

## COVID-19: STUDENTS' PERCEPTION OF E-LEARNING & E-ASSESSMENT PLATFORMS UTILISED IN PHARMACOLOGY CURRICULUM DELIVERY

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### ABSTRACT

The COVID-19 pandemic has resulted in the move to open and distance learning (ODL) mode for all higher education institutions in Malaysia. This has also impacted the curriculum delivery for B.Pharm students at the Faculty of Pharmacy, Universiti Teknologi MARA. Although there has been a gradual shift in health-related education delivery over the past decade, with e-learning being increasingly utilised, this was mostly meant to be a supplement to conventional face-to-face teaching methods. The untimely change brought upon by the pandemic has resulted in several challenges, including inadequacy of ICT infrastructures and unpreparedness in curriculum delivery. Pharmacology is a fundamental component of the undergraduate pharmacy curriculum. The extensive amount of knowledge to be delivered and learnt, as well as the hurdles of delivering it completely through the ODL mode rendered an already complex subject even more challenging to teachers and students alike. After more than a semester of ODL, evaluation and optimisation of learning needs to be carried out. Regular curriculum review and reassessments of existing teaching delivery methods are important in ensuring that the learning process is as effective as possible to adequately prepare pharmacy graduates. An important factor to be considered in curriculum review is students' perception of their educational experience. One of the very basic necessities of ODL is ensuring that a decent online platform is utilised for curriculum delivery. This research assessed students' views on e-learning implementation, focusing on their perception of the suitability of online learning platforms used in pharmacology courses in the B.Pharm (Hons) programme during the COVID-19 period. Google Classroom is ranked highest in terms of suitability, followed by Gradescope and YouTube. The findings of this study will facilitate the faculty and content developer in making a more informed decision when improving the online-learning process.

*Keywords:* E-learning; Online distance learning; Pharmacy education; Curriculum delivery; COVID-19 pandemic

### 1. Introduction

Advances in technology have resulted in the growth and acceptance of e-learning. In general, e-learning or online education is defined as an approach to education that is facilitated by information communication technology (ICT) (Lee, 2010; Rosenberg & Foshay, 2002; Ruiz et al., 2006). Over the past 15 years or so, there has been a shift in medical- and health-related education delivery. E-learning became increasingly utilised as one of the means of instruction in medical and other healthcare-related education around the world (Al-Fraihat et al., 2020). It can be used alone or as a supplement to conventional teaching methods. When utilised effectively, e-learning allows students to have control over their learning i.e. allowing flexibility over content and pace, and gives them access to a wide range of information thus improving quality and understanding of curriculum contents (Panigrahi et al., 2018).

In medical and pharmacy schools throughout the world, it is common for curriculum instructions to be done via blended learning modules, in which students learn via online learning activities at their convenience in addition to traditional face-to-face sessions. In most cases though, traditional face-to-face learning activities played a bigger role as compared to online learning. The use of online learning platforms and resources were only supplemental in nature. This has changed tremendously over the past year.

As a result of COVID-19, the educational sector was hugely impacted, with temporary suspension of physical presence in educational institutions all over the world including Malaysia (Lim, 2020). Face-to-face classes including lectures and hands-on laboratory classes could not be run while other learning experiences mostly came to a halt. Colleges and universities were faced with the dilemma of making sure teaching and learning would proceed while keeping their faculty, staff, and students safe. COVID-19 brought with it an accelerated and radical change in the mode of education delivery to a fully online platform. This not only ensures the safety of students and staff, but also addresses the issue of education continuity for students, especially during the Movement Control Order (MCO) period in Malaysia and, if need be, beyond.

Consequently, Universiti Teknologi MARA (UiTM), including the Faculty of Pharmacy, moved all classes to open and distance learning (ODL) mode effective 13 April 2020 for all its campuses nationwide (Karim, 2020). Although the move to online instruction ensured a flexibility in teaching and learning from anywhere and at any time, it was very sudden. The abrupt change has resulted in several challenges including inadequacy of ICT infrastructures and unpreparedness in curriculum delivery.

Pharmacology is a fundamental component of the undergraduate pharmacy curriculum, laying the foundational concepts required for understanding of patient-specific drug therapy and rational drug therapeutic decisions (Saseen et al., 2017; William B. Jefferies, Kathryn K. McMahon, Gary C. Rosenfeld, Jack W. Strandhoy, 2010). There is significant development in drug innovation and consequently a continuous development of knowledge and information in the pharmacology area especially over the recent 2 decades (Baños et al., 2002). It is thus a constant challenge for pharmacology teachers to ensure that contents are regularly updated to reflect the dynamic development of information, as well as providing students with engaging contents that promote learning and retention of information (Engels, 2018). The extensive amount of knowledge to be delivered and learnt, as well as the hurdles of delivering it completely through ODL mode have rendered an already complex subject even more challenging to teachers and students alike.

For the online pharmacology courses featured in this study, the tools and technologies including Google Classroom, UFuture (UiTM's self-developed learning management system), YouTube, Padlet, WhatsApp/Telegram, Gradescope, and Quizziz were used by faculty members. Google Classroom is a cloud-based learning management system that ties together Google's G Suite tools i.e. Drive, Gmail, Docs, Forms, Sheets and Slides. It was launched in 2014 (Etherington, 2014). Over the 6 years since its initial release, Google Classroom has evolved as a learning management system (LMS). With Google Classroom, teachers can streamline how classes are managed (i.e. integration with other Google tools e.g. Docs, Drive and Calendar), digitally organise, distribute and collect assignments as well as course materials, communicate with students and provide timely feedback on their classwork.

The use of online social networks in medical or pharmacy education can enhance teaching and learning. One such platform is YouTube, a well-known sharing platform that hosts a wide variety of videos ranging from entertainment, news, and documentary to instructional/educational topics. As one of the platforms with a wide outreach and easy access, YouTube is a valuable tool for managing and organising online educational video resources

(Snyder et al., 2008). In general, analysis of research related to YouTube in the classroom indicated that it is used for two general purposes in education: to curate existing videos or as a platform to host video creations (Snelson, 2016).

Padlet is a web application that allows collaborative content sharing and editing similar to blogs and other “Social Software” i.e. social bookmarks, discussion forum and social network pages (Cole, 2009). In the educational context, Padlet is used by students to share knowledge i.e. post their thoughts, ideas, questions and answers, links, pictures and videos on a virtual bulletin board (Fiester & Green, 2016). In higher education, students need not only learn academic concepts, but more importantly they should also learn important skills such as acquiring, internalising, applying and creating new knowledge (DeWitt et al., 2015). The use of Padlet provides users with a platform for generating new knowledge, as students share relevant materials and acquire new ideas from sources shared by their peers. Padlet users can actively contribute instead of being merely consumers of information. Several published papers have proposed that this technologically-enabled collaboration and knowledge sharing, would give educators opportunities for creating socially engaging tasks that require active student participation and knowledge building (Cole, 2009; Sigala, 2007).

Gradescope is an e-assessment system. It is a grading software that is designed to streamline and standardise paper-based and digital assignments (Singh et al., 2017). It allows a student or class instructor to upload assignments via an online interface, which will then be assessed using a rubric-based digital grading tool.

After more than a semester of ODL, evaluation and optimisation of learning needs to be carried out. Feedback from educators and students is essential to ensure the online learning process is as effective as possible. One of the very basic necessities of ODL is ensuring that a decent online platform is utilised for education delivery. A good online platform will lead to greater satisfaction levels, which in turn can help guarantee the success of online education. This research assessed students' perception on e-learning implementation, focusing on the appropriateness of the various online platforms used in pharmacology courses instruction in the B.Pharm (Hons) Programme at UiTM during the COVID-19 period. This would allow content developers and instructors of online learning to gain information on the suitability of the various online platforms utilised and employ the data for a more informed decision making in the future.

## **2. Materials and Methods**

### ***2.1 Research design and participants***

This was a descriptive, cross-sectional study conducted among students enrolled in the Bachelor of Pharmacy Honors programme (B.Pharm, Hons) at the Faculty of Pharmacy, UiTM, Puncak Alam Campus during the 2019/2020 academic year. Convenience sampling was applied, and all students were enrolled in the pharmacology subjects in semesters 2, 4 and 6.

### ***2.1 Study instrument and procedure***

A structured questionnaire was developed according to the study's objective. The questionnaire was designed to assess students' perception of online learning of pharmacology modules. It contained statements relating to a range of topics relevant to the pharmacology curriculum including curriculum delivery and online learning platforms. Item types ranged from open-ended and multiple-choice questions as well as items scored on a 5-point Likert scale.

The questionnaire was disseminated via the online platform, SurveyMonkey®. The importance and potential impacts of the study were explained to the students beforehand. Completion of the questionnaire was on a voluntary basis and none of the information collected was identifiable, thereby maintaining data anonymity.

### 2.3 Data analysis

The collected data were analysed using the Statistical Package for Social Sciences (SPSS), Version 26. This data was analysed using frequency counts and percentages for ordinal categories or in mean values of the scale. Analysis of variance with Kruskal-Wallis test was used to identify differences in scoring tendencies between subgroups. Probability values of less than 0.05 were considered statistically significant for all statistical tests.

### 3. Results

The Faculty of Pharmacy at UiTM Puncak Alam Campus offers a 4-year, 8-semester B.Pharm (Hons) course. B.Pharm students are taught pharmacology over a duration of 3 years, between their second to seventh semesters, where they learn the various drug classes by body system. Feedback responses for this study were obtained from students who were enrolled in the pharmacology courses for semesters 2, 4 and 6 of the 2019/2020 academic year. Five pharmacology courses were offered in this affected semester—including basic principles of pharmacology, anti-infective drugs pharmacology, endocrine drugs pharmacology, gastrointestinal (GI) drugs pharmacology and central nervous system (CNS) drugs pharmacology. A total of 532 students were enrolled in these courses (total of students registered for each course and response rates are documented in Table 1). Students were asked to complete the questionnaires at the end of the 14-week semester for each of the pharmacology courses they enrolled in.

Table 1: Number of students registered and questionnaire response rates.

Courses	Semester/ Study Year	No. of Students Registered (n)	Response Rate
Basic principles of pharmacology	2 <sup>nd</sup> / Year 1	159	138 (86.79%)
Anti-infective drugs pharmacology	4 <sup>th</sup> / Year 2	182	147 (80.77%)
Endocrine drugs pharmacology	4 <sup>th</sup> / Year 2	185	172 (92.97%)
Gastrointestinal (GI) drugs pharmacology	6 <sup>th</sup> / Year 3	184	154 (83.70%)
Central Nervous System (CNS) drugs pharmacology	6 <sup>th</sup> / Year 3	185	140 (75.68%)

The study first looked at students' perception on the clarity of information dissemination pertaining to the course conduct at the start of online learning. This is important as it is essential to prepare students on what to expect with such a big change in curriculum delivery. In general, the majority of students (92.7%) agreed that clear explanations were given with regard to the conduct of online courses i.e., adequate information on course requirements, class schedule, and assessments. The level of agreement on the clarity of instruction disseminated within the different pharmacology courses offered were compared. The GI pharmacology course scored the highest, followed by CNS pharmacology, endocrine pharmacology, basic principles of pharmacology and lastly, anti-infective drugs (Table 2). A Kruskal-Wallis test showed that there was a statistically significant difference in the score between the different pharmacology courses,  $\chi^2(2) = 18.367$ ,  $p = 0.001$ , with a mean rank score of 332.39 for anti-infective pharmacology, 377.34 for principles of pharmacology, 355.35 for endocrine drugs pharmacology, 404.45 for CNS drugs pharmacology and 408.48 for GI drugs pharmacology.

Table 2: Outline, schedule and assessments were explained clearly at the beginning of the course.

	Number of respondents (Percentage, %)					Mean ± SD	n
	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree		
Overall	4 (0.5)	4 (0.5)	47 (6.3)	468 (62.5)	226 (30.2)	4.21 ± 0.62	749
Basic principles of pharmacology	1 (0.7)	1 (0.7)	9 (6.6)	83 (60.6)	43 (31.4)	4.21 ± 0.66	137
Anti-infective drugs pharmacology	1 (0.7)	3 (2.1)	9 (6.2)	105 (71.9)	28 (19.2)	4.07 ± 0.63	146
Endocrine drugs pharmacology	0 (0)	0 (0)	18 (10.5)	108 (62.8)	46 (26.7)	4.16 ± 0.59	172
GI drugs pharmacology	0 (0)	0 (0)	7 (4.5)	89 (57.8)	58 (37.7)	4.33 ± 0.56	154
125 pharmacology	2 (1.4)	0 (0)	4 (2.9)	83 (59.3)	51 (36.4)	4.29 ± 0.66	140

A major challenge for educational institutions in conducting ODL was evaluating the numerous choices of online platforms and subsequently implementing them for effective learning. In online learning, various platforms (i.e. learning management system (LMS), educational websites, social media, and mobile applications) can be utilised. For the online pharmacology courses featured in this study, the tools and technologies including Google Classroom, UFuture (UiTM's self-developed learning management system), YouTube, Padlet, WhatsApp/Telegram, Gradescope, and Quizziz were used by faculty members. Table 3 shows the online platforms used in each pharmacology course. This study looked at students' perception of the suitability of online learning platforms (Table 4). In general, Google Classroom ranked the highest in terms of suitability (mean = 4.52 ± 0.62), followed by Gradescope (mean = 4.24 ± 0.83), YouTube (mean = 4.16 ± 0.82), Quizziz (mean = 3.95 ± 1.10), WhatsApp/Telegram application (mean = 3.75 ± 1.02), UFuture (mean = 3.66 ± 1.11) and lastly Padlet (mean = 2.56 ± 1.41). The study also looked at students' perception of knowledge gained (Table 5). The majority of respondents (89.3%) agreed that their knowledge increased at the end of the course, while 1.8% disagreed and 8.8% maintained neutrality.

Table 3: Online learning/ assessment platforms

	Google Classroom	UFuture	Padlet	WhatsApp/ Telegram	YouTube	Grade scope	Quizziz
Basic principles of pharmacology	√	√	√				
Anti-infective drugs pharmacology	√			√			
Endocrine drugs pharmacology	√	√	√	√	√		
GI drugs pharmacology	√	√	√	√		√	
CNS drugs pharmacology	√	√	√			√	√

Table 4: Suitability of online platform

	Number of respondents (percentage, %)					Mean ± SD	n
	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree		
Google Classroom	2 (0.3)	5 (0.7)	23 (3.1)	290 (38.8)	427 (57.2)	4.52 ± 0.62	749
UFuture	39 (6.5)	55 (9.1)	114 (18.9)	261 (43.3)	134 (22.2)	3.66 ± 1.11	603
Padlet	209 (34.8)	98 (16.3)	101 (16.8)	134 (22.3)	59 (9.8)	2.56 ± 1.41	601
WhatsApp/Telegram	25 (5.3)	26 (5.5)	89 (18.9)	231 (49.1)	99 (21.1)	3.75 ± 1.02	470
Gradescope	8 (2.7)	5 (1.7)	11 (3.8)	153 (52.2)	116 (39.6)	4.24 ± 0.83	293
YouTube	2 (1.2)	5 (2.9)	19 (11.0)	83 (48.3)	63 (36.6)	4.16 ± 0.82	126
Quizziz	10 (7.2)	3 (2.2)	19 (13.7)	59 (42.4)	48 (34.5)	3.95 ± 1.10	133

Table 5: My knowledge increased after completing this course

	Number of respondents (Percentage, %)					Mean ± SD	n
	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly Agree		
Overall	10 (1.3)	4 (0.5)	66 (8.8)	502 (67.0)	167 (22.3)	4.08 ± 0.67	749
Basic principles of pharmacology	2 (1.5)	0 (0)	11 (8.0)	94 (68.6)	30 (21.9)	4.09 ± 0.65	137
Anti-infective drugs pharmacology	2 (1.4)	0 (0)	19 (12.8)	97 (65.5)	30 (20.3)	4.03 ± 0.67	148
Endocrine drugs pharmacology	4 (2.3)	0 (0)	18 (10.5)	115 (67.3)	34 (19.9)	4.02 ± 0.72	171
GI drugs pharmacology	1 (0.6)	1 (0.6)	12 (7.8)	101 (65.5)	39 (25.3)	4.14 ± 0.63	154
CNS drugs pharmacology	1 (0.7)	3 (2.2)	6 (4.3)	95 (68.3)	34 (24.5)	4.14 ± 0.65	139

#### 4. Discussion

Due to the wide spread of Coronavirus disease (COVID-19), universities worldwide experienced an unprecedented change, having to move from traditional face-to-face classes to online platforms. In Malaysia, the government enforced a nationwide suspension of universities and schools on 18 March 2020 in accordance with social distancing measures. Shortly after, thousands of faculty members started to teach online, with students at home learning through the internet. The Faculty of Pharmacy, Universiti Teknologi MARA (UiTM) was one of the faculties affected by this move to online learning.

Various platforms were used to facilitate teaching and learning in this particular study cohort. These platforms were utilised for various purposes including creating, distributing, and managing the delivery of educational content, assessment conduct, and submission. This study aimed to look at the perceived effectiveness of online instruction for pharmacology courses focusing on the appropriateness of the platform used.

In our study, Google Classroom was ranked as the most suitable online learning platform, similar to what was documented in numerous published papers regarding student acceptance of

the said platform (Albashtawi et al., 2020; Huang et al., 2021; Khairani et al., 2020; Nanthinii M, 2020). This observation might be closely tied to the many reported benefits linked to the use of Google Classroom, including ease in sharing information, giving assignments communicating and affording opportunities for learners to engage (Albashtawi et al., 2020; Crane, 2016; Hamid et al., 2020; Heggart & Yoo, 2018; Iftakhar, 2016; Mafa, 2018). Assessments have long been recognised as one of the main drivers underlying students' learning behaviour. The shift to online learning also means the need for an effective online assessment, or e-assessment system. E-assessment or electronic assessment means that all assessment procedures from the start to the end of assessment are carried out electronically (Alruwais et al., 2018). This means that the design, test implementation, recording the response and providing the feedback are all completed using ICT.

In our study, Gradescope was ranked highly, second only to Google Classroom. There are several advantages of an e-assessment system such as Gradescope. At the teacher's end, it renders the administration, collection and marking of the assessment, and communication of results much easier and quicker, saving time and effort and making the hardcopy needless particularly with large classrooms (Jordan, 2013; Koneru, 2017; Simin & Afrooz, 2013). From a student's perspective, there are also several advantages that might have prompted the positive acceptance of Gradescope. E-assessment enables students to hand in assignments and sit for tests from the comfort of their own homes. The ease of use and intuitive and user-friendly interface could also be a deciding factor. More importantly, utilisation of Gradescope, makes it much more realistic for students to get timely and appropriate feedback. Providing students with feedback on assignments is integral to the development of academic skills (Beaumont et al., 2011). With Gradescope, students are able to access digital feedback outside of class for review, are assured of consistent grading, and would be able to have detailed identification of strengths and weaknesses of submitted assignments.

In this study cohort, YouTube was among the top three platforms that were scored highly by respondents in terms of their suitability. This is in accordance with several published research that reported positive views on the utilisation of YouTube in teaching and learning from students' perspective (Fleck et al., 2014; Jaffar, 2012). There could be several reasons YouTube is perceived as a suitable online learning platform. The implementation of YouTube videos particularly in the science classrooms, provides greater flexibility in instruction as it adds a dynamic element to learning (Clifton & Mann, 2011). Studies have shown that the use of audio-visual aids in the classroom is greatly helpful for the students in developing an understanding of complex concepts (Carmichael et al., n.d.; Ulloa Salazar & Díaz Larenas, 2018). It is often easier to recall something which has been seen, than heard. Through YouTube, educators are able to easily share video clips including detailed charts, graphs or diagrams illustrating complex processes/procedures and ideas, thus enhancing comprehension of difficult concepts. Uploading content to YouTube makes it convenient for learners to access and view it, not only on the laptop or PC screen, but on the go via the YouTube app on smartphones and tablets, making it ideal for mobile learning (Clifton & Mann, 2011). And of course, YouTube use is ubiquitous, making it easier to navigate as most students would have used it in other contexts especially for entertainment purposes.

In spite of the many perceived advantages associated with Padlet use, respondents in our study seemed averse to the choice of Padlet as one of the online platforms used in online learning. There could be several reasons underlying this particular observation. There have been previous reports that to some extent, the pedagogical approaches employed had some influence on students' perceptions and their use had a negative effect on the perceptions (Md Deni & Zainal, 2018). Other reported issues with Padlet include accessibility problems with different devices and difficulty in navigating the links on the Padlet wall (Md Deni & Zainal, 2018).

Aside from that, the absence of “dynamic-data”/“in-browser editing abilities” (e.g. like Google Docs that allow text document editing within the platform without the need for downloading), lack of notification and “folder” functions for easy filing and categorisation (e.g. Dropbox/OneDrive) are among the downsides of Padlet and could consequently result in students’ negative perception of its use (Lowe & Humphrey, 2018).

This study has several limitations. To begin with, its generalizability could be limited by its cross-sectional design and its use of data from a single university. The general characteristics of B.Pharm students of UiTM, as well as the specific institutional and cultural context, might have affected the results of this study. Additionally, this research was not designed to determine causal relationships i.e., why some platforms were deemed to be more satisfactory as compared to others.

## 5. Conclusion

In the absence of traditional face-to-face classroom teaching, online distance learning has taken over as the main source of knowledge for the majority of students in higher learning institutions. Against such a backdrop, it is pertinent to examine students’ perception and preference for the ODL system adopted at the university level. E-learning/ E-assessment platforms contribute to a seamless and meaningful learning experience. In this study, our cohort of students ranked Google Classroom highest in terms of suitability, followed by Gradescope and YouTube. It is highly likely that these choices were influenced by the ease of accessibility and organisational features that are simple and easy to use.

A well organised and intuitive web-based learning platform enables students to focus on the coursework rather than having to sort out technical issues that may arise from poorly designed sites and systems. In even simpler terms, the best online learning platforms provide an easy way for students to access and use course materials through the internet. A well perceived system makes learning efficient, pleasurable and painless. The findings of the study will facilitate the faculty and educators in making a more informed decision in improving the online-learning process.

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