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Research Note

Forecasting academic success through implementation of an online prerequisite review tutorials program for first year pharmacy students



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ABSTRACT

Objective: Online prerequisite review (OPR) tutorials were designed and implemented to reinforce foundational scientific material in order to protect in-class time, foster self-directed learning, and ensure all students have similar baseline knowledge.

Methods: Twenty-one tutorials covering undergraduate prerequisite material were developed by faculty and organized into six core modules, comprising basic biology, chemistry, and physiology topics. A quiz on this material was given on the first day of each course. This score was correlated with the final exam score at course completion. Additional student and faculty feedback was collected through surveys.

Results: 2372 quiz-exam pairings were collected over three consecutive fall semesters. A one point increase in the quiz score was associated with a 3.6 point (95% confidence interval 3.1–4.0) higher exam score, as well as a greater probability of passing the exam ($P < 0.0001$). Furthermore, simple linear regression revealed a positive correlation between quiz and exam scores ($P < 0.0001$). Three full years of student survey data revealed an overwhelmingly positive perception of the OPR tutorials, and surveyed faculty reported better use of class time and improved student competency and participation.

Conclusions: Implementation of OPR tutorials may give faculty more efficient use of class time, and their associated quizzes serve as an early indicator for students at-risk of not passing who are candidates for early interventions. Furthermore, the OPR tutorial design gives it great transferability to biomedical post-graduate programs.

Introduction

This report describes a novel ‘twisted’ classroom model that provides self-directed review of prerequisite undergraduate coursework for first year pharmacy students in order to investigate whether prerequisite performance is indicative of overall success in coursework. This ‘twisted’ classroom model is an innovative modification of the flipped classroom.¹ The traditional flipped

Abbreviations: OPR, online prerequisite review.

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classroom shifts in-class instruction of new material to home study in advance of class to better utilize in-class time for problem-solving, advanced concepts, and collaborative learning, and has been successfully utilized across a number of pharmacy programs.^{2,3} What distinguishes our ‘twisted’ model from the flipped classroom is that the material being studied in advance of in-class time is prerequisite material that the student should have learned, rather than new course material. This ‘twisted’ model, utilizing online prerequisite review (OPR) tutorials, highlights key concepts in prerequisite material in order to ensure all students enter the course with access to resources that revisit pertinent foundational knowledge.

The major motive behind implementing OPR tutorials was the observation by faculty teaching in the first professional (P1) year that entering students have highly varied proficiencies in foundational scientific knowledge that should have been covered in prerequisite coursework.⁴ The variability is likely a result of both when and where prerequisite coursework was taken and can result in an inefficient use of in-class time spent covering basic foundational knowledge to benefit a handful of students. Prerequisite courses are taught at diverse institutions where content and instruction varies both in quality and quantity. Thus, some students may have forgotten key material or failed to learn concepts that are considered fundamental knowledge for pharmacy programs.

The ability to recall and apply foundational knowledge in the basic sciences is a critical skill necessary for student success in pharmacy school. The literature supports this, suggesting that advanced biology coursework and a science baccalaureate degree are significantly associated with academic success in pharmacy school.^{5,6} In addition, this is reflected within content area 1 of the Accreditation Council for Pharmacy Education (ACPE) Standards 2016, in which science courses within the pharmacy curriculum are expected to build upon foundational elements acquired earlier in a student's academic career.⁷ Therefore, a critical need exists for students to enter the curriculum with a strong background in and understanding of relevant basic science areas. This need is magnified at the Pacific University School of Pharmacy due to our accelerated curricular model, a three-year modified block curriculum. Instructional hours are often at a premium, and thus coverage of advanced pharmacy-related topics rather than the review of basic physiology, biology, and chemistry topics may benefit student learning. We have observed that students weak in basic science foundational knowledge fall behind more easily and are more likely to become overwhelmed and disengaged. This may lead to increased student attrition rates or greater struggles with advanced topics, such as pathophysiology, pharmacology, and medicinal chemistry, which utilize core scientific principles. Faculty members are then likely to invest additional time and effort both in class and during office hours with these individuals, rather than cultivating academic skills for all students.

Currently, a minimum of 62 prerequisite semester credits is required for prospective applicants to be considered for acceptance into the Pacific University School of Pharmacy.⁸ Of these credits, a minimum of 35 (56%) are based in the biologic and chemical sciences. While it is expected that students will retain basic knowledge acquired in these courses to prepare them for the rigors of the PharmD program, we acknowledge a large variability in preparedness relevant to basic science foundation knowledge by our students. OPR tutorials were developed and implemented for first year pharmacy (P1) students during their fall semester to: (1) ensure all students have similar baseline knowledge despite when and where prerequisite coursework was taken, (2) foster self-directed learning, (3) optimize classroom time for more advanced learning, and (4) increase academic success. An added value was that the OPR tutorials afforded faculty an opportunity to introduce students to the format and capabilities of our online learning management system (Moodle)⁹ and examination platform (ExamSoft),¹⁰ thereby easing student transition into our program.¹¹

Benefits from the student perspective are that it is made clear what level and scope of knowledge they are expected to bring to the program, and those who require extra time to review challenging prerequisite material can do so at their own pace. This ensures students enter each course with a strong foundational understanding, thus leveling the playing field. From the faculty perspective, this tutorial provides an opportunity to designate more in-class time for active learning strategies and group-work to encourage learning and understanding, rather than prerequisite review. Tutorial-based assessments can also be used as a diagnostic tool to identify potential gaps in knowledge that may otherwise have gone unaddressed. The opportunity to identify areas in which students excel or struggle can promote dialogue and conversations in the classroom.

Methods

Context

All research presented herein was reviewed and approved by the Pacific University Institutional Review Board. The School of Pharmacy at Pacific University has a modified block curricular design that incorporates eight biomedical and pharmaceutical science courses (blocks) in the fall and eight in the spring, all of which are graded using a Pass/Fail system based on a 90 point competency threshold. Each course typically runs six days over a two-week period, with six hours of instructional time per day. Therefore, there is little time within each course for students to review prerequisite-level material while also keeping up with new material. During orientation (one week prior to the start of fall semester) students were given a 30 minute presentation to confirm they were able to access the OPR tutorials through the Learning Management System (Moodle) and to inform them that they would be quizzed on specific OPR tutorials on the first day of each course. Within a stand-alone Moodle course, six core modules containing 21 specific OPR tutorials were created to cover key foundational science topics (Table 1). Each block required from one to five tutorials to be completed before the first day of class. Faculty posted all tutorials two weeks prior to the start of fall semester, affording students the ability to review the prerequisite tutorials at their own pace since all tutorials were accessible throughout the semester.

Design

Implementation of the OPR tutorials involved four phases, which are described in more detail below. These four phases consisted

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