






Diploma in Pharmacy Students' Preference and Perception of Online Laboratory Practical Throughout the COVID-19 Pandemic in Malaysia

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Abstract. Students in the Diploma in Pharmacy programme are required to attend a practical session in subjects related to life sciences, chemistry and pharmaceutical courses as a requirement for graduation. When COVID-19 hit Malaysia, the face-to-face practical laboratory sessions were converted to an online delivery mode as a solution to remain the syllabus requirement. Despite having online laboratory practical sessions, students' preferences and perceptions of online laboratory practicals remain uncertain. Therefore, this study aims to investigate the preferences and perceptions of the Diploma in Pharmacy students regarding online laboratory practicals. A cross-sectional survey employing a custom questionnaire was carried out from June to August 2022. Convenience sampling was applied and selected 102 students from the Faculty of Pharmacy, Universiti Teknologi MARA (UiTM), Penang branch, Bertam campus. The majority of students, $n = 45$ (44.1%), preferred to engage in hands-on laboratory activities while watching live demonstrations, compared to pre-recorded video demonstrations, $n = 41$ (40.2%). According to our results, most students, $n = 36.3$ (34%), disagreed with the claim that an online lab practical could provide the same advantages (such as knowledge and skill) as a face-to-face lab practical session. While 31 (30.4%) and 34 (24.3%) students were neutral and admitted that an online laboratory practical is as successful as a face-to-face laboratory practical. In conclusion, pharmacy diploma students could accept the online practical approach, even though there were disadvantages criteria in online laboratory practicals. A further study on overcoming the barrier factors of online laboratory practicals is highly recommended for future research.

Keywords: COVID-19 · Online Laboratory Practical · Perception · Pharmacy · Students

1 Introduction

The outbreak of the coronavirus disease in 2019 or more well-known as COVID-19, has caused a pandemic around the world [1]. COVID-19 is highly contagious [2], therefore a movement control order (MCO) was implemented by governments to control

the infection rate among the population. This new enforcement has affected many sectors, including the global education system. Given the fatal and rapid infection rate of COVID-19, schools and universities had compelled to be closed temporarily. As a result, educational programmes need to change from a face-to-face structure to an online one [3]. Thus, the online approach was chosen to develop immediate solutions for distance learning [4].

In Malaysia, the government of Malaysia announced the MCO on 18th March 2022, thus affecting teaching and learning activities in all educational institutions, from using the face-to-face approach to online learning [5]. For example, this sudden change in the education system inevitably led to all MARA University of Technology (UiTM) programmes having to revise their syllabus, re-plan the timetables and change the policy on the delivery of lessons and the assessment rubrics. This included the UiTM Diploma in Pharmacy programme, which also had to follow the same process [6]. These changes had to include subjects that involved practical sessions as the practice needed to be conducted online even though most of the laboratory practical sessions required specific facilities such as equipment, safety apparatus, and direct supervision by the lab instructors. With the absence of complete equipment and direct monitoring from the laboratory instructor, the practical skill objective was doubted can be achieved effectively. Therefore, there would be many challenges to the education policy maker, educators, and students in aligning the educational need with the pandemic situation.

Currently, there are limited studies on preferences and perceptions in online practical sessions as most of the previous studies focused on the impact of the COVID-19 pandemic among students on online learning in general terms only [7, 8]. Therefore, this study aims to gain preference and perceptions among pharmacy diploma students during online learning, specifically for laboratory practical sessions. It is crucial to gather the information from the Diploma in Pharmacy students' perception regarding online laboratory practicals as it is a part of the teaching and learning improvement process.

2 Literature Review

Reference [9] has suggested that online learning is a medium of instruction offered in an online environment using the Internet for teaching and learning and is not dependent on their actual location. Initially, online learning was mainly implemented for part-time mode study and non-residents or people living in remote areas [10]. Online teaching and learning help educators to develop and improve their teaching modules. Moreover, teaching and learning activities become more flexible as the communication between educators and students can be conducted synchronously (real-time interaction) or asynchronously (not restricted to timeframe) according to institutional needs.

In response to curbing COVID-19 from spreading, online learning has emerged as the ideal means for sustaining the educational system. With no exception, a rapid shift to online mode for laboratory practical sessions were also taken as contingency steps to ensure lesson continuity [11]. Online laboratory practical or virtual laboratory is a wise choice considering that lockdown regulation and social distancing can be complied. For students in the field of science, the virtual lab is fully applied in content delivery, experiments, and analysis [12].

Based on Miller's learning pyramid, the laboratory sessions account for the behavioural components of practical competence, which involve assessment in simulated and real settings and served a higher domain than the cognitive domain [13]. Therefore, to align with the needs of syllabus outcomes, students of the Diploma in Pharmacy were expected to develop skills involving application, analysis, and critical thinking [14]. The students need to do practicals such as in life sciences, chemistry, and pharmaceutical subjects. In a pandemic situation, an online practical session is the best alternative. However, the laboratory instructor needs to plan the framework properly so that the students would engage more, and feel satisfied and motivated for learning [15]. Although it might be argued that this approach cannot wholly replace the direct engagement of students with the equipment, online laboratory practicals may help students gain critical practical skills [16]. Therefore, it is crucial to gather the information from the Diploma in Pharmacy student's perception regarding online laboratory practicals as a part of the teaching and learning improvement process.

3 Methodology

3.1 Study Design, Sample Size and Participants

A cross-sectional study using a self-constructed questionnaire was performed from June to August 2022. Convenience sampling was applied among the Faculty of Pharmacy students in Universiti Teknologi MARA (UiTM) Penang branch, Bertam campus. The survey was conducted online using the Google Form platform and the link for the survey was distributed to participants through social media, mainly via WhatsApp, as it is the most popular social media platform among the students. The sample size was calculated using Raosoft, an online sample size calculator. The size of the student population in the institution, who were involved in online laboratory practical sessions, was 138 persons. Based on the sample size calculator (with a 95% confidence level), the minimum number of participants needed for this study was 102 persons. The inclusion criteria are as follows:

- i) The participant must be an undergraduate student.
- ii) The participant must participate in at least two semesters of online lab practicals.

3.2 Ethical Approval and Consent Note

This study has been approved by Universiti Teknologi MARA, Malaysia Research Ethics Committee, BEREC/05/2022 (UG/MR/70). It was conducted following the guidelines of the Declaration of Helsinki.

3.3 Data Collection Tool

The questionnaire consisted of four sections and was available in English. The first section gathered the demographic information of the students. The second section consisted of online practical learning preference styles. The last section of this survey covered the student's perception of online practicals. It consisted of nine questions and the answers were based on a Likert scale with five levels of agreement: "strongly agree, agree, neutral, disagree, and strongly disagree".

3.4 Data Analysis

Data were analysed using the IBM Statistical Package for the Social Sciences (SPSS) version 26 software. Descriptive data were analysed and presented as frequencies and percentages.

4 Results

This study has successfully explained the status of perception and preference of online laboratory practice among Diploma in Pharmacy students. The study has covered various angles such as educator preparation, appropriateness of the implementation methods, and the benefits of online laboratory practicals. Furthermore, this study also provides an overview of the diversity of pharmacy student preferences in the implementation of online laboratory practicals.

4.1 Sociodemographic Characteristics of Respondents

A total of 102 students from the Diploma in Pharmacy participated in this study. Table 1 shows the sociodemographic characteristics of the respondents. The majority of the students were females, with $n = 74$ (72.5%). The respondents' median (IQR) age was 21 (IQR 20–21). Regarding the location of students conducting online laboratory practicals, 56 (54.9%) of 102 students performed their online laboratory practicals at home, and 46 (45.1%) conducted online laboratory practicals at college. During the lockdown, the students stayed in urban (38.2%), suburban (23.6%), and rural areas (38.2%). Internet connection is one of the crucial elements for online learning. Most of the respondents also had good internet coverage with 47 (46.1%), followed by moderate internet coverage with 52 (51.0%), and weak internet coverage with only 3 (2.9%). Lastly, our survey shows that most of the students used more than one device, such as a handphone (80.8%), laptop (95.2%), tablet (13.5%), and printer (24%) to accomplish online practical learning.

Table 2 shows a comparison of online laboratory practical delivery mode options preferences. Items A and B reflected the questions that assessed the students' preferences in synchronous delivery. In contrast, asynchronous delivery is embedded in items C and D. From the result, most of the students prefer to be hands-on with the laboratory practical synchronously watching live demonstration (item B), $n = 45$ (44.1%), compared to pre-recorded video demonstration (item D), $n = 41$ (40.2%). These findings may be because, if the hands-on laboratory were done live with the lecturer, the students could communicate directly with the lecturer, especially in the pharmaceutical laboratory, which involves dose calculation and drug preparation.

Table 3 shows nine items of students' perceptions regarding online laboratory practicals. For each item, students were required to rate their level of agreement as strongly agree, agree, neutral, disagree, and strongly disagree. Based on item 3, "I think that online lab practical is relevant, whether during or without a pandemic," most students (46.1%) perceived that online laboratory practicals should be continuously implemented even after the pandemic. Nevertheless, from our findings, about 17(16.7%) and 7(6.9%) of respondents disagreed and strongly disagreed with the statement.

Table 1. Sociodemographic Characteristics of Respondents

Characteristics		Frequency (n)	Percentage (%)
Gender	Male	28	27.5
	Female	74	72.5
Age	19–20	47	46
	21–22	55	54
Age median (IQR)	21 (20–21)	-	-
Execution of online laboratory practical	College	46	45.1
	Home	56	54.9
Area of living	Urban	39	38.2
	Rural	24	23.6
	Sub-Urban	39	38.2
Level of Internet coverage	Good	47	46.1
	Moderate	52	51.0
	Weak	3	2.9
Type of devices used during online practical	Handphone	84	80.8
	Laptop	99	95.2
	Tablet	14	13.5
	Printer	25	24.0

Table 2. Preference for An Online Laboratory Practical Delivery Method

Item	The choice of online laboratory practical delivery methods	Frequency (n)	Per cent (%)
A	Watch a live demonstration from the instructor only	10	9.8
B	Watch a live demonstration from the instructor and hands-on the lab	45	44.1
C	Watch pre-recorded demonstration video only	6	5.9
D	Watch pre-recorded demonstration video and hands-on with the lab	41	40.2

Item 7 shows the students' agreement that online laboratory practicals would give the same benefits (such as knowledge and skill) as face-to-face laboratory practicals. From our findings, most respondents, $n = 37$ (36.3%), did not agree with that statement. While $n = 31$ (30.4%) and $n = 34$ (24.3%) respondents expressed neutral and agreement that an online laboratory practical is equally successful as a face-to-face laboratory practical, respectively.

Item 8 assessed whether the online laboratory practical would interfere with the student's studies or daily lives. Most students, $n = 38$ (37.3%), have no issues implementing online laboratory practicals. Nevertheless, about 29 (28.4%) respondents felt that online laboratory practicals triggered a sense of student encumbrance. In this study, the majority of the students, $n = 44$ (43.1%), did not agree with the statement in item 9, which assess the acceptance of students about whether all practical subjects can be done online.

5 Discussion

This study has successfully provided an overview of the Diploma in Pharmacy students' preferences for online practical sessions. In addition, the perception of students who opposed the online practical laboratory sessions would also be clearly stated in the discussion below.

5.1 Student's Preference for Online Laboratory Practical Performance

Online laboratory practical implementation can be done synchronously or asynchronously. Synchronous delivery is similar to a regular classroom setting, except that all interactions occur virtually rather than face-to-face or in person. In comparison, asynchronous delivery modes, teaching, and learning activities may happen at various times and places. Consequently, there would be a time gap in the communication between the educator-learner [5].

From the result in Table 2, students prefer to be hands-on with the laboratory practical by synchronously watching live demonstrations as compared to a pre-recorded video demonstration. This opinion is similar to the statement that synchronous hands-on components can be fully integrated with online laboratory practicals where students may conduct the experiment in a real laboratory setting and have a live discussion with the teaching staff via a video stream [18]. Our findings also show that pre-recorded video is essential in the online laboratory practical process. With pre-recorded videos, students would have ample time to complete their tasks. The same result was observed among engineering students, where the importance of viewing pre-recorded lectures and practical sessions was compulsory during the pandemic and in the post-COVID-19 era [15]. From our assessment, online laboratory practical delivery without involving students in hands-on, regardless of synchronous (item A) and asynchronous (item C), received the least favourite with a response of 10 (9.8%) and 6 (5.9%), respectively.

5.2 Students' Perception of Online Laboratory Practical

In agreement with online laboratory practicals, this study provides information about students' perceptions of online laboratory practicals, which can be relevant under any circumstances. The result explicitly shows that most of the respondents (46.1%) supported the implementation of laboratory practicals online without any emergency reason such as the pandemic. This finding is similar to a study in North India, where around half

Table 3. Students' Perception of online laboratory practical

Item	Statement	n (%)				
		Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
1	I think that lecturers are well prepared for online lab practical.	32 (31.4)	50 (49.0)	16 (15.7)	4 (3.9)	0 (0)
2	I think that faculty/ lecturers are responsible for supplying the items needed, such as disposable lab materials to the students, to complete the online lab practical report.	46 (45.1)	43 (42.2)	12 (11.8)	1 (1.0)	0 (0)
3	I think that online lab practical is relevant, whether during or without a pandemic.	12 (11.8)	35 (34.3)	31 (30.4)	17 (16.7)	7 (6.9)
4	I always refer to rubrics while completing the online lab practical report.	46 (45.1)	41 (40.2)	12 (11.8)	3 (2.9)	0 (0)
5	I think that the time provided by the lecturers to complete the online lab practical reports is sufficient.	31 (30.4)	48 (47.1)	19 (18.6)	4 (3.9)	0 (0)
6	I can finish my online lab practical report on time.	38 (37.3)	48 (47.1)	13 (12.7)	3 (2.9)	0 (0)

(continued)

Table 3. (continued)

Item	Statement	n (%)				
		Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
7	I feel that the online lab practical had the same benefits (such as knowledge and skill) as the face-to-face lab practical.	10 (9.8)	24 (23.5)	31 (30.4)	26 (25.5)	11 (10.8)
8	I feel that online lab practical is a burden to my life or study.	10 (9.8)	19 (18.6)	35 (34.3)	27 (26.5)	11 (10.8)
9	I think that online lab practical is suitable for all subjects with practical sessions.	9 (8.8)	21 (20.6)	28 (27.5)	31 (30.4)	13 (12.7)

(48.5%) of the students wanted the practical classes to be conducted in a mixed mode (online and offline), even after the COVID-19 period [11].

From our observation, 36.6% did not agree that online laboratory practicals would give the same benefits (such as knowledge and skill) as face-to-face laboratory practicals of students. According to [16] the online practical may help students gain critical practical skills, even though the online practical session arguably cannot replace the student's actual physical application with the equipment. Another observation among medical students in Saudi Arabia by [17], has stated that the students admitted that online clinical practical was less effective than live interaction clinical practical due to the lack of real-life communication, and the absence of instructors or students may restrict these virtual applications' efficacy [17]. Conversely, in a study among medical students in a medical college in North India, around 62% to 80% of students were contented with online practical teaching or engaged with the benefits of various online tools used in the teaching sessions [11].

In this study, we also assessed whether the online laboratory practical would interfere with the student's studies or daily lives. There may be several causes for this condition. Inevitably, students need to have stable internet coverage and communication devices such as computers, mobile phones, and tablets. This is parallel to the discoveries in Table 1, where students had to use more than one device throughout the online practical session.

However, this study may lack information on the reasons for the simultaneous use of multiple devices, as the underlying reason needs further investigation. Moreover, all practical online models were mediated through a computer or gadget screen, restricting the student's hands-on interaction with physical experimental tools [18]. By the way, a student may need to apply many learning styles to cope with the course such as group discussion and simulation [14]. Consequently, the limitations to the actual laboratory experimental process may lead to the deterioration of students' performance.

The acceptance of students and whether all practical subjects can be done online, as in item 9 was observed, and the majority of the students did not agree. In Malaysia's Diploma of Pharmacy syllabus, students are also given pre-recorded videos for life sciences courses such as cell biology, human anatomy, chemistry, and microbiology. The reason behind the limitations was that the subjects depend on highly specialised tools such as microscopes, biosafety hoods, and incubators. In addition, these subjects involved experiments with animals or microbial samples which need to be supervised by experienced instructors and laboratory staff and need to be conducted in a proper laboratory setting. Therefore, not all subjects in the pharmacy diploma syllabus on our campus are suitable to be conducted online.

6 Conclusion

In conclusion, although the students in the Diploma in Pharmacy course could accept the online laboratory practicals approach as an immediate alternative to fulfil syllabus requirements during the COVID-19 lockdown, there were limitations of online laboratory practicals. Some of the experiments cannot be conducted with a similar outcome as the face-to-face approach, as there were constraints in terms of the material and equipment used in the laboratory setting. Therefore, further improvements in the feedback system between educators and learners are needed so that online laboratory practical becomes more effective and able to provide the same benefits as a face-to-face practical session. A study on the effectiveness of the method of communication during online laboratory practicals is highly recommended in the future.

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