

Using a Flipped, Blended Learning Model to Build a Modern Classroom for Senior Medical Students Transitioning to Residency

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Abstract Transition-to-residency courses have been developed to aid in the transition from senior medical student to intern. However, few modern learning techniques have been used in this setting to make learning actionable. We describe an innovative transition-to-residency course, “Ready 4 Residency” (R4R), that capitalized on a novel flipped, blended learning model. In both qualitative and quantitative feedback, students praised the flipped, blended format, the overall course quality, and the enjoyable nature of the course. This new model can be used to build a modern, high-yield, and engaging classroom for senior medical students.

Keywords Flipped classroom · Blended learning · Modern · Medical education · Transition-to-residency

Background

The transition from medical student to intern is challenging with implications for all stakeholders. New interns abruptly assume significant patient care responsibilities with varying levels of supervision, potentially causing stress and other mental health problems [1]. Residency program directors and

medical educators face heterogeneity in new interns’ knowledge, skills, and attitudes [2]. Furthermore, trainee changeovers at the end of the academic year have been associated with poorer outcomes [3]. Educational interventions to improve the gap between medical students’ abilities at the end of medical school and interns’ required skills on their first day of residency have the potential to improve education and patient care.

Transition-to-residency courses for senior medical students have been implemented to meet these challenges, though with significant variability in length, structure, and content [4]. While these courses aim to make learning actionable, they often miss opportunities to do so, given the lack of implementation of modern learning pedagogies that encourage students to apply knowledge. “Blended learning” combines various digital teaching modalities to create a diverse and interactive learning environment [5]. In a “flipped classroom,” instructional content is delivered outside of class, while in class, students consolidate and apply knowledge [6, 7]. Given calls to modernize medical school curricula [6, 8], these models have been implemented and appear to improve medical student learning and satisfaction [5, 7, 9].

Activity

We describe “Ready 4 Residency” (R4R), the first example of a flipped, blended learning transition-to-residency course and the first example of a medical school course applying a structured, case-based approach to these pedagogies.

Course Structure

R4R is a 1-month required course for senior medical students, piloted in September 2015 for 31 students and repeated in March and April 2016 for 71 and 53 students. The course

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contains three subcomponents: online modules, classroom learning, and simulation sessions. The course was designed to be time-neutral with time allotted for online work. In the mornings, students typically spend 3–4 h in classroom sessions. Two afternoons per week, each student participates in one simulation and one skill-building session (~1 h each). Students complete the online modules outside of class. Students work in small teams (5–6 students) across all components of the course.

R4R aims to provide a general foundation of knowledge for students across all intended specialties, given that residency program directors have identified the need for a common residency preparation for all senior medical students [2]. However, in recognition of varying student interests, several classroom sessions are targeted towards specialties (e.g. obstetric emergencies, fever in the newborn, abdominal surgical emergencies), and students choose to attend sessions relevant to their intended careers.

The Online Modules

The weekly online case-based modules are interactive, virtual patient care experiences, each following different patient cases that students will likely encounter throughout residency. The modules integrate various embedded e-learning resources that teach to the virtual cases. While navigating the modules, students make clinical decisions as the patient's course unfolds. Students navigate the modules at their own pace while meeting specific deadlines, allowing for flexibility and self-directed learning as well as synchronizing the modules with the classroom and simulation sessions to reinforce common teaching points. For example, students may be confronted with an ethical conflict in the modules and, in class the following day, work in teams to discuss approaches to the conflict. Below are descriptions of the embedded content in the modules.

Chalk Talks (Instructional Videos) “Chalk talks” are short (5–15 min) instructional videos covering a variety of topics. Some were developed at our institution while others were curated from publicly available resources.

“Rounds” (Team Discussion Boards) Students contribute free-text responses to clinical questions in “rounds” (team discussion boards). Students then view and reply to their teammates' responses, engaging in an online discussion. Course instructors and resident educators reply to the ongoing virtual conversation with feedback and teaching.

“Attending Questions” (Quizzes) Students answer clinical questions in multiple-choice quizzes. After selecting a response, students are provided with comprehensive explanations of the correct and incorrect responses.

Peer-Reviewed Literature To reinforce the role of evidence-based medicine in clinical decision-making, students are provided with or asked to research peer-reviewed literature relevant to the clinical conditions in the modules. Students are also asked to choose their own questions to research to personalize learning.

Assignments Students submit extended written responses to prompts that pertain to the virtual case, e.g. developing an admission order set for the virtual patient or describing an approach to an interpersonal conflict. Instructors review the submissions and provide feedback.

Interactive Clinical Experiences The interactive clinical experiences (ICEs) (10–60 min) are interactive patient cases with embedded quizzes, activities, and learning resources. In contrast to the overarching case-based modules that cover a variety of topics, the ICEs are condensed, targeted opportunities to deeply explore specific topics.

Classroom Sessions

Lecture time is minimized throughout the course. Instead, the classroom sessions are interactive and collaborative opportunities for students to consolidate and apply knowledge. The sessions are topic-based, each with specific learning objectives, focusing on core medical topics such as arrhythmias, oxygen therapy, and pain management. A faculty “content expert” works through cases with the students, leading class discussion and posing questions for individual or team consideration using team-based learning and audience response systems.

Simulation and Skill-Building Sessions

Student teams participate in simulation sessions mimicking common clinical scenarios and practicing teamwork and communication skills while applying their medical knowledge. The simulation curriculum was included to build student comfort in making clinical decisions and reacting to challenges in vivo. Additionally, students engage in skill-building sessions, practicing skills such as phlebotomy, placing central lines, and bedside ultrasound.

Evaluation Methods

We conducted an evaluation of the course primarily assessing student satisfaction and perceived progress of learning. We emailed students comprehensive final questionnaires, receiving 115/155 responses (74 % yield), providing both quantitative and qualitative feedback. All students in the initial pilot participated in summative focus groups led by education specialists. The study was deemed not human subjects research

by the Columbia University Institutional Review Board, considered a program evaluation using deidentified data.

Results and Discussion

Quantitative Feedback

Overall, students regarded the course very favorably. In the surveys, students rated aspects of the course as “below,” “met,” or “exceeded” expectations. 87 % (100/115) of students reported that the overall quality of the course exceeded expectations. 82 % (93/114) of students noted that the online curriculum exceeded expectations. 80 % (92/115) rated the relevance of the course as exceeding expectations. 81 % (92/114) reported their overall progress of learning as exceeding expectations. Students evaluated each type of embedded content in the modules (e.g. “chalk talks,” “rounds”); every methodology was rated by the majority of students as exceeding expectations.

Qualitative Feedback

We collected qualitative data from the focus groups and surveys. Education specialists performed a qualitative data analysis. Several themes emerged, displayed in Table 1 with representative comments. Students highlighted the high overall course quality, the efficacy of the flipped, blended learning model, the high-yield nature of the content, and the enjoyable nature of the course. Several students acknowledged that they were initially “skeptical” of the format but, by the conclusion of the course, were “pleasantly surprised” and “confident in its merits.”

Discussion

We believe that this flipped, blended learning model represents an innovative pedagogy for the medical school classroom, one that capitalizes on the benefits of modern learning technologies while encouraging interpersonal and teamwork skills. Our initial evaluation demonstrates that R4R was able to deliver a high-yield, engaging, and enjoyable learning experience while increasing students’ confidence in mastery of course content.

We learned important lessons about transforming the medical school classroom. We were able to garner student “buy-in” to this new pedagogy by creating an enjoyable online curriculum that felt like a true clinical encounter. Classroom sessions should be interactive with a focus on experiential learning to ensure optimal participation and engagement.

Implementing these pedagogies can be challenging, as they require a re-conceptualization of the role of the teacher and an intentional use of technology to facilitate communication. Designing, implementing, and improving the course required

Table 1 Results from qualitative data

Theme	Representative comments
Overall course quality	<p>“This is what a 21st century medical education should look like—compelling, engaging, relevant, creative, interactive”</p> <p>“Far exceeded my expectations”</p> <p>“Overall very well taught and greatly contributed to my learning”</p> <p>“BEST course in medical school so far in terms of format, teaching style, and relevance of content”</p> <p>“R4R is how I wish that all of medical school was taught. It is engaging, fun, practical, relevant, and feasible.”</p> <p>“We need MUCH more of this kind of learning to make 4th year worthwhile”</p>
Efficacy of the flipped, blended learning model	<p>“Strikingly effective”</p> <p>“Fantastic and engaging”</p> <p>“A wonderful learning experience”</p> <p>“An interesting and effective learning tool”</p> <p>“The gem of the course”</p> <p>“The modules prompted us to think critically and apply our knowledge to situations we are bound to encounter next year”</p> <p>“The at-home preparation, which allowed class to be interactive and fun, I think was critical and I did not expect to be so affected by a teaching format”</p> <p>“The online components were very strong and kinda fun”</p>
High-yield content	<p>“Very relevant to what we should know as interns, but would not otherwise be taught formally”</p> <p>“Helpful for residency preparation”</p> <p>“One of the most high yield learning experiences I have had in medical school”</p> <p>“I am terrified by the thought of entering intern year without having taken this course”</p>
Enjoyable	<p>“Fun” “exciting” “enjoyable”</p> <p>“Felt more like an activity than a mandatory assignment”</p> <p>[The team format] “motivated me to put more thought into answers and learn the material”</p>

significant time and institutional support; however, it was feasible. Education technology specialists added value, assisting with module design and embedded content. Faculty members received individualized coaching on learner-centered teaching techniques with instructors versed in these methods, and some

required more coaching than the others (these differences we found to be largely idiosyncratic to individual teaching styles).

Flipped, blended learning courses hold tremendous potential. Given their convenient, online format and placement shortly before graduation, these courses can provide insight into student performance in curricular competencies such as the entrustable professional activities [10]. The online nature of the modules and embedded content also provides opportunities for collaboration and sharing resources between institutions.

Innovations in medical education are needed to challenge students to consolidate and apply their knowledge, especially in the final year of medical school. Educators need not be limited by the traditional lecture format—the flipped, blended model described here can deliver an engaging, enjoyable, and modern medical education. As one student summarized, “this is what a 21st century medical education should look like—compelling, engaging, relevant, creative, interactive.”

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