

BRIEF

A Six-Semester Integrated Pharmacy Practice Course Based on Entrustable Professional Activities

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Objective. To design and assess the outcomes of a longitudinal, integrated pharmacy course.

Methods. A one-credit course, Applications of Pharmacy Practice, was built into a revised curriculum. The course was offered during the first six semesters of the Doctor of Pharmacy curriculum and met once every three weeks for a total of five sessions per semester. Each session integrated curricular material from all courses taught during a given semester into an individual, case-based assessment and a team activity. Team activities were evaluated using rubrics developed based on the Core Entrustable Professional Activities for New Pharmacy Graduates.

Results. First-year students were automatically enrolled in the inaugural offerings of the course in fall 2018 and spring 2019, and the majority of students achieved final course grades of 70% to 89% for each semester. Students reported that the course helped them to develop critical-thinking skills and to keep up with semester material. Although the majority of students believed the addition of the course to the curriculum was beneficial, some felt the expectation for them to keep up with all course material was excessive.

Conclusion. The addition of a longitudinal integrated course, Applications of Pharmacy Practice, appeared to benefit students, helping them integrate material from all of their courses during the semester. This integration of clinical, administrative, and pharmaceutical sciences material reduced compartmentalization of knowledge. Future studies should investigate the impact of this course on student success and performance on standardized assessments.

Keywords: pharmacy education, integrated coursework, entrustable professional activities, pharmacy curriculum

INTRODUCTION

Pharmacy education in the United States evolved significantly over the past decade from 2010 to 2020. Efforts to provide a more integrated pharmacy education that is reflective of the “real world” is a primary focus of many schools and colleges of pharmacy.¹ The introduction of entrustable professional activities (EPAs) for pharmacists has prompted academicians to explore novel ways of integrating EPAs into didactic coursework.² As Jarrett and colleagues noted, EPAs are not usually assessed using traditional methods of grading and therefore may be difficult to integrate into didactic coursework.³ Because direct observation of EPA task completion may be required, its assessment is often relegated to experiential portions of the curriculum. As schools and colleges of pharmacy continue to explore

new opportunities for the inclusion of EPAs, more information is needed to guide implementation steps, the development of assessment tools, and the establishment of milestones.^{4,5}

Despite the relatively recent introduction of EPAs to the profession, schools and colleges of pharmacy, as well as postgraduate training programs, have already begun to explore outcomes related to utilization of the EPAs as a performance measure. Rhodes and colleagues used EPAs as an assessment tool for early pharmacy practice experiences and found an increase in student performance of EPAs over a two-month period.⁶ Moon and colleagues described how EPAs were applied to the performance assessment for postgraduate year one residents. In both instances, EPAs were found to be a useful tool for skills evaluation.

In 2018, the Howard University College of Pharmacy underwent curricular revision and developed a longitudinal course, Applications for Pharmacy Practice.

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The course was launched in fall 2018 with the incoming class of pharmacy students. Rather than introduce new material, the course was meant to integrate all of the semester's coursework into extended cases and team activities to reinforce and elucidate relationships between content being taught in different courses across pharmacy disciplines (pharmacy sciences, administration, and clinical). The development, implementation, and outcomes derived from the course in its first year are described, as well as lessons learned.

METHODS

During the 2018 curricular revision, the Applications for Pharmacy Practice course was built into each of the first six semesters as one-credit-hour required courses. In addition to the development of this new course, each course in the revised curriculum was remapped to both the Center for the Advancement of Pharmaceutical Education (CAPE 2013) outcomes and the EPAs. Within the Doctor of Pharmacy (PharmD) curriculum, the applications course was first offered to students during the first semester of pharmacy school in 2018 and each subsequent semester throughout the three years of the didactic curriculum. By design, the course was co-coordinated by one clinical pharmacy faculty member and one pharmaceutical sciences faculty member, thereby ensuring appropriate integration of semester materials by content experts.

Students met with course coordinators for an introductory session at the beginning of each semester. Thereafter, they convened every three weeks for a three-hour session. During each of the five semester sessions, students received a one-hour, individually completed, closed-resource integrated case; a one-hour, open-resource team activity; and a one-hour debrief session. Each class session was worth 100 points, with the individually completed case counting 40% and the team activity counting 60%. The course also emphasized professionalism. Students were required to wear professional attire underneath a white coat and attend class on time. Students who did not adhere to the dress code policy or were more than 10 minutes late to a class received a 20-point deduction from their total score for that class session. The faculty intended for the course structure to remain fixed for all six semesters; however, the content varied. The methods described here focus only on implementation of the course during the first professional year of the PharmD program.

Development of the integrated content was led by the course coordinators, but required the input of all faculty members who were teaching a course during the corresponding semester. At the beginning of each three-

week period, the course coordinators e-mailed a request for faculty members to submit two to three questions related to content they had taught during the three weeks, a listing of all EPAs mapped to content, and any content areas in which students seemed to require improvement. Course coordinators had to provide the requested materials by a given deadline that allowed the Applications for Pharmacy Practice co-coordinators enough time to assemble and develop course materials for the upcoming class session. Questions could be submitted in any format (eg, multiple choice, free response), but the course co-coordinators reserved the right to modify question wording and format as needed.

For the case-based portion, each case contained between 11 and 13 questions. Question types included open-ended, multiple-choice, and K-type questions. Questions that were multiple choice often contained prompts to access further open-ended explanation or rationale behind a chosen multiple-choice response. Case content reflected the previous three weeks of material from all courses in the semester and was presented as an integrated patient case (Appendix 1). Students were not permitted to use any resources when resolving the case.

Team activities, which were developed by the course coordinators, were highly variable. Types of activities included but were not limited to role-playing, viewing videos to identify answers to questions, and team development of case questions. Team activities were evaluated based on select EPA learning objectives provided by faculty members during the preceding three weeks of coursework. An EPA-based rubric was developed for each course session's team activity (Appendix 2). Students in their first professional year of the PharmD program were expected to perform at level 1 (observation).³ Each session concluded with a one-hour debrief, which allowed time to discuss the solutions to the individual case and the team activity.

Student feedback regarding the applications course was elicited at the conclusion of each semester. Each student received a survey sent through e-mail by the college's director of assessment to evaluate the course anonymously. Students were allowed up to four weeks to complete this evaluation and were sent daily reminders, which were automatically generated. Student completion of each survey was optional. Once results of each survey were collated, the director of assessment provided the cumulative score to the applications course coordinators.

RESULTS

During the fall 2018 semester, 37 first professional year students were enrolled in the Applications of Pharmacy

Practice course (Table 1). One student dropped the course because of poor performance. As a result, 36 students were eligible for and enrolled in the spring 2019 offering of the course. The average age of the enrolled students was 25 years, with an age range of 20 to 38 years. The students attended a total of 10 course sessions during the fall and spring semesters. In both semesters, most students achieved a final course grade of 70% to 89%. Only two students required remediation after earning a final score of 65% to 69%. No students scored above 89% in the course in either semester. Students scored higher on team assignments than on individual assignments. Scores for team assignments, which were derived from EPAs, averaged 85% or greater based on a scale of 0-60 (Table 2).

Entrustable professional activities were incorporated into team activities, which were graded using a modified rubric (Appendix 2). During the first professional year, EPAs focused mostly on the patient care provider domain,

population health promoter domain, and information master domain. Nine of the ten applications course sessions offered in the first year evaluated team activities based on three core statements: analyze information to determine the effects of medication therapy, identify medication-related problems, and prioritize health-related needs. Six out of ten sessions focused on establishing patient-centered goals and creating care plans, maximizing the appropriate use of medications in a population, and minimizing adverse drug events and medication errors.

Optional student evaluations of the course were administered at the end of each semester (Table 3). Students rated the course on a scale of 0 to 5, with 5 being the best possible score. Fourteen students in the fall semester and seven in the spring semester responded to the survey (response rates of 38% and 19%, respectively). Overall, students believed that the course had assisted them with improving their critical-thinking and problem-solving skills throughout the first year. Despite that no new information was taught during the sessions, students reported they felt the course helped them learn and retain new information. Students also felt it was difficult to remember three weeks of information for each class session, particularly when all of their semester classes had different examination schedules and they had not mastered the content in some of their classes when the Applications for Pharmacy Practice sessions were held.

DISCUSSION

Based on the data collected at the conclusion of the first year, overall the Applications for Pharmacy Practice course was a success. The course structure provided obvious advantages to both the end users and the program. Allowing coordinators to integrate semester course material into comprehensive cases helped foster a foundational understanding among students of the real-world dynamic

Table 1. Demographics for Students Enrolled in the First Offering of an Applications for Pharmacy Practice Course

Variable	No. (%)
Age, y	
20-25	27 (72)
26-30	7 (19)
31-40	3 (8)
Gender	
Female	23 (62)
Male	14 (38)
Degree status	
Prior degree	31 (83)
No Prior degree	6 (16)
Race/ethnicity	
African American/ African	33 (89)
Caucasian	2 (5)
Asian	2 (5)

Table 2. Grades Earned on Entrustable Professional Activity Team Assignments by First-Year Doctor of Pharmacy Students Enrolled in an Applications for Pharmacy Practice Course

Class Session	Mean Score (out of 60 points total)	Median Score (out of 60 points total)	Standard Deviation
Session 1, Semester 1	56.5	55.0	1.7
Session 2, Semester 1	55.9	57.0	4.6
Session 3, Semester 1	55.1	54.0	3.6
Session 4, Semester 1	54.0	55.0	3.0
Session 5, Semester 1	54.0	56.0	5.1
Session 1, Semester 2	51.6	50.5	3.1
Session 2, Semester 2	51.5	57.0	6.9
Session 3, Semester 2	52.1	52.3	3.1
Session 4, Semester 2	53.6	55.0	4.5
Session 5, Semester 2	56.1	55.5	3.4

Table 3. First-Year Pharmacy Students' Mean Evaluation Scores of the Applications for Pharmacy Practice Course

Survey Questions	Fall Semester (n=14) ^{a,b}	Spring Semester (n=7) ^{a,b}
The course was organized in a way that helped me learn	3.8	2.4
The course assignments, lectures and labs usefully complemented each other	4.2	3.2
Instructions for the course materials (including manuals, handouts, etc) were clear	4.5	3.5
The course developed my ability to read and think critically	4.1	3.3
In this course, I feel I learned and retained a lot of new information	3.3	3.0
The course improved my problem-solving skills	3.9	3.0
How satisfied were you with this course?	3.6	2.5
Considering both the limitations and possibilities of the subject matter and the course, how would you rate the overall effectiveness of this course	4.1	2.8
Average	3.9	3.0

^a Number of students who completed the survey

^b Survey items rated on a five-point scale

interaction between different areas of pharmacy practice while at the same time avoiding the common “siloeing” of pharmaceutical science, administrative, and clinical concepts. The debrief and assessments during each class session allowed instructors to identify areas of weakness in student knowledge and skills, and to inform course coordinators of course materials that need further reinforcement. Use of the Entrustable Professional Activities as an assessment tool also allowed for targeted scaffolding, an instructional method that enables students to solve problems and carry out discreet tasks achieved through prompted content and peer support, with the goal of incremental content mastery demonstrated by the gradual shedding of instructor assistance.⁷ Although performance expectations for students in this first-professional-year course were set at level 1 (observation), they were informed that the level of expectation would gradually increase as they advanced through the course sequence in their second and third years.⁴ In addition to helping students achieve curricular milestones related to EPA practice competencies, the course also reinforced professional behaviors such as professional attire and timeliness, skills that would likely be essential in impending experiential coursework.^{2,8}

Experience in the overall implementation of the Applications for Pharmacy Practice course during the fall and spring semesters provided useful lessons to continually improve the course for the future. First, because the course is built on content from all semester courses, course coordinators relied heavily on semester course

instructors to submit content via email in a timely manner in order to integrate cases. In many instances, faculty members struggled to meet deadlines for content submission, resulting in the Applications for Pharmacy Practice course coordinators having insufficient time for preparation and finalization of content before each session. The course coordinators developed a new strategy during the third iteration of the course that included sending instructors calendar invitations at the start of each semester with deadlines and embedded deliverables. The course coordinators may need to explore different ways to ensure content is submitted or adjust deadlines to allow more time for finalizing each three-week case. Second, although not intentionally, the Applications for Pharmacy Practice course sessions often coincided with a semester examination in another course. The course coordinators found students focused more on the course examination rather than preparing for the cumulative closed-book case, and may have performed poorly because of this frequent overlap and their inability to prepare for both. In the future, the course may provide more benefit by having each three-week session scheduled between examinations in other courses as an incentive for students to keep up with the content between examinations. Third, as each team activity was based on an EPA rubric, the nature of the team assignment had to be active rather than case based. In some instances, because of the nature of the course content, which mostly related to basic sciences during the first two semesters, APP course coordinators had difficulty developing active exercises and occasionally

relied on paper-based team cases. They found that the development of the active-learning EPA-based team activities required more time and effort than originally thought. Additionally, permitted use of open resources during team activities meant that grades for this portion tended to be higher than grades for the individual portion, regardless of the activity. As a result, no team failed (<70%) to achieve level 1 of the EPAs, and there were no processes put in place to determine how to remediate the students if they did. This information is useful for future Applications for Pharmacy Practice course coordinators to consider and plan accordingly to ensure team activities match the EPA expectations for each course. Another lesson learned was the importance of encouraging professionalism throughout the course. Students observed that the wearing of white coats was not always enforced evenly throughout and between courses. In the future, the dress code policy needs to be enforced consistently to ensure that students are modeling appropriate professional behavior at all times. Other lessons included discovering that students required more formative and summative feedback than expected from the course coordinators related to performance and strategies for success. In response, during the course improvement meeting, course coordinators devised additional strategies to meet this need in the future, such as building in-class time for faculty members to provide feedback to students about areas of weakness ascertained from previously graded assessments. Also, at the conclusion of each semester, students would be given a document entitled “Tips for Success” that would assist them with navigating the Applications for Pharmacy Practice course in subsequent years.

Overall, students’ feedback regarding the course was positive despite receiving only moderate scores on assessments. Students felt that although the course was difficult, taking it resulted in improvements in areas such as critical thinking and course preparation (through consistent implementation of effective study habits). These findings are consistent with those from similar pharmacy courses that use both integration and scaffolding techniques.^{7,9} Some students who were unsuccessful in passing the course were also unsuccessful in passing one or more of their other courses during the same semester. This finding suggests that a student’s performance in the Applications for Pharmacy Practice course is reflective of their grasp of the semester’s curriculum, though no tool

was developed to evaluate this correlation. Future directions for research include evaluating whether different combinations of semester courses may make the Applications for Pharmacy Practice course more or less beneficial for student learning, as well as the impact of this course on overall PCOA and NAPLEX scores.

CONCLUSION

The addition of an integrated longitudinal course in a PharmD curriculum may aid students in their abilities to think critically about material learned throughout the semester in other courses. The successful use of EPAs as an evaluation tool in this didactic course suggests there may be opportunities to incorporate EPAs in areas other than experiential rotations. The majority of students believed the course was helpful to their learning and appreciated the addition of the course to the curriculum. Future research will explore the impact of this course on student performance on standardized examinations such as the PCOA and NAPLEX.

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Appendix 1. Selection of sample questions from the individual integrated case activity for the Application for Pharmacy Practice Course

Case: Bradley is a 40-year-old man who visits your community pharmacy today for follow-up about his medications. He has a history of COPD x 2 years, hypertension x 5 years, and osteoarthritis x 10 years.

You take him to the community pharmacy patient counseling area and say “Hi Bradley, nice to see you again. How can I help you today?” You wait silently for Bradley to answer while maintaining eye contact. He states that he has experienced more frequent breathlessness and wheezing when going up and down the stairs in his apartment building this week. He also notes that he has used his rescue inhaler (albuterol) an average of 3 times daily this week. He has not taken his daily COPD medication (Symbicort) within the past month. He also tells you he is dropping off two new prescriptions, one for himself and one for his daughter, both ophthalmic medications that his doctor just prescribed them this morning.

Social History: Divorced 2 years ago. He quit smoking 2 years ago after being diagnosed with COPD. He drinks 1-2 beers daily. He denies illicit drug use. Bradley has two adult daughters who live with him and are alive and well (5 years old and 19 years old). His father died of a heart attack at 64 years old, and his mother is living with type 2 diabetes mellitus and hypertension.

Bradley is a 40-year-old obese man in mild distress. Lungs: wheezing, short of breath, CV: tachycardia. Medications that you are able to ascertain from his profile include albuterol sulfate HFA, Ibuprofen 400mg, and amlodipine 10mg, and Symbicort.

First, you take a look at Bradley’s ophthalmic prescription for himself because you realize it needs to be compounded, and this can be done while you are doing MTM. The physician prescribes 250 mL of an ophthalmic suspension to contain 100 mg of cortisone acetate in 8 mL of the suspension. You check your stock and find out you have a 2.5% (w/v) suspension of cortisone acetate. How many milliliters of 2.5% suspension should be used in preparing the medication order? Show all calculations (No calculation work=0).

- a. 225 mL
- b. 200 mL
- c. 150 mL
- d. 125 mL

Next, you perform a physical assessment with the sphygmomanometer and stethoscope to determine Bradley’s blood pressure today along with additional vitals. His blood pressure today is 155/82, Pulse 102, Respiratory Rate 16, Temp. 37.1C, Wt 290 lbs, Ht 5’8.” Based upon his blood pressure reading, Bradley most likely has what stage hypertension? Justify your answer

After completing Bradley’s physical exam, you take a look at the ophthalmic prescription for his daughter. It is for Tobrex, ophthalmic drops which contain 0.3% w/v of tobramycin, instill 1 drop in each eye for 7 days. The drops are to be administered to Bradley’s 5-year-old daughter, weighing 35 lbs. Bradley wanted to know how much of this drug his daughter would actually be getting because he is worried that the physician didn’t dose it properly for a 5-year-old. If the drops are to be administered to both eyes over a 7-day period, how many micrograms of the drug would be administered per drop from a dropper delivering 20 drops per mL? Show all calculations (No calculation work=0).

- a. 3,000
- b. 275
- c. 90
- d. 150

After you complete Bradley’s physical assessment, you print some suggestions for Bradley to better manage his COPD. You include advice about reducing alcohol intake, exercise, and adhering to his chronic COPD treatment with Symbicort. You are completing which step in the MTM process?

After Bradley’s visit is over, you sit down to write a note in his Chart about the encounter. Bradley’s medication list should be documented in which section of the SOAP Note? Justify your answer.

A few weeks later Bradley returns to your pharmacy and asks if he can speak with you privately. He lets you know that his two daughters are going to visit their mother for the first time since the divorce two years ago, and he is worried about the visit. He tells you they divorced because his wife (their mother) became addicted to opioids and became an alcoholic after a terrible car accident. He gained custody of the children because of the mother’s addiction, but after getting help over the past year, she is requesting a visit. He said he heard she was on methadone to help her get better but knew it was an opioid. He asked if you could explain why she’s on an opioid if that was her problem to begin with? What should be included in your response?

- a. It is an orally administered methadone and can stabilize the patients by mitigating opioid-withdrawal syndrome.
- b. It works as the opioid receptor antagonist.
- c. It reduces withdrawal symptoms but suppresses the "high" that other opioids can elicit.
- d. All the above.
- e. A and C only.

Bradley is thankful for your answers and has a follow up. He is wondering why his wife can't just be put on pain medications that are used over the counter, like ibuprofen, and just have her take a lot of the ibuprofen pills to help her replace the opioids, since they are all pain medications anyways. To help him understand better, you explain how opioids and NSAIDS work differently. Please explain to Bradley the difference in how opioids and NSAIDS work in the body.

You receive a frantic call from Bradley a week later, he is in a huge panic and needs your help. He says he already called 911, but the ambulance has not arrived yet, so he wanted to ask you if you could help answer his questions before it gets to the house. He tells you he was meeting his wife regarding a discussion of visitation rights for her. He had asked about her alcohol use and she said she stopped cold turkey a week ago. Then suddenly, she starts having a seizure. Bradley thought it would stop on its own, but 15 minutes passed by, and she is still seizing. He was warned this might happen with alcohol withdrawal and wants to make sure the ambulance gives her the right drug when it arrives to help her. He asks you what the best drug option would be since she has been seizing so long? Justify your answer.

- a. Lorazepam 0.1 mg/kg intravenously (IV)
- b. Phenobarbital 20 mg/kg IV
- c. Phenytoin 7 mg/kg IV
- d. Phenytoin 20 mg/kg IV

Appendix 2. Sample EPA-based rubric for the team activity for APP, designed for first year students in the fall 2018 semester. Students were instructed to watch a patient counseling video and answer a set of questions.

EPA: Analyze information to determine the effects of medication therapy, identify medication-related problems, and prioritize health-related needs.

Supporting Task(s):	How were health records used in this setting of care and how did the health records help with this encounter? Be specific.	____/10
	What pieces of medication history did the pharmacist collect? Be specific.	____/10
	Total	____/20

EPA: Maximize the appropriate use of medications in a population.

Supporting Task(s):	List at least 4 times during the video that the pharmacist provided information that assisted Billy's father in using the medication correctly. Be specific and list what information was given regarding the medication use.	____/20 (5 pts/item)
	Total	____/20

EPA: Educate patients and professional colleagues regarding the appropriate use of medications

Supporting Task(s):	Describe how/in what manner the pharmacist educated Billy's father about the new medication, being sure to address.	
	a. Describe her communication style?	____/10
	b. What education methods did she use?	____/10
	Total	____/20

Comments:
TOTAL: ____/60