Original Research Article

Student Pharmacist Led International E-Learning Collaborative and Educational Experience: Understanding the Role of Pharmacists and Pharmacy Curriculum in Mexico and USA

ABSTRACT

Background: Pharmacy students in Mexico are exposed to United States' pharmacy community services in hopes to adopt the services for their own pharmacy program.

Objectives: This study aims to assess the effectiveness of a strictly online-based teaching method to improve student knowledge on the role of pharmacists and the pharmacy curriculum in Mexico and the United States.

Methods: This was a prospective study of pharmacy students attending the University of California, San Diego Skaggs School of Pharmacy and Pharmaceutical Sciences (UCSD SSPPS) and Facultad de Quimic-Pharmaco-Biologia de la Universidad Michoacana San Nicolas de Hidalgo (UMSNH) during the 2015-2016 academic year who enrolled in the E-Learning Collaborative and Educational Experience Independent Study.

Results: The e-learning course had 25 students total from both the United States and Mexico enrolled. Out of the 25 students, 4 students from the United States and 11 students from Mexico agreed to participate in the study. In the familiarity/confidence section of survey, there was a significant increase in 4 out of 5 questions in the Mexico group and 2 out of 5 in the U.S. groups. In the survey section regarding students' perspective of e-learning and likelihood of community involvement, there was no statistical difference in the U.S. group and only one in the Mexico group.

Conclusion: Despite the lack of statistical significance, the increase in median scores and proportion of correct responses in addition to the feedback provided by students suggest a positive learning experience to supports continuation of this study.

INTRODUCTION

The role of a pharmacist and pharmacy curriculum varies widely among countries. Pharmacy programs in the United States provide a professional doctorate degree compare to other countries which provide a bachelor's degree in pharmacy. Certain countries, such as Mexico, allow students to enter a four-year general science program in which they are able to choose from one of three paths: clinical biologist and microbiologist, pharmacy, or food technology. The Mexican pharmacy education program only provides one year of didactic education and almost no clinical experience unlike in the United States. Thus pharmacists in Mexico play a small role in the in Mexican health-care system. In recent years however many efforts have been attempted to increase the role of pharmacist in Mexico in hospitals as it pertains to monitoring for prescription drug errors and drug adherence, and providing preventive services.[1-3] Collaboration between pharmacy students in the United States and Mexico to explore these differences may prove useful in enhancing cross-cultural awareness of the pharmacy profession and ideally aid in expanding the profession in Mexico to have a more clinical focus in health care. Due to the difficulty of developing a traditional classroom setting course with pharmacy students in both the United States and Mexico,

an alternative teaching method to present this information would an e-learning course. Currently there is little information regarding the benefits of e-learning involving pharmacy students in Mexico and the United States regarding this topic.

With stronger dependence of online technology in present day society, the number of people participating in online web-based courses has markedly increased.[4-8] Among health care professionals, there is evidence in regards to effectiveness of e-learning.[9-11] There is also a systematic review published recently in which the authors comprehensively evaluated literature on the effectiveness of e-learning, specifically within the realm of pharmacy education.[12] The review suggests significant improvement in knowledge after e-learning and the method was as effective as traditional classroom learning. Lastly, the review concluded e-learning as a highly acceptable instructional format from participating pharmacists and pharmacy students. Thus, this evidence provides enough support for the use of e-learning as an independent course for pharmacy students in the United States and Mexico to engage in peer-peer teaching.

Through this course, pharmacy students in the United States will be able to enhance their understanding of the language, culture, and health practices in Mexico. Pharmacy students in Mexico will be introduced to the field of clinical pharmacy and help them to develop clinical and educational pharmacy skills. In addition, pharmacy students in Mexico will also be exposed to United States' pharmacy community services in hopes to adopt the services for their own pharmacy program.

The purpose of this research is to describe the E-Learning Collaborative and Educational Experience Independent Study Course curriculum as well as to assess the effectiveness of a strictly online-based teaching method to improve student knowledge on the role of pharmacists and the pharmacy curriculum in Mexico and the United States. It was hypothesized that completion of the E-Learning Collaborative and Educational Experience course would increase pharmacy student knowledge level from the pre-survey compared with the post-survey as well as promote student collaboration and outreach efforts. Reflective commentary provided by students in the post-survey will provide insight into challenges which may have limited the effectiveness of the course and serve as constructive feedback to improve the course. Overall this course will enable students to bridge the practice of pharmacy from different countries with an innovative teaching method.

The development of the E-Learning Collaborative and Educational Experience began in the 2014 calendar year and made available during January 2016. The course was specifically designed as a unique educational opportunity as the first e-learning course offered at both the University of California, San Diego Skaggs School of Pharmacy and Pharmaceutical Sciences (UCSD SSPPS) and Facultad de Quimico-Pharmaco-Biologia de la Universidad Michoacana San Nicolas de Hidalgo (UMSNH) as well as a platform of international collaboration between pharmacy students in the United States and Mexico.

METHODS

Course Design
The E-Learning Collaborative and Educational Experience Independent Study Course was designed as a ten-week curriculum using a professional video conferencing software called Citrix GoToMeeting®. The course consisted of nine one-hour long webinars and two one-hour long small group discussions. Webinars were developed and led by pharmacy students and translated by either faculty members or students. Guest speakers affiliated with either pharmacy schools were also invited to talk. Discussions had up to a total of six pharmacy students from either country and aimed to facilitate a more interactive learning experience in a smaller and more intimate group setting.

Pharmacy students from UCSD SSPPS and UMSNH were recruited into the course using an e-mail invitation sent to all students enrolled in both pharmacy programs. The e-mail invitation included a course description and objective, dates and time of course, and contact information. For pharmacy students enrolled at UCSD SSPPS the number of unit credits offered and registration information were also included. We accepted enrollment in the course from the period of November 2015 until the start of the course on January 24, 2016. UCSD SSPPS students enrolling completed an Independent Study Form which was sent to Curriculum Coordinator of the UCSD SSPPS Office of Academic Affairs. An additional recruitment e-mail was provided to enrolled students for those interested to consent in participation of this study.

After enrollment, all course materials were distributed through weekly e-mails to facilitate easy access for students to the course syllabus, surveys, and various course instructions. Authors provided technical support to all students and faculty participating in the course.

Course Content
Course content focused on two main areas: pharmacy school curriculum and current practices of pharmacy. Webinar topics discussed included different roles of pharmacist in each respective country, pharmacy school curriculum and student involvement in each respective country, asthma with an inhaler technique workshop, and diabetes with a diabetic foot care workshop. Webinar workshops provided demonstration inhalers and 10-gram monofilaments for pharmacy students in Mexico to practice proper inhaler technique and diabetic foot checks respectively. Discussion topics involved personal opinions of pharmacy school curriculum and specific pharmacy career path of interest that each pharmacy student shared with their discussion group.

Assessment of Effectiveness
The study is a one-group, pre-test and post-test, quasi-experimental designed to assess the effectiveness of the ten-week course and the students' knowledge level on the role of pharmacists and pharmacy curriculum in Mexico and the United States. The subjects of the study will be students enrolled at SSPPS and UMSNH. The data collection instruments to used for this study are the pre- and post- survey questionnaires which includes specific questions to measure the students' knowledge on the various course topics described in the course syllabus. The survey designed for this assessment

included familiarity/confidence questionnaire, a quiz portion, and questions regarding perspective of effectiveness and likelihood of community involvement. The familiarity/confidence questionnaire portion used a 4-point Likert scale (4 = extremely familiar/very confident, 3 = moderately familiar/confident, 2 = somewhat familiar/ confident, 1 = not at all familiar/not confident. Course-related self-confidence/familiarity surveys consists of questions designed to get an approximate measure of the students' self-confidence or familiarity in relation to a specific topic from the course. These types of instruments help faculty members assess their students' level of confidence in their ability to learn the material and clinical skills. When faculty members can measure the student's level of confidence, and what affects that confidence, they can structure course materials in a way to build confidence and enhance learning.

The primary outcomes in this study are the scores of the pre-survey and post-survey questionnaires from each country. Secondary outcomes in this study were student perspective of the effectiveness of the e-learning course and likelihood of community involvement following the completion of the e-learning course.

Statistical Analysis
Data analyses were performed using STATA version 12.1. The median scores of each question in the pre- and post-survey were evaluated for significance in differences between each answer using the non-parametric Mann-Whitney U test. A non-parametric test was chosen because the data collected was ordinal, the sample size was too small, and the assumption of normal distribution was not met. Furthermore, since the surveys were completed anonymously, the data could not be analyzed using a paired test.

RESULTS
The e-learning course had 25 students total from both the United States and Mexico enrolled. Out of the 25 students, 4 students from the United States and 11 students from Mexico agreed to participate in the study and completed surveys. To note, 4 out of the 11 students from Mexico completed both the pre- and post-survey versus remainder only completed the pre-survey .

Familiarity/Confidence Questionnaire
Overall, there was an increase in knowledge and/or confidence of the topics discussed in the course as indicated by the higher medians in the post-survey questionnaire. In the surveys completed by students in the United States, there was a statistically significant increase in the level of familiarity of the role of pharmacists in the United States and with the pharmacy curriculum in Mexico. In the surveys completed by the students in Mexico, there was a statistically significant increase in the level of familiarity of the role of pharmacists in the United States, the pharmacy curriculum in the United States, the students' confidence in performing a comprehensive diabetic foot exam, and the students' confidence in teaching proper inhaler technique. The question with the highest increase from pre-survey responses to post-survey responses was the question rating the Mexican students' confidence in performing a diabetic foot exam. The median score of confidence was 1 (not confident) on the pre-survey and 4 (very confident) on the post-survey.

Quiz Portion

In the Mexico group, proportion of correct answers were increased in for all quiz questions. There was a statistically significant increase in right answers for the question regarding breath time post inhalation of a metered dose inhaler. However, in the United States group, there was no change in the proportion of correct answers except for the questions regarding breath time post inhalation of a metered dose inhaler (which decreased) and preventative services of pharmacist in Mexico (which increased). There was no statistical difference in correct answers of the quiz portion.

Perspective of Effectiveness and Likelihood of Community Involvement

In the United States group, there was no significant difference between the pre- and post-survey sections regarding the students' perspective of effectiveness in an e-learning course or their likelihood of community involvement. Also the median scores were lower in the post-surveys. In the Mexico group, a significant difference was observed in their perspective of effectiveness of an e-learning course. The median scores were higher in the post-survey.

Table 1: U.S. Familiarity/Confidence Questionnaire

Questions	Pre-Survey Median Response Likert Scale (1-4)	Post-Survey Median Response Likert Scale (1-4)	p-value
What is your level of familiarity of the role of pharmacists in the US?*	3	4	0.040
What is your level of familiarity of the role of pharmacists in Mexico?*	1.5	2.5	0.061
What is your level of familiarity of the pharmacy curriculum in the US?*	4	3.5	0.49
What is your level of familiarity of the pharmacy curriculum in Mexico?*	1	3	0.022
How confident are you in performing a comprehensive diabetic foot exam?**	2.5	3.5	0.45
How confident are you at teaching someone how to	3.5	3.5	1.0

properly administer a MDI?**			

* 1 = not at all familiar, 2 = slightly familiar, 3 = moderately familiar, 4 = extremely familiar

** 1 = not confident, 2 = somewhat confident, 3 = confident, 4 = very confident

Table 2: Mexico Familiarity/Confidence Questionnaire

Questions	Pre-Survey Median Response Likert Scale (1-4)	Post-Survey Median Response Likert Scale (1-4)	p-value
What is your level of familiarity of the role of pharmacists in the US?*	2	3	0.0066
What is your level of familiarity of the role of pharmacists in Mexico?*	3	4	0.22
What is your level of familiarity of the pharmacy curriculum in the US?*	2	3	0.014
How confident are you in performing a comprehensive diabetic foot exam?**	1	4	0.0025
How confident are you at teaching someone how to properly administer a MDI?**	2	4	0.053

* 1 = not at all familiar, 2 = slightly familiar, 3 = moderately familiar, 4 = extremely familiar

** 1 = not confident, 2 = somewhat confident, 3 = confident, 4 = very confident

Table 3: U.S. Quiz Portion of Survey

Questions	Pre-Survey Correct response (n = 4)	Post-Survey Correct response (n = 4)	p-value
Pharmacists in the USA provide preventive services such as immunizations (%)	4 (100)	4 (100)	1.0

Pharmacists in Mexico provide preventive services such as immunizations (%)	0 (0)	2 (50)	0.32
Pharmacists in the USA manage chronic health conditions (%)	4 (100)	4 (100)	1.0
What is the lowest HbA1c to be considered diabetic? (%)	3 (75)	3 (75)	1.0
How often should a diabetic patient receive a comprehensive diabetic foot exam? (%)	2 (50)	2 (50)	0.079
Which of the following is a symptom of asthma? (%)	4 (100)	4 (100)	1.0
How long should a patient hold their breath after inhaling from metered dose asthma inhaler? (%)	3 (75)	2 (50)	0.49

Table 4: Mexico Quiz Portion of Survey

Questions	Pre-Survey Correct Response (n = 7)	Post-Survey Correct Response (n = 11)	p-value
Pharmacists in the USA provide preventive services such as immunizations (%)	6 (86)	11 (100)	0.21
Pharmacists in Mexico provide preventive services such as immunizations (%)	2 (29)	7 (64)	0.15
Pharmacists in the USA manage chronic health conditions (%)	5 (71)	10 (91)	0.29

Question	Pre-Survey	Post-Survey	p-value
What is the lowest HbA1c to be considered diabetic? (%)	2 (29)	7 (64)	0.16
How often should a diabetic patient receive a comprehensive diabetic foot exam? (%)	0 (0)	4 (36)	0.079
Which of the following is a symptom of asthma? (%)	6 (86)	10 (91)	0.74
How long should a patient hold their breath after inhaling from metered dose asthma inhaler? (%)	2 (29)	10 (91)	0.0079

Table 5: U.S. Perspective of Effectiveness and Likelihood of Community Involvement

Question	Pre-Survey Median score	Post-Survey Median score	p-value
Do you agree that E-learning is an effective method to learn?*	3.5	3	0.74
How would you rate your current level of community health outreach involvement?**	3	2.5	0.65
During the next month how likely is that you will participate in a community health outreach event?***	3	2	0.19
During the next 3 months how likely is that you will participate in a community health outreach event?***	3	2.5	0.34
During the next 6 months how likely is that you will participate in a community health outreach event?***	3.5	3	0.88

*1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree
** 1 = poor, 2 = average, 3 = good, 4 = excellent
*** 1= unlikely, 2 = possibly, 3 = likely. 4 = certain

Table 6: Mexico Perspective of Effectiveness and Likelihood of Community Involvement

Question	Pre-Survey Median score	Post-Survey Median score	p-value
Do you agree that E-learning is an effective method to learn?*	3	4	0.023
How would you rate your current level of community health outreach involvement?**	1	3	0.36
During the next month how likely is that you will participate in a community health outreach event?***	2	2	0.33
During the next 3 months how likely is that you will participate in a community health outreach event?***	2	3	0.22
During the next 6 months how likely is that you will participate in a community health outreach event?***	2	3	0.67

*1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree
** 1 = poor, 2 = average, 3 = good, 4 = excellent
*** 1= unlikely, 2 = possibly, 3 = likely. 4 = certain

DISCUSSION

The E-Learning Collaborative and Educational Experience Independent Study course is the first strictly online-based course offered at both UCSD SSPPS and UMSNH. The course is a unique academic opportunity that fulfills a need for educational offerings on the subject of the role of pharmacist and pharmacy school curriculum in both Mexico and the United States. Using an online-based method to reach students in both countries, this e-learning course allowed for peer-peer teaching where students led webinar lectures and discussions despite geographical barriers, which would otherwise be impossible in a traditional classroom setting. Providing translators also enabled students to overcome cultural and language barriers. Additionally, there is a strong benefit to the pharmacy profession as a whole in introducing pharmacy students in

Mexico to clinical pharmacy. By sharing the specific clinical training of the pharmacy curriculum in the United States, this course provided pharmacy students in Mexico a stepping stone in expanding the pharmacy profession in Mexico to a more clinical focus.

The results indicate a positive learning experience for students in both countries. In both the United States and Mexico groups there was an increase in median scores in nearly all questions relating to the course material in the confidence/familiarity questionnaire portion of the survey. However, not all were shown to be statistically significant likely due to the small sample size of students completing both pre- and post-surveys. The quiz portion in the United States group showed no statistical difference in proportion of correct responses, which is explained by their prior knowledge gained from materials covered in the first year of pharmacy school. Their highest score increases were from questions regarding their knowledge of the curriculum and pharmacy roles in Mexico. These scores reflect the course's focus as a learning opportunity for the Mexico group rather than the United States group.

Conclusion

The study was unable to conclude a strong positive impact on the perspective of effectiveness of e-learning and likelihood of community involvement with the lack of statistical significance in the United States group and only one question resulting in a statistical significance in the Mexico group. Despite these results, the authors understand there were many challenges in designing and executing a completely new e-learning course. Some challenges included the one-hour webinar and discussion time constraint which limited the amount of content that could be discussed, especially because all content required translation. Translation time was much longer than expected and sometimes required further clarification by students. Also due to unforeseeable schedule conflicts, the authors had to eliminate one course which further minimized content and focus on community involvement.

The feedback received from students completing the course has made this a very rewarding teaching experience and supports the continuation of this course for future students to participate as well as development of other e-learning courses for pharmacy students. Students from both the United States and Mexico agreed the interactions between international students were overall a positive experience, the course was well organized, and that the course was intellectually stimulating. Students from Mexico expressed their gratitude towards the course coordinators for initiating the project. They also shared their growing interest in the clinical role of health-systems pharmacists, a field that was initially foreign to them. Students and faculty at UMSNH shared their movement to change their curriculum to be more focused on clinical pharmacy and adding clinical rotation similar to the United States pharmacy curriculum model.

With plans to continue this course for future years, the authors plan to take note of results and challenges faced to improve its effectiveness for both students in Mexico and the United States groups. It would be ideal to extend the ten-week course and allocate more time sufficient for both content and translation in addition to adding more

discussions to aid review of topics discussed during the webinars. To improve the learning experience for the students in the United States, a possible change could be to add workshops hosted by students in Mexico to share topics not already known to students in the United States.

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