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Using Technological Advances to Improve Surgery Curriculum: Experience With a Mobile Application

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OBJECTIVE: Our previous home-video basic surgical skills curriculum required substantial faculty time and resources, and was limited by delayed feedback and technical difficulties. Consequently, we integrated that curriculum with a mobile application platform. Our purpose is to describe this application and learner satisfaction.

MATERIALS AND METHODS: The mobile platform incorporates a patented pedagogical design based on Ericsson's deliberate practice and Bandura's social learning theory. Instructors built step-wise skills modules. During the challenge phase, learners watched a video of surgical tasks completed by experts and uploaded a video of themselves performing the same task. In the Peer Review phase, they used a grading rubric to provide feedback. In the Recap stage, learners received individual feedback and could review their own videos. Two groups of learners, graduating medical students and matriculating surgical residents, participated in this independent learning platform, along with 2 to 4 laboratory sessions, and completed a survey about their experience. Survey responses were summarized descriptively and comments analyzed using content analysis.

RESULTS: Fifty learners submitted videos of assigned tasks and completed peer reviews. Learners reported positive experiences specifically for the Peer Review Stage, structured home practice, ease of mobile access to submit and review videos, and ongoing immediate feedback. Over half of the learners reported spending at least 10 to 30 minute practicing skills before recording their videos and over 80% rerecorded at least 2 times before submission. Content analysis revealed learners engaged with the educational concepts designed into the platform.

CONCLUSION: Learners easily used and were satisfied with a mobile-technology teaching platform that maintained the fundamental content, educational theories, and organizational structure of our previously effective surgical skills curriculum. Prior challenges were directly addressed through the mobile application's ease of use, support of deliberate practice, and improved timeliness of feedback. (J Surg Ed ▮:▮▮▮-▮▮▮. © 2018 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

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COMPETENCIES: Patient Care, Medical Knowledge, Practice Based Learning and Improvement, Systems Based Practice, Interpersonal Skills and Communication

INTRODUCTION

At our institution, we designed a home-video basic skills curriculum and demonstrated that using it results in technical skill acquisition for learners from various backgrounds.[1,2] During the last 5 years, the curriculum has been adapted to maximize our learner outcomes. First, objective grading rubrics were designed for the basic knot-tying home exercises.[1-5] Validity evidence for the score from the rubrics includes content,[1,2,4] rater reliability,[4] and association with other variables.[3-5] Using these validated rubrics, we extrapolated to create additional rubrics for each of the home exercises. Residents seem to have a grasp of the concepts of the rubric since they are observed using vocabulary from the rubric in the operating room. We found improved performance with the addition of peer review,[5] which has become a standing component of the home-video curriculum.

Although learners are enthusiastic about this curriculum, challenges emerged.[1] First, review and scoring of the individual videos by attending surgeons proved extremely time consuming. Second, tedious collection, distribution, and review of the weekly video exercises required a variety of media platforms and resulted in significant delay of learner feedback. Third, learners complained that set up and use of the recording equipment was cumbersome.[1]

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Technology can enhance the transfer of knowledge from teacher to learner in many ways.[6] Recently, we have seen how educational content can be distributed to a much broader audience by improving accessibility.[7] Additionally, by using various multimedia platforms we can avoid some of the temporal and spatial limitations that exist in traditional classroom learning.[8] Specifically, simulation technologies have great appeal in the health sciences and surgery in particular,[6,9-12] However, adoption of technology can be enticing even without validation of success[13] or empirical evidence of enhancement.[14,15] Some educators argue that "while technologies can have positive educational impact in restricted instances, successes pale in comparison to failures overall."[16] Thus, deciding what technological tools to adopt and when to do so can be challenging.

To overcome the prior challenges of timely feedback and cumbersome set up/transfer posed by our previous curriculum, we integrated it into an online, mobile-technology teaching application ("platform") that embedded instructional principles in a consistent and accessible context, encouraging learners to provide feedback and allowing for timely assessment of work. Here we describe the format of this application and learner satisfaction.

MATERIALS AND METHODS

Design of the Original Home-Video Curriculum

Our original curriculum, described in 2014,[1] was used by general surgery interns. A fundamental component of this curriculum is that learners received a video camera, tripod, and all of the materials required to complete the surgical tasks and record all assigned exercises.[1,3] This allowed for practice and completion of tasks outside of the classroom or operating room. Learners had specific homework assignments, instructions for which are within each video, which were accessed via YouTube. Each video initially demonstrates an expert performing a surgical task. The task is then broken down and described step-by-step. Each video also discusses common mistakes and challenges learners tend to experience. After watching each video, learners then practiced and ultimately recorded themselves completing the task.

At the subsequent in-class session, learners submit the assigned videos for review. This data collection evolved over the years. First, learners submitted videos via video camera (large, bulky, and tricky to distribute and recollect). Then they used jump drives (smaller profile but still required physically transporting the drives to individual reviewers stationed throughout multiple campuses). Finally, they uploaded videos to an online file-sharing program (limited the physical transport of data but resulted in a large number of files and challenges tracking graded vs ungraded videos).

Attending surgeons had to learn to access the files in each of these approaches and then score each video. The process of scoring the videos evolved, too, from separate paper sheets to excel files in an attempt to simplify tracking learner scores. After review, experts completed an assessment with a score and comments. They returned the video and score sheet or file. The faculty redistributed these files to the learners to ensure they received feedback on their performance. Attending responses took days to weeks, depending on their responsiveness, availability, and efficiency. The multiple platforms needed to complete this whole process, collection and distribution of the videos from learner to attending surgeons, and back to the learner, required significant efforts and led to substantial delays.

Design of the Technology Learning Platform

The online learning platform, Practice XYZ, was founded in 2011 with a Small Business Innovation Research grant from the National Science Foundation. The platform is a video and mobile learning solution that fosters strong learning cultures to increase learners' competence and confidence. It does this by providing a scalable means for learners to frequently practice core competencies and self-reflect, and also receive meaningful, timely feedback through the power of peer and expert review.

This mobile platform incorporates a patented pedagogical design based on Anders Ericsson's deliberate practice[17] and Albert Bandura's social learning theory[18] so that learners ultimately acquire a skill. Ericsson based his theory of deliberate practice on the premise that expertise has more to do with how one practices than merely repetition of skill. According to this theory, expertise occurs by breaking down a skill into its individual components and perfecting each step. Often times, this practice is paired with immediate coaching or feedback. Bandura's social learning theory describes learning as a cognitive process that occurs within a social context. He argues that learning can occur through observation and self-reflection.

Instructors can use the mobile platform to build modules that include different activities in the following stages: frequent practice, peer interaction, self-reflection, and coaching and mentoring. These modules then become a step-wise approach to learning (Fig. 1).

Design of the New Integrated Platform

Our previously described home-video curriculum,[1] was built upon principles similar to that of the Practice XYZ (Fig. 2). Integration with the mobile platform did not require altering the curricular content. Using our prior basic surgical skills home-video curriculum, we created 16 different modules with associated grading rubrics. The individual exercises or challenges are detailed in the Appendix and represent the fundamental course content.[1] Examples of