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Online Teaching and learning: Classroom Practices, Implementation, and its Impact on Engineering Science and Fundamental Thermodynamics Courses

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Abstract

Covid-19 has disrupted the education system worldwide. The sudden outbreak has forced the education system especially the tertiary education to shift to online teaching and learning which serve as the best solution for the continuation of learning during the Covid-19 pandemic. This study aims at evaluating the online classroom practices and its implementation as well as the impact of online teaching and learning from the student perspectives at Universiti Kuala Lumpur, Malaysian Institute of Marine Engineering Technology that enrolled in Engineering Science and Fundamental Thermodynamics courses. The analysis was carried out using the data collected through the questionnaire responses. Approximately 80% of students from Engineering Science course and just about 46% of students from Fundamental Thermodynamics course like the approached used during the online teaching and learning. This indicated that around 54% of students from Fundamental Thermodynamics course preferred the conventional methods more. However, students from both courses revealed that they were satisfied with the student-teacher interaction during the online teaching and learning with more than 90% agreed on this. The study also disclosed positive feedback on the acceptance and usage of the online teaching and learning with around 78% of students from Engineering Science course and 58% of students from Fundamental Thermodynamics course rated good and above despite the challenge faced by both academicians and students throughout this new way of teaching and learning. The results from this survey may lead to the improvement of the online classroom execution for these two courses.

Keywords: Classroom Practices, Online Teaching, Online Learning, Web-Based Learning, Convenience Sampling Method

Introduction

Covid-19 pandemic that hit the world in 2020 had caused various countries to implement nationwide lockdown. The emergency measure had deeply impacted various industries as

almost all economic activities are not allowed to operate including the higher educational sector. This is due to the sector involve large gathering that possessed higher risk during the pandemic period (Selvanathan, Hussin and Azazi, 2020). Physical social distancing and isolation are among the preventive measures taken to prevent further spread of infection (Singh et al., 2020). The pandemic had posed significant challenges to the universities and colleges as the outbreak not only disrupt the teaching and learning process but also disturbed the ongoing laboratory research work, delayed the intake of new students both local and international as well as postponed many of the planned academic conferences and workshops. It was estimated that around 87% of the world's student population from more than 160 countries were impacted due to the lockdown based on a report from UNESCO (Kamal et al., 2020).

The government of Malaysia had imposed the Movement Control Order (MCO) from 18th March 2020 onwards (Kamal et al., 2020). Following the announcement on the state of MCO, the higher educational sector in Malaysia had instructed the closure of universities and colleges. As a result, conventional face-to-face lectures and tutorial classes are discouraged and online teaching has emerged as an alternative education tool (Aznar-Díaz et al., 2020). The adoption of online learning had caused drastic changes in the teaching and learning deliveries nationwide. According to Janse van Rensburg (2018), online teaching mode can ensure accessibility and continuation of the learning process as classes can be conducted from any location, and students from various geographical areas can easily access these classes (Scherer et al., 2021). However, the sudden change from physical to online teaching has a significant effect on the quality of teaching hence impacted the students in the higher education sector (Selvanathan, Hussin and Azazi, 2020). Both academicians and students need to adapt to this new normal as the academicians need to effectively design their content delivery while the students need to have technology access to be involved in the online learning (Kamal et al., 2020).

As the sudden change from conventional to online teaching and adapting to the new way of learning are the two massive challenges to be dealt by both academicians and students,

- this paper aims to evaluate the online teaching and learning for technical courses such as Fundamental Thermodynamics and Engineering Science during this pandemic period. This is following the revelation from the study by Engzell et al (2021) which have shown that despite the adoption of online teaching and learning, there was evidence of learning loss especially among students from disadvantaged homes. Though online learning has been reported to bring a positive impact on both teachers and students but the quality of education through online learning needs to be improved as online classes requires students to be self-motivated (Kulal and Nayak, 2020). Hence, a questionnaire survey was conducted to understand the student's view on the online classroom practices, the implementation and the impact of the online teaching and learning on them.

Literature Review

Migration towards Online Teaching and Learning

The pandemic situation has provided the opportunity for Malaysia to improve its online education. Despite the concern on the quality of online learning in comparison to face-to-face learning, the Malaysian Ministry of Education had introduced initiatives in making the online learning as an integral component of the higher education and lifelong learning under

the Malaysian Education Blueprint 2015–2025 (Higher Education) for its educational development. Some of the universities, colleges, and polytechnics under the higher education sector are even reported already using Massive Open Online Courses (MOOCs) (Shahzad et al., 2021). In term of change in implementation of the educational process, some difficulties related to online education and technological complexities are felt.

From the course development point of view, online courses development is more complex, and academicians faced difficulty in preparing the teaching materials that involve a very time-consuming process (Selvanathan, Hussin and Azazi, 2020). Moreover, careful planning is required in translating written materials into an online format while maximizing the available online technologies (Roddy et al., 2017). Despite the higher technical requirement for conducting online teaching, some universities have taken proactive action by having contingency online learning and digital tools known as E-learning at hand as replacement (Sia and Adamu, 2020). Even though there is a still gap in the E-learning system among universities in Malaysia (Shahzad et al., 2021), the unexpected migration from conventional to online teaching was undertaken to minimize disruption in the higher education sector despite the lack of skill among academicians (Scherer et al., 2021). Some universities even subscribed to online teaching platform such as Zoom, Microsoft Teams, Spectrum (Iglesias-Pradas et al., 2021), Moodle cloud, Cisco Webex, Blackboard collaborate and Canvas to meet these new challenges (Sia and Adamu, 2020).

According to Dhawan (2020), online learning refers to a more innovative teaching and learning process that comes with many flexibilities. With internet access, students can learn and interact with teachers and peers remotely on digital platform using different devices (Armstrong-Mensah *et al.*, 2020). Online teaching provides a teaching medium that can deal with the needs of society and students (Rensburg, 2018) while encouraging active learning (Swaminathan et al., 2021). The pandemic has made the online and web-based learning a popular alternative method and drive the universities to quickly executing it as learning resources to facilitate the teacher-student interaction (Kamal et al., 2020). Khairi et al (2021) reported that about 56.8% of respondent agreed on their readiness to conduct lectures or tutorials online through the survey done on online teaching at University of Malaya. Continuous technical support from the university was found to improve the academic readiness and lessen the anxiety among the academician in acquiring new skills in the shortest time. The fact that Malaysian universities have adopted the E-learning portals prior to the pandemic might be the reason that contributed to this finding (Shahzad et al., 2021).

Online Learning Environment

With the continuation of higher education and physical class closure, online teaching mode became a necessity to maintain continuity in education (Mishra, Gupta and Shree, 2020; Lockee, 2021). The adoption of online education suggests that the course delivery will rely a lot on asynchronous methods of communication (Roddy et al., 2017) while the synchronous methods provide real time interaction during the session as both student and teacher were simultaneously present. Some online classes have combination of both methods (Perveen, 2016). However, the success of online learning requires both the students and the teacher to initially possess a device of various sorts and to be proficient in using the device for this purpose (García and Weiss, 2020). Students can learn and clarify doubts with the teacher through online learning. Meanwhile, teachers can share the course materials, perform online presentation, organize Q&A session, conduct online assessments, and track the students' academic progress with the help from the internet-oriented technologies (Kulal

and Nayak, 2020). The use of a variety of online tools, systems, and software requires the teacher to have technical skills in instructional technologies and software applications (Roddy et al., 2017). These skills are crucial for the teacher to create online teaching environment that is more interactive by involving the students in the learning process and encourage the students to actively engage with the material as they build new knowledge (Kulal and Nayak, 2020).

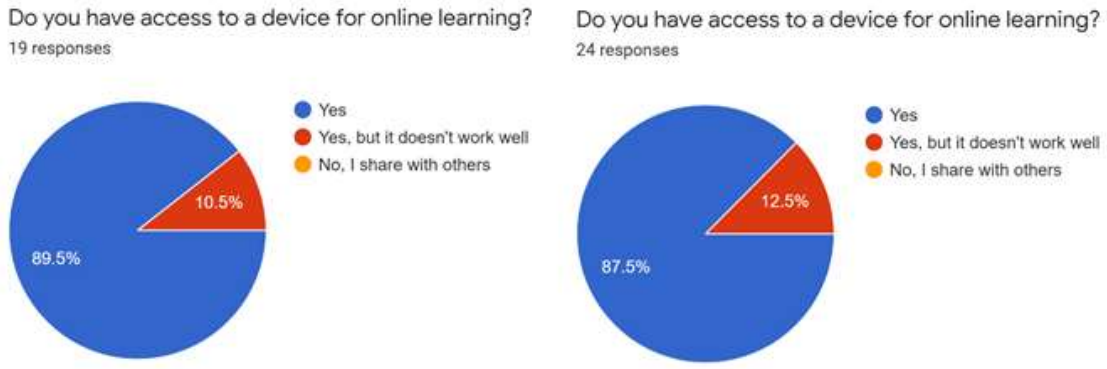
Following the steps of other public universities in Malaysia, private university such as Universiti Kuala Lumpur (UniKL), have taken a proactive action by embracing the online teaching and learning to ensure the safety and well-being of their students and staffs through the implementation of its mitigation plan known as UniKL Beyond C. The mitigation plan is aimed at ensuring the student to meet all the necessary requirements in completing their respective courses during the uncertain period. Through this plan, all teaching and learning activities are fully implemented using UniKL Virtual Learning Environment (VLE) and supplemented with the Microsoft Teams application to enable the 'live-classroom' deliveries. According to Iglesias-Pradas et al (2021), Zoom, Microsoft Teams, Blackboard collaborate, or WebEx were among the mostly used tools for online teaching video conferencing.

Methodology

This study was based on a questionnaire survey. The questionnaire was made using Google forms and answered by the diploma and bachelor students that enrolled in Fundamental Thermodynamics (N = 24) and Engineering Science (N = 19) courses (which represent the views of 90% of the targeted participants). The questionnaire was distributed in the final week of the January 2021 semester. The students were informed about the purposed of the survey and were aware that the data would be used for educational purpose. The convenience sampling method (Elfil and Negida, 2017) was chosen for this survey as this method can provide useful insight on the students view on the practice as well as the implementation of the online teaching and learning in the specific courses. The data collected include (1) age, gender, and sort of device used in the demographic profiling; (2) online classroom practices; (3) online classroom implementation; and (4) impact of online teaching and learning through single or multiple-choice and open-ended questions to the participants. The data extracted for each question by the Google forms was presented in the form of percentage of response that were automatically generated by the Google forms.

Results and Discussion

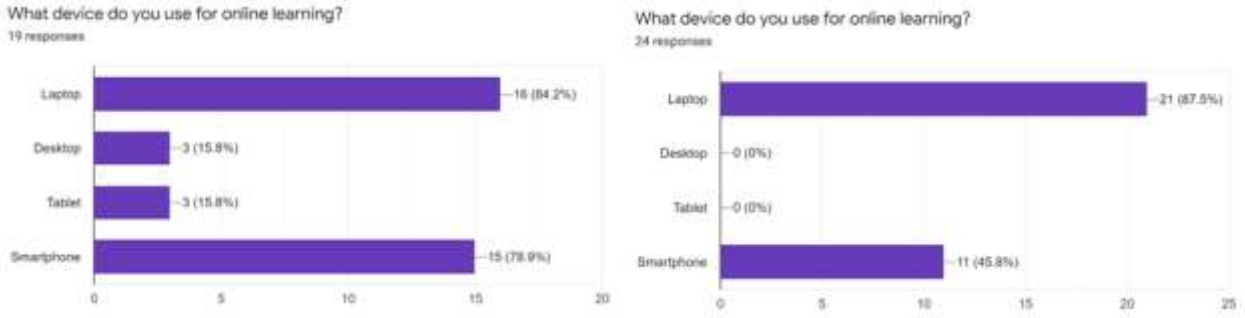
From the demographic profile, a total of 43 students responded to the questionnaire survey. During the lockdown, 90.7% of the students have access to electronic devices while the remaining 9.7% indicated that their device does not work well as shown in Figure 1 (a) and (b).



(a) (b)

Figure 1 Student's access to online learning for (a) Engineering Science and (b) Fundamental Thermodynamics course

For the usage of devices, most students were using laptop (86%) and smartphone (60%) to join the online classes compared to tablet and desktop as can be seen from Figure 2 (a) and (b).



(a) (b)

Figure 2 Types of electronic devices used by students in (a) Engineering Science and (b) Fundamental Thermodynamics course

Analysis on Online Classroom Practices

Though the course content in the online learning is similar to the face-to-face learning but the classroom approach adopted was slightly different. Besides lecturing, class discussion was actively used to engage the student in the learning process and tutorial session was used to assess the student's problem-solving skill (Banky, 2018). However, the findings from Figure 3 (a) and (b) shows that only 57.9% and 33.3% of students that enrolled in Engineering Science and Fundamental Thermodynamics courses agreed that the approach used motivates them to engage with the course materials. For the bachelor students that enrolled in Engineering Science course, collaborative learning was implemented whereby they were required to team up in a group of two to three students to discuss a topic of their interest at the beginning of the semester and present it to the class. During the presentation, the other students took part in solving the problems found throughout the presentation slides and the lecturer assisted in clarifying a particular concept or problem upon request by the students. Positive feedback received from students regarding this activity which indirectly forced them to participate more actively otherwise the online class would be a passive experience. Meanwhile, normal lecturing was applied to the diploma students that enrolled in Fundamental Thermodynamics course. Nevertheless, diploma students were still required to solve the problems collaboratively same as the bachelor students. Hence, only 16.7% of

student from Fundamental Thermodynamics course agreed that the approach encouraged them to speak in class compared to 63.2% of students from Engineering Science course. The adoption of the collaborative learning style among the students that enrolled in Engineering Science course reflected in 63.2% of the students agreed that the approach allowed them to take more responsibility and to work independently, and 52.6% of the students agreed that the approach had help foster their confidence while they prepared for this activity. The collaborative learning activity not only promoted two ways communication but also educate the students to work as a team while developing their weaker skill (Le, Janssen and Wubbels, 2018).

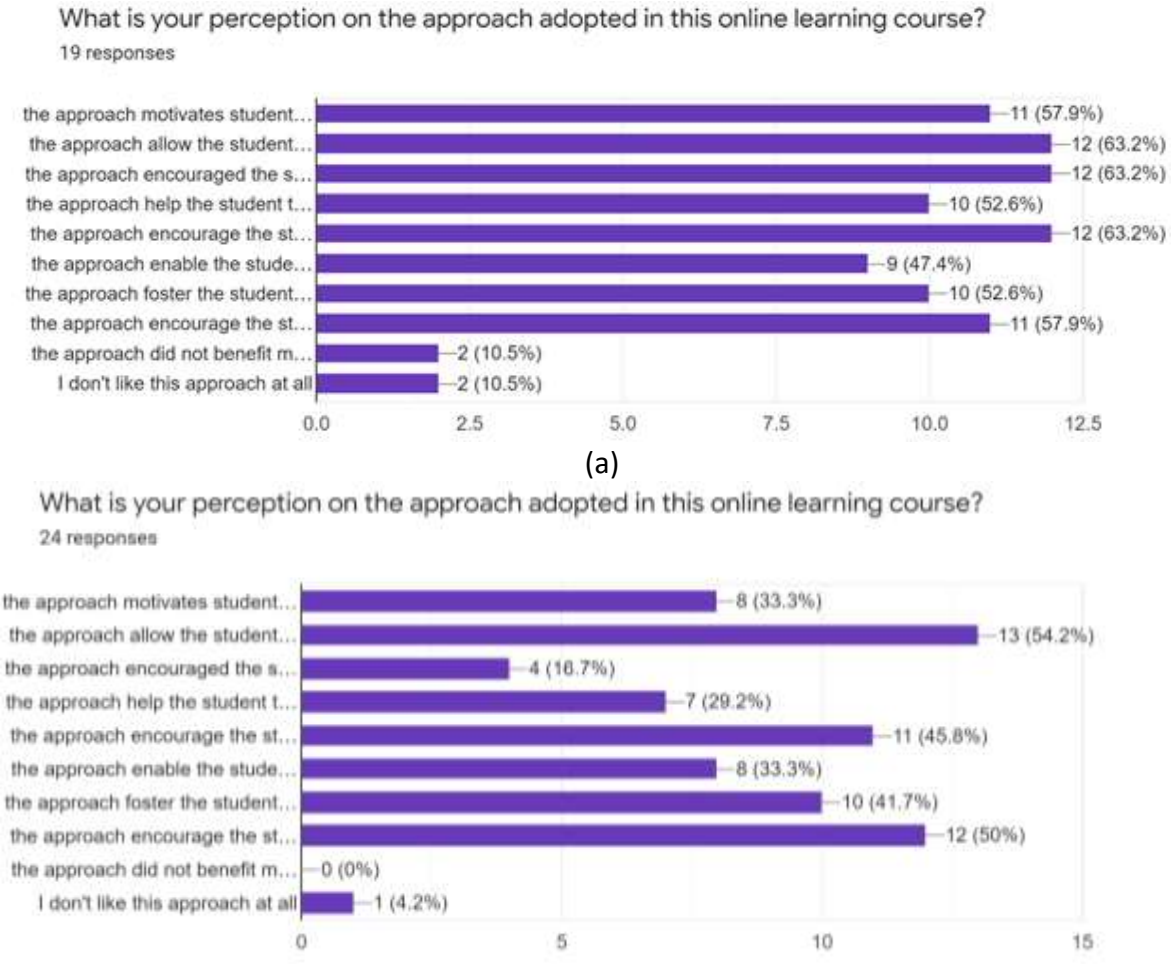
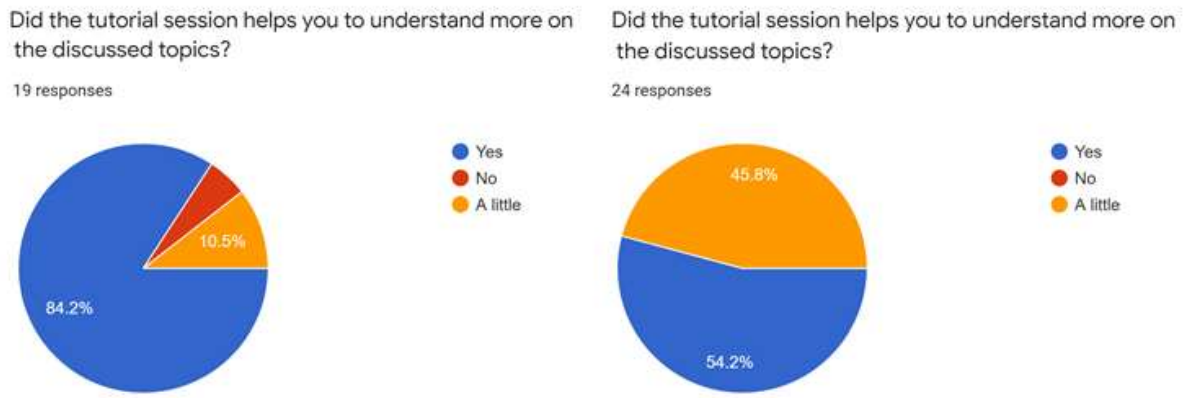


Figure 3 Student's perception on the approach use in online learning for (a) Engineering Science and (b) Fundamental Thermodynamics course

To keep the classroom environment fun and interesting, the students for both courses was assigned to create online games using an online assessment tool such as Quizziz on the topic that was given to them earlier. 57.9% and 50% of students that enrolled in Engineering Science and Fundamental Thermodynamics courses agreed that the approach encouraged them to be involved in the lesson through this activity. The activity was intended to help relieve the students stress while improving the student's decision-making skill and understanding at the end of each topic. Despite the effort taken to make the class more active, 10.5% and 4.2% of students in the Engineering Science and Fundamental

Thermodynamics courses indicated that they dislike the approach used in these classes while 10.5% of students from Engineering Science course stated that they did not benefit in any way from the approach used. This finding could be contributed by the first semester student from one of the two groups that enrolled for the course and are not prepared to take this course online.

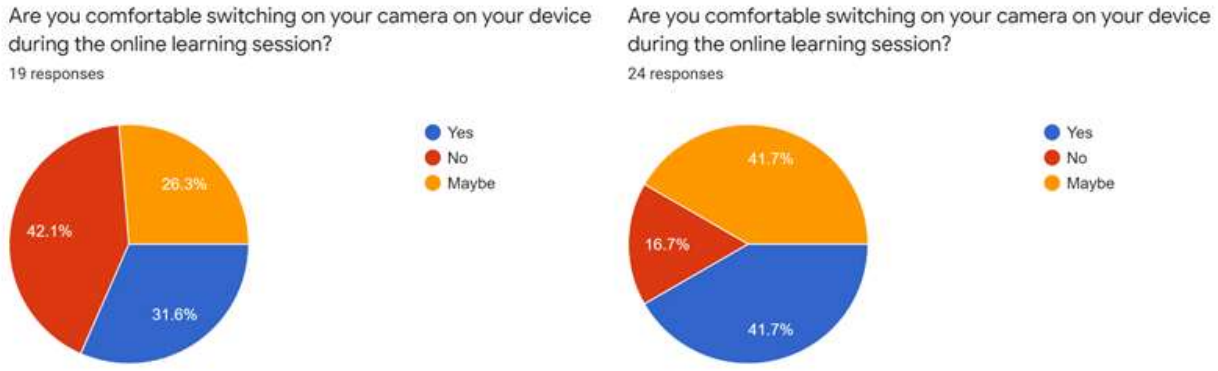
Apart from attending online lectures, the students also had to attend the tutorial session online. The tutorials questions were prepared in advanced, and these questions were assigned to the students at the end of every topic. From the survey, 84.2% of bachelor students and 54.2% of diploma students agreed that the tutorial session help them to understand more on the topic discussed as shown in Figure 4 (a) and (b). This could be because this activity allows them to discuss the solution to the problem with their peers and give them confidence to share their solutions online during the discussion session. This session help improved the students intellectual, communication and social skills (Karve, 2006). As many students were still trying to adapt to this new way of tutorial being conducted (Rapanta et al., 2020), at least 10.5% and 45.8% of students from Engineering Science and Fundamental Thermodynamics courses indicated that the online tutorial sessions only help them a little. Meanwhile, 5.3% of student from Engineering Science course indicated that the session was not helpful.



(a) (b)

Figure 4 Student's response on the benefit of tutorials session during online learning in (a) Engineering Science and (b) Fundamental Thermodynamics courses

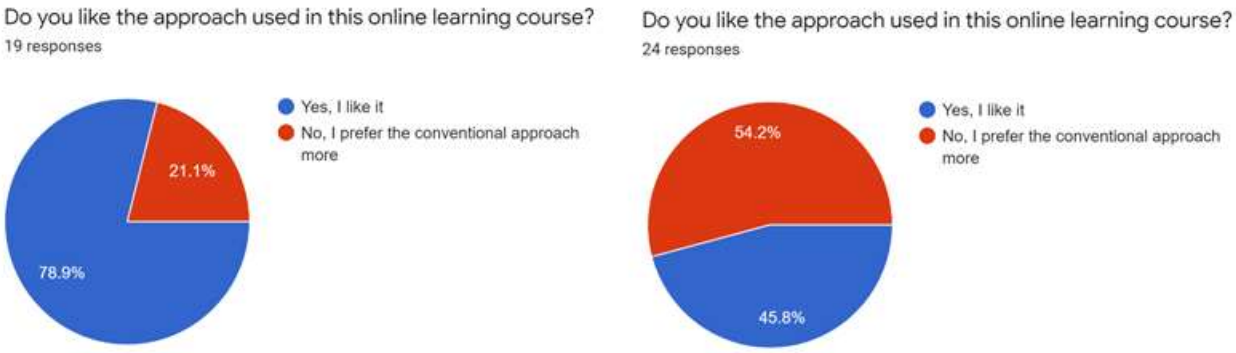
The students were also encouraged to switch on their cameras during the online session. The turning on camera idea was made clear to the students since the first day of class. This practice is performed to ensure the student presence during the online class as well as to create a more responsive learning environment. From the survey, 31.6% and 41.7% of students that enrolled in Engineering Science and Fundamental Thermodynamics courses indicated that they are comfortable switching on their cameras during class for the face-to-face online class as shown in Figure 5 (a) and (b). These group of students were also active during the online learning session. The positive attitude shown by the student help improved the teacher-student and student-student relationship.



(a) (b)

Figure 5 Student's preference on switching on their cameras during online learning in (a) Engineering Science and (b) Fundamental Thermodynamics courses

This might also be the reason that 26.3% and 41.7% of students that enrolled in Engineering Science and Fundamental Thermodynamics courses were undecided to switch on their cameras as some might saw the benefit of it, but they feel awkward with this new way of teaching. According to Pokhrel and Chhetri (2021), the consumption of more data packages among the students from the average income earned family for face-to-face online class could also be contributing to this finding apart from poor internet connectivity. By having the camera on, the teacher can also benefit from the nonverbal cues from the students such as their facial expressions, body language, eye contact etc. and adjust their teaching accordingly (Castelli and Sarvary, 2021). Meanwhile, 42.1% of students from Engineering Science course indicated that they are not comfortable switching on their camera during the online learning session compared to only 16.7% of students from Fundamental Thermodynamics course. These students felt that this was the norm and for many, turning off their cameras provides a layer of security. Overall, 78.9% and 54.2% of students from Engineering Science and Fundamental Thermodynamics courses have indicated that they like the approached used in the respective courses as shown in Figure 6 (a) and (b).



(a) (b)

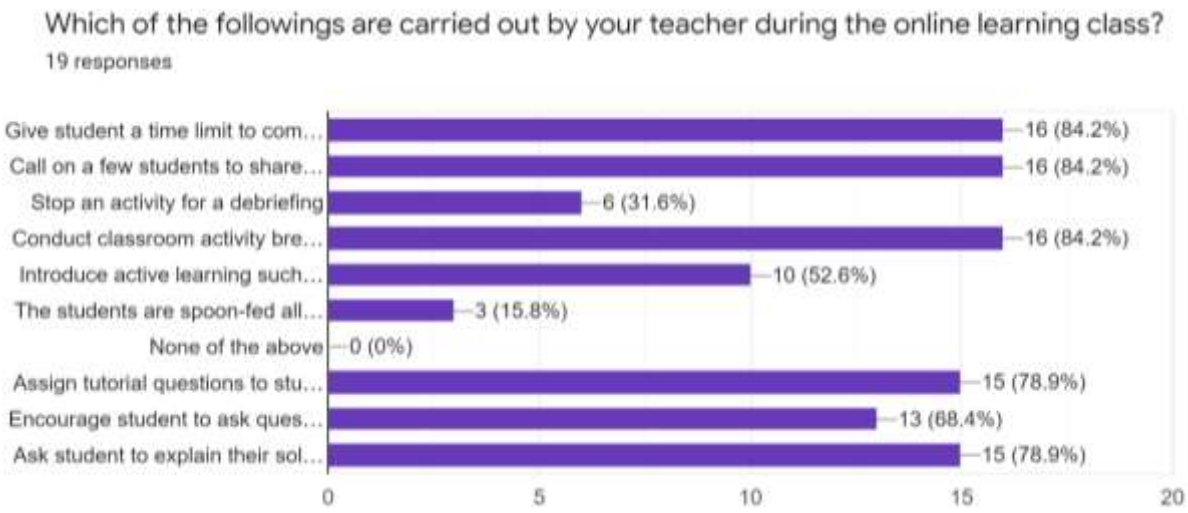
Figure 6 Student's preference on the approach use in online learning for (a) Engineering Science and (b) Fundamental Thermodynamics courses

Analysis on Online Classroom Implementation

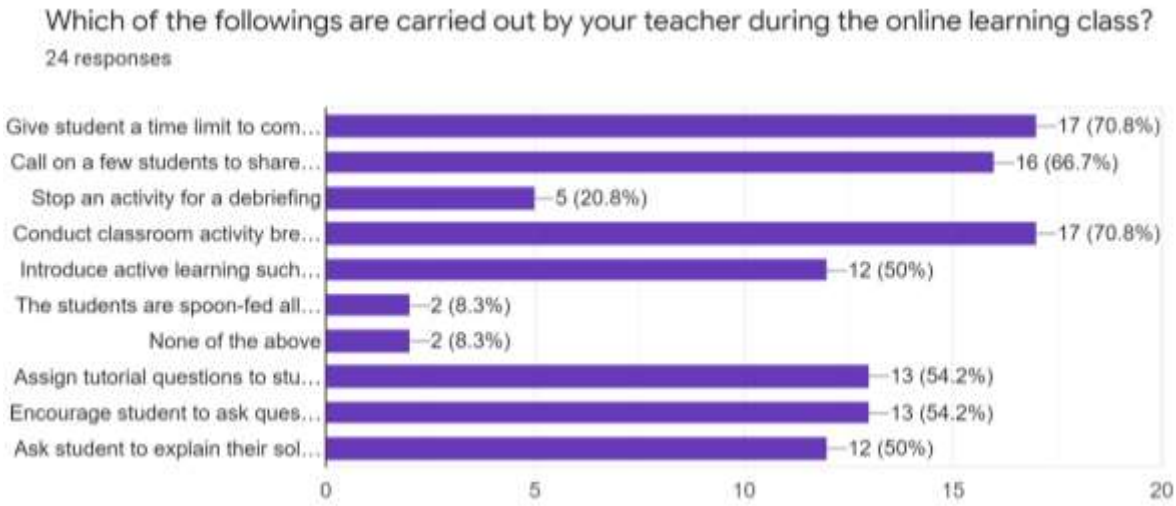
Figure 7 (a) and (b) assessed the implementation of the online classroom in these two courses. 84.2% of students from Engineering Science course and 70.8% of students from Fundamental Thermodynamics course indicated that they were given time to complete a task/question. For presentation, students from Engineering Science course were given two

to three weeks to prepare. Students were also given enough time to prepare for the online games and solving tutorial questions assigned to them. In case of any incomplete task by the students, the class will continue with new topic and the incomplete task will be resumed in the following day/week. 84.2% of students from Engineering Science course and 66.7% of students from Fundamental Thermodynamics course agreed that few students were called by the teacher to share their thoughts on the problem discussed or to answer any tutorial questions. Many of the students from Engineering Science course were observed to volunteer to give their thoughts on the topic discussed when asked by the teacher and this classroom activity promoted two-way communications and active listening during the online class. However, the percentage was a bit lower for the students from Fundamental Thermodynamics course. This was because they were still adjusting to the new way of online teaching and learning. Pertaining to an activity was stop for a debriefing, 31.6% of students from Engineering Science course and 20.8% of students from Fundamental Thermodynamics course chose this as the students clearly understand their role in each activity as well as most debriefing was conducted at the end of an activity. Debriefing can serve as a mean through which the experience of the students had during the activity becomes the foundation for learning (Johns, Moyer and Gasque, 2017). 84.2% of students from Engineering Science course and 70.8% of students from Fundamental Thermodynamics course indicated that classroom activity break such as online games were conducted during the online learning. Online games were played at the end of a topic discussion to keep the learning interesting and fresh. Although active learning such as peer-teaching and problem solving were conducted during each meeting online, only 52.6% of students from Engineering Science course and 50% of students from Fundamental Thermodynamics course indicated that these activities were conducted.

However, the students agreed that they were not spoon-fed all the time as the result percentage obtained for this item was low with 15.8% and 8.3% from the Engineering Science and Fundamental Thermodynamics students, respectively. 78.9% of students from Engineering Science course and 54.2% of students from Fundamental Thermodynamics course agreed that the teacher assigned them with tutorial questions to be solved and 78.9% of students from Engineering Science course and 50% of students from Fundamental Thermodynamics course indicated that they were asked to explain their solution to a problem. These activities allowed the teacher to assess the students understanding of each topic due to the learning pace of each student are different. This is because students with fast learning pace and action will be able to solve a task much quicker than students whose pace of action was affected by learning or knowledge between the two actions even though the students have similar cognitive skills (Hershkovitz and Nachmias, 2009). Apart from these activities, 68.4% of students from Engineering Science course and 54.2% of students from Fundamental Thermodynamics course agreed that they were encouraged to ask questions during the online class. Though many activities were carried out during the online teaching and learning, 8.3% of students from Fundamental Thermodynamics course indicated that none of the above activities were conducted.



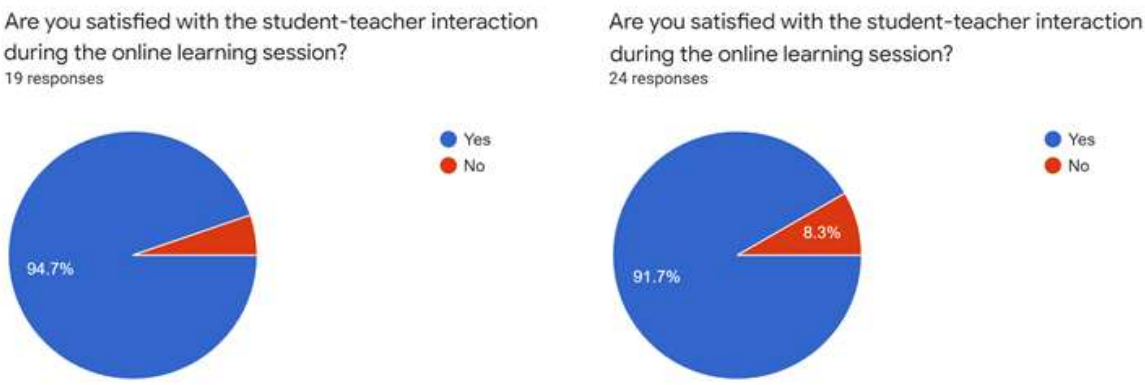
(a)



(b)

Figure 7 Student's response on the activities carried out during online learning for (a) Engineering Science and (b) Fundamental Thermodynamics courses

The implementation of the synchronous methods during the online teaching and learning that requires the attendance of both teacher and students resulted in 94.7% of students from Engineering Science course and 91.7% of students from Fundamental Thermodynamics course as shown in Figure 8 (a) and (b) indicated that they satisfied with the student-teacher interactions. However, the fact that 5.3% of students from Engineering Science course and 8.3% of students from Fundamental Thermodynamics course were not satisfied with the student-teacher interaction suggested that some changes need to be made to the current practice of the online classes.

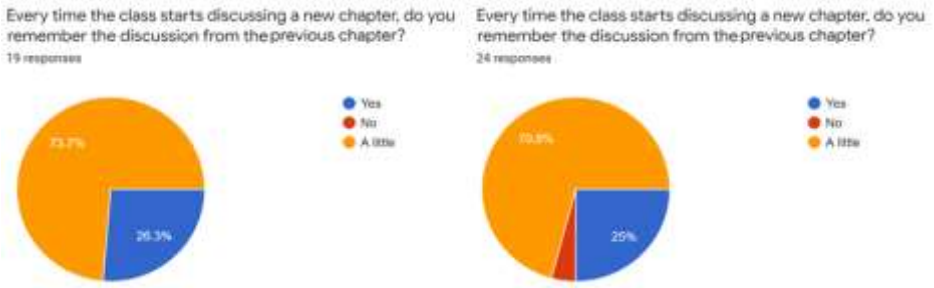


(a) (b)

Figure 8 Student's satisfaction on the student-teacher interaction during online learning in (a) Engineering Science and (b) Fundamental Thermodynamics courses

Analysis on the Impact of Online Teaching and Learning

Based on the classroom practices and implementations, 26.3% of students from Engineering Science course and 25% of students from Fundamental Thermodynamics course as shown in Figure 9 (a) and (b) indicated that they can recalled the discussion from the previous chapters. Meanwhile, 73.7% of students from Engineering Science course and 70.8% of students from Fundamental Thermodynamics course indicated that they can recalled a little from the previous discussion. This can be considered as a good indicator as online learning can be quite challenging to some students due to distraction cause by the digital technology. The ability of the students to recall the discussion from previous chapters suggested that the students were capable to manage their technology-related distractions and learn to use the technology effectively to support their learning as reported by Schmidt (2020).

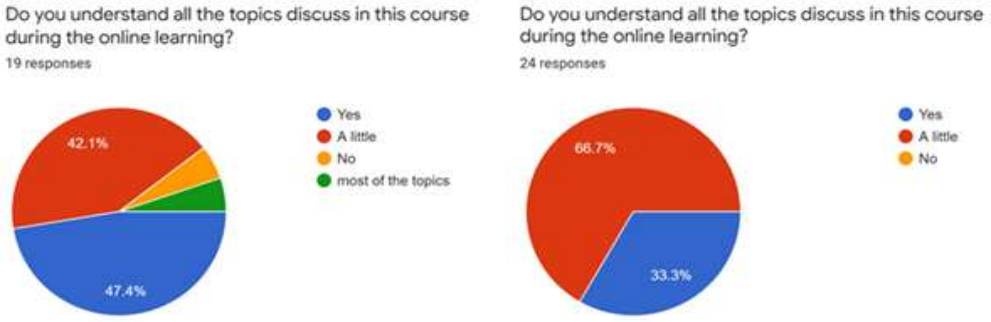


(a) (b)

Figure 9 Student's ability to remember discussion from previous chapter during online learning in (a) Engineering Science and (b) Fundamental Thermodynamics courses

From Figure 10 (a) and (b), 47.4% of students from Engineering Science course and 33.3% of students from Fundamental Thermodynamics course indicated that they could understand the topics discuss during the online learning. Meanwhile, 42.1% of students from Engineering Science course and 66.7% of students from Fundamental Thermodynamics course indicated that they could understand a little. This might be the indication from the students who like the approach used in this online learning. However, the pace in the students' learning and action might be the reason that distinguish between these first two findings. Despite 5.3% of students from Engineering Science course indicated that all topics discussed were easily understood, another 5.3% of the students indicated the opposite where none of the topics discussed were understood. The latter findings can be related to

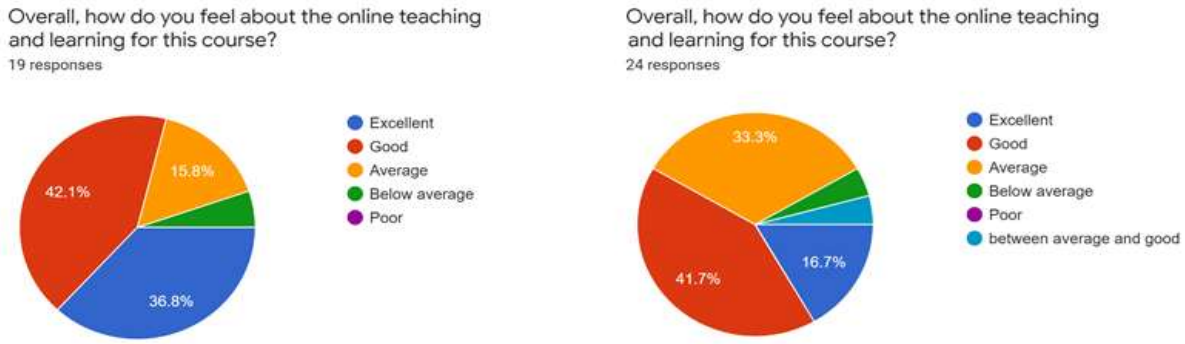
how some students respond to difficulties experienced during the online learning environment. According to Lodge et al. (2018), some students might feel stuck and confused that might lead towards blockage in the learning process.



(a) (b)

Figure 10 Student's understanding on topics discussed during online learning for (a) Engineering Science and (b) Fundamental Thermodynamics courses

From the above findings, 42.1% of students from Engineering Science course and 16.7% of students from Fundamental Thermodynamics course rated the overall online teaching and learning as excellent as shown in Figure 11. Meanwhile, 42.1% of students from Engineering Science course and 41.7% of students from Fundamental Thermodynamics course graded the online teaching and learning as good. 15.8% of students from Engineering Science course and 33.3% of students from Fundamental Thermodynamics course rated the online teaching and learning as average. Even though no students rated the online teaching and learning of these courses as poor but small percentage of students rated the online teaching and learning as below average. These findings revealed that some improvements need be done to make the online teaching and learning more effective. Suggestions by students such as to include some interesting videos related to the course can be considered in the coming semester.



(a) (b)

Figure 11 Student's overall viewpoint on online teaching and learning for (a) Engineering Science and (b) Fundamental Thermodynamics courses

Conclusions

This survey revealed the student's point of view on the online teaching and learning in terms of its practices, implementation, and its impact. Though this survey does not represent the views of all students at the university, but this survey help gathered information on how the current online teaching and learning can be further improved. Based on the findings of online classroom practices, nearly 80% of students from Engineering Science course while around 46% of students from Fundamental Thermodynamics course like the approached.

Meanwhile, based on the online classroom implementation, more than 90% of students from both courses indicated that they were satisfied with the student-teacher interaction. Despite the findings, the practice and implementation of the online classroom needs to be further enhanced to provide the students with the best online learning experience.

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