Experiences in Teaching and Learning

Utilization of a virtual patient for advanced assessment of student performance in pain management

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ARTICLE INFO

ABSTRACT

Background and purpose: To assess student performance and achievement of course objectives following the integration of a virtual patient case designed to promote active, patient-centered learning in a required pharmacy course.

Educational activity and setting: DecisionSim™ (Kynectiv, Inc., Chadsford, PA), a dynamic virtual patient platform, was used to implement an interactive patient case to augment pain management material presented during a didactic session in a pharmacotherapy course. Simulation performance data were collected and analyzed. Student exam performance on pain management questions was compared to student exam performance on nearly identical questions from a prior year when a paper-based case was used instead of virtual patient technology.

Findings: Students who performed well on the virtual patient case performed better on exam questions related to patient assessment (p = 0.0244), primary pharmacological therapy (p = 0.0001), and additional pharmacological therapy (p = 0.0001). Overall exam performance did not differ between the two groups. However, students with exposure to the virtual patient case demonstrated significantly better performance on higher level Bloom's Taxonomy questions that required them to create pharmacotherapy regimens (p = 0.0005). Students in the previous year (exposed only to a paper patient case) performed better in calculating conversions of opioids for patients (p = 0.0001).

Summary: Virtual patient technology may enhance student performance on high-level Bloom's Taxonomy examination questions. This study adds to the current literature demonstrating the value of virtual patient technology as an active-learning strategy.

Background and purpose

The use of educational technology has expanded across the pharmacy education landscape, now being nearly omnipresent.[1] Virtual patients have been utilized by pharmacy educators in a variety of ways, including but not limited to augmenting lecture and replacing paper based cases.[2–9] As previously described, virtual patient technology ranges from computer-based programs that simulate a healthcare professional-patient encounter to lifelike patient simulators that place a student into a full-size patient care situation.[10] While allowing students the opportunity to refine their assessment and decision-making skills in a risk-free environment, virtual patient programs have also been designed to capture much greater detail in student performance when programmed to do so. Virtual patient technology allows for real-time feedback on student activity that can influence decision-making at the point of patient contact; it also provides students with multiple opportunities to repeat the process, thus exploring the consequence of a wide variety

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of decisions. If utilized correctly, virtual patient technology should assist the student in development of multiple skills including clinical assessment, patient interaction, critical thinking, therapeutic selection, and adaptability in a changing environment.[5,7,8,10] Faculty can subsequently view student decision pathways, response to real-time feedback, and ability to tailor therapeutic choices to changing patient scenarios. If concerns are identified, faculty can then alter educational content or teaching techniques to ensure that students meet learning objectives prior to any course assessments.

Despite the wide use of virtual patient technology, the literature is lacking sufficient data in advanced assessment of student performance and is mostly limited to improvement in pre- and posttest scores or student perception of learning. This manuscript details the development and evaluation of a virtual patient case in chronic pain management designed to provide in-depth assessment of student performance. The objective of this study was to assess student performance and achievement of course objectives following the integration of a virtual patient case in pain management. Ultimately, the results of this study are intended to assist the University of the Sciences Philadelphia College of Pharmacy in determining the value of virtual patient technology in preparing students for examinations in associated courses.

Educational activity and setting

Faculty used DecisionSim™ (Kynectiv, Inc., Chadsford, PA), a virtual patient platform that affords students the opportunity to simulate a healthcare provider encounter in a safe environment. This program has been described in detail previously.[5,7,8,10] The simulation content was derived from a paper-based patient case centered around pain management that was utilized the year prior and was written by the therapeutic content expert. The paper-based case was transformed to an appropriate medium for translation into a virtual case by the content and simulation experts. Detailed feedback and an algorithm of case progression were developed to ensure achievement of learning objectives. The virtual patient case consisted of text and pictures. The development of the case took approximately 100 hours from paper-case development to implementation. No information technology or administrative support was used during the development of the virtual patient.

The simulation content was developed for use in Human Disease and Application of Therapeutics II, a team-taught, four credit-hour required course offered to third professional (P3) year students in the fall semester. Course pre-requisites include physiology, pharmacology, and two semesters of therapeutics; a case studies course runs concomitantly with the didactic course and is intended to supplement the didactic content. Examinations in the therapeutics course are administered four times throughout the semester, consisting primarily of multiple choice questions with some additional short-answer questions (responses to short-answer questions were not evaluated in this study); these occur after the students have reinforced the therapeutic content through formative activities in the case studies course. Pain management is the first disease state module in this therapeutics course each year, encompassing four didactic lecture hours and a patient case for the accompanying case studies course. Notably, this is the only time in the curriculum where students receive formal exposure to pain management.

Pre-defined learning objectives (Table 1) were developed for the patient cases and standardized using Bloom's Taxonomy.[11] Of note, these objectives were consistent between both the paper-based and virtual cases as well as the didactic pain management content, and exam questions mapped directly back to the objectives. The virtual patient case was designed to be complex, but allow for flexibility in student progression based on performance. Each student was allowed one hour and fifteen minutes during class time, in the classroom, to complete the case individually. Students were first introduced to the patient and provided information related to the patient's in-patient hospital stay, home medications, admission and progress notes, and other pertinent information. This information was all programmed within the simulation to emulate retrieving information from an electronic medical record. After receiving this information, students progressed to the first evaluation point.

Students were asked to assess the type of pain the patient was experiencing (acute, chronic, neuropathic, nociceptive). Based on student selection, each option and combination of options led to individualized feedback with only the correct answers being allowed to progress in the case. Students that answered correctly were provided individualized feedback confirming their selections. If answered incorrectly, the student was provided individualized feedback based on any individual or combination of selections made. After receiving this feedback, students were provided a second opportunity to assess the patient's pain and needed to answer correctly to continue the case. If answered incorrectly the second time, the case ended and the student was provided feedback as to the reason why. This same process (question, individualized feedback, progression/remediation) continued throughout the rest of the case. Students were asked to identify the patient's goals of therapy (seven choices), determine step on the World Health Organization analgesic ladder[12] (three choices), design a primary treatment plan (eighteen choices), recommend adjunctive therapies (nine choices), provide additional medications to manage side effects (seven choices), evaluate monitoring parameters (eight choices), and re-evaluate the patient's other chronic medications (five choices).

Students could track their progress through the case utilizing a scoring based system, where they would lose points for incorrect

Table 1
Pre-defined learning objectives for the patient cases.

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1. Assess the patient's pain and determine goals of therapy based on his clinical presentation.
2. Design a medication regimen for the patient that includes therapy for his pain as well as additional medications that may be required to address adverse effects of the pain regimen.
3. Select appropriate monitoring parameters for the patient's new pain management regimen.
4. Recommend appropriate medication therapy changes for the patient's comorbidities based on implementation of the new pain management regimen.