

A Tale of Two Calculations Course Designs and the Impact on Sequential Calculation Competency Exams

Vy K. Dinh, PharmD Candidate 2025; Apryl N. Peddi, PharmD, BCACP; Laura M. Frankart, PharmD, MEd, BCPS; Alexis N. Crawford, PharmD, BCCCP, BCPS
Virginia Commonwealth University School of Pharmacy, Richmond, VA, USA

Background

- Flipped classroom instruction using video lectures and video podcasts have been shown to be effective for teaching calculations.^{1,2}
- The pharmaceutical calculations course (PCEU501) was taught as an in-person, synchronous lecture series with team homework and multiple-choice exams. In Fall 2020, it was redesigned to be an intentionally online course with video lectures, learning mastery quizzes, application activities, and three comprehensive exams with fill-in-the-blank questions.
- Longitudinal calculations competence is assessed via calculation exams in the Foundations Laboratory course sequence from P1 spring until the end of P3 year.

Objective

- Compare the impact of an asynchronous, online versus a traditional, synchronous, in-person course design on longitudinal pharmaceutical calculation performance through exam averages.

Methods

Figure 1: Calculations Teaching Structure

P1 Fall: PCEU501 Pharmaceutical Calculations Course
 - Traditional, in-person, design (before Fall 2020) with multiple-choice calculation exams
 - Asynchronous, online design (starting Fall 2020) with fill-in-the-blank calculation exams & one competency-based exam with a passing threshold at 75%

P1 Spring: PHAR524 Foundations Laboratory II
 - One fill-in-the-blank calculations competency (passing threshold 75%)

P2 Fall: PHAR534 Foundations Laboratory III
 - One fill-in-the-blank calculations competency (passing threshold 75%)

P2 Spring: PHAR535 Foundations Laboratory IV
 - One fill-in-the-blank calculations competency (passing threshold 75%)

P3 Fall: PHAR534 Foundations Laboratory V
 - One fill-in-the-blank calculations competency (passing threshold 75%)

- Exam averages and remediation attempts were collected for the calculations course and for the sequential Foundations Laboratory courses from before (c/o 2021) and after the calculations course redesign (c/o 2024).
- Students were stratified into top 25%, middle 50%, and bottom 25% performances on the PCEU501 exams.
- Descriptive statistics were used to characterize longitudinal calculations exam performance.
- Data were analyzed with student's t-tests.

Results

Table 1: Comparing Exam Averages: Traditional In-Person v. Online Calculations Course Design

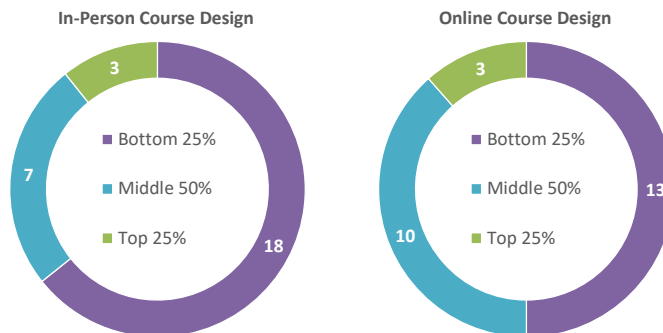
	PCEU501 Performance	PHAR524 Performance	PHAR534 Performance	PHAR535 Performance	PHAR640 Performance	Overall Foundations Performance
In-person Course Design (N=109)	98.03%*	85.86%	89.33%	94.47%*	95.30%	91.24%
Online Course Design (N=83)	85.66%*	89.58%	84.37%	90.36%*	95.71%	90.00%

*Denotes a statistically significant result ($p < 0.05$) comparing in-person vs online course design

Table 2: Comparison of Foundations Calculation Exam Averages Based on Student Performance Categories

	Bottom 25% Student Performers	Middle 50% Student Performers	Top 25% Student Performers
In-person Course Design	87.25% (N=27)	91.79% (N=52)	93.88% (N=30)
Online Course Design	84.34% (N=14)	90.21% (N=49)	93.46% (N=20)

Figure 2: Number of Calculation Exams in Foundations Courses that Required a Repeat (Score < 75%)



Results

Table 3: Number of Students with Calculation Exam Score(s) < 75% Across the Four Foundations Courses Assessed

	0 repeats	1 repeat	2 repeats	3 repeats
In-person Course Design (N=109)	87	17	4	1
Online Course Design (N=83)	63	15	4	1

Limitations

- Transition from multiple-choice exam questions to written response exam questions in new course modality increases the complexity of assessing exam competency.
- New modification in course modality occurred during COVID-19 pandemic which could have both negative and positive impacts on student performance outcomes.

Conclusions/Future Directions

- Overall, longitudinal calculations exam performance remained similar despite the course redesign.
- Students performing in top 25% or bottom 25% of the cohort continue to maintain their performance level regardless of course design.
- Shifts in calculation exam repeats occurred from the bottom 25% to the middle 50%. Restructuring remediation efforts to support students performing in the bottom 25% may prove beneficial, which could include providing extra tutorial sessions or additional practice questions.
- Additional research regarding the best modality to teach pharmaceutical calculations in our current climate is needed.

References

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- Mmatzaganian CL, Singh RF, Best BM, Morello CM. Effectiveness of Providing Video Podcasts to Pharmacy Students in a Self-Study Pharmaceutical Calculations Module. *Am J Pharm Educ.* 2020;84(12):ajpe7977. doi:10.5688/ajpe7977

Correspondence

Alexis N. Crawford, PharmD, BCCCP, BCPS (acrawford4@vcu.edu)
 Apryl N. Peddi, PharmD, BCACP (peddian@vcu.edu)
 Vy K. Dinh, PharmD Candidate 2025 (dinhvk@vcu.edu)