Using Lessons from Authentic Medication Errors to Promote Student Learning, Critical Thinking, and Active Learning in Pharmacy Curriculum

Reza Karimi and Joe Su
Pacific University School of Pharmacy
College of Health Professions – Hillsboro, Oregon USA

Abstract

Background: Pharmacy students' awareness of medication errors is a critical component of pharmacy education and patient care.

Purpose: To promote first year (P1) pharmacy students' awareness of medication errors to improve patient safety and link medication errors to P1 curriculum to support student learning in biomedical and pharmaceutical sciences.

Methods: We have created a novel curricular activity referred to as "Medication Errors and Sciences Applications (MESA)". Three P1 classes (14 teams/class) implemented the MESA activity by working on authentic medication errors and generated professional reports and presentations that integrated biomedical and pharmaceutical sciences. Descriptive statistics were used to analyze assessment data.

Results: The assessment results indicated that 70-85% of students believed that the MESA activity improved student learning in biomedical and pharmaceutical sciences. More than 95% of students agreed that the MESA activity introduced them to medication errors and to the important role that patient education played in preventing medication errors. Approximately, 90% of students agreed that the MESA activity increased their team work dynamics, integrated the knowledge they developed through the P1 curriculum, promoted active learning, critical thinking, and self-directed learning. Our data indicated that 90% of students stated that the achievement of Bloom's Taxonomy learning objectives were promoted by completing the MESA activity.

Conclusion: The MESA activity encouraged discussions of patient safety among pharmacy students to link medication errors to biomedical and pharmaceutical sciences which ultimately promoted and reinforced student learning in P1 curriculum.

Introduction

Most medication errors are known to cause life-threatening conditions for patients and can occur at any level of the five rights rule: right drug, right dose, right patient, right route, and right time. Approximately, 98,000 patients die in U.S. health systems every year because of medication errors. As a result, health professions who work with prescriptions, *i.e.,* prescribing physicians, optometrists, physician assistants, dentists, nurses, and pharmacists are prone to medication errors. Of particular concern is pharmacists who oftentimes work in in a less-than-ideal working environment (due to staff shortage, high volume of prescriptions per day, lack of standardized procedures, etc.).

Pharmacists are in a good position to intervene and mitigate medication errors at their practice sites. Therefore, it is imperative to include training for pharmacy students to discuss patient safety, medication errors, the devastating impact of these errors to patients, and what steps they can take to mitigate medication errors. At Pacific University School of Pharmacy, we acquaint students with some of the life-threatening medications errors that have caused devastating consequences, ask students to identify root causes, and discuss manageable plans to prevent medication errors. This poster describes a method using lessons from authentic medication errors to assist students in appreciating the consequences of medication errors and in learning biomedical and pharmaceutical sciences.

Aims

The Doctor of Pharmacy (PharmD) degree program at Pacific University School of Pharmacy has a 3-year, year-round curriculum. One objective of this study was to use authentic medication errors to capture student attention on the significant impacts that errors have on patients, patient caregivers and healthcare providers. Another objective was to promote student learning in pharmaceutical and biochemical sciences by using these media reported medication errors.

Methods

We generated a new learning tool referred to as "Medication Errors and Sciences Applications" (MESA). Three P1 cohorts (approximately 95 students/cohort), implemented the MESA activity. We built at least 14 student teams (6-7 students/team) per cohort. Student teams were asked to generate a 2-3 page MESA report and/or Power Point presentations over at least two 2-hour in class sessions. All three cohorts followed a consistent step-by-step process to generate their MESA reports (**Figure 1**).

Each MESA report included an authentic medication error related to a specific drug product. Student teams were asked to integrate biochemistry, medicinal chemistry, pharmacology, pharmacokinetics, pharmaceutics, and immunology topics to the select drug product and its medication error.

Student teams presented a 15-minute MESA report to their peers. After completion of all presentations, a survey tool was administered to assess the effectiveness of MESA activity. Approximately 220 students (≈75% of each cohort) completed the survey.
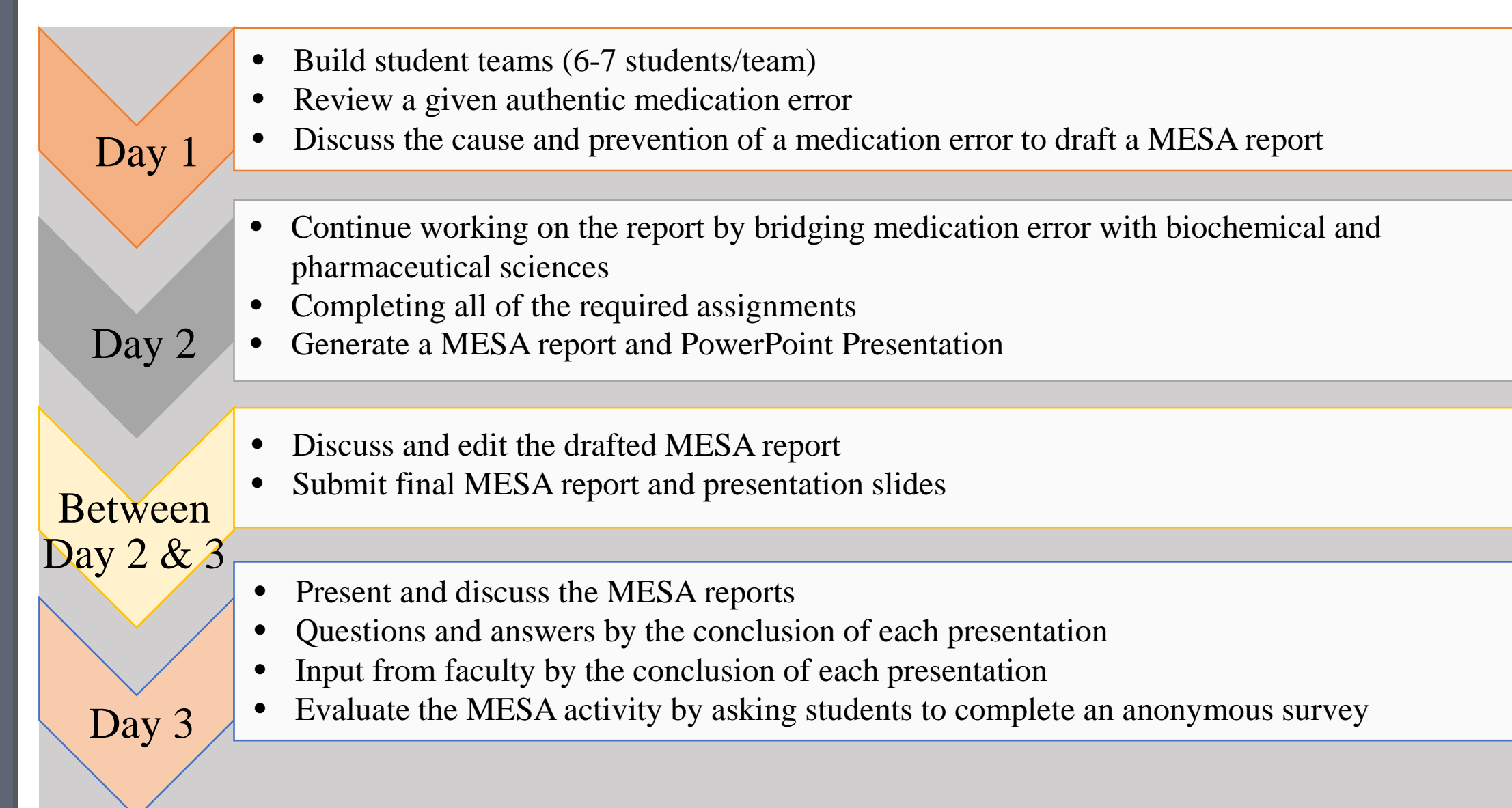
Results

Figure 2 demonstrates the positive role the MESA activity played on student learning in different subject areas of the first year curriculum.

We assessed student perception of the role the MESA activity played on promoting students' knowledge or skills. **Table 1** indicates teamwork, active learning, critical-thinking and self-directed learning skills were positively affected by the MESA activity.

Table 2 indicates the role of the MESA activity on various levels of learning as indicated in Bloom's taxonomy. All of these levels were highly rated, with the lowest rating (88.7%) in Evaluation and highest in Analysis and Application domains (94.6%).

Figure 1. The Step-by-step process to generate and present a MESA report.

Day 1	• Build student teams (6-7 students/team) • Review a given authentic medication error • Discuss the cause and prevention of a medication error to draft a MESA report
Day 2	• Continue working on the report by bridging medication error with biochemical and pharmaceutical sciences • Completing all of the required assignments • Generate a MESA report and PowerPoint Presentation
Between Day 2 & 3	• Discuss and edit the drafted MESA report • Submit final MESA report and presentation slides
Day 3	• Present and discuss the MESA reports • Questions and answers by the conclusion of each presentation • Input from faculty by the conclusion of each presentation • Evaluate the MESA activity by asking students to complete an anonymous survey

Figure 2. Student agreement (%) with the positive role the MESA activity played to assist students in increasing their knowledge based in the P1 curriculum. Data are from two P1 cohorts in two academic years. n = 70 (72%); n = 83 (86%).
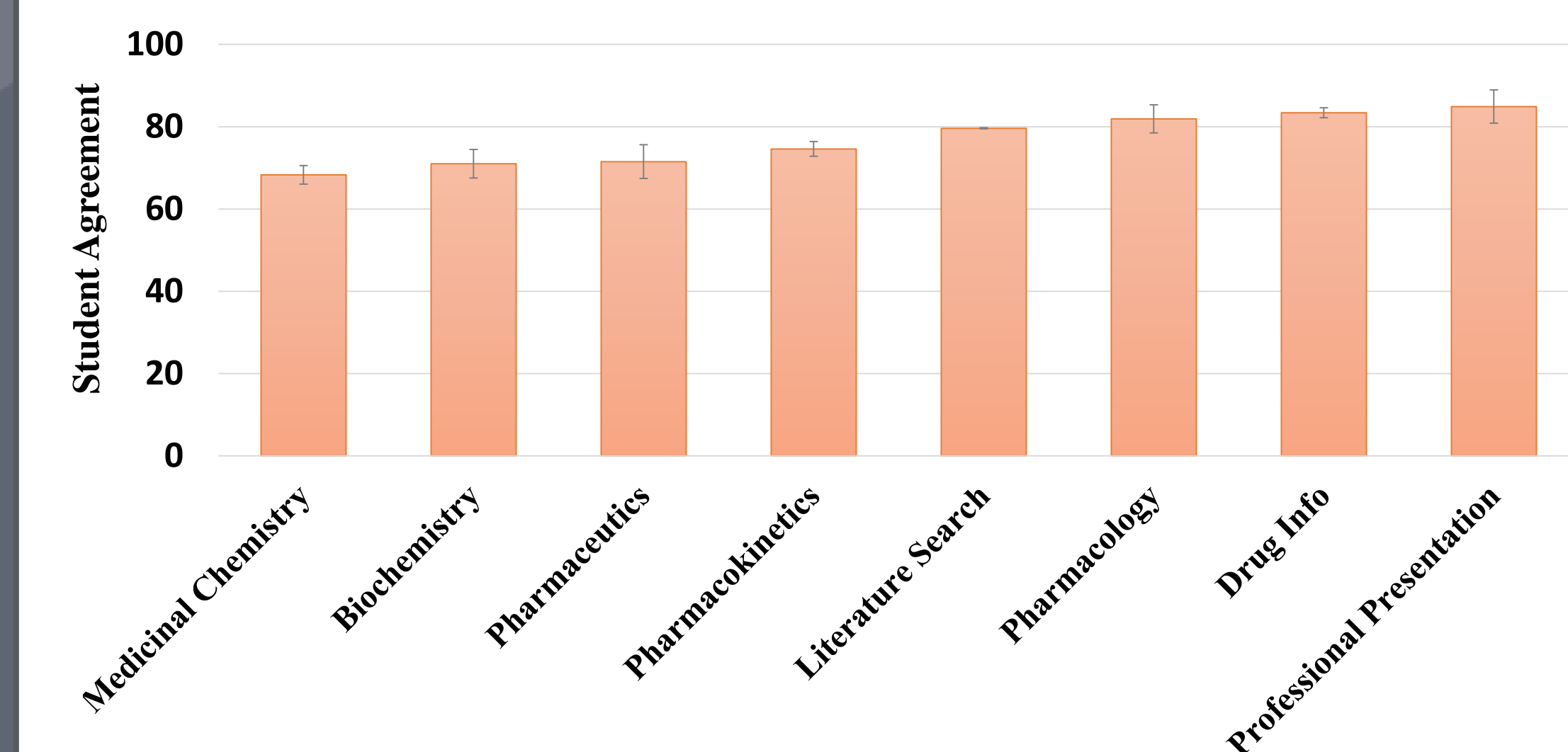
Table 1. Student perceptions of how the MESA activity assisted students in promoting their knowledge and skills in P1 curriculum. Data are mean (± SD) from three P1 cohorts: n= 70 (72%); n= 78 (87%); and n= 77 (79%).

Assessment Question	% Strongly agree + agree (±SD)
MESA activity enhanced the awareness of devastating effects that a medication error can cause to patients, healthcare providers, and a healthcare community at large.	98.3 (0.608)
MESA activity promoted patient safety discussions to establish a plan to prevent a medication error.	96.9 (1.02)
After working with your MESA project, you believe patient education plays an important role in the prevention of a medication error.	97.9 (1.30)
MESA activity increased the dynamic of student teamwork.	90.0 (2.60)
MESA activity integrated the knowledge and skills developed through the didactic part of the P1 curriculum.	92.3 (2.98)
MESA activity promoted your critical thinking.	90.2 (1.38)
MESA activity promoted your active learning.	93.7 (0.929)
Encouraged you to be a self-directed learner.	92.8 (1.55)
Helped you to apply integrative pharmaceutical sciences to patient care.	92.4 (0.945)
MESA was an innovative student learning tool.	92.4 (1.74)
Fink's taxonomy: Fostered caring *i.e.,* building new interests and values about something related to what you were learning. This helped you to be energized and engaged in the project.	91.1 (0.777)

Discussions

The MESA activity was designed to integrate and reinforce student learning in biomedical & pharmaceutical sciences. Our data indicated that students' knowledge base in these sciences were enhanced as a result of completing the MESA activity (**Figure 2**).

Pharmacists are well trained and widely accessible to patients and their families in both community and health system pharmacy settings. Accordingly, they play a vital role in providing patient education and reducing medication errors. Approximately, 98% of students indicated that after working with the MESA project, they believed patient education played an important role in the prevention of a medication error (**Table 1**). Additionally, our assessment data indicated that more than 90% of students believed that the MESA activity promoted both critical-thinking and active learning (**Table 1**).

Bloom taxonomy educational objectives *i.e.,* Evaluation, Analysis, Synthesis, Application, Comprehension and Knowledge were applicable to the MESA activity. In order to gather accurate data, we directly incorporated descriptions of Bloom's taxonomy into our survey instrument. As **Table 2** indicates, approximately, 90% of students perceived that the achievement of all of six objectives were promoted by completing the MESA activity.

Table 2. Student perception on the impact of MESA activity on Bloom's taxonomy educational objectives. Data are mean (± SD) from three P1 cohorts: n= 70 (72%); n= 78 (87%); and n= 77 (79%).

Assessment Question	% Strongly agree + agree (±SD)
Promoted evaluation: the MESA activity created an environment where you gave defensible opinions and based on given criteria you have judged accuracy, consistency, logic of information or argumentation.	88.7 (3.92)
Promoted analysis: the MESA activity created an environment where you broke the MESA project into its constituent parts. You organized, clarified, concluded, or made inferences. This process of analysis helped you understand the relationship among the constituent parts to grasp the big picture.	94.6 (1.55)
Promoted synthesis: the MESA activity created an environment where you integrated and combined different elements and parts to create a plan or structure that was not seen by you before.	92.4 (1.40)
Promoted application: the MESA activity created an environment where you used and applied previously learned knowledge from the P1 curriculum in new and concrete situations with a minimum of direction.	94.6 (1.53)
Promoted comprehension: the MESA activity created an environment where you comprehended information based on prior learning from the P1 curriculum and translated knowledge into your own words.	93.8 (0.907)
Promoted knowledge: the MESA activity created an environment where you remembered or recognized previously learned material from the P1 curriculum.	93.7 (2.35)

Conclusion

It is of paramount importance to train pharmacy students in reducing and preventing medication errors. Our study has indicated that reviewing authentic medication error cases, that are readily available online, can assist students in both becoming aware of the impact patient safety has on patient care and in promoting student learning in biomedical and pharmaceutical sciences. In addition, we have demonstrated that the MESA activity can positively affect Bloom's taxonomy of six learning objectives to promote student learning.

Contact Information

Reza Karimi, RPh, PhD
Pacific University School of Pharmacy
Phone: 503-352-7276
Email: karimir@pacificu.edu