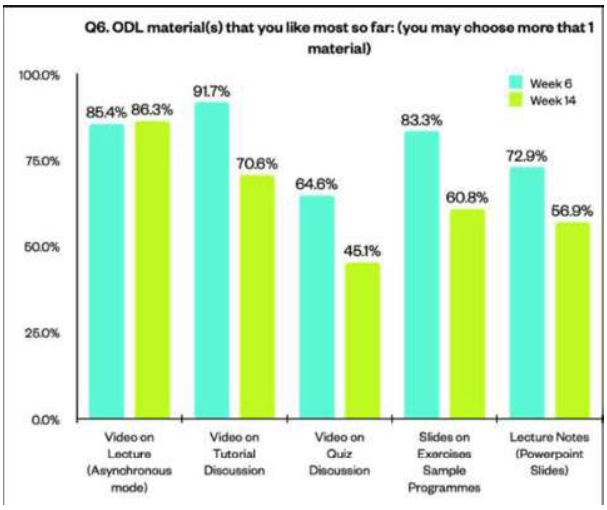

Fig. 12 : Descriptive Results on Question 6

Fig. 12 illustrates the most ODL materials that the student like the most. In Week 6 and Week 14, video on tutorial discussion, video on lecture and slides on exercises sample programs are the top three materials that the students like although there is some reduction in video on tutorial and quiz discussions. This demonstrates that students would rather take courses with recorded content because they can rewatch the material at their own convenience. This was further illustrated in Boz and Adnan's (2017) study where, despite their opposition to online learning, students regularly cited their ability to retake virtual lessons. Students instead highlighted the advantage of being able to watch or replay clips whenever and wherever they wished. Findings in Mali (2018) also shows that by the end of mid semester, most students felt that watching videos before lectures was a lot helpful. Most of them felt like being active part of the learning process and it helped them in catching up missing classes.

C. Responses on Challenges, Problems, and Suggestions for Improvement

Two open-ended questions were asked at the end of the survey form. The students were asked to comment on challenges or problems that they faced during the implementation of ODL in Question 7 while in Question 8, students were asked to suggest the improvement that could be made on ODL for this course. The responses given by students for Question 7 can be classified into five groups as tabulated in Table II.

Table 2 :
Student's Responses On Challenges And Problems

Challenges / Problems	Students' Responses
Technical problems	• Low Internet connection speed. • Unstable Internet connection. • Limited Internet data. • Video lagging and not sharp. • WiFi lagging. • No laptop. • Students with poor Internet coverage are affected especially during live video conference session as it will disturb the flow of the video and I can't understand at all what my lecturer is trying to explain about the topics. • Do not have access to laptop or personal computer, thus rely on smartphone. • Lack of equipment.
Need personal interaction	• Difficult to digest the content of the lecture without face-to-face interaction. • To learn by myself. • It is hard to refer if I did not understand some topics because I need to call or text my classmates and sometimes, they are not free, if in normal class, I can ask them directly since we are in the same room. • Challenge to adapt with ODL. • Just need some time to adjust with new learning with multiple subject. • Hard to understand some coding. • Difficult to understand certain topics. • Adapt with the new class environment. • Hard to adapt with the learning process. • Problem in to get used to the learning method. • Do not understand.
Feeling overwhelmed	• Need to alert with any announcement made by the lecturers. • Too many assignments at one time.
Inconducive environment	• I was not able to concentrate because of the distraction at home. • Hard for me to concentrate due to inconducive environment. • Noisy study environment.
Feeling demotivated	• Lack of motivation and abnormal student lifestyle. • Difficult to motivate myself to study.

Access to computers or specific apps, Internet access, a quick Internet connection, and technical support are all examples of technological issues (Boz & Adnan, 2017). Since students without a personal computer or Internet access must pay for Internet cafés unless universities provide computer labs for such students, the accessibility advantage of online learning may also be seen as a barrier (Boz & Adnan, 2017). Some of the students are staying in rural areas where the Internet coverage are not that wide with unstable connectivity due to geographical factor. As shown in Fig. 6, approximately 65% of students are relying on data plan which may have limited bandwidth while around 11% of students relying on public Wi-Fi. Students that encounter this problem are normally depending on Internet facilities and computers provided by the university while there are in campus. However, due to MCO, all students are residing in their hometown and it is difficult for the students to use public Wi-Fi due to limited movement. Thus, they must bear with the limited facilities that they have. Due to that reason, the lecture for this course was conducted on asynchronous mode. As this is a Computer Programming course, students without access to computer or laptop just used their smartphone to do exercises on writing C++ programs and utilize online based compiler to execute their program (Bergmann, 2021).

In general, students prefer to interact with their lecturers face-to-face in the classroom or during office hours. According to research by Boz and Adnan (2017), although on-campus students could personally see their lecturers outside of class hours, the absence of such interpersonal contact in virtual lectures is a significant disadvantage for students when it comes to online learning. Based on this, it can be concluded that text-only communication or even real-time chats in online classes do not feel like real communication. In addition, pupils struggle to learn alone when their peers are not around. According to Boz and Adnan (2017), their preference for a face-to-face learning environment is a result of their longstanding learning habits, which include the physical presence of a lecturer in the classroom teaching while students are writing notes, their lack of familiarity with technology, their incapability to effectively use a keyboard, and their stereotypes about using technology in a crucial course like calculus. As stated by Sohoni (2018), face-to-face classes not only provide a continuous interaction with the lecturer, but also with other classmates. Furthermore, Sohoni also believed that the engagement in the teaching and learning activities becomes very difficult in an environment where students and lecturers are

physically away from each other. According to Boz and Adnan (2017), when connected to classes from a location other than a classroom with the physical presence of a lecturer, they were easily distracted by external stimuli like social media, television, online games, or the Internet in general, despite the claimed advantage of time and space flexibility in online learning. The class was difficult for the students to focus on, and they struggled to manage their time well.

Another issue raised by one of the students is the inconducive learning environment. The student may come from a poor family that may need to share the rooms and devices with their siblings and does not have a proper space for them to study. As presented by Firat and Bozkurt (2020), the demographics of the ODL students, gender, age, and employment status, are the indicators of online learning readiness. Thus, it is important for the education provider to design the ODL approach based on the different demographics. On top of that, students have raised the issue of feeling demotivated and difficult to maintain the readiness to study. Students might be demotivated and stress with the problems and challenges listed above. A study by Wei and Chou (2020) shows that all the above factors mentioned by students in the challenges and problems that they faced have affected the students' motivation towards learning.

In the last question of the survey, students need to suggest on how the lecturer can improve the ODL approach in this course. Some of the verbatim suggestions given by the students are as follows:

- Show more examples and explanations.
- In my opinion, the best solution is to extend the due date for submission and discuss the exercise through WhatsApp group.
- Maybe can do more of exercises because students are not clear with what they are doing based on exercise.
- Only one task in a week.
- Slow down the pace.
- If possible, please show us each of it, way to solve the question, how to tackle it, before the submission date.
- Maybe a little bit less of question
- I wish less task are given to be completed.
- More examples of coding need to discuss.
- Give more time to submit the task.

Based on the suggestions given by the students, they are still adjusting with the ODL approach. Since that was the first time that the students need to learn through ODL approach, they need time to adapt. This is proven with the problems or challenges stated by the students in the first open-ended question. Furthermore, the changes from face-to-face manner to ODL approach was done in ad hoc manners, thus students were not prepared to learn in different environment without direct engagement with the lecturers and fellow classmates. Learning in ODL requires the students to be more independent. They need to manage the time wisely juggling between the family chores and the university work. The asynchronous mode delivery method requires them to be more discipline and find their time to watch the video lecture and carried out the assessment. Hence, some of them felt overwhelmed with the exercises given. Lecturers also need to be more considerable in giving the assessment. With this survey, the lecturer managed to gauge the work that have been provided to the students whether it is enough or to burden the students. The students were also expecting to get more explanation and examples from the lecturer. As this is ODL approach, lecturers need to guide the students in different way since ODL approach is more on student centered learning rather than being spoon fed by the lecturers.

D. Comparison of Student's Performance for March 2019 and March 2020

Outcome Based Education (OBE) is practiced by all institute of higher educations in Malaysia since more than 15 years ago which are focusing on the outcome of the learning process. Engineering program in Malaysia is following the Engineering Accreditation Council (EAC) standard where the evaluation is conducted at course level and program level (Mohammad et al., 2022). Course level evaluation is carried out through the COs attainment level. It is begun with the faculty setting the Key Performance Indicators (KPI) used as performance achievement indicator for COs score which should be attained by the students at the of the semester for the specific course. In the Faculty of Electrical Engineering, Universiti Teknologi MARA, Shah

Alam, each student is expected to achieve a score of 50% or Level 2 which is the minimum passing score, in order to attain the respective COs as shown in Table III while Table IV tabulates the COs for this course, learning domains and the assessments used to evaluate the respective COs attainment.

Table 3 :
Lesson Plan For ODL Session

CO Score (%)	Level	Status
0	1	Non-compliance
50	2	
65	3	Compliance

Table 4 :
Course Outcomes (COS) Evaluation Methods

CO	Description	Learning Domain	Assessments
CO1	Analyze program statements to produce the required output (s)	Cognitive	Quizzes and Assignments
CO2	Develop programs to solve selected engineering problem	Cognitive	Mini project, Coding, Report, and Test
CO3	Perfom programming tasks in solving selected engineering problem	Pscychom otor	Mini Project Demonstration

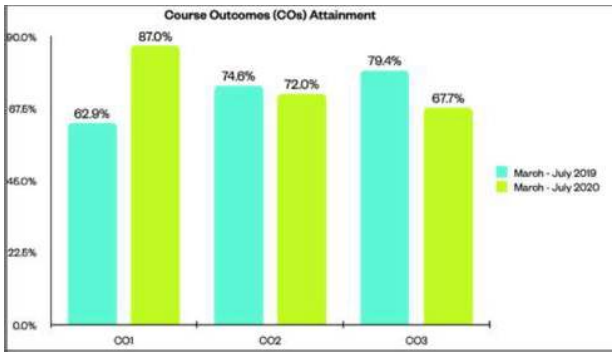

Fig. 13 : Average Score For Course Outcomes Attainment

Fig. 13 depicts the average score for COs attainment. Semester March to July 2019 was conducted through face-to-face normal classroom while the ODL approach was conducted in semester March to July 2020. Based on COs attainment average score, CO1 has increased to 87% which is from Level 2 to Level 3. CO1 is focusing on the analysis of given programming statements and programming syntax where it was evaluated through quizzes and assignments. This is maybe due to the short videos provided to the students where the students could replay the video and consequently enhanced their understanding on the fundamental and syntax of C++ programming. On top of that, tutorial questions provided in the Online Learning Center developed by the second author of this paper have trained the students with same pattern of question for certain concept. Hence, after several questions, the students were able to grasp the idea behind the concept. As far as CO2 and CO3 average score is concerned, there are slight reduction in the average score, but it is still within Level 3 range. CO2 and CO3 are focusing more on developing programs and the evaluation were mostly carried out through the mini project. Students might have difficulty in writing programs since they have missed most of the hands-on practical that is normally conducted in the laboratory. Moreover, they are away from the lecturers and fellow classmates, hence the writing programming skills may not be as good as students in semester March to July 2019 who had the lesson in face-to-face manner. Improvement should be made in the ODL materials and guidance approach by the lecturers need to be improved so that the students are able to write the programs and coding to solve the given problem. This is in line with the suggestion given by some students in the survey where they need more examples on coding to be discussed or given to them.

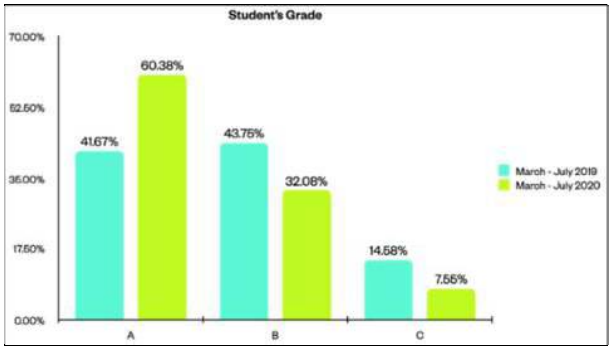

Fig. 14 : Percentage of Student's Grade for the Course

Fig. 14 illustrates the percentage of students who obtained grade A, B and C respectively in the course. There are no students in the group who failed the subject since the lowest grade obtained by the student is C. The grading system classifies Grade A into three subcategories based on percentage ranges: A+ for marks between 90% to 100%, A for marks between 80% to 89%, and A- for marks between 75% to 79%. Similarly, Grade B encompasses B+ (marks between 70% to 74%), B (marks between 65% to 69%), and B- (marks between 60% to 64%). Lastly, Grade C includes C+ (marks between 55% to 59%) and C

(marks between 50% to 54%). As can be seen from the figure, the number of students who obtained grade A has increased tremendously by 18.71% while there is decrement by 11.62% and 7.03% for grade B and C respectively. Despite of having difficulty with the ODL approach, majority of students able to get grade A maybe due to the short videos where they can replay and learn at their own pace. The exercises given in the Online Learning Center also helps the students in understanding the fundamental concepts of C++ programming.

Although students have difficulty in developing programs and writing coding as shown in Fig. 13, but this has not affected the grade since it only covers 40% of the total marks. During the ODL implementation, students need to submit the video on mini project demonstration, where in normal practice as in previous year students had gone through, students need to do demonstration in front of their lecturer. Although the ODL students had difficulty in developing the program, the video demonstration may make them more confident as compared to physical demonstration which might make them feel more nervous hence could affect their marks.

Table V shows the assessment breakdown for the course. As outlined in the table, the assessments for the course consists of quizzes, assignments, test, and mini project which are divided into mini project coding and report as well as the demonstration. There is no final examination for the course thus the students completed all assessments within the 14 weeks of the semester.

Table 5 :
Course Assessment Breakdown

Asssessment	Percentage
Quizzes	15
Assignments	15
Test	30
Mini Project Demonstration	10
Mini Project Coding and Report	30

Conclusions And Recommendations

This paper discussed the perceptions and performance of 53 students who underwent the Computer Programming course which is a course that does not have a final examination through ODL with same lecturer. ODL was conducted on ad hoc manner where it was started in Week 5 of the semester due to MCO announced by Malaysian government due to Covid-19 pandemic. The study on the students' perceptions were conducted through an online survey while the performance is gauged based on COs attainments and students' grade. COs attainments were evaluated based on the respective assessments' marks for each CO. The performance of the students was also evaluated by comparing COs attainment and grades with the previous year group of students taught by the same lecturer which took the subject in normal face-to-face environment. Based on the survey conducted, it is seen that generally students are adjusting with the new ODL approach. The challenges are more on the limited Internet access and adapting to the new system. In terms of the students' performance, there is an improvement in CO1 average score although there is slight decrement in CO2 and CO3 as compared to previous year group of students who undergone the same course in normal classroom environment. CO2 and CO3 focused on developing programs that the students might be lacking off since they cannot exchange ideas with their friends in face-to-face manner. They may have difficulty in learning to create the program on their own unlike CO1 which is mainly on the fundamental and syntax of C++ program. As far as the students' grade is concerned, the percentage of students who obtained A has increased as compared to previous year students although there is a slight decreased in grade B and grade C. Based on these two findings, it can be concluded that the change of teaching and learning approach did not affect the students' performance significantly although students need time to adapt with the new method.

As this is the first time the course is conducted in ODL on ad hoc basis, lecturer might have limited time to prepare for the ODL material. It is suggested that the material provided to the students will be more interactive and lecturers could also plan for the assessment so that students will not be feeling overwhelmed. Students also need more time to adapt with the new norm in teaching and learning, thus it is envisaged that in future students will be more prepared to face the classes through ODL approach.

Future studies could further explore the point of view of the lecturers in implementing the ODL for the first time which is also on ad hoc basis. The findings from the research can be correlated with findings in

this paper to match the expectation of both parties on ODL implementation. The findings from this paper may not representing the whole programming student's community in the university and Malaysia. Thus, future research can be done by including more participants from other faculties and universities to confirm the results of this study.

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