

The Flipped Classroom: A Course Redesign to Foster Learning and Engagement in a Health Professionals School • Academic Medicine

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The Flipped Classroom: A Course Redesign to Foster Learning and Engagement in a Health Professionals School

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Medical, nursing, and pharmacy schools all have been challenged to better prepare their students to meet the evolving health care needs of society.^{5–8} Since the 1910 Flexner report,⁹ the amount of information about health and medicine has grown significantly, the health care system has become increasingly complex, patients have become more engaged in their care, and educational innovations in technology and pedagogy have grown rapidly. Yet, little has changed in the way that education is structured and delivered to aspiring

health professionals, and in-class lectures continue to prevail in the vast majority of classrooms across the country.¹⁰

A growing body of literature consistently points to the need to rethink what is taking place in the classroom. Research shows that students’ attention declines substantially and steadily after the first 10 minutes of class^{11,12} and that the average attention span of a medical student is 15 to 20 minutes at the beginning of class.¹³ Although student material presented during class often bores students and can deprive them of their own, but they need to be guided in solving problems. Research suggests that only 20% of the time spent in class often bores students and can deprive them of their own, but they need to be guided in solving problems. Research suggests that only 20% of the time spent in class often bores students and can deprive them of their own, but they need to be guided in solving problems.

Active learning exercises engage students and reflect their own, but they need to be guided in solving problems. Active learning exercises engage students and reflect their own, but they need to be guided in solving problems. Active learning exercises engage students and reflect their own, but they need to be guided in solving problems.

Developments in active learning have prompted some educators to flip the classroom.^{17,23} In the flipped classroom, instructors prerecord lectures so that class time can be dedicated to student-centered activities and strategies.^{17,23–25} This approach allows instructors to implement problem-based learning and flipping the classroom to engage the student.¹⁷

Most important, the flipped classroom model is student-centered. Each student is responsible for coming to class with a basic understanding of the material, so that she or he can fully participate and engage in class discussion. Content acquisition then is self-paced and self-guided, enabling students to control when and how much content they view. To facilitate learning, instructors guide students to the content, organize interactive experiences, challenge students to think creatively, and provide expert insight and feedback. Rich, open-ended experiences within the classroom equip students for success by fostering critical cognitive development and promoting innovation through collaboration.¹⁷

In spring 2012, in the highly collaborative Project 4-1-1 Flip, we flipped a graduate-level health professions course in pharmaceuticals required for first-year pharmacy students. The purpose of this article is to describe the philosophy and methodology used in the course redesign and to outline the research we conducted to investigate the outcomes of this project. This article is intended to serve as a guide to instructors and educational programs seeking to develop, implement, and evaluate innovative and practical strategies to transform the learning experience in a large cohort of students within a health professions learning environment and beyond.

Course Redesign

Our course redesign was inspired by a desire to transform the educational experiences of our students and to meet students’ requests for enhanced in-class active learning exercises.^{26,27} At the time, an increasing number of classroom innovations were permeating the University of North Carolina (UNC) Eshelman School of Pharmacy as the result of a collective awareness that the methodologies employed in our classrooms, which consisted mainly of traditional lectures, had remained largely unchanged for decades. The goals of our course redesign were to (1) improve students’ learning and develop students as critical thinkers, problem solvers, and team players; (2) fully engage students and instructors throughout the learning process; and (3) stimulate higher-order thinking through the use of creative technologies and applied learning.

Course description

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The UNC Eshelman School of Pharmacy four-year professional program requires six semesters of course work in the classroom and 10 months of experiential practice. The approximately 120 full-time faculty and 620 doctor of pharmacy students are housed on three campuses (the main UNC campus in Chapel Hill and satellite campuses in Elizabeth City and Asheville).

Basic Pharmaceutics II (PHCY 411) is the second course in a yearlong sequence required for first-year professional students. V
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complex, specialized, ar
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In the nine years prior t
traditional lecture form
which consisted of a 75-
share activity).^{28,29} To
questions were multiple

New course form

As shown in [Figure 1](#), in
videos and filled the sch
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 [F1-17](#)
[Figure 1:](#)
Flipped classroom
in 2012 at the
University of North Carolina Eshelman School of Pharmacy. Important features included
offloaded content and student-centered learning which were designed to align with Bloom's
Taxonomy of Learning.³³ , ³⁴

Following an extensive literature review and consultations with experts in educational technology and pedagogy, we focused on three essential elements in our PHCY 411 flipped classroom: offloaded content, student-centered learning, and appropriate assessment.

Offloaded content.

At the UNC Eshelman School of Pharmacy, we refer to offloaded course content as an integrated learning accelerator module (iLAM).^{26,27} We prerecorded 25 content-focused iLAMs using Echo360 Classroom Capture³⁰ and offloaded them to a Web site embedded in Sakai,³¹ a Web-based learning management system that students could access at any time on any computer or Internet-enabled device.³¹ Students had the ability to pause, rewind, and fast forward the videos and were allowed to view each iLAM multiple times, which enabled students to learn at their own pace. We adapted the iLAMs from PowerPoint slides used to deliver PHCY 411 in 2011 and designed them to emphasize only critical concepts, information, and illustrations.

One particular challenge in developing the final content-focused iLAMs was consolidating about 29 hours of lectures used in previous years. However, we deemed this step necessary both to minimize students' out-of-class preparation time and to emphasize only the critical concepts students needed to learn prior to coming to class. The average length of each iLAM was 34.6 minutes (range of 21–55 minutes), with a total viewing time for all 25 lectures of 14.4 hours.

Student-centered learning.

With prerecorded iLAMs and assigned textbook and background readings designated as preparatory tools for students prior to class, every in-class period was devoted to student-centered learning exercises designed to

assess their knowledge, promote critical thinking, and stimulate discussion. In general, each 75-minute class accommodated the following activities (see [Figure 1](#)).

Activity #1 (audience response and open questions).^{28,29} We assessed students' understanding of the basic concepts presented in the assigned iLAMs and readings at the beginning of class using clicker (or audience response) questions and open questions. The UNC Eshelman School of Pharmacy requires that all students purchase a clicker on a 30 seconds to respond to immediate feedback and students that addressed

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Activity #2 (pair & share)
activities: rapid, reflective
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perspective, and expand
online 24 to 36 hours be
provide a structured an
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Activity #3 (student presentation) was responsible for presenting students' questions about the topic to prepare and submit presentation materials to three groups to present and lead the in-class discussion. All groups were graded on their presentation materials regardless of whether they were selected to present, and all students in each group received the same grade. Groups were required to prepare presentation materials twice during the semester, and the average total work for each student was three to five hours for each preparation. The majority of groups presented once; only two groups were chosen to present twice.

Activity #4 (individual or paired quiz). At the end of each class, the instructor administered a 10-question multiple-choice quiz on paper; then, he selected the quizzes from eight classes to grade based on overall student workload and exam schedule. At the time the quiz was administered, the instructor notified the students whether it would contribute to their final grade. Each quiz covered only that class's material, and, in some cases, students were permitted to work in pairs and openly discuss the questions. This activity encouraged students to stay current with the course content and learn from one another, and provided valuable feedback to the instructor as the course progressed.

*Microlectures.*³² A critical component of the PHCY 411 flipped classroom was the microlecture, used by the instructor to reinforce and, if needed, redirect students' learning. These microlectures were typically one to three minutes in length and were incorporated when needed on the basis of classroom dynamics. Not only did the microlectures provide an opportunity for the instructor to bring the students back to a "good place" from the chaos of an active learning environment but they also reinforced the idea that students could, in fact, explore and extend themselves knowing that the instructor would provide clarity and perspective when confusion ensued.

Appropriate assessment.

Appropriate assessment was a central tenet of the course redesign. Active engagement activities, like clicker questions and pair & share activities, enabled instructors to make real-time, formative assessments of students' learning and provide immediate feedback concerning misconceptions or gaps in students' knowledge. Students' presentations (worth 1.6% of the final grade), eight graded quizzes (worth a total of 12.9%), three scheduled examinations (each worth 16.1%), and one comprehensive and cumulative final examination (worth 32.3%) assessed students' understanding of the course content and measured students' ability to achieve desired learning outcomes and objectives.

Two projects assigned at the beginning of the semester provided additional practice opportunities, encouraged higher-order thinking, and assessed students' ability to analyze, synthesize, and evaluate material, consistent with the top of Bloom's Taxonomy of Learning.^{33,34} The first project (package insert analysis, worth 4.8%) required students to apply the concepts they learned in PHCY 410 and PHCY 411 to the prescribing information of a Food and Drug Administration–approved product. The second project (clinical pharmaceuticals proposal outline) asked students to identify a clinical shortcoming, design a dosage form for treatment, and write a treatment plan. At the beginning of the course, the instructor converted this second project into a written assignment. At the end of the course, the instructor converted this second project into a written assignment. At the beginning of the course, the instructor converted this second project into a written assignment.

Finally, students received an additional 1.6% or 1.6% of the course grade.

Course implementation

In 2012, the redesigned course was delivered synchronously via video (Elizabeth City) while the remainder of the course was delivered on Monday and Wednesday evenings. The course consisted of 12 additional classes for the semester. The course consisted of 12 additional classes for the semester. The course consisted of 12 additional classes for the semester.

We recognized that the transition, we provided an explanation detailing our motivation for the redesign. In addition, we provided a guide with tips for success in the course, which emphasized our expectations that the students would review the offloaded material prior to each class and would actively engage in the in-class exercises.

Throughout the semester, we closely monitored the students' ability to balance the course workload under this new format. We were committed to facilitating students' exploration of the course material in this new dynamic environment without burdening them or limiting their opportunities. We recognized that students had to invest time upfront and continuously during the semester, but we believed that this investment paid dividends as it required students to spend less time studying prior to exams. By routine, informal student polling, we ensured that the total out-of-class time per credit hour was consistent with UNC guidelines. In response to students' feedback, for example, we chose about three-quarters of the way through the semester to convert the clinical pharmaceuticals proposal outline project into an optional bonus exercise to better balance students' workload.

When implementing the flipped classroom, we recommend that faculty time and resources also be taken into consideration. In 2012, faculty needed 127% more time to prepare the flipped classroom than they needed in 2011 to prepare the traditional classroom (see Supplemental Digital Table 1, <https://links.lww.com/ACADMED/A177>). We attributed this increase in time commitment (93% for the teaching assistant and 170% for faculty) to the extra time required to capture lectures, prepare active learning exercises, and grade projects and examinations. However, the ability to reuse resources and greater efficiencies incorporated into the course design will reduce these time commitments in 2013.

Our flipped classroom model required a highly trained teaching assistant, who, except for class facilitation, functioned at the level of efficiency and expertise of the instructor, especially as it related to providing thoughtful written feedback. Our model also required that the teaching assistant work full-time, committing 20 hours per week (or about 260–270 hours per semester) to the course. In both 2011 and 2012, the teaching assistant was a full-time PhD student in the Division of Molecular Pharmaceuticals who attended classes, held office hours, communicated with students, and prepared and graded assignments (see Supplemental Digital Table 1, <https://links.lww.com/ACADMED/A177>).

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Although faculty will see a significant drop in time commitment in 2013 compared with 2012, the teaching assistant's time commitment will be about the same. We realize that many medical schools do not employ teaching assistants. However, we offer that medical schools may address this gap by employing senior medical students who already have completed the course and/or PhD students who are enrolled in graduate medical programs and have expressed a desire for teaching experience.

Course Outco

Examining how student impact of this innovativ review board, we admin demographic informati engagement behavior. V course. That year, we al the number of times eac and the number of time and 2012, we tracked th

Participation in the pre-evaluation was required demographic informati collected data. We cond Here, we present contin and postcourse survey r scores for the 2011 and variables. We establishe

In 2012, 150 of the 162 s male, 111 were white, 121 held at least a bachelor's degree, 131 came from a science, technology, engineering, or mathematics (STEM) background, and the mean age was 23.91 ± 4.00 years (see [Table 1](#) for complete 2011 and 2012 demographics). All students completed the course evaluations (162 in 2012 and 153 in 2011).

 [T1-17](#)
[Table 1:](#)

Demographic Characteristics of Students Who Completed the Basic Pharmaceutics II Course in 2011 and 2012 at the University of North Carolina Eshelman School of Pharmacy*

Of survey respondents in 2012, 82.0% reported listening to all 25 iLAMs, while an additional 15.3% reported listening to 20 to 24 iLAMs. Next, 79.3% reported watching iLAMs more than once a week, with an additional 19.3% reporting watching one iLAM per week. On average, students accessed the course Web site 194.09 ± 90.02 times and the iLAM site 39.37 ± 16.84 times throughout the semester. All correlations between online engagement measures and final exam performance were weak ($r_p = -0.04$ to $r_p = 0.20$). The correlation between the number of completed extra credit activities and raw final course grade was moderate ($r_p = 0.34$).

Students from the flipped classroom were more likely than students from the traditional classroom to agree that active student engagement was consistently encouraged by the instructor ($P < .001$) and that preparation for class was necessary to be successful ($P < .001$, see [Table 2](#)). On the 2012 course evaluation, 91.2% of students agreed or strongly agreed that learning materials and resources were helpful, 93.1% agreed or strongly agreed that teaching and learning methods in the flipped classroom promoted understanding and application of key concepts, 95.6% agreed or strongly agreed that they were confident in their ability to apply the knowledge and skills they developed, and 98.1% agreed or strongly agreed that the knowledge and skills they developed would be relevant for the future. Furthermore, attendance was higher in the flipped classroom ($P = .03$), and an independent t test showed a statistically significant difference ($P = .001$) between final exam grades (out of 200 points) in 2012 (165.48 ± 13.34) compared with those in 2011 (160.06 ± 14.65).

 [T2-17](#)
[Table 2:](#)

Comparison of Course Evaluation Responses Between Students Who Completed the Basic Pharmaceutics II Course in 2011 (Traditional Format) and 2012 (Flipped Classroom Format) at

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understanding the UNC institutional tudents' y format, and typical t the end of the the course Web site, t reported watching, . In addition, in 2011 ion scores.

the course fiers and s to any other nonk, New York). ests to compare pre-nses and final exam n continuous

[Table 3](#) details changes in students’ perceptions of educationally purposeful activities prior to and following participation in the flipped classroom. Paired *t* tests revealed a significant increase in students’ responses to the following items: prerecorded iLAMs greatly enhanced my learning ($P < .001$); learning key foundational content prior to coming to class greatly enhanced learning of course material in class ($P < .001$); interactive, applied in-class activities in class ($P < .001$); and engaged in discussions in class ($P < .001$). In contrast, we did not observe a significant enhancement from assigned readings prior to coming to class ($P < .001$).

 **T3-17**
Table 3:
Students’ Perceptions of Participation in the Flipped Classroom at the University of North Carolina Eshelman School of Pharmacy

When students were asked to provide the most beneficial activity, 58.0% of students indicated that the iLAMs “helped me prepare for the exams,” 58.0% of students strove to enhance their learning by completing the precourse survey to the flipped classroom format increased their learning. When students changed their

 **F2-17**
Figure 2:
Comparison of students’ preferences for the traditional lecture format and the flipped classroom format of the Basic Pharmaceutics II (PHCY 411) course offered at the University of North Carolina Eshelman School of Pharmacy in 2012 before and after participation in the course ($P < .001$).

On the 2012 course evaluation, students articulated the value of the iLAMs and active learning experiences despite their initial apprehension (see Supplemental Digital List 1, <https://links.lww.com/ACADMED/A177>). However, many students also recommended changes to the format, primarily focusing on the assigned readings and specific active learning exercises. Student feedback along with faculty experiences will be used to inform future course changes.

Next Steps

We believe that offloading content, engaging students in active learning, and appropriately assessing performance are essential for enhancing students’ learning experiences in the flipped classroom. Improved outcomes in the flipped classroom can be explained, in part, by self-determination theory, which identifies autonomy, relatedness, and competence as the innate needs for intrinsic motivation.³⁵ By offloading content, our flipped classroom encouraged students to explore the material and develop new skills on their own, with the understanding that they would apply this new knowledge through various active learning exercises during class. Active learning in the form of applied activities and in-class discussions with peers and the instructor emphasized relatedness. Furthermore, competence was fostered through robust assessments and feedback that enabled students to identify their own strengths and weaknesses in mastering the content. Improved exam performance and high levels of confidence in their ability to apply knowledge and skills reflect students’ enhanced competency.

Although we have specifically described our course redesign approach, we recognize that various offloading, active learning, and assessment approaches are available. For example, offloading may instead use high-level animated eBooks with built-in assessment tools after chapters or modules, captured video, instructor handouts, or textbooks. In addition, a plethora of different tools are available to engage students in active

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learning in the classroom.^{28,29} We believe that the actual practice of offloading content and engaging in active learning in the classroom is far more important than the specific methods we used.

As with any classroom, creating a sustainable, reproducible, and manageable flipped classroom requires adaptation and adjustments. On the basis of our experiences and the feedback of our students, we have identified a number of new strategies that we believe will enhance students’ learning and further foster their motivation. To the spring

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Conclusions

In our experience, flipping a cohort of students on m responsibility between s academic excellence and the flipped classroom d higher-order cognitive s health care.

Acknowledgments: The authors would like to thank the UNC Eshelman School of Pharmacy Class of 2015 for their willingness to participate and engage in Project 4-1-1 Flip. They proved to be trailblazers and epitomized the attributes that we seek for professional students. The authors also would like to thank the other PHCY 411 instructors, including Professors Michael Jay, Leaf Huang, and Richard Kowalsky, as well as Anthony Emekalam and Mollie Scott for their efforts facilitating the course at the Elizabeth City and Asheville campuses, respectively, and Casey Emerson and other educational technology staff for providing critical technology and expertise.

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