RESEARCH ARTICLE

Online versus classroom learning in pharmacy education: Students' preference and readiness

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Abstract

Introduction: Online learning has been adopted in delivering many courses by tertiary education institutions due to several advantages it offers. Similarly, online learning has been promoted in pharmacy education to enhance student learning. This study explored pharmacy students' performance and preferences towards online versus classroom learning.

Methods: An online learning module was developed for an independent subject focused on basic patient counselling skills based on the course syllabus of Hospital Pharmacy. All second-year Diploma in Pharmacy students were stratified into online learning and face-to-face learning groups according to their cumulative grade point average (GPA) scores. The two groups were then invited to learn separately via online or face-to-face learning. After the activities, students' knowledge on the subject was compared before they completed an online feedback survey.

Results: There was no significant difference between the knowledge scores when comparing online learning and face-to-face learning, suggesting online learning was as effective as the face-to-face learning method. The majority of students reported that they enjoyed online learning and found that online learning was a useful learning tool. Having said that, most students purported a preference for a blended learning approach. The students valued the interaction available in face-to-face learning and the time flexibility offered by online learning.

Conclusion: Online and face-to-face learning methods were found equally effective for student learning, yet pharmacy students denoted that they favoured a blended learning approach. Although computer and innovative technologies diversify existing teaching and learning methodologies, matching students' learning needs is crucial when selecting the delivery approach to maximise student learning outcomes.

Keywords: *Classroom, e-Learning, Pedagogy, Teaching Methodology, Web-based*

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Introduction

Pharmacy education has undergone drastic changes reflecting the evolution of pharmacy practice and increasing adoption of new technologies for teaching and learning (Jatau, Ming, & Awaisu, 2018; Mohamed Ibrahim, 2018). For example, teaching curricula now place emphasis on clinically-oriented practice and less on compounding-based practice, reflecting the changing role of pharmacists in the workplace (Curley, Wu, & Svirskis, 2018; Ming & Khan, 2018). At the same time, the teaching and learning approaches have shifted from teacher-centred to student-centred processes. Students are required to be proactive rather than being passive in their own learning.

On the other hand, the fourth industrial revolution (4IR) or Industry 4.0 is transforming how people live, learn, work and communicate. Digitalisation, automation and artificial intelligence are the catalyst agents in 4IR which has an enormous impact on individuals' learning and later job requirements (Lu, 2017). 4IR requires the next generation who will enter the workforce to be creative and efficient problem solvers (Lu, 2017). Didactic lectures delivered within conventional classroom settings may no longer be sufficient to cater to students' needs. Different teaching and learning methods such as the flipped classroom, distance learning, online learning, problem-based learning, and blending learning need to be explored to equip students with the knowledge and necessary skills to be competent in their future careers, and to continue to retain competence throughout their careers (Revere & Kovach, 2011). Cybertechnologies, which include networked computing and communication devices and technologies, involving the internet or cyberspace, have created a unique and transformative learning process (Maloy *et al*., 2014). For example, the use of digital media, video conferencing, virtual field trips or simulation, and social networking technology provide learning opportunities where students are more likely to engage in critical thinking and problem solving, creative expression and communication (John *et al*., 2016). Using light-weight, portable devices - including smartphones, laptops and tablets - students can also access information and participate in the teaching and learning activities online at their convenience.

Given the widespread use of cybertechnologies, students need to embrace online learning as part of their learning skills, and online learning is advantageous in preparing students for pharmacy practice (Managing-Drug-Supply, 2012). Nevertheless, students' ability and willingness to participate in online learning vary considering the differences in up-bringing culture, learning attitude and perceived self-responsibility (Jatau *et al*., 2018). Although some studies have suggested that online learning is as effective as conventional learning (Bloomfield, Roberts, & While, 2010; Porter, Pitterle, & Hayney, 2014), evidence of its long-term impact towards students' learning is still limited (Salter *et al*., 2014). Besides, studies on students' acceptance towards the adoption of online learning in Malaysian pharmacy education are lacking. At the time of commencing this study, the Faculty of Pharmacy, Universiti Teknologi MARA had not routinely conducted online courses for the Diploma in Pharmacy students. Nonetheless, there had been a campus-wide voluntary initiative for educational innovation such as Week Without Wall and massive open online courses (MOOCs) to increase teaching and learning flexibility outside the classroom. Therefore, this study aimed to: (i) compare the effectiveness of online and conventional classroom learning methods towards students' knowledge; and (ii) document pharmacy students' preference and readiness towards online learning.

Methods

Study subjects and setting

All the second-year Diploma in Pharmacy students (n = 95) of Faculty of Pharmacy, Universiti Teknologi MARA (UiTM), Bertam campus, Malaysia were invited to participate in this study. Students were randomly allocated into two independent groups according to a stratification based on cumulative grade point average (cGPA) that ensured that both groups had similar academic performance (both groups had average cGPA of 3.49). Each group was initially assigned to one of two learning methods: (i) online learning or (ii) face-to-face learning. All students gave written informed consent before participation. The study protocol was approved by Research Ethics Committee, UiTM [600-IRMI (5/1/6)].

Implementation of the online and classroom learning module

The development and pilot-testing of the online learning module used in this study has been described previously (Lean *et al*., 2018). For online learning, students were required to sign up for the first time and log onto the webpage to access the learning materials. For face-to-face learning, students attended a two-hour lecture delivered by an instructor with the aid of PowerPoint slides. Students received a copy of printed lecture notes at the beginning of the lecture. The theoretical content of the learning module for both online and face-to-face learning groups were identical. Both groups of students sat for the knowledge test at the end of the week after participating in their initial assigned learning method.

A week after the knowledge test, students were then switched and exposed to the other teaching method (i.e. students in online learning group were switched to face-to-face learning and vice versa). Students were given the chances to participate in an alternative learning method to minimise bias towards their preference of any particular method. In both groups, questions about the lecture content raised by the students in the classroom were discussed.

Data collection

A 30-item multiple-choice test was developed based on module content to evaluate students' knowledge. One mark was given for each correct answer, yielding a total maximum score of 30. To attain feedback on the interventions, an anonymous 19-item survey was administered via online electronic survey (SurveyMonkey.com) after completion of all learning activities. The questionnaire was developed based on previous studies (Krauss & Ally, 2005; Yang *et al.*, 2005; Dantas & Kemm, 2008; Park & Shrewsbury, 2016). The survey used a Likert scale of 1–5, (1 = strongly disagree and 5 = strongly agree) to measure students' opinions regarding the two different learning methods used for the module. An open-ended question was added to capture students' experience towards both learning methods (i.e. online learning and face-to-face learning).

Data analysis

Data were analysed using SPSS, version 22. The *chi*-square test was used to compare sociodemographic variables between the two groups and students' post-knowledge scores were analysed using paired *t*-test, for both tests, any *p*-values <0.05 were considered statistically significant. Pearson's correlation coefficient (r^2) test was performed to determine the relationship between the knowledge scores and students' cGPA. Categorical data based on Likert scale were analysed descriptively. Students' learning experiences captured by the open-ended question were analysed using thematic analysis. Each response was iteratively read and line-by-line coded by the principal investigator. Subsequently, all the codings were arranged with similar codings and collapsed to generate overarching themes. All the themes were reviewed by an experienced qualitative researcher.

Results

Participants' sociodemographic characteristics

A total of 93 students (97.9%) participated in this study. Students in online learning (n=47) and face-to-face (n=46) learning groups had no significant differences in the sociodemographic characteristics (Table I). All students possessed their own personal computer. Students in online learning (68.1%) and face-to-face learning groups (56.5%) revealed that the internet was their preferred source of soliciting information. Up to 53.2% of online learning versus 56.5% of face-to-face learning groups spent three to six hours on the internet daily. Approximately 70% of the students in both groups spent less than two hours online for the allocated learning activities. A slightly higher percentage of students in face-to face-leaning group (80.4%) compared to the online learning group (66%) had enrolled in other online learning courses previously. More than half of students in both groups accessed online learning activities using personal computer rather than mobile phone.

Table I: Participants' sociodemographic characteristics (n=93)

	online learning (n=47) n (%)	face-to-face learning (n=46) n (%)	*p*-value[*]
Gender			
Male	12 (25.5)	12 (26.1)	0.45
Female	35 (74.5)	34 (73.9)	
Age (years old)			
19	30 (63.8)	30 (65.2)	0.58
20	14 (29.8)	13 (28.3)	
21	3 (6.4)	4 (8.7)	
22	1 (2.1)	0 (0)	
Sources of information			
Lecturers	9 (19.1)	12 (26.1)	0.38
Friends/ course mates	5 (10.1)	8 (17.4)	
Family members	1 (2.1)	0 (0)	
Internet	32 (68.1)	26 (56.5)	
Books or magazines	0 (0)	0 (0)	
Time spent on internet daily			
< 3 hours	8 (17.0)	7 (15.2)	0.74
3-6 hours	25 (53.2)	26 (56.5)	
7-9 hours	7 (14.9)	9 (19.6)	
10-12 hours	5 (10.6)	2 (4.3)	
> 12 hours	2 (4.3)	2 (4.3)	
Ever enrolled in online learning courses			
Yes	31 (66.0)	37 (80.4)	0.06
No	16 (34.0)	9 (19.6)	
Mode of access to online module			
Computer (desktop or laptop)	31 (66.0)	26 (56.5)	0.40
Mobile phone, iPad or tablet	16 (34.0)	20 (43.5)	
Duration spent on online learning module			
< 30 minutes	4 (8.5)	3 (6.5)	0.92
30 minutes - 1 hour	16 (34.0)	18 (39.1)	
1-2 hours	14 (29.8)	11 (23.9)	
2-3 hours	8 (17.0)	8 (17.4)	
3-4 hours	4 (8.5)	5 (10.9)	
5-6 hours	1 (2.1)	1 (2.2)	

[*]*p*-values from *chi*-square test

Students' knowledge scores

All students participating in the learning activities completed the knowledge test after the first learning method. More than 60% of students in both groups scored 70 marks and above. The mean scores of online and face-to-face learning groups were respectively 70.3 (SD = 11.3) and 71.7 (SD = 10.7), no significant knowledge difference was found between the two groups (Table II). Nonetheless, knowledge scores were

significantly correlated with student's cGPA (Figure 1) for both the online learning ($r^2 = 0.549$; $p < 0.001$) and face-to-face learning ($r^2 = 0.443$; $p = 0.002$) groups respectively.

Students' preference towards learning approaches

Figure 2 shows the students' experience towards online e-learning, compared to face-to-face learning. The majority found that online learning was useful (71.6%) and time-saving (78.9%). More than half enjoyed the online activities (62.1%) and perceived it provided a meaningful learning experience (58.9%). Slightly more than half (50.5%) felt that online learning helped them to manage their learning time more efficiently. Close to half (47.4%) agreed that the online learning improved their confidence level in pharmacy subjects. Whilst one-third found that online learning was more interesting than classroom lectures and preferred online learning module over classroom, however, up to 37.9% of students disagreed with this. Furthermore, only 40% of the students agreed that the online module should be applied to other pharmacy subjects. Approximately twice as many students agreed than disagreed that the online learning activities should be continued.

Figure 1: Correlation between knowledge scores and students' cGPA in A. Online learning (OL) and B. Face-to-face (F2F) learning groups
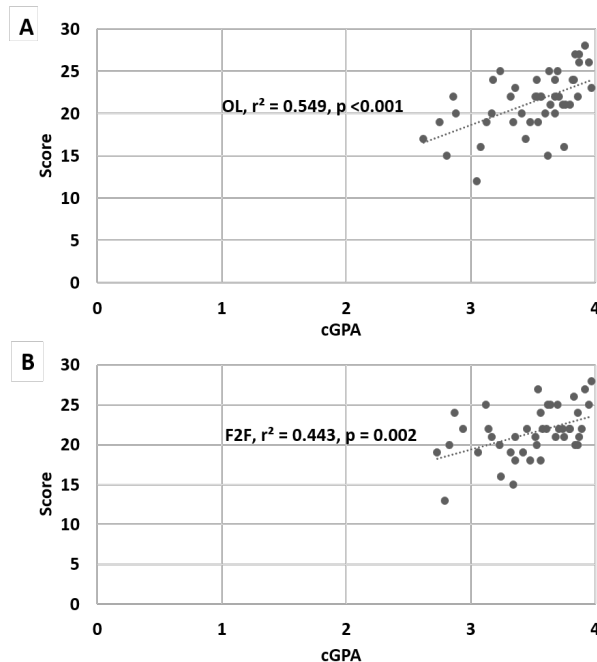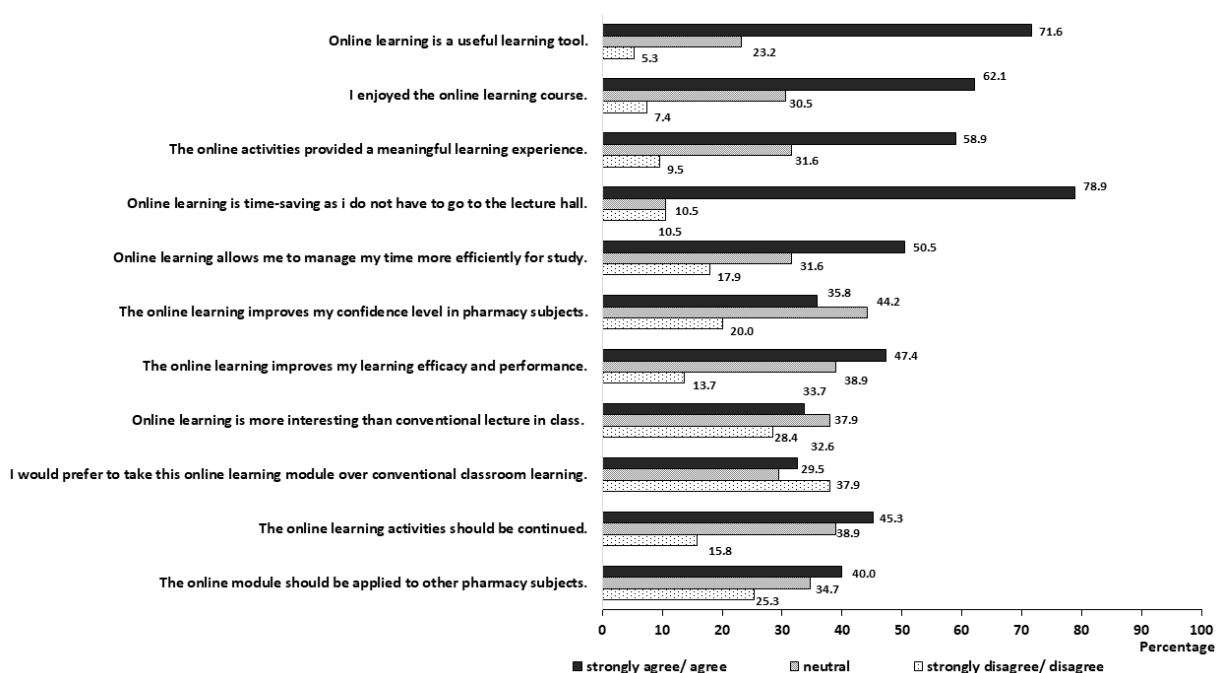

Table II: Knowledge scores between the interventional groups

Group		Knowledge scores		paired *t*-test
	Mean	≥ 70, (n, %)	< 70, (n, %)	
Online learning	70.3 ± 11.3	30 (63.8)	17 (36.2)	$t_{45}= 0.242$, $p= 0.81$
face-to-face learning	71.7 ± 10.7	30 (65.2)	16 (34.8)	

Figure 2: Students' experience towards the learning approaches

Students' acceptance of learning approaches

The contents and videos were considered to be the most useful for the online learning source (Table III). Approximately two-thirds of students were willing to participate in another online learning course based on this experience. Nevertheless, the majority of students preferred blended learning (83.1%), compared to online module or classroom lecture alone. Students indicated that their interests towards online learning were attributed to its flexible learning hours and engaging multimedia (e.g. videos, audios and images). In contrast, 26.3% of students disliked online learning as they preferred to learn in the classroom.

Students' preferences and concerns of learning approaches

Of the students who participated in the study, 66 (71%) participants provided narratives of their learning experiences. Two major themes emerged from the data collected: i) preferences and perceived values of online, classroom and blended learning approaches; and ii) concerns and preparedness towards online learning.

Theme 1: Preferences and perceived values of online, classroom and blended learning approaches

It was found that certain students valued the flexibility of online learning.

The online learning is really convenient, time-saving and flexible. [Participant A]

Online learning allows me to learn comfortably in my room without the need to dress formally and going to the lecture hall. I can also start learning when I'm ready, rest whenever I wanted to and finish the e-learning according to my pace. [Participant B]

Conversely, classroom learning remains as a preferred learning method for some students.

I prefer class lecture because being in lecture hall gives me an opportunity to speak and ask questions directly to the lecturer. Also, I get the chance to interact with my fellow friends and exchange our ideas. It is easy to stay motivated in this way, rather than having to motivate myself on my own. [Participant C]

I prefer classroom or face-to-face lectures. I can manage time better through assigned lecture schedules. [Participant D]

Some students valued a combination of learning approaches because blended learning increased their understanding towards a subject and therefore better retention of knowledge.

I prefer both, but the complex things should be learned in classroom. [Participant E]

A combination of both are more recommended because online learning can help students in terms of revision while conventional classroom lecture provides a better understanding on the subject matter. [Participant F]

I prefer we learn it in mixed mode where we learn through the online website first and then go to class lecture as it will enhance the interactions between the lecturer and the students during the lecture. [Participant G]

Table III: Students' acceptance of learning approaches (n=93)

Item	n (%)
Most useful and interesting component of the online course	
Contents	29 (30.5)
Images/ pictures	18 (18.9)
Videos	39 (41.1)
Examples of drugs or devices	5 (5.3)
Flowcharts	4 (4.2)
Based on this experience, would you take another online learning course?	
Yes	61 (64.2)
No	34 (35.8)
*Reasons of interest**	
More interesting	35 (36.8)
Easy to understand	17 (17.9)
Flexible learning time	37 (38.9)
Convenient	31 (32.6)
Containing multimedia (videos, audio and images etc)	35 (36.8)
Easily accessible	26 (27.4)
Do not have to go to class/ lecture hall	27 (28.4)
Others[a]	5 (5.3)
*Reasons of disinterest**	
Difficult to learn	12 (12.6)
Lacking interest or excitement	12 (12.6)
Need to go online	20 (21.1)
No internet access	18 (18.9)
Prefer to learn in class	25 (26.3)
Lacks online learning skills	5 (5.3)
Fear of computers and technology	2 (2.1)
Others[b]	7 (7.4)
Preferred teaching mode	
Class lecture only	13 (13.7)
Online website only	3 (3.2)
Class lecture followed by online website	54 (56.8)
Online website followed by class lecture	25 (26.3)

*students can choose more than one options;

Others[a]: easy to participate, information can be watched in colour and repeatedly;

Others[b]: lazy to learn by oneself; distraction, difficult terms, lack of time; need more explanation.

Theme 2: Concerns and preparedness towards online learning

Compared to students who pursue distance learning programmes, these pharmacy students were relatively new to online learning approaches. Some students perceived that online learning was a self-directed learning approach which required high discipline and motivation levels to pursue. Furthermore, the opportunity to interact with lecturers and peers within classroom was essential in motivating their continuous learning. They also expressed concern over online learning as they could be easily distracted with social media when going online.

Online learning is good but it is hard to stay focus because I will easily get distracted by social media.
[Participant H]

I don't really like online class as it doesn't give me chance to interact with the lecturers   [Participant I]

Through online learning, I will procrastinate and easily distracted.   [Participant J]

Some students expressed the concern about their abilities to understand difficult content if complex lecture material was solely delivered in an online mode.

Sometimes it is quite difficult to understand the contents online.   [Participant K]

It is good but online learning is only suitable for certain subjects and in my opinion, subjects that only contain facts that can be easily understood and remembered is the most suitable subject that can be used for online learning.   [Participant L]

Discussion

The use of online learning has been shown to be an effective student learning approach, however it was not fully implemented in pharmacy education in the Malaysian setting. At the point of study, all units or modules were delivered through conventional didactic teaching using lectures, tutorials and laboratory sessions at the University's pharmacy school. This study aimed to compare online learning to conventional face-to-face classroom learning on the acquisition of knowledge and to evaluate students' preference and readiness towards online learning. No significant differences in students' knowledge scores were observed, either from the online learning or face-to-face learning group. The study's finding mirrored a previous similar study which reported students' academic performance was similar between the classroom and online learning (Warnecke & Pearson, 2011; Porter *et al.*, 2014). Also, the findings concurred with other studies that online learning was as effective as didactic learning and replacing classroom learning with online self-learning does not necessarily increase students' performance (Bloomfield *et al.*, 2010; George *et al.*, 2014; Porter *et al.*, 2014).

Whilst both the online learning and face-to-face learning approaches were generally accepted, the students preferred blended learning compared to a single learning approach. Students viewed the online module as a useful supplementary tool for revision but did not wish to have it as a replacement for conventional classroom learning. This finding is in line with other studies which found that blended learning is more preferable and suitable for training healthcare professionals (Rowe, Frantz, & Bozalek, 2012; Duque *et al.*, 2013; Makhdoom *et al.*, 2013). Compared to conventional classroom learning, the blended learning approach has been shown to enhance learning and teaching experiences and students' performances (Vo, Zhu, & Diep, 2017). This may be because different pedagogy approaches and tools can help to engage and motivate students with different preferences of learning styles.

The development and evaluation of innovative educational methods for pharmacy education has become an area of greater focus (Maxwell *et al.*, 2018; Waite, Scaletta, & Hadley, 2018). Given the emergence of MOOCs, students could be exposed to various learning and networking opportunities beyond their universities which are valuable for cultivating life-long-learning skills (Maxwell *et al.*, 2018; Waite, Scaletta, & Hadley, 2018). In outlining the training and learning activities for pharmacy curricula, it is important to tap into the evolution of the pharmacy profession and changing healthcare system (Curley *et al.*, 2018). Pharmacy education needs to embrace various teaching and learning approaches to ensure that pharmacy graduates can meet the demands of a future workforce. Similarly, information and communications technology (ICT) competency is crucial among pharmacy graduates as technology is seamlessly integrated into the workplace environment (Managing-Drug-Supply, 2012). To ensure effective learning and course quality, the online courses must be developed based on the learners' characteristics and needs. It often assumed that current students, known as digital natives, have adequate ICT competence and are comfortable in using computers and online software. In reality, students differ in their computer and information literacy as they come from different socioeconomic backgrounds (Scherer & Siddiq, 2019), such that their abilities and adaptability with online learning may vary. Besides, this study's findings revealed that for online learning to take place, students need to be empowered with focus and time management skills, as overindulgence of social media and overt flexibility of online learning schedules have been reported as detrimental factors to students' learning (Kirschner & Karpinski, 2010; Harman & Sato, 2011). Therefore, it is of utmost importance to teach students how to search and evaluate reliable information, at the same time, to empower them to use digital technology wisely (Maloy et al., 2014).

Recently, active and interactive learning have been shown to have favourable learning outcomes as they increase students' engagement in learning (Campbell & Blair, 2018). Similarly, successful online learning

modules often have interactive features integrated into the platforms (Revere & Kovach, 2011); hence, interactive platforms such as discussion forums, chat rooms, announcement boards and emails should be included in the online learning activities. Accordingly, students can learn informally via virtual social interactions with other students and instructors using digital platforms. The instructors can post probing questions or comments which encourages critical thinking and knowledge transfer whereas students can post responses which reflect their understanding or to issue questions directly if there is a problem or any confusion (Annansingh, 2019). The incorporation of a rewarding or gaming system may also be an attractive method to promote participation of both active and reticent students (Buckley & Doyle, 2016).

Nonetheless, it is challenging to keep pace with the rapid changes in technology and learners' interests (Mahlangu, 2018). Lecturers who are often demanded to develop online courses need to adapt to the changes swiftly. To ensure a smooth virtual teaching and learning process, lecturers are required to adopt new technologies in developing effective instructional design, materials and resources, and interactive elements for the online learning environment (Mahlangu, 2018). Without proper planning and training, this may create frustrations among faculty staff. In addition, the construction of online courses without any clear quality assurance mechanism may result in poor standards and online courses which fail to meet students' expectation (Clarke, Schott, & Arnold, 2018). Therefore, there should be appropriate measures to ensure that academic staff have sufficient ICT support and professional training in the methods of teaching including the online learning practices.

There are some limitations in this study. First, although investigators had given instructions to students that no sharing of learning content should take place before the knowledge test, there was no complete seclusion method to prevent students from discussing the learning activities. Hence, cross-over information contamination could have taken place. Next, the authors acknowledge that the self-reported survey ratings may be subject to response bias, however, the anonymous survey might help to promote students' likelihood of providing thoughtful feedback towards their learning preferences. Since the survey was anonymous, students' preference toward learning approach could not be correlated to the cGPA of students. Furthermore, this study was a single-centre study and the students' performance and preference were derived from one particular learning subject, therefore findings from this study could not be generalised to other courses and faculty students at large.

Conclusion

For the first-time, students' preferences towards online and classroom learning were measured using a comparative study design in the Faculty of Pharmacy, Universiti Teknologi MARA, Bertam campus. Both learning approaches were found equally effective in increasing students' knowledge. Neither method in this study was shown to be superior. Nevertheless, the findings suggested that pharmacy students preferred blended learning compared to a single learning approach, either online or classroom alone. The findings provide some evidence for academics in Malaysia to develop appropriate interactive and integrative interventions to enhance students' learning outcomes. Consideration should be given to students' learning preferences when employing the most effective teaching and learning strategies for pharmacy education.

Authors' Contributions

QYL, LCM conceived the concept; QYL conducted the work and wrote the initial draft. YYW, SNFM, MF, CFN, QYL, LCM finalised the manuscript. All authors contributed toward editing the paper and agree to be accountable for all aspects of the work.

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