The Crossover Experience: An Integrated Approach to Making Cross-Disciplinary Connections in Pharmacy Curriculum

Patti W. Adams, PhD,1 Vicki Mody, PhD,2 Tracey Meade, PharmD,1 Andria Fettermann, PharmD,1 Kelly Clark, PharmD,1 Adegoke Adeniji, RPh,1 Mostafa Elgebay, RPh, PhD,4 Karyn Cotta, PhD3

1Philadelphia College of Osteopathic Medicine, School of Pharmacy, Suwanee, GA
2South University College of Pharmacy, Columbia, SC
3Larkin Health Sciences Institute, College of Pharmacy and Health Sciences, Miami, FL

Abstract
Objective: Completion of required minimum science prerequisites may not sufficiently prepare all nursing and pharmacy students for the complex skills required to make deeper connections across science disciplines. Hence, we implemented the Crossover Learning Experience (CLE) to emphasize relationships between science disciplines by requiring students to use a multidisciplinary approach to address Higher-Order problems.

Methods: Multidisciplinary, faculty expert teams collaboratively generated a case-based assignment and two quizzes for each CLE, and provided feedback during discussion sessions. Quizzes consisted of open-ended, higher-order-level questions (e.g., critical thinking, problem solving). Student Work Groups were assigned to lead discussion of each case assignment but were still required to answer the assigned question at the end of the discussion. Student groups were randomized on a higher-order quiz (Pre- or Post-CLE) but were still required to answer the assigned question at the end of each CLE. Student Work Groups submitted one completed assignment to the LMS. At the end of each CLE, a mandatory interdisciplinary discussion session was held, followed by a Post-CLE quiz (in which each student individually participated).

In each CLE, student HO Post-Quiz scores were significantly higher than HO Pre-Quiz (t-test, p<0.05).

The CLE improved students' ability to solve Higher-Order problems.

Introduction
The ACPE 2016 Standards and the Center for the Advancement of Pharmaceutical Education (CAPE) 2013 Educational Outcomes initiated by the AACP emphasize the need for pharmacy students to be able to interpret and apply foundational knowledge in the basic and pharmaceutical sciences.1,2 The value of basic science courses in evidence-based clinical decision making frequently is not appreciated by pharmacy students.3 Several strategies have been introduced to solve this problem however, active learning strategies for broader integration and application of basic sciences within pharmacy programs have not been reported.4,5

Multidisciplinary, faculty expert teams collaboratively generated a case-based assignment and two quizzes for each CLE, and provided feedback during discussion sessions. Quizzes consisted of open-ended, higher-order-level questions (e.g., critical thinking, problem solving). Student Work Groups were assigned to lead discussion of each case assignment but were still required to answer the assigned question at the end of the discussion. Student groups were randomized on a higher-order quiz (Pre- or Post-CLE) but were still required to answer the assigned question at the end of each CLE. Student Work Groups submitted one completed assignment to the LMS. At the end of each CLE, a mandatory interdisciplinary discussion session was held, followed by a Post-CLE quiz (in which each student individually participated).

Evaluation and Analysis
Overview: Pre- and Post-Quizzes were used to determine if CLE improved students' ability to solve higher-order problems. Two Assessment Groups were formed by evenly dividing student Work Groups into Assessment Group A or B (Figure 3). Group A and Group B were similar in pre-pharmacy science GPA (Group A, 3.12 ± 0.53 and Group B, 3.19 ± 0.39) and baseline Assessment scores (Group A, mean score = 42.12%; Group B mean score = 40.47; p = 0.909). Pre-Post-Quiz Instrument: Two assessments were generated for each CLE. The Control Quiz consisted of questions that were Bloom's Levels Remember and Understand. The Higher-Order Quiz consisted of questions that were Bloom's Levels Apply, Analyze and Evaluate. Students who took the Pre-Quiz were required to answer the assessment questions first before they were given an introduction to the CLE. Students who took the Post-Quiz were submitted (the students' response to which of these quizzes they would take as the Control Quiz, which required them to demonstrate the ability to remember and understand information. For the Pre-Quiz, the Higher-Order Quiz was identical to the Higher-Order Quiz, but it was given to the respective Assessment Group (Assignment Group A or B). Likewise, the Control Quiz was identical to the Pre-Quiz, but it was given to the respective Assessment Group (Assignment Group A or B). Changes in Assessment scores on the Higher-Order Quiz were assessed by comparing the Assessment Group mean scores on the Higher-Order Quiz before and after participation in the Crossover Experience. Data were analyzed by two-tailed independent t-test (t-test, p<0.05) for statistical differences.

Summary
We have designed and implemented a novel active learning approach, the Crossover Learning Experience (CLE), that allows students to strengthen connections between various basic and pharmaceutical sciences.

The CLE involved the participation of a large and diverse team of faculty at South University, including both Pharmaceutical Science and Pharmacy Practice faculty.6

The CLE was structured to allow faculty members to participate at a level that was comfortable to them. This approach enabled collaboration of a large number of faculty members over the course of the year.

A novel and critical component of the CLE was the inclusion discussion session that included a large and diverse team of faculty members to enhance understanding and discussion of specific disease states.

A CLE Post-Quiz method was utilized to assess student progress in development of critical thinking and problem-solving skills after participation in each CLE. Our findings indicate that the CLE improved students’ ability to solve higher-order problems.

References

Figure 3. Overview of Assessment Method. Prior to each Crossover Assignment being distributed to students, participants were randomized into Assessment Group A or B. Each Assessment Group consisted of 16 students, and the assignment was distributed to the students through their Learning Management System (LMS). For the Pre-Quiz, the Higher-Order Quiz was identical to the Higher-Order Quiz, but it was given to the respective Assessment Group (Assignment Group A or B). Likewise, the Control Quiz was identical to the Pre-Quiz, but it was given to the respective Assessment Group (Assignment Group A or B). Changes in Assessment scores on the Higher-Order Quiz were assessed by comparing the Assessment Group mean scores on the Higher-Order Quiz before and after participation in the Crossover Experience. Data were analyzed by two-tailed independent t-test (t-test, p<0.05) for statistical differences.

Table 2. Crossover Experience Results of Cohort Performance on Quizzes Assessing Dверent Skills Related to the Case Examples in Appendix 1 of ACPE 2016 Accreditation Standards

Figure 2. Design of Crossover Experience Assessment Groups. CLE Work Groups were divided into two Assessment Groups: Group A (of 8 total Work Groups) or Group B (of 9 total Work Groups). Of these Work Groups, 6 were composed of students located on the Savannah campus (Sav), and 6 were composed of students located on the Columbia campus (Col). Assignment Groups were designed so that both Assignment Groups contained an equal number of Work Groups from each campus (i.e., 3 Savannah Work Groups and 3 Columbia Work Groups)

Figure 1. Timeline For Each Block for the Crossover Experience. Each block of the crossover experience lasted 3 weeks. On day 1, each individual student took the Pre-Quiz. Later that day, the quizzes were released to the students through their Learning Management System (LMS). From Day 2 on, student groups conducted interdisciplinary discussion session (Assessment Group A) or Post-Quiz (Assessment Group B). On Day 25, each student group submitted one completed assignment to the LMS. (On Day 25, a mandatory interdisciplinary discussion session was held, followed by a Post-CLE quiz in which each student individually participated.)

Design (Cont.)
Case assignments: (Table 1) were designed to emphasize the connectedness of pathophysiology, biochemistry, medical chemistry, pharmacology, laboratory skills, and drug information. For the multidisciplinary discussion sessions for each CLE, student Work Groups were assigned to lead discussion of each case assignment but were still required to answer the assigned question at the end of the discussion. Brief discussion in a small group was encouraged prior to the virtual group discussion. Other Work Groups were then asked to add or delete the lead group’s position on the question. Faculty experts interjected follow-up questions throughout the discussion that required one or more Work Groups to defend positions, drew on deeper knowledge to problem solve, or connect their responses to another discipline.

Pre-Quiz Assignment Released
Day 1-20
Students In Group A To Complete Assignment
Day 20
Assignment Due by Midnight
Day 21
Assignment Submitted to DropBox

Group A

Group B

Pre-Quiz

Post-Quiz

Pre-Quiz

Post-Quiz

Phase 1:
Aspirin and a Topic areas from Appendix 1 of ACPE 2016 Accreditation Standards were assigned to questions if knowledge of these topics were required in any way to answer the questions asked, including understanding components of the case and the question. Case Progression: Upon completion of labs and EKG the MD orders an echocardiogram and angiogram. Upon visualization of the heart, the

- Pulmonary edema.
- ST depression.
- Sinus tachycardia.
- Mild diastolic dysfunction.
- Aortic stenosis.
- Right bundle branch block.
- Mitral regurgitation.
- Aortic regurgitation.
- Left bundle branch block.
- LVH.
- Pulmonary hypertension.
- Pulmonary stenosis.
- Right ventricular infarction.
- Right ventricular dysfunction.
- Left ventricular systolic dysfunction.
- Pericardial effusion.
- Diastolic dysfunction.
- Mitral valve prolapse.
- Aortic valve prolapse.
- Hypertrophic cardiomyopathy.
- Right ventricular hypertrophy.
- Right ventricular hypertrophy.
- Aortic regurgitation.
- Pericardial effusion.
- Pulmonary hypertension.
- Pulmonary stenosis.
- Right ventricular infarction.
- Right ventricular dysfunction.
- Left ventricular systolic dysfunction.
- Pericardial effusion.
- Diastolic dysfunction.
- Mitral valve prolapse.
- Aortic valve prolapse.
- Hypertrophic cardiomyopathy.
- Right ventricular hypertrophy.
- Right ventricular hypertrophy.
- Aortic regurgitation.
- Pericardial effusion.
- Pulmonary hypertension.
- Pulmonary stenosis.
- Right ventricular infarction.
- Right ventricular dysfunction.
- Left ventricular systolic dysfunction.
- Pericardial effusion.
- Diastolic dysfunction.
- Mitral valve prolapse.
- Aortic valve prolapse.
- Hypertrophic cardiomyopathy.
- Right ventricular hypertrophy.
- Right ventricular hypertrophy.
- Aortic regurgitation.
- Pericardial effusion.
- Pulmonary hypertension.
- Pulmonary stenosis.
- Right ventricular infarction.
- Right ventricular dysfunction.
- Left ventricular systolic dysfunction.
- Pericardial effusion.
- Diastolic dysfunction.
- Mitral valve prolapse.
- Aortic valve prolapse.
- Hypertrophic cardiomyopathy.
- Right ventricular hypertrophy.
- Right ventricular hypertrophy.
- Aortic regurgitation.
- Pericardial effusion.
- Pulmonary hypertension.
- Pulmonary stenosis.
- Right ventricular infarction.
- Right ventricular dysfunction.
- Left ventricular systolic dysfunction.
- Pericardial effusion.
- Diastolic dysfunction.
- Mitral valve prolapse.
- Aortic valve prolapse.
- Hypertrophic cardiomyopathy.
- Right ventricular hypertrophy.
- Right ventricular hypertrophy.