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Challenges in Online Practical Learning Among Engineering Diploma Students: A Case Study at Kuching Polytechnic During the COVID-19 Pandemic

Amizanuryanti Binti Ali[1], Azmanirah Binti Ab Rahman[1]*

[1] *Faculty of Technical and Vocational Education,*
Universiti Tun Hussein Onn Malaysia, 86400, Parit Raja Batu Pahat Johor, MALAYSIA

*Corresponding Author: azmanira@uthm.edu.my
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Abstract

The COVID-19 pandemic has impacted education system across the world and caused changes in how schools conduct their daily activities. As a result, practical learning among polytechnic students has shifted to an online mode of delivery. This research investigated the challenges faced by engineering students at Kuching Polytechnic Sarawak during online practical learning and their stress levels. Online survey using quantitative approach was adopted inn this research to identify the challenges and students' stress levels during the online practical learning. A total of 335 engineering students were selected using simple random sampling method. The research found that the smartphone is a modern device used by students frequently, while videos from YouTube sources were commonly used as a teaching material by the lecturers. This study also found out that the challenge and the engineering students' stress level are at a moderate level, and there was no significant difference in the stress level between male and female students. Nevertheless, this research discovered that there was a significant relationship between the stress level and the student challenges during online practical learning. The present findings suggest that students should take these challenges as opportunities to explore a more innovative way of learning to ensure their engagement in online practical learning is more effective. Besides, lecturers should integrate educational technology into online practical learning in order to make the learning process more engaging and adaptive. On top of that, the findings also recommend that the Ministry of Higher Education should formulate a strategy to improve the infrastructure and provide specific training for TVET lecturers to enhance their pedagogical competency in online practical teaching in engineering education. This aspect requires further research to ensure that online practical learning is not regarded as an obstacle for both students and lecturers .

1. Introduction

The COVID-19 virus began to spread in Malaysia around January 2020, when the Ministry of Health discovered several cases involving people infected with the COVID-19 virus. To prevent the spread of the COVID-19 epidemic from getting worse, the government took action by imposing a Movement Control Order (MCO), establishing policies and guidelines, and restrictions on all sectors. The students and lecturers were surprised by the sudden

movement control order as they had never faced such a situation earlier. This situation has caused schools and institutions of higher learning to be closed for the moment and the Malaysian Education Ministry instructed teachers to teach online from their respective homes.

Therefore, to ensure the learning process can continue as usual, various platforms such as Google Meet, Teams, Zoom, WhatsApp, and Telegram were implemented (Mohammed, 2021). Even though online learning is not a new phenomenon, its implementation is still underemphasized and underutilized among students, leaving them unable to adapt fully to the new norms. As a result, students encounter various problems and constraints when participating in practical online learning. The challenges and constraints when coping with the COVID-19 pandemic might cause students to experience stress. According to Abdul Aziz, Zulkifli, Othman, and Musa (2021), too much pressure might interfere with student focus during practical online learning.

The issue of mental health has been more prominent after the spread of COVID-19. According to statistics by Statistica (2022), 59% of 16 to 24-year-old students encounter high stress levels. Some increase in stress levels among students is most likely due to the abrupt shift in the learning environment from face-to-face to online, which occurred without enough preparation by all parties. In general, online learning allows both the learner and the instructor to carry out the teaching and learning process any time and anywhere minimizing the necessity for in-person meetings. However, online learning during the COVID-19 pandemic is challenging due to students' various issues, especially those taking courses that require hands-on implementation in a laboratory or workshops.

Students face technical problems such as unstable internet connections in some areas and limited devices to participate in online learning sessions. Accordingly, the lack of infrastructure: limited use of equipment and practical materials for students to use independently at home, and the lack of virtual laboratory facilities held by professors are also constraints during the practical online learning implementation during COVID-19. There is a lack of effective communication between students and lecturers due to the lack of face-to-face sessions. Finally, the student has personal challenges, such as a less conducive learning environment due to less comfortable learning spaces noise interference from the environment, and financial problems in meeting practical learning needs when learning online at home.

The situation faced because of the spread of COVID-19, where practical learning in a physical laboratory is now delivered online, students have created new challenges that put pressure on them. As a result, this research aims to identify the challenges and levels of stress felt by engineering students at Kuching Polytechnic in Sarawak during online practical learning.

2. Literature Review

2.1 Practical Learning Before the COVID-19 Pandemic

Before the emergence of the COVID-19 pandemic in our country, practical learning was carried out face-to-face in laboratories every week according to a specified schedule (Raiyn, 2016). Practical learning is usually in the laboratory and involves demonstrations by the lecturers utilizing specialized equipment such as machines, hand tools, and associated materials (Ismail, 2020). According to Vielma and Brey (2020), hands-on practice operating equipment, tools, and materials under the supervision of a lecturer while in a workshop or laboratory is an essential part of the engineering field. Engineering is generally more hands-on in improving problem-solving and critical-thinking abilities (Asgari, Trajkovic, Rahmani, Zhang, Lo & Sciortino, 2021).

2.2 New Norms for Practical Learning During the COVID-19 Pandemic

Learning sessions at educational institutions have also shifted from face-to-face to online at home. According to Mat Dawi, Theam, Palaniandy, and Dolah (2016), one of the measures to continue student learning during COVID-19 is the adoption of technology in the learning process. Various teaching and learning technologies, including Google Meet, Microsoft Team, WhatsApp, Telegram, and Zoom, can be used throughout the current COVID-19 pandemic during online learning (Abdillah & Musa, 2021).

Since the students are not physically on campus, virtual laboratory practice or 'virtual lab' has been implemented (Shidiq, Permanasari, Hernani & Hendayan, 2020). There is also video-based practice, in which pre-recorded videos are displayed during lectures or live demonstration videos using Google Meet to provide students with an overview of the procedures and processes involved in the practice by the lecturer (Khan, Patra, Vaney, Mehndiratta & Chauhan, 2020).

In addition, lecturers also use Learning Management System (LMS) to monitor their student progress as well as free online tools to create an interactive simulation to attract students' interest in addition to giving a picture of the real environment while performing practical in the laboratory during the COVID-19 pandemic (Aldarasyeh, 2020).

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2.3 Stress During Online Learning Among Students

According to Shiel (2018), factors that contribute to stress are physical, mental, and emotional. External factors such as the environment and social settings, as well as emotional symptoms such as restlessness, fear, difficulty calming the mind, moodiness, and sadness, all contribute to the enactment of stress.

The research findings of Zalaznick (2020) found that 75% of students reported that the adoption of online distance learning caused them stress and anxiety, whereas Son, Hegde, Smith, Wang, and Sasangohar (2020) discovered that 71% of students feel that learning online increase the stress. This situation occurred because of unstable internet connectivity issues encountered by students daily throughout the online learning implementation affected stress levels (Hashim, Abd. Kadir, Mansor & Azudin, 2020).

In addition, students may experience stress as a result of a lack of appropriate devices (Baticulon, Sy, Alberto, Baron, Mabulay & Rizada, 2021), a limited internet quota (Yeap, Suhaimi & Nasir, 2021), an excessive workload (Ahad, Hamid, Noor & Lazin, 2020), and some lecturer provided students with material that is difficult to understand during the new norm of COVID-19 (Maulana, 2021). Although online learning raises challenges for students, some students respond positively to the online learning implementation as an initiative during COVID-19 (Rev & Simanullang, 2020).

2.4 Challenges of Practical Online Learning During COVID-19

Research conducted by Iyer and Kalyandurgmath (2021) to analyze the challenge of online practicals during COVID-19 found that the lack of face-to-face interaction, unstable internet access, and the inability to create a laboratory atmosphere online have become crucial challenges during practical learning implementation. Most students, up to 48.7%, had unreliable internet connectivity.

Besides that, according to Wisanti, Ambawati, Putri, Rahayu, and Khaleyla (2021), there are three crucial barriers to practical learning online implementation: technology, students, and teachers. Unstable internet access (42.4%) is caused by technical factors, followed by other students' challenges (21.5%), which are low motivation and lack of modern devices such as smartphones. Lastly, from the teacher's perspective (36.1%), they faced difficulty delivering complicated topics online as they did not have the skills to use technologies (Wisanti et al., 2021).

3. Methodology

This section discusses the methods and approaches involved in collecting relevant research information and data. The information and data gathered will aid in understanding the flow of this study. This section also consists of the research design, research instrument, sampling method, research samples, data collecting, and data analysis play a crucial part in this study.

3.1 Research Design

This study used a quantitative approach through the survey method to gather an overall summary from students on the perception of engineering diploma students at Kuching Polytechnic towards the practical online learning implementation during the COVID-19 pandemic. This survey method is also suitable for use especially when dealing with a large population (Showkat & Parveen, 2017).

3.2 Population, Sample and Sampling Technique

This research used a cluster sampling approach to collect data because Malaysia has several zones, including the North, Central, South, East, and Borneo zones. Since Sarawak is in the Borneo zone, the researcher chose Kuching Polytechnic as a case study location. Random sampling means each population has an equal probability of being included in the sample (Taherdoost, 2016). The 335 engineering students' study respondents were selected using a simple random sampling method.

3.3 Research Instrument

This instrument study employs a questionnaire to collect data from the respondents. The questions were composed of four parts: (1) demographic information of the respondents, (2) challenges faced during practical online learning during the COVID-19 pandemic categorized into five categories that consist of technical, communication, infrastructure, personal challenges, and lastly pedagogy, (3) level of student pressure when participating practical online learning and (4) perception toward practical learning. A five-point Likert scale that consists of Strongly Disagree, Not Agree, Disagree, Agree, and Strongly Agree was used in this research to rate and answer parts B and C. The questions were transformed into an online survey questionnaire using Google Forms to obtain responses from respondents.

3.4 Data Analysis

Data obtained was analyzed based on descriptive statistics involving percentage, frequency, means, and standard deviation for modern devices that students frequently use, approaches that lectures used to conduct practical online learning, the level of challenges faced by polytechnic students, and their stress level when participating in practical online learning during the COVID-19 pandemic. Meanwhile, inferential statistics illustrated the difference in stress levels between male and female polytechnic students when participating in practical online learning using a T-test and the relationship between the level of stress and the challenges faced by polytechnic students when participating in practical online learning during the COVID-19 pandemic were discussed using Pearson analysis to fulfill the objectives of this study.

4. Result and Discussion

4.1 Respondent Profile

Table 1 shows the result data that was analyzed in this research. A total of 335 respondents were 206 males (61.5%), and 129 females (38.5%), most of which were Diploma in Civil Engineering 219 were in the city (65.4%), 111 were in rural areas (33.1%), and five (5) people were at the hostels (1.5%) when participating in practical online learning during the COVID-19 pandemic. This study found that 102 students received funding from PTPTN and family (30.4%), while only 20 respondents (6.0%) supported studies on their own. The majority of respondents (85.9%) use smartphones, 77% use laptops, 11.6% use computers, and 9.8% use tablets when accessing their practical online learning during the COVID-19 pandemic.

Table 1 *Respondent's demographic profile*

Demographic Characteristic		Frequency	Percentage (%)
Gender	Male	206	61.5
	Female	129	38.5
Program of Study	Diploma of civil engineering	129	38.5
	Diploma in Building Services Engineering	21	6.3
	Diploma in Geomatics	4	1.2
	Diploma in Electronic Engineering (Communication)	4	1.2
	Diploma in Electrical and Electronics Engineering	30	9.0
	Diploma in Mechanical Engineering	47	14.0
	Diploma in Mechanical Engineering (Automotive)	57	17.0
	Diploma in Mechanical Engineering (Manufacturing)	9	2.7
	Diploma in Mechanical Engineering (Air Conditioning and Freezing)	25	7.5
	Diploma in Process Engineering (Petrochemical)	9	2.7
Location	City	219	65.4
	Rural area	111	33.1
	Hostel	5	1.5
Study funding	Own support	20	6.0
	Zakat	0	0
	Zakat and family	0	0
	Family	79	23.6
	PTPTN	95	28.4
	PTPTN and family	102	30.4
	Others	39	11.6
Devices Used to Participate Practical Online Learning During Covid-19 Pandemic.	Smartphone	288	85.9
	Laptop	258	77
	Computer	39	11.6
	Tablet	33	9.8
	Others	0	0

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Figure 1 depicts that the majority (72.5%) of respondents indicate that their lecturers showed videos from YouTube while none of the lecturers were using Virtual Reality (VR) and Augmented Reality.

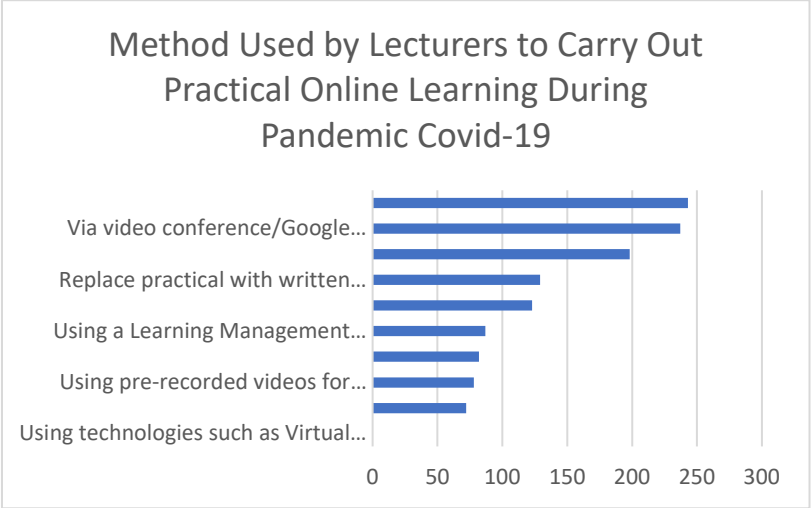

Fig. 1 *Method used by lecturer during practical online learning on COVID-19*

4.2 Level of Challenges Faced by Polytechnic Students During Practical Online Learning on COVID-19 Pandemic

The respondents were asked about the challenges while participating in practical online learning during the COVID-19 pandemic. The responses were analyzed quantitatively by coding the mean into five categories as shown in Table 2. The results indicate that personal challenges have the highest mean value, with a mean value of 3.35. The results of this study are similar to the findings of Harun et al. (2021) and Fernanda et al. (2020), who said that most students encounter issues in an unpleasant environment because of being disturbed by loud noises either coming from within or outside the house. However, the findings contrast with the study by Wang, Liu, Zhang, Xie, and Yang (2021), who found that a less conducive learning environment has no effect on practical online learning during the COVID-19 among students.

Challenges in communication have a mean value of 3.02, where most students have difficulty understanding lessons online due to a lack of face-to-face interaction with their lecturers. Followed by infrastructure challenges have a mean value of 3.00, caused by apps or software used by lecturers that require massive amounts of data. Following that were pedagogical problems, where students have a problem understanding what the lecturer says during practical online learning have a mean value of 2.94, and lastly were technical challenges, with the lowest mean value of 2.82. Although the technological challenges are low, some students face the challenge of obtaining learning materials online due to poor stable internet access.

Table 2 *Mean value of challenges in practical online learning during COVID-19*

Challenges Category	Mean	Interpretation
Technical	2.82	Moderate
Infrastructure	3.00	Moderate
Communication	3.02	Moderate
Personal	3.35	Moderate
Pedagogy	2.94	Moderate
Total	**3.01**	**Moderate**

4.3 Level of Challenges Faced by Polytechnic Students During Practical Online Learning on COVID-19 Pandemic

Table 3 shows that the stress levels of polytechnic students during practical online learning during the COVID-19 pandemic are at a moderate level have a mean value of 3.05. Unable to fully focus during practical online learning was held causing stress among polytechnic students. This study's findings are consistent with Abdelwahed, Aldoghan, Moustafa, and Soomro (2022), Madhusanka, Jayasuriya, Ravishanka, Pothupitiya, Weerarathna, and Dunuwila (2021), Ramli and Dawood (2020), and Ghafar, Jamal, and Hasan (2021). However, the study findings

contradict the findings of Ahad et al. (2020), where only a few students stated that they paid less attention during online learning.

Table 3 *Stress level of polytechnic students during practical learning online on COVID-19 pandemic*

	Mean	Interpretation
Stress Level	3.05	Moderate

4.4 Analysis of Differences in Stress Level when participate Practical Online Learning During the COVID-19 Pandemic Based on Gender

The results of the T-test to test the difference in stress levels among polytechnic students based on gender during practical online learning are shown in Table 4. Based on Table 4, the finding found that no significant difference in the stress level when participating in practical online learning during the COVID-19 pandemic based on gender with a value of t (333) = -0.80 and a value of p = 0.42. This significant value is greater than 0.05 (p > 0.05). Table 4 also indicates that the stress level of male students has a mean value of 3.04, while female students have a mean value of 3.07. This result shows that the stress level faced by students when participating in practical online learning does not differ significantly between males and females. This is supported by the findings of Aziz, Zulkifli, Othman, and Musa (2021), who discovered no significant differences in stress levels between males and females as gender is not highly highlighted because there are other more crucial elements. However, Graves, Hall, Dias-Karch, Haischer, and Apter (2021) discovered that the stress level of female students is higher than male students because female students are more emotional when confronted with challenging situations.

Table 4 *T-test differences in stress level when participate practical online learning during the COVID-19 pandemic based on gender*

	Gender	N	Min	T Value	df	Sig
Student Stress Level	**Male**	206	3.04	-0.80	333	0.42
	Female	129	3.07			

4.5 Analysis of Relationship Between Stress Levels and Practical Online Learning Challenges During the COVID-19 Pandemic

Table 5 shows the value of the correlation coefficient obtained from the analysis that has been carried out. The study found that the Pearson coefficient between stress levels of practical online learning challenges during the COVID-19 pandemic is r = 0.27 and p = 0.00 (p < 0.05). Therefore, there is a significant relationship between the level of stress and the challenges faced by students at Kuching Polytechnic during the teaching and learning process for practical learning online during the COVID-19 pandemic. This result supports Rahe and Jasen (2022), who found a significant relationship between stress levels and practical online learning challenges during the COVID-19 pandemic. However, the result of this study contradicts the findings of Altaf, Kling, Hough, Baig, Ball, Goldstein, Brunworth, Chau, Dybas, Jacobs, and Costin (2022), who found that the challenges faced during the COVID-19 pandemic did not affect student pressure and students believe that implementing practical online learning is more convenient and less stressful than learning face-to-face.

Table 5 *Analysis of relationship between stress levels and practical online learning challenges during the COVID-19 pandemic*

Correlations

		Practical Online Learning Challenge	Student Stress Level
Practical Online Learning Challenge	Pearson Correlation	1	.278**
	Sig. (2-tailed)		.000
Student Stress Level	Pearson Correlation	.278**	1
	Sig. (2-tailed)	.000	

**Correlation is significant at the 0.01 level (2-tailed)

5. Conclusion

In conclusion, the shift from face-to-face to online learning has an impact on delivering practical engineering education. Polytechnic students faced difficulties during their practical online learning during the COVID-19 pandemic, which increased their stress levels. The result reveals that both the challenges and student stress are at a moderate level. Besides, gender does not affect student stress levels, and there is an association between challenges faced and student stress levels. The majority of students prefer face-to-face practical learning over online learning.

This study thus recommends the following to address these issues and challenges where lecturers should be exposed more to recent digital technologies such as the use of Virtual Reality (VR) and Augmented Reality (AR) so that they can implement them in their daily delivery of practical learning to create learning environment become more effective. Implementation of VR and AR has several benefits such as allowing students to delve deep into complex concepts and able to bring students closer to exploring the heavy machinery involved in the engineering field that is hard to access in the institution. In addition, lecturers must be proactive in exploring advanced technology to support preparation and enhance the knowledge transfer digitally.

Besides that, the findings also benefited the Kuching Polytechnic management in discovering issues in practical online learning among engineering students. These results can help the management to make optimal and efficient decisions on how to enhance the implementation of practical online learning from an infrastructure and facilities perspective. Polytechnic institutions should formulate a strategy by organizing the lesson plan and the content based on current circumstances and focusing on online methods. The ministry should also look into the issue more thoroughly to develop new training materials and resources for practical learning in the engineering field, whether implemented online or offline and improve existing learning materials into an online format to keep up with current developments.

Not only that, but the Ministry of Higher Education may work on a national level with the private sector to ensure that the practical online learning implementation does not merely stop after the COVID-19 pandemic but is enhanced in the future by focusing more on integrating digital technologies widely. Last but not least, the findings also indirectly contribute to the TVET field by enhancing the quality of online learning so that it meets or exceeds other countries' standards. Therefore, several insights can be drawn from the COVID-19 pandemic, where aside from having traditional classroom settings, online learning is on the verge of becoming an essential method of teaching and learning.

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