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Opportunities and challenges in converting a pharmacy curriculum elective course from a live to an online teaching environment

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Abstract

Objective: Discuss the strengths and limitations regarding creating and implementing an asynchronous online elective course on drug discovery within an accredited college of pharmacy's Pharm.D. curriculum.

Methods: Students enrolled in the first two iterations of the course were surveyed before and after course completion.

Results: All liked the convenience of self-paced online learning with the first offering. Despite student satisfaction, most (63%) students watched half or fewer lectures. In the second offering, course satisfaction was comparable to the first. Implementation of short post-lecture quizzes substantially increased lecture viewership. Lower satisfaction rates were noted across both course iterations when students were asked whether interaction with faculty and peers was sufficient.

Conclusion: Our experience demonstrates that the flexibility of online education comes at the potential cost of additional work and reduced interaction among students and faculty. However, overall student approval was high with this course style and all students reported they would recommend it to others.

Keywords: *Asynchronous, Course, Elective, Online, Pharmacy*

Introduction

Online education is an increasingly popular classroom tool in pharmacy schools across the United States. Benefits of online learning include the ability to accommodate larger class sizes, increased flexibility within student schedules, and expanded options for electives in cases where on-campus physical space is limited or multiple campuses exist (Vanderbush *et al*., 2007). The University of Illinois at Chicago (UIC) College of Pharmacy maintains two campuses separated by a distance of about 90 miles. The main campus is based in Chicago, Illinois and the sister campus is in Rockford, Illinois. The Pharm.D. programme is administered as a four-year post-graduate professional degree. While all course lectures in the core curriculum are broadcast live from one campus to another, elective courses may be site-specific. Electives offered within the online environment allow students and faculty from both campuses to interact within a flexible, self-paced virtual classroom without a substantial transportation burden.

This novel, 16-week elective course on Concepts in Drug Development was designed for asynchronous, online delivery to first, second, or third year pharmacy students. This course would contribute to the curricular requirements for Pharmaceutics/Biopharmaceutics as outlined in the 2016 Accreditation Council for Pharmacy Education's [ACPE] Accreditation Standards (ACPE, 2017). The objective of this survey study was to evaluate Pharm.D. students' perceptions, attitudes, and engagement in this online course in order to identify the strengths and limitations of an online learning environment.

Methods

The course, 'Concepts in Drug Development: from Bench to Bedside', was created by converting a three credit-hour live elective for Ph.D. students into a two-credit-hour online elective for Pharm.D. students. The goals and objectives of this course were to: (1) describe the various stages of the drug development process; (2) compare and contrast the objectives of Phase I, II, III, and IV clinical trials; (3) recall important guidelines and legislation governing the conduct of clinical research; (4)

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describe the role of regulatory bodies during the course of drug development, approval, and marketing; (5) critically assess a study protocol to develop a new chemical or biologic entity; and (6) identify career opportunities for clinicians along various stages of the drug development process.

Faculty from Pharmacy Practice, Biopharmaceutical Sciences, Medicinal Chemistry, and Pharmacognosy were recruited to provide recorded lectures. Additionally, representatives working within the pharmaceutical industry were interviewed to describe application of concepts discussed in lecture to their daily practice and careers. In order to transition the content to an online learning environment, traditional 50-minute lectures were converted to multiple mini-lectures (two segments, approximately 20 minutes each, per week) plus a new online activity each week designed to maintain student engagement (Volery & Lord, 2000). This format was utilised consistently over 16 weeks to maintain continuity within the course structure.

The class was divided into four units of varying lengths: (1) Introduction to the Drug Development Process; (2) Drug Discovery and Preclinical Research; (3) Clinical Development and FDA Approval; (4) Additional Topics in Drug Development. For each unit, students viewed approximately four to six didactic lectures plus one interview of an industry professional. They completed the following graded assignments: (1) an introductory discussion board post describing their interest in the course and any prior experience in drug development; (2) two 500-word essays describing application of unit objectives to primary clinical literature; (3) an online scavenger hunt requiring students to use the FDA.gov website to answer assigned questions; and (4) weekly quizzes (introduced during the second course offering). Additionally, each unit was linked to a folder with optional reading and web links tying current or interesting historical events to concepts discussed in lectures. Online interactivity was promoted by encouraging students and faculty to post on the discussion board after the mandatory self-introduction and by encouraging hands-on use of the FDA.gov website via the online scavenger hunt.

While each component of the drug development process is an important step to the overall process, many pharmacy students may find it difficult to relate to the early drug development phases, *e.g*., drug discovery, drug delivery, *in vitro* and *in vivo* animal investigations. The 500-word essays, or case studies, were utilised to promote connection with the material. Students were instructed to find a scientific paper within a discipline of their interest (*e.g.,* psychiatry, cardiology, surgery, infectious diseases) and compose a 500-word essay describing how the article illustrated and/or applied the specific learning objectives of the respective module. In order to deter potential plagiarism, each case study was submitted online by students using the plagiarism detection tool, SafeAssign, within the local learning management system, Blackboard. The majority of the total course points (approximately 75%) were based on these case studies, with the remaining 25% corresponding to graded quizzes. A final course grade was assigned based on a traditional scale of 90-100% as an A, 80-89% as a B, *etc*.

Students enrolled in the course were surveyed before and after completing the course. The pre-course survey was administered using SurveyMonkey; questions used both multiple choice and a quantitative Likert scale format (Strongly disagree = 0, Neither agree nor disagree = 50, Strongly agree = 100) (Survey Monkey, 2017). The post-course survey was administered using RedCap; questions included a combination of multiple choice and the same quantitative Likert scale format, with 0 representing strongly disagree and 100 representing strongly agree (Harris *et al*., 2009). Both surveys were administered anonymously and online. Each was available for a week-long period at the beginning and end of the course, respectively. An online Blackboard announcement notified students of survey availability. Students were offered a small amount of extra credit for completing each survey. Local Institutional Review Board approval was granted to evaluate and publish survey results. Data from both pre- and post-surveys were compared using descriptive statistics.

Results

In the first course offering, ten students were enrolled and the survey response rate was 8/10. Half were in their second year and half were in their third year of the four-year Pharm.D. programme. Fifty percent reported taking an exclusively online course in the past. When asked what reason they chose to take this particular online course, 100% indicated (*i.e*. 75% strongly agreed, 25% agreed) they enrolled because they were interested in the subject matter. All students reported liking the convenience of a self-paced course (37.5% strongly agreed, 62.5% agreed). The majority identified lack of scheduling conflict with other courses as a reason for taking the course (50% strongly agreed, 25% agreed) and felt that working from home was preferable to working on campus (25% strongly agreed, 50% agreed). With respect to the time students expected to invest in the two credit-hour course (in hours per week), 25% of students anticipated spending one-two hours, 37.5% anticipated two-three hours, 12.5% anticipated four-five hours, and 25% anticipated spending ≥seven hours per week.

At the end of the first course offering, students were anonymously surveyed again. With respect to the number of hours they reported spending per week on the course, 37.5% reported they spent between zero-one hours, 50% reported one-two hours, and 12.5% reported spending between two-three hours per week. With regard to viewing the course lectures, only 25% students reported watching 12-15 of the 15 total lectures and 62.5% watched half or fewer lectures. In spite of low lecture viewership, the mean Likert scale score for the statement, ‘the lectures were a valuable learning method’ was 90 (73 – 100) (Table I). When evaluating the statement,

'online lectures were a good substitute for live lectures', the mean Likert scale score was 92 (73 – 100). The sentiment regarding the case studies varied more widely (Table I). Although the mean Likert scale score regarding the statement 'the case studies were a valuable assessment method' was 81, the scores ranged from 30 - 100. All students reported the amount of work was appropriate for a two credit-hour elective. Students were lukewarm regarding whether the course offered sufficient interaction with classmates and teaching faculty (mean Likert scale score 57, range 12 – 98) (Table I). All students strongly agreed or agreed the course was well-suited to the online environment and their enrolment increased flexibility for school and non-school-related activities. All students reported the course met their expectations and stated they would recommend the course to a classmate.

Table I: Post-course survey results by course offering*

Statement	First Offering, Mean Likert Score (Range) N=8	Second Offering, Mean Likert Score (Range) N=10
The lectures were a valuable learning method	90 (73 - 100)	87.3 (72 - 100)
Online lectures were a good substitute for live lectures	92 (76 - 100)	76.4 (26 - 100)
The case studies were a valuable assessment method	81 (30 - 100)	77.9 (23 - 100)
The assigned reading contributed to my understanding of the course material	87 (67 - 100)	75.1 (19 - 100)
I had difficulty finding an article or published study for the case study assignment	18 (0 - 20)	6.5 (0 - 36)
I had technical difficulties accessing course reading and lectures	7.5 (0 - 70)	0 (0 - 30)
I had technical difficulties submitting assignments	10 (0 - 56)	0 (0 - 13)
My interaction with my classmates, the TAs, and the faculty was sufficient	57 (12 - 98)	72.25 (47 - 100) (8/10 responses)
This course was well-suited to the online environment	89 (70 - 100)	89.9 (70 - 100) (9/10 responses)
Taking an online course increased my flexibility for other school or non-school related activities	92 (80 - 100)	94.2 (79 - 100)
*Students responded to the following statements using a continuous Quantitative Likert scale (Strongly disagree=0, Neither agree nor disagree=50, Strongly agree=100)	Key TA = teaching assistance	

Noting this feedback, particularly the low rates of lecture viewership, subsequent course offerings incorporated participation grades based on tracking of lecture views in Blackboard and mandatory quizzes following each lecture. Tracking technology via Blackboard allowed the instructor to determine whether a specific student opened each lecture link. Each quiz contained three to four multiple choice questions designed to test whether students had listened to the lecture content. Quizzes were due weekly on Fridays at the same standard time.

Seventeen students enrolled in the second course offering and ten completed its corresponding post-course survey. Lecture viewership increased substantially: 70% of students reported viewing 12-15 lectures, 20% viewed 9-11. Again, 100% of students reported the coursework was appropriate for a two credit-hour elective. While overall students agreed lectures were a valuable learning method 87.3 (72 – 100), the sentiment of online lectures being a good replacement for live lecture was reduced 76.4 (26 – 100) (Table I). Like the students in the first course offering, satisfaction with the case studies as an assessment method varied, 77.9 (23 – 100). Again, all students reported the course met their expectations and stated they would recommend it to a classmate.

The course continues to be a popular elective, with a waitlist required each semester despite increasing enrolment to 25 students.

Discussion

Successful conversion of a live course to an online format has been previously described (Fuji & Galt, 2015). The development of an online drug development elective course for the Pharm.D. curriculum is unique in the pharmacy education literature. Proposed advantages of asynchronous online learning previously reported include flexibility for both faculty and students as well as increased student access to content and faculty without the restrictions of classroom space and scheduling (Vanderbush *et al*., 2007). In this experience, online lecture and activities without corresponding assignments and/or faculty feedback resulted in poor student engagement with the material, classmates, and faculty. To contrast the Vanderbush experience, in 2005, Zhang published a study regarding the effectiveness of multimedia-based e-learning and found that undergraduate students performed better and achieved higher satisfaction levels in an interactive e-learning environment compared to those in a traditional classroom (Zhang, 2005).

Sustaining student engagement requires high attentiveness by faculty and an increased workload from the student. In the two credit-hour lecture-based online health informatics course offered to Pharm.D. students reported by Fuji and Gault, faculty routinely posted feedback to the class (Fuji & Galt, 2015). Frequent faculty input may negate the benefits of flexible faculty scheduling often associated with online teaching. In addition, students completed a substantial list of

assignments for a two-credit-hour elective: three examinations, three quizzes, two five-page literature review papers, and a weekly written response to a discussion question posed for each lecture (Fuji & Galt, 2015). Based on the current survey results reported herein, a similar increase in workload may not be as well-received by local pharmacy students, as they already felt the course provided an appropriate workload. Depending on the local university policy, a two credit-hour course typically requires about three - four hours of online interactivity time per week. This work could include viewing of didactic lectures and completion of all accompanying online assignments and/or activities. One study of a blended learning anatomy course for multiple other healthcare professions demonstrated that increased student engagement with online activities, defined as percent of videos viewed and hits on forums, was associated with a slight, but significant increase in a student's final grade (Green *et al.*, 2017). The prerequisite course grade was actually shown to be the strongest predictor of course performance in this study, yet online engagement was estimated to enhance the effect of the prerequisite course grade by 15%. This accompanying data suggests there may be some minor benefit to increasing simpler, less intensive tasks online. The optimal balance of duration and intensity of online interactivity time for pharmacy students remains unclear and should be pursued in future educational research.

Specific strengths and limitations were identified regarding the development and implementation of this online elective course. Student satisfaction remained high both with course structure and course content. Strengths of the online format included a self-paced environment with the ability to re-watch lectures per individual preference, the opportunity to work ahead in the course, and complete weekly quizzes ahead of their deadlines.

The identified limitations of creating this online course primarily included lack of interaction with faculty and classmates, reduced participation among students viewing recorded lectures, and not being able to tailor teaching to individual learning styles. Although not directly applicable to our course, another potential benefit of online education could be seen in a hybrid course, where online lecture may allow for more active learning time and opportunities in a live course (Prunuske *et al.*, 2012).

Furthermore, limitations of surveys and our methods also exist. As the pre-and-post-course surveys were anonymous, there was not a means to correlate viewership of lectures to performance in the course. Additionally, due to survey anonymity, it is unknown if the same students participated in the pre- and post-course surveys. Also, a pre-course survey was not performed during the second course offering, thus limiting comparison with the first course offering. Other limitations include small sample sizes, change in survey source used, and general survey limitations.

Conclusion

After developing and continuing to modify this online elective course, we suggest caution and continuous evaluation in schools' approach to online education. We are hopeful that novel online technologies will continue to develop and made accessible to faculty at minimal cost on a wide variety of learning management systems. Such advancements may ultimately shift the online classroom experience to more closely mimic the live classroom and help balance the workload currently needed to deliver an effective online pharmacy course.

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