Incorporating Web-Based Learning in the Teaching of Pharmaceutical Compounding and Dispensing

Hwee Lin WEE*, Mui Ling TAN, Pei Shi ONG, Li Lian WONG, Sock Leng YONG, Sui Yung CHAN and Wai Ping YAU

Department of Pharmacy, Faculty of Science, National University of Singapore, Singapore 117543

*Corresponding Author’s E-mail: phawhl@nus.edu.sg

Keywords: Web-based Learning, Curriculum Design, Blended Learning, Information and Communication Technology, Applied Skills Teaching, Pharmacist Education

Extended Abstract

Background and Objectives
Extemporaneous compounding and dispensing is an important skill imparted to pharmacy undergraduates through traditional laboratory teaching. A typical laboratory session lasts for three hours, with the first hour dedicated to an explanation of the theory followed by hands-on demonstration of the steps involved in compounding and dispensing. Given the broad range of products that may be compounded (e.g. mixture, linctus, capsules, inhalation, paint, suspension, etc.), students have limited hands-on time to spend on individual product types, resulting in a touch-and-go experience during the laboratory session with limited scope for honing their skills. As such, we sought to develop a web-based platform for delivering some of the teaching materials which students can access anytime, anywhere. We assumed that the learning outcomes will be similar between web-based and in-person teaching and tested this assumption in a crossover trial. Feedback provided by students and staff on the web-based platform were evaluated through surveys.

Methods
Developing the Course Website
A total of 11 videos that introduced the basics of compounding and dispensing were produced in-house and uploaded onto the course website. In addition, three documents that introduced the list of laboratory apparatus, demonstrated the correct way of pasting labels on containers and explained the calculations for making capsules were uploaded. Before each week’s practical class, instructions to students on the specific videos to view and relevant pages of the laboratory manual to review were uploaded onto the Integrated Virtual Learning Environment (IVLE) workbin.

Study Design

The first year Pharmacy undergraduates were divided into three groups for their laboratory classes. Web-based learning versus in-person teaching were evaluated using a crossover design (Table 1). The learning outcome was defined as the quality of capsules prepared. All capsule preparations were graded on a scale of 0 to 10 by a single lecturer using a standardised marking scheme which was developed by all co-lecturers in the module. Two surveys were administered during the first and after the third practical classes to obtain students’ feedback. Students commented on the quality of the video, stated if viewing videos alone was sufficient for them to complete their assignment, stated their preferences for the location and timing to view the videos and stated their preferences for web-based learning versus in-person teaching (for Groups 1 and 2). Staff were also surveyed on their preferences for web-based learning versus in-person teaching.

Table 1. Sequence of activities by group.

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video Series 1 (30 min)</td>
<td>In-person teaching (20 min)</td>
<td>View videos before practical class</td>
</tr>
<tr>
<td>Make preparation (1 hr)</td>
<td>Make preparation (1 hr)</td>
<td>Make preparation (1 hr)</td>
</tr>
<tr>
<td>In-person teaching (20 min)</td>
<td>Video Series 1 (30 min)</td>
<td>Survey / Print Labels</td>
</tr>
<tr>
<td>Video Series 2 (10 min)</td>
<td>Video Series 2 (10 min)</td>
<td>Submit preparation</td>
</tr>
<tr>
<td>Survey/Print Labels</td>
<td>Survey/Print Labels</td>
<td>In-person teaching (20 min)</td>
</tr>
<tr>
<td>Submit preparation</td>
<td>Submit preparation</td>
<td></td>
</tr>
</tbody>
</table>

Results and Discussion

Quality of Capsule Preparations

The median (interquartile range) score was 9 (8 to 10) for Group 1 and 9 (7 to 10) for Groups 2 and 3 respectively (Figure 1). We noticed that the range of the scores was wider in Group 3 (range: 2 to 10) compared to Groups 1 and 2 (range: 4 to 10). Otherwise, the learning outcomes were similar across the three groups.

![Figure 1. Score distribution for capsule preparations by group and overall.](image-url)
The Survey

Video Demonstrations

Slightly more than half of the students who took the survey felt that the video instructions were quite clear (53.5%). The majority of students were quite confident to make the preparations just by viewing the videos alone (61%) and the proportions were similar across the three groups (Group 1: 60.6%, Group 2: 63.8%, Group 3: 58.6%, p=0.528). For the purpose of completing the weekly practical assignments, the majority of students preferred to view the videos online anytime (59.8%) compared to viewing them in the laboratory, with no difference among the groups (p=0.430).

In-person Teaching

Only students in Group 1 and 2 completed this section of the survey. In this case, there were more students who felt that the instructions provided by the demonstrators were very clear (86.4%). In contrast, only 43.6% of students in these two groups felt the instructions in the videos were very clear.

With regards to whether they had a clear view of the various steps involved in making the preparations through in-person teaching, we were surprised to learn that the majority of students felt that they had a very clear view of the steps (75.0%), with no statistically significant differences between the groups (p=0.143).

![Figure 2. Preferred mode of teaching.](image)

When asked about their preferred mode of teaching (videos alone, in-person teaching alone or both), students overwhelmingly indicated that they would prefer to have both (86.4%) and the responses were similar between the two groups (Group 1: 85.9%, Group 2: 87.0%, p=0.613, Figure 2). Staff also preferred in-person teaching over web-based learning as they found that they could intervene more frequently (to correct the students’ technique) in Groups 1 and 3 compared to Group 2.

Conclusions

In this case, the learning outcome was similar between web-based learning and in-person teaching. This was similar to a study that compared online versus live delivery of education to pharmacists (Taylor, Jung et al., 2013). Web-based learning was useful as it allowed students to access the teaching material anytime, anywhere. Students intended to use it as a preparation tool before class and as a revision tool before the test. However, it is unlikely that online learning can replace in-person teaching completely as it does not provide opportunities for interaction between staff and students, where students can seek clarifications on any doubts that they have. Hence, a blended learning approach is preferred.
Acknowledgements

We would like to acknowledge (1) the financial support received from the National University of Singapore (NUS) through the Centre for Development of Teaching and Learning Teaching Enhancement Grant; (2) the support of Dr Adrian Michael Lee from the Department of Chemistry, Faculty of Science, NUS who generously shared with us his experience in constructing an online courseware which provides students with all the information and instructional resources to perform laboratory experiments in chemistry; (3) the support of the Centre for Instructional Technology, NUS in the video production and development of the online courseware; (4) the support of Miss Teo Yi Ling and Ms Gan Hua Pey, our graduate talents who were cast in the videos; (5) the Pharmacy undergraduates who participated in the survey.

Reference