4-19-2016

Student-generated e-learning for clinical education

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Student-generated e-learning for clinical education

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Summary

Background: Within clinical education, e-learning facilitates a standardized learning experience to augment the clinical experience while enabling learner and teacher flexibility. With the shift of students from consumers to creators, student-generated content is expanding within higher education; however, there is sparse literature evaluating the impact of student-developed e-learning within clinical education. The aim of this study was to implement and evaluate a student-developed e-learning clinical module series within ambulatory care clinical pharmacy experiences.

Methods: Three clinical e-learning modules were developed by students for use prior to clinical experiences. E-learning modules were created by fourth-year professional pharmacy students and reviewed by pharmacy faculty members. A pre-/post-assessment was performed to evaluate knowledge comprehension before and after participating in the e-learning modules. Additionally, a survey on student perceptions of this educational tool was performed at the end of the clinical experience.

Results: Of the 31 students eligible for study inclusion, 94 per cent participated in both the pre- and post-assessments. The combined post-assessment score was significantly improved after participating in the student-developed e-learning modules (p = 0.008). The student perception survey demonstrated positive perceptions of e-learning within clinical education.

Discussion: Student-generated e-learning was able to enhance knowledge and was positively perceived by learners. As e-learning continues to expand within health sciences education, students can be incorporated into the development and execution of this educational tool.

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Funding: None.

Conflict of interest: None.

Acknowledgements: The authors would like to acknowledge Bethany Peschel and Rebecca Taylor for their assistance in developing and recording the clinical e-learning modules.

Ethical approval: The study received exempt status from the Butler University Institutional Review Board. Informed consent was provided by all students

Introduction

E-learning has been used within health sciences education for the past 25 years.[1-6] Benefits of e-learning over traditional teaching include the flexibility in time and location of instruction.[1,2] This convenience is important for clinical educators who have competing demands for their time, including patient care, committee participation, research and teaching. E-learning is a tool that can be used to provide opportunities for teaching core topics in the clinical setting. Effective e-learning allows clinical educators at various sites to ensure that learners receive standardized information to enable instruction for application and higher-level learning.

Although traditional e-learning has been developed by instructors, educational organizations highlight the role of student-generated e-learning.[7] Emerging technology is facilitating the shift of students from consumers to creators.[7] Student peer teaching has the advantages of understanding baseline knowledge deficiencies and potentially being able to clarify at a more appropriate level than the faculty members.[8-10] Evaluations of peer teaching have demonstrated that students perceive peer teachers as effective educators within a structured, classroom environment.[8–10] The concerns of peer teaching identified by students were related to lack of clinical experience and less knowledge, compared with faculty members;[8-10] however, close guidance by faculty members can minimize these concerns.[3,9,10] Therefore, there is potential in intertwining e-learning with peer teaching in the clinical setting. The use of student-generated content for e-learning encourages a student-centered learning environment with increased emphasis on active learning, creativity, communication and collaboration.[1-7]

While there is literature to support the effectiveness of e-learning and peer teaching within the health professions, there is limited literature evaluating the utility of student-generated e-learning within clinical education. The purpose of this study was to implement a student-generated e-learning clinical module series and evaluate its ability to enhance students' baseline knowledge of commonly encountered disease states prior to clinical experiences in ambulatory care.

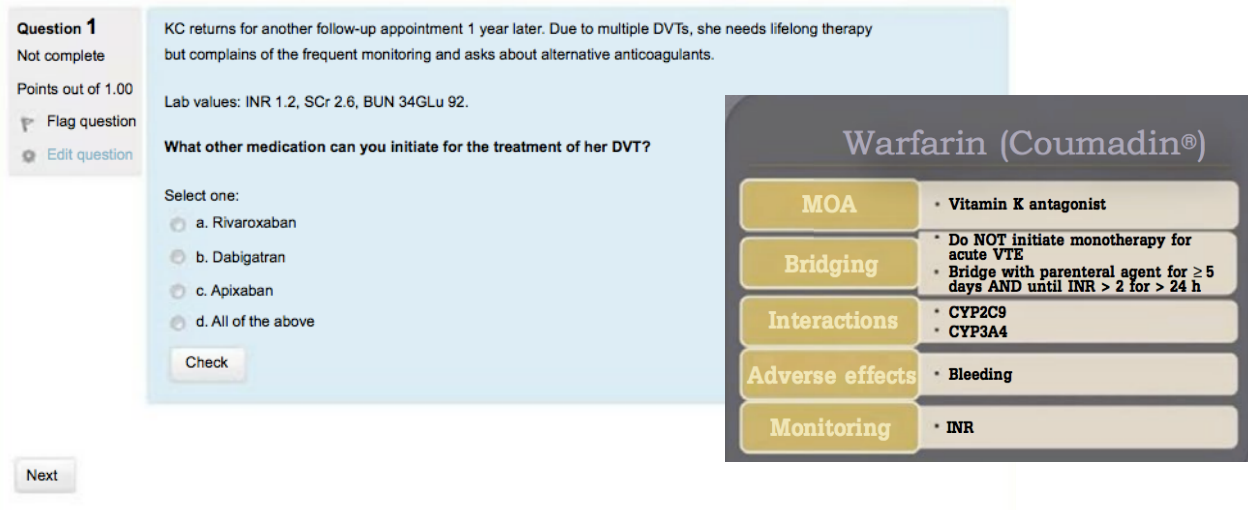
Methods

Development of e-learning

The clinical modules and assessment were created by two student developers in the final year of pharmacy school at Butler University College of Pharmacy and Health Sciences. Students were selected based on an interest in using this work for their capstone research project. The number of student developers was restricted by the limited number of modules envisioned for this pilot study.

The selection of the e-learning topics was guided by clinical deficiencies as noted by faculty members. Topics selected included diabetes, anticoagulation and medication therapy management. After topic selection, student developers were given autonomy in content synthesis. The content was guided by the student developers identifying knowledge gaps within the selected topics, through communication with peer learners and through self-reflection. Student developers were responsible for all of the creation and recording of e-learning content, including modules, patient cases, assessments, and a survey. Student-generated materials were reviewed for content validity by a pharmacy resident and a clinical faculty member. Review

Figure 1. Examples of e-learning modules: didactic component shown in right-hand image, with interactive patient case on the left



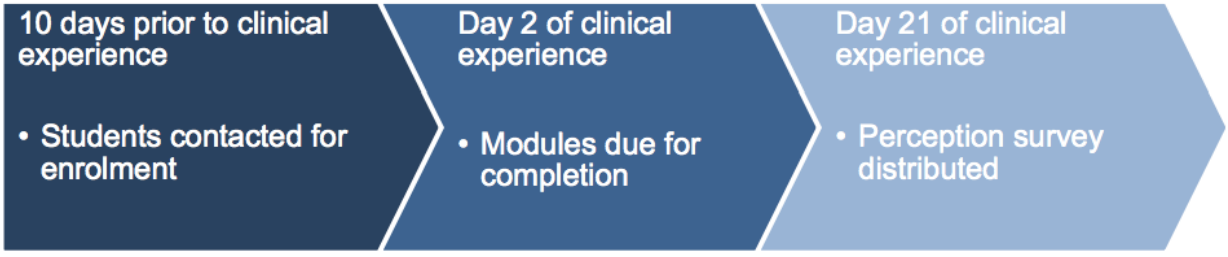
by clinical instructors was adopted based on previous literature demonstrating that student-generated content was enhanced through expert review.[3,9]

The modules were developed using PowerPoint© and recorded as a synchronised narrative audio via Panopto©. Each clinical module was 15–20 minutes in length, combining didactic instruction with interactive patient cases incorporated throughout the modules. Interactive patient cases with real-time feedback were embedded within the didactic instruction to enable the application of didactic material. Outside the patient cases built within the modules, an identical pre- and post-assessment was developed composed of 15 multiple-choice questions, with five questions from each module topic. The questions were focused on patient cases and aimed at a higher learning level using Bloom's Taxonomy (**Figure 1**).11

Study enrollment

Ambulatory care clinical experiences are required 4-week experiential training for pharmacy students to advance their knowledge and application of out-patient medication management for patients with a variety of acute and chronic disease states, within a clinic or doctor's office. Pharmacist and student services include patient interview and review of medications, patient education on medication therapies, provision of pharmacotherapy recommendations in an

Figure 2. Study timeline



interdisciplinary environment, and pharmacist-driven collaborative drug therapy management. Eligible participants for inclusion were all fourth-year Butler University pharmacy students enrolled in an ambulatory care clinical experience facilitated by a Butler University faculty member during the academic year, from August 2013 through April 2014. Students were excluded from the study if they had used the e-learning modules previously or did not complete all study components by day 2 of the clinical experience. Student enrollment occurred prior to the clinical experience, allowing students the time to view and complete the modules before beginning the clinical experience (**Figure 2**). All students provided informed consent before completing any study components. The pre-assessment was accessible at any point during the 10-day enrollment period, before participating in the interactive modules. Following the completion of all e-learning modules, students had immediate access to the post-assessment. All e-learning modules and assessments had to be completed within the 12-day time period to be included in the analysis. Learner perceptions were captured at the end of the clinical experience through an anonymous survey using SurveyMonkey®. The perception survey asked for the learners' level of agreement using a four-point Likert scale (strongly agree, agree, disagree, or strongly disagree) on 15 items regarding navigation, interactivity, content, and applicability of the e-learning modules. The even-numbered Likert scale was selected to avoid neutrality, and required students to select a degree of agreement or disagreement with each item.

Evaluation

The primary end point of this study was the change in the combined pre- and post-assessment score, as analyzed by the Wilcoxon signed rank sum test. Secondary end points included post assessment scores by practice site and a student perception survey. Post-assessment scores by health care system were evaluated by a one-way anova. The perception survey was reported using descriptive statistics. Statistical analysis was performed using the Statistical Package for Social Sciences, SPSS 22.

Results

During the study period, 31 students were eligible for inclusion representing 29 per cent of the 2014 graduating class. Of those eligible for inclusion, 94 per cent (n = 29) participated in both the pre- and post-assessments.

Figure 3. Pre- and post-assessment scores

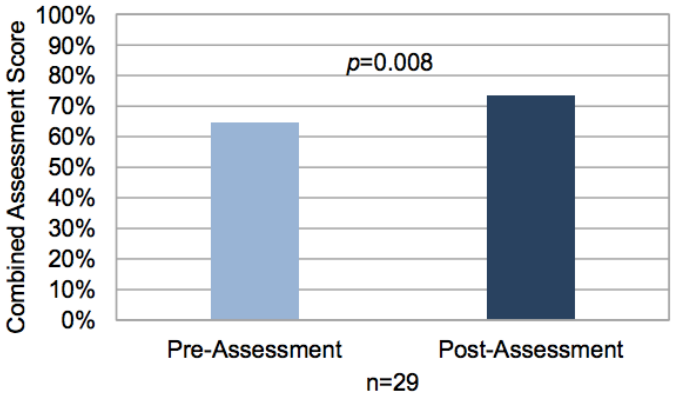


Table 1. Post-assessment scores by practice site

Practice site	Faculty educators	Student participants	Post-assessment % (SD*)	p value
1	1	4	73 (12)	0.718
2	1	6	68 (12)	
3	1	6	74 (11)	
4	1	13	75 (14)	

*SD, standard deviation

Table 2. E-learning student perception survey results

Survey statement	% agree/strongly agree (n = 24)
Navigation and interaction	
The modules were easy to navigate	96
The display of information was appealing	96
The method of instruction was stimulating and informational	67
I enjoyed the interactive patient cases	83
Content	
Knowledge from the modules was applied during the clinical experience	79
The orientation module was useful	83
The modules enhanced my understanding of disease state concepts	83
Modules	
The anticoagulation module improved my delivery of patient care	79
The diabetes management module improved my delivery of patient care	83
The medication therapy management module improved my delivery of patient care	75
Application	
E-learning enhanced my comfort level during the clinical experience	67
E-learning supplemented the clinical experience	75
E-learning should be used for future ambulatory care clinical experiences	75
E-learning should be used before every clinical experience	71
Summary	
Overall, e-learning was a beneficial educational tool for clinical experiences	79

Combined pre- and post-assessment scores are shown in **Figure 3**. There was a statistically significant improvement in the post-assessment score (p = 0.008). Analysis revealed similar post-assessment scores between each of the clinical practice sites (**Table 1**).

The student perception survey results are shown in **Table 2**. Of the 29 eligible students, 24 responded to the perception survey (83%). Globally, at least two-thirds of all students agreed or strongly agreed with each individual survey item.

Discussion

This study demonstrated the utility of student-generated e-learning within clinical education, as it was able to reinforce clinical knowledge while being positively perceived. With emerging technology, students' roles are shifting within higher education; however, outside of blogs and wikis, there is sparse literature within health sciences education on student-generated content.[3,4]

Within medical education, Gill et al. described the development of e-learning modules created by medical students and reviewed by faculty members for use during pediatric clinical rotations.[3] The modules contained patient cases, quizzes, podcasts and videos related to pediatric care. The authors noted the utility of a standardized student-generated resource as an educational tool for learners in a variety of pediatric settings. Similar to the pediatric resource, the current analysis demonstrated the benefit of a standardized student-generated e-learning resource for clinical education across multiple sites; however, unlike the current analysis, the article by Gill focused on the benefit to those developing content, not those learners using e-learning as an educational tool.

Most of the student-generated literature within health sciences education focuses on the impact on the student developer, not on the integration of this tool for educating peers;[3,4] however, there are a few examples within higher education. Willmott evaluated student-generated videos for a bioethics course for medical students.[5] The authors noted that learners felt their knowledge and interest in bioethics significantly increased after using the student-generated content. Outside of health sciences education, Bolliger and colleagues administered a survey evaluating student-generated audio files within a graduate-level instructional technology course.[6] Over 75 per cent of learners indicated that peer-developed audio files increased their learning. Similar to this literature, the current study demonstrated that learners had positive perceptions, and these studies, although limited, highlight the encouraging utility of student-generated content.

There are limitations with this analysis. The use of a pre- and post-assessment may reflect student memorization, but no assessment materials were provided to learners to minimize this confounding factor. Although the rate of voluntary enrollment was high, the sample size of the study was small, which affects the external validity. Despite these limitations, this study highlights the benefits of a student-developed e-learning resource to span the gap between classroom and clinical education.

Conclusion

Student-generated e-learning prior to clinical experiences was able to enhance clinical knowledge and was positively perceived by learners. As e-learning continues to expand within health sciences education, students can be incorporated into the development and execution of this educational tool.

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