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Validation of online learning in pharmacy education: Effectiveness and student insight

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Abstract

This study aimed to evaluate the effectiveness in terms of knowledge change pre- and post-online learning and to explore Malaysian pharmacy students' perception and acceptance of online learning. An independent web-based learning module was developed for a module on basic patient counselling skills for pharmacy students of a Malaysian public university. Out of a total of 124 students, 120 (96.8%) students participated in the study and completed an assessment and feedback survey. Students' knowledge scores were found to have significantly improved after completing the online learning activity, with a 47.9 ± 25.1% ($p < 0.001$) improvement. Overall, more than 90% of students agreed that the online module was useful for new topic learning and revising, provided relevant content, which was arranged in a clear and logical manner, and thus facilitated their understanding. The majority of students reported to have enjoyed and satisfied with the online learning. More than half of them agreed that online learning was time-saving, allowed self-paced learning and improved their confidence level.

Keywords: *e-Learning, Patient Counselling, Knowledge Assessment, Perception*

Introduction

Effective teaching and learning activities in the education system are essential for facilitating students' learning. The conventional classroom and textbooks are no longer the main medium of knowledge transfer given the technological advancements of the present era. Currently, online learning (or e-learning) with classes fully delivered via internet or blended learning (which combines classes delivered virtually through internet and periodic face-to-face meetings in a traditional classroom) has been widely utilised for teaching and learning in tertiary educational institutions, as it offers several advantages over didactic lectures (Arkorful & Abaidoo, 2015). Online learning is a general term used to describe learning that takes place over the internet whereas e-learning is defined as a learning process involving the use of electronic media or devices as tools for facilitating the learning (Means *et al*., 2009; George *et al*., 2014). One of the major advantages is the flexibility of online e-learning. Furthermore, this modern application of learning pedagogy has enabled course contents to reach broader audiences throughout the world (Means *et al*., 2013) with online e-learning platforms such as Future Learn, Coursera, Udacity, Alison and edX recording millions of global learners registering for online courses offered by top universities (Bendezu-Quispe *et al*., 2017). Importantly, it may reduce the educational cost for both the school and students as the use of interactive web-based courses to complement conventional curricula on campus can serve to efficiently deliver educational programmes to students (Casement, 2013).

The internet has been used as a digital repository of teaching materials from which students have access to lecture notes (Thakore & McMahon, 2006). Nonetheless, apart from valuable online lecture notes, it is unclear to what extent students benefit from online e-learning (Salter *et al*., 2014). In Malaysia, study of the practice of e-learning in medical education, especially in pharmacy courses is still limited, hence the mechanism of how e-learning can be integrated into conventional teaching and learning activities remains unknown (Azhari & Ming, 2015). Since massive open online courses

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(MOOC) have been advocated as a method of promoting productive learning in Malaysia (Fadzil, Latif, & Azzman, 2015), it is important to understand students' perceptions and expectations of online learning in order to improve the e-learning technology in creating student-centred learning sessions.

The Universiti Teknologi MARA (UiTM) Diploma in Pharmacy is a three-year programme. The Hospital Pharmacy course is a core subject taken by second-year students in a classroom setting. This course provides the students with knowledge of basic hospital set-up and drug usage. The students are exposed to various pharmacy departments' services namely, out-patient and in-patient departments, manufacturing unit, store inventory control and clinical pharmacy. The course lectures are currently offered in the classroom and a soft copy of lecture notes and the reference links would be provided to students through the university learning management system which is known as i-Learn. Apart from promoting the use of blended learning, there has been a campus-wide initiative for each course to be developed and validated for MOOC, however the development of this course for MOOC has not yet been initiated at the time of this study. Seeing the potential benefits of applying online learning to pharmacy courses, this study was designed to evaluate the effectiveness of online learning in improving students' knowledge and skills. This paper describes the implementation and evaluation of an online learning module on patient counselling skills for second-year diploma pharmacy students. This online module replaced the conventional two-hour, face-to-face didactic lecture. The authors aimed to evaluate whether online e-learning using a website containing learning materials and videos was a viable method of teaching pharmacy students. The authors also intended to determine students' knowledge development and to attain feedback as well as acceptance of online learning among students.

Methods

Study design and setting

A prospective pre-post study design was employed to evaluate the effectiveness of the online learning. The study was conducted at the Faculty of Pharmacy, UiTM located in the state of Penang, Malaysia. The whole cohort of second-year pharmacy students (N=124) were invited to participate in the online learning from 4th to 18th January 2017. The study protocol was approved by the Research Ethics Committee, UiTM [600-IRMI (5/1/6)].

Development and implementation of the online learning module

The module contents were developed based on the syllabus of a three-year long Diploma of Pharmacy course. Basic patient counselling, which is one of the lecture topics of the 'Hospital Pharmacy' unit, was selected at the outset of developing the online module as it is the core job responsibility of the pharmacy profession. The website solution (meteor.com) was used to build a website (www.kloudclass.com) containing this online learning module. Key sub-topics included were: basic principles of pharmaceutical care, introduction to patient counselling including its objectives, structured approaches of counselling and essential information to counsel patients. Most commonly used medication delivery devices including inhalers and insulin injection, were selected and demonstrated through video clips to illustrate techniques/steps of administering insulin and using inhalers. The layout of the website was designed to be simple and easy to navigate (Figure 1 and Figure 2). Students were required to sign up for the first time and log in, in order to gain access to the materials. All materials including text, tables, simple graphics found on the website were required for student self-directed learning. The content accessible online was similar to the content intended for the two-hour classroom lectures. An introductory video by the instructor and videos on how to use the medical devices were also embedded to enhance the learning experience. A self-evaluation quiz was also available on the website to assist students' understanding and students received immediate feedback on their answers upon submission. Although the email and telephone contact of the instructor were posted on the webpage, there was no forum/discussion board to allow the participants to post questions, responses or comments on the webpage.

Data collection

To evaluate the effectiveness of the online module, an 18-item multiple-choice questionnaire was developed based on the course syllabus to evaluate students' knowledge before and after the online learning activity. All questions were content validated by five pharmacy lecturers who are also registered pharmacists. The same questions were used as a post-test to reduce the risk of bias. The results were used to quantify any knowledge increase attributable to participation in this online learning. The knowledge test was first administered to all participants in a class prior to the online learning activity. Upon completion of the baseline knowledge test, a hyperlink which granted students' access to the developed online module was posted on the university student web-portal and UiTM pharmacy student society's social media webpage. Students had access to the website, for a duration of two weeks. They could view the website content as many times as they wished, at their own pace, at anytime and anywhere. After two weeks, a post-test knowledge was conducted in the class to avoid possible knowledge exchange among students and to ensure this was the individual's best effort. Apart from assessing the post-test knowledge, the instructor also prepared a role-play session in which every student had to perform medication counselling and using a medical device (insulin injection pen or inhaler), based on a prescription given in a laboratory session. The students were given feedback by the instructor and their

counselling skills were scored based on the provision of information or techniques of using the medications and medical device. The total scores could range from 1 (minimum score) to 10 (maximum score).

The post evaluation, an anonymous survey was administered online via SurveyMonkey.com to collect participants' background information and feedback on the online learning. The survey consisted of 19 questions, adapted from previous studies (Krauss & Ally, 2005; Yang *et al*., 2005; Dantas & Kemm, 2008; Park & Shrewsbury, 2016), required participants to grade module content, usability and layout using a five-point Likert scale ranging from 'Strongly Disagree (1)' to 'Strongly Agree (5)'. In addition, an open-ended question requiring a narrative response was included to explore participants' online learning experiences.

Data analysis

Students' pre- and post-knowledge scores were analysed using paired *t*-test (IBM SPSS, version 22) with a *p*-level less than 0.05 considered statistically significant. Categorical data based on Likert scale were analysed descriptively. A theme-based analysis of qualitative data from narratives of students' views was used. Narratives which described the students' views and experiences of online learning were included. The comments and feedback received served as a reference to improve the content, design and user satisfaction toward online learning.

Results

Students' knowledge scores

Of a total of 124 students registered for the course, 120 students (96.8%) participated in the online learning had completed the knowledge tests. Students' knowledge mean (standard deviation, SD) scores in the pre- and post-tests were 8.9 (1.85) and 13.11 (1.78), respectively; a 4.2 (2.23) increment ($p < 0.001$). All students completed the role play session with a mean score of 6.79 ±1.08.

Students' online learning experiences

All students reported having their own personal computer (Table I). Participants revealed that internet (68.3%) was the most popular source of course related materials. Nearly a quarter of the students allocated three hours or less per day on the internet whereas more than half (56.7%) of students spent three to six hours daily. Up to 65.8% students admitted that they have enrolled in online learning courses before. Moreover, compared to using personal computer (60.8%), the rest of the students gained access to the module using a mobile phone. Videos (57.5%) were found to be the most useful and interesting aid in the online learning source.

Students' perceived usefulness and experience towards the website and online learning are respectively shown in Figure 3 and Figure 4.

Students' acceptance towards online learning

Overall, the majority of students (96.7%) agreed that online learning should be applied to other topics for this course (Table II). Up to 90% of students indicated that they were willing to take another online learning course based on this experience. Only a minority of students did not wish to take other online learning courses as they preferred to learn in class (8.3%).

Table I: Participants' online learning experience (n=120)

Own a personal computer	**n (%)**
Yes	120 (100)
No	0 (0)
Sources of information	
Lecturers	30 (25.0)
Friends/coursemates	6 (5.0)
Family members	0 (0.0)
Internet	82 (68.3)
Books or magazines	2 (1.7)
Time spent on internet daily	
< 3 hours	29 (24.2)
3-6 hours	67 (56.7)
7-9 hours	16 (14.2)
10-12 hours	5 (4.2)
> 12 hours	3 (2.5)
Ever enrolled in online learning courses	
Yes	79 (65.8)
No	41 (34.2)
Mode of access to online module	
Personal computer (desktop or laptop)	73 (60.8)
Mobile phone	47 (39.2)
Duration spent on online learning module	
< 30 minutes	4 (3.3)
30 minutes - 1 hours	24 (20.0)
1-2 hours	36 (30.0)
2-3 hours	30 (25.0)
3-4 hours	14 (11.3)
5-6 hours	6 (4.8)
6-7 hours	3 (2.4)
7-8 hours	0 (0.0)
8-9 hours	3 (2.4)
Other	0 (0.0)
The most useful and interesting part of this online learning	
Contents	21 (17.5)
Images/ pictures	19 (15.8)
Videos	69 (57.5)
Flowcharts	7 (5.8)
Examples	2 (1.7)
Other (videos and examples)	2 (1.7)

Figure 1: Online e-learning website home page

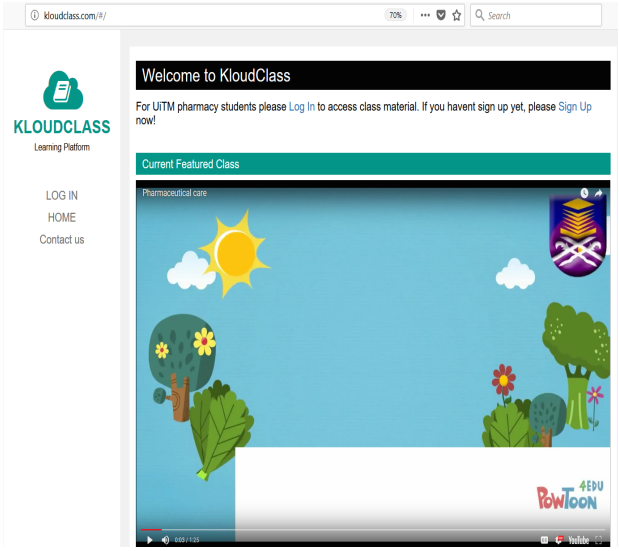


Figure 2. Example of the layout and design for the content of e-learning website

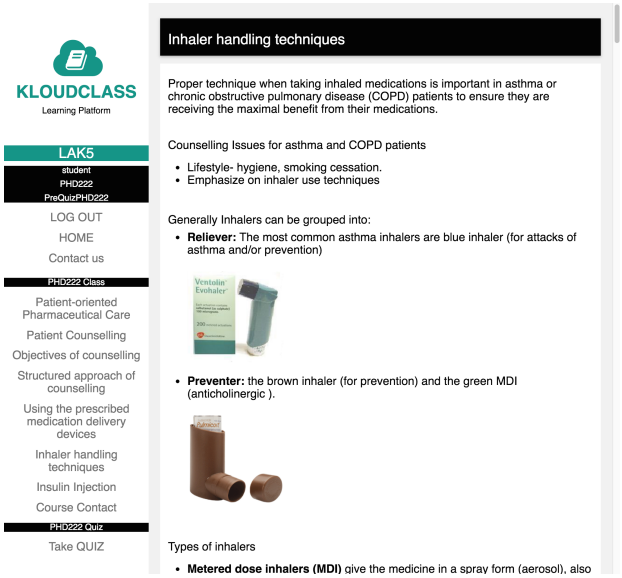


Figure 3: Perceived usefulness of the website and content

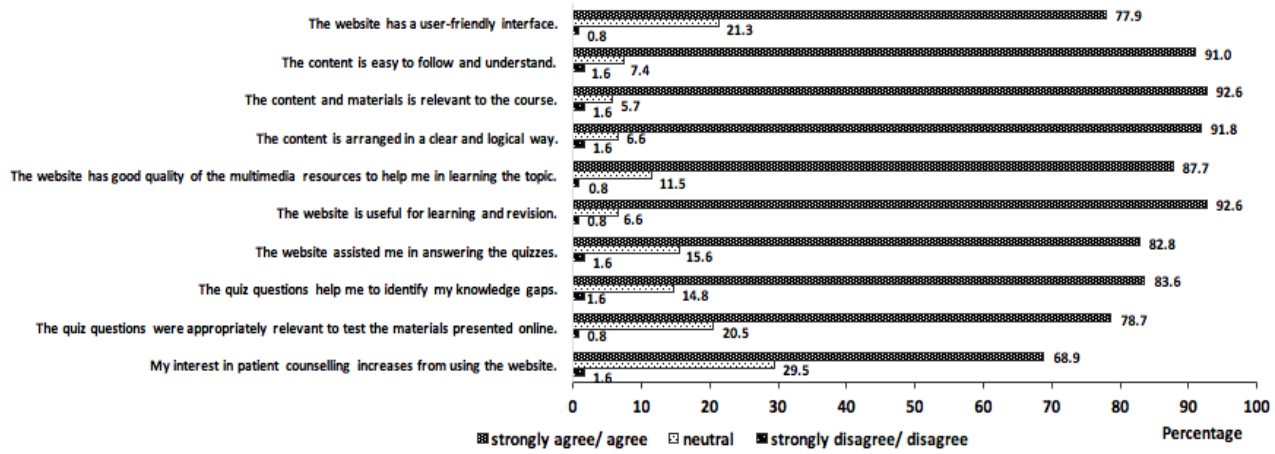
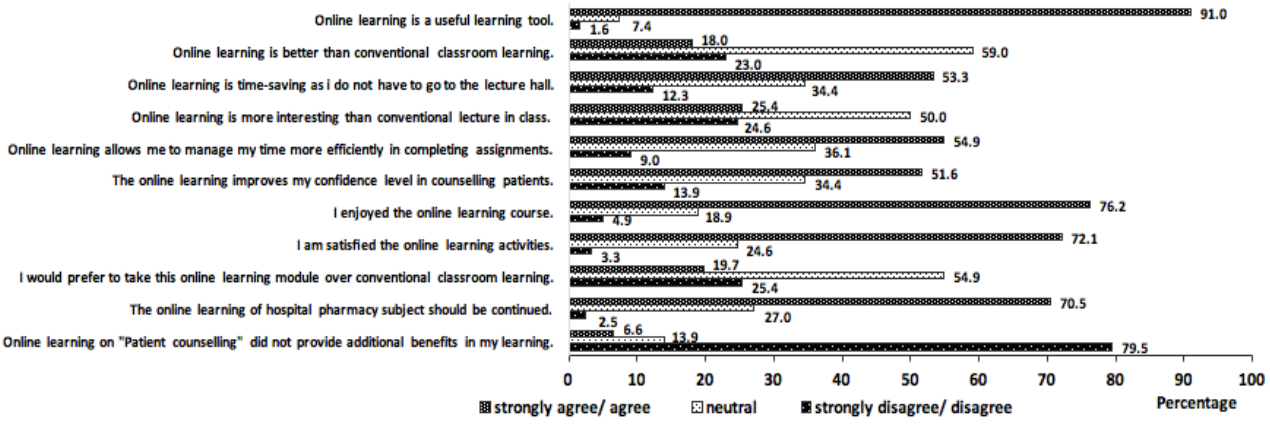


Figure 4: Students' experience towards online e-learning



"Poor network connection" (93.3%) at the campus was chosen as the main barrier of learning online by participants, this was followed by the difficulties faced by students including "not sure what is important" (30%) and thus they "could be easily confused" (19.2%) with information.

Table II: Acceptance of online learning among students (n=120)

Item	n (%)
The online learning should be applied to other subjects or topics.	
Yes	116 (96.7)
No	4 (3.3)
Based on this experience, would you take another online learning course?	
Yes	108 (90.0)
No	12(10.0)
Reasons of interest*	
More interesting	56 (51.9)
Easier to understand	61 (56.5)
Flexible learning time	68 (63.0)
Convenient	51 (47.2)
Containing multimedia (videos, audio and images *etc.*)	65 (60.2)
Easily accessible	42 (38.9)
Do not have to go to class/ lecture hall	24 (22.2)
Reasons of disinterest*	
Difficult to learn	4 (3.3)
Lacking interest or excitement	5 (4.2)
Need to go online	7 (5.8)
No internet access	5 (4.2)
Prefer to learn in class	10 (8.3)
Other	4 (3.3)
Most frustrating problem you encountered during the online learning*	
Slow internet connection	112 (93.3)
Not sure what is important	36 (30.0)
Not sure where to start	14 (11.7)
Difficult to follow	4 (3.3)
Too much information	12 (10.0)
Easily get confused	23 (19.2)
Other	2 (1.7)

*students could choose more than one

Students' comments on online learning

Of the 120 students who participated in the study, only 84 (70%) of participants provided text comments regarding online learning. Most responses were positive (66.7%), others commented on ways to improve the online learning and website. The responses were subjected to thematic content analysis. The responses were categorised into three major themes: adequacy of content; online learning value/usefulness; and usability of website.

Theme 1: Adequacy of content

Students liked several features of the educational content, especially videos and pictures.

> *"I can improve my knowledge through videos and photos provided."* (Participant 1)

However, students raised the issue of too much information and requested to limit or highlight important points to avoid confusion during the self-oriented learning.

> *"I like it better if the information is shorter but complete."* (Participant 2)

Theme 2: Online learning values and usefulness

Students valued online learning as it was flexible for them to access the material anytime, anywhere.

> *"In my opinion, I love online learning because I can study anytime I want to or in other word, I have flexibility to manage my time. Not only that online learning also gives me so much new information."* (Participant 3)

Mixed responses were recorded regarding the efficacy of online learning based on subject contents. Few participants stressed that the online learning should be continued and applied to other core subjects.

> *"I think this online learning really helps me to understand more about the topics in hospital pharmacy. I hope that other topics of hospital pharmacy should be included in the online learning."* (Participant 4)

Nevertheless, a few students disclosed that they preferred traditional classes over online learning, which might reduce socialisation and interaction with peers or guidance from faculty staff.

> *"Online learning is a useful tool to help students to get visual imaginations in understanding topics in the subject but we cannot be too dependent on online learning because we may lack of skills to speak and mingle with our lecturers as well. The point is we cannot be dependent on online learning."* (Participant 5)

Theme 3: Usability of website

Some of the participants suggested more interactive user interface design of webpages would be interesting.

> *"Better user interface gives better impression for students to learn."* (Participant 6)

Discussion

This study uses empirical data to report on online learning acceptance and knowledge creation with the purpose of validating the use of online learning in undergraduate pharmacy education. A significant improvement in students' mean knowledge scores was observed after participating in the short period of online learning activity. This suggested that the web-based materials are effective in improving students' knowledge and skills in patient counselling. The findings echoed other studies in which application of e-learning in pharmacy education effectively increases knowledge among pharmacy students (Cook *et al*., 2008; Salter *et al*., 2014; Williams, 2014).

It is reasonable to assume that the students could be representative of the group studying the course as most of the students enrolled in the course participated in this study. The feedback on the online learning experience was very encouraging, considering this was the first trial of online learning for the course. Like other studies assessing the perception of learners on online learning application (Nesterowicz, Librowski & Edelbring, 2014; Azhari, Ming & Khan, 2015;), the authors found that the students had a positive attitude toward the use of this alternative in the local setting. The online learning was highly acceptable among students as a useful learning tool, due to the flexibility provided to students, which they could learn at the pace and place that was appropriate to the individual (Azhari & Ming, 2015; Neoh *et al.*, 2015). Most enjoyed and were satisfied with the online learning activities, and would like to continue to learn online. Importantly, students also reported that the website assisted them in answering the quizzes, which helped them in identifying their knowledge gaps and increased their interest in the topic after using the website. The study fits in the current practice to incorporate web-based education as a useful tool to enhance students' confidence in their knowledge and skill. This was in agreement with previous findings that e-learning was useful and can improve students' confidence (Hassali *et al*., 2012; Ruehter *et al.*,2012).

In classroom, different teaching methods including various active instructional approaches such as class discussions, problem-based learning, role playing and game-based learning have been used to facilitate the effective knowledge gain and skill development among students. Nonetheless, technologies have created different ways of learning among students. Advancements in information technology has transformed pharmacy teaching methodology from traditional didactic delivery of lectures to web technology-based virtual learning in tertiary education (Azhari & Ming, 2015). The use of technology in teaching aids is rapidly advancing and internet has become the main source of information. Technology supporting digital learning such as learning management systems and mobile applications has been extensively used by students. Previous studies also reported that students are prone to using social networking tools for learning (Benetoli, Chen, & Aslani, 2015). The limited use of books or textbooks among students in this study might suggest a higher utilisation of digital learning resources. Similarly, a study in another local university found that most students prefer to use e-books or e-versions of textbooks and reference sources (Roesnita & Zainab, 2013). Another study showed medical students had a strong preference towards mobile learning (Han, Nelson & Wetter, 2014). To optimise teaching and learning strategies, it is essential to consider students' learning habits while designing academic curricula. Besides, when social media platforms are integrated in the curriculum of university courses, students may perceive social networking sites are reliable resources for learning. Therefore, lecturers can help students to optimise effective learning strategies such as by motivating students to read useful related resources and encouraging students to use different learning sources, thus empowering them with the skills to discern reliable information online (Zainal *et al*., 2017; Scott, Morris & Marais, 2018).

Currently, the replacement of didactic classes with distance learning such as MOOC in our setting is still in an infant stage and continued research is needed to ensure positive learning outcomes, satisfaction and appropriateness. Nonetheless, the online learning module, as one of the approaches to complement face-to-face teaching, could enhance student engagement and improve learning outcomes. The online materials could also serve as additional reference for students who will attend classes to be equipped with similar levels of knowledge. On top of that, it could be used repeatedly by students as a mean of revision, or could be used by other learners who are interested in the subjects. In this study, students preferred the videos over other platforms to learn. This is in line with other studies, videos have been rated as a powerful teaching aid in learning clinical and pharmaceutical skills (Gormley *et al*., 2009; Park & Shrewsbury, 2016). Compared to texts, pictures and videos are often more useful and preferable for the delivery of visually intensive information (Park & Shrewsbury, 2016). Visual aids are widely embraced by browsers and are believed to increase knowledge retention among people who watch video clips online compared to pure text. Many clinical and pharmaceutical skills are visually intensive, with the online videos students can view, pause and replay the videos as often as required.

Online learning may promote learner isolation or reduction of socialisation. This study also highlighted that there were students who preferred classroom lessons over online self-learning and they stressed the importance of face-to-face interaction or feedbacks attained from lecturers during lessons in class. Nonetheless, the use of online discussion or forum may help to connect the students and instructor. The interactive board allows students to share content, encourage online debate and answer queries, which is believed to provoke more positive responses from

students. Instructor-directed online e-learning and interactive activities may be more interesting and engaging than a student-driven online course. Moreover, in on-campus programmes, online e-learning is usually part of a blended approach in teaching. Students have active learning sessions in the classroom or laboratory, and while working on a group assignment they are able to develop interpersonal and communication skills (Goodie *et al*., 2011). In pharmacy education, different teaching methodologies may be best suited depending on the types of subjects and students. Many core pharmacy subjects are classroom lecture-based, while pharmacy practice may prefer a different way such as blended learning or flipped classroom approach and laboratory sessions (Ruehter *et al*., 2012; Wong *et al.*, 2014). In our local tertiary institutions, although online learning could have a positive impact on students' performance, the issue of a smooth access to network is a concern as slow connection speed in the university compounds may discourage students from studying online. As a developing country, the move by the Malaysian government to increase broadband connection speed in campus network is encouraging, it is hoped that upgrades to the internet connection and coverage are proportional to an increased number of students pursuing tertiary education and therefore able to meet demand.

There are a few limitations of this study. There was no direct track record of each individual learner to ensure the content was being viewed and revised entirely. Hence, the study is unable to prove that the online website is solely responsible for the observed improved in knowledge scores among students. Additionally, the authors did not gather information on students' learning preference and prior knowledge, exposure to which may have affected their acceptance of online learning.

Conclusion

Preliminary findings from this study supported the effectiveness and acceptability of online learning as a complementary tool for the Hospital Pharmacy course. This module was found to have effectively increased students' knowledge in the evaluated topic. Furthermore, a high satisfaction level and pleasant experience associated with the online learning activity observed in this study further substantiated the usefulness of the website as a learning tool for students. In the future, the website, its content and format could be modified and enhanced based on the feedback from students before it is used to compare outcomes of online learning with the conventional lecture. To support changing educational trends and increase learners' engagement and satisfaction, this platform may also allow easy integration of social media like Twitter, Facebook or LinkedIn for instant notification as pharmacy students actively learn online.

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