Integration of Mobile Technology in Educational Materials Improves Participation: Creation of a Novel Smartphone Application for Resident Education

Christiana M. Shaw, MD, and Sanda A. Tan, PhD

Department of Surgery, University of Florida, Gainesville, Florida

OBJECTIVE: Traditional education consists of didactics and book learning. Recently, technology has been integrated into graduate medical education, primarily in the form of simulation. The primary aim of this study was to investigate if a novel smartphone application using technology to engage learners would improve participation in an educational activity when compared with a daily e-mail format and how this use translated to performance on standardized testing.

DESIGN: The UF Surgery App (App), which is a smartphone application, was developed to deliver 2 questions from a general surgery educational database every weekday from October to February 2013. The App, developed for iOS, featured a notification alarm and a reminder icon to actively engage the learner. Learners who used the App responded to multiple-choice questions and were provided instantaneous feedback in the form of a correct answer with an explanation. The response rate and answers were collected prospectively and compared with the American Board of Surgery In-Training Examination score.

SETTING: University of Florida, College of Medicine, Gainesville, Florida, a university teaching hospital.

PARTICIPANTS: A total of 46 general surgical residents were enrolled in a university training program. Participation was voluntary.

RESULTS: Overall, 26 of 46 (57%) residents participated. Of the users, 70% answered more than 20% of the questions, while 46% responded to more than 70% of questions. The percentage of correct answers on the App was positively correlated with standardized score ($p = 0.005$), percentage correct ($p = 0.02$), and percentile ($p = 0.034$) on the ABSITE examination.

CONCLUSIONS: Technology can be used to actively engage residents. Deployment of this novel App improved participation over a daily question-answer e-mail format, and answers correlated with standardized test performance. The effect of the App on overall education is unclear, and a multi-institutional study has been initiated. (J Surg 72:670-673. © 2015 Association of Program Directors in Surgery Published by Elsevier Inc. All rights reserved.)

KEY WORDS: smartphone application, App, resident education, graduate medical education, technology in education

COMPETENCIES: Practice-Based Learning and Improvement

INTRODUCTION

Resident education traditionally consists of in-classroom didactics and service conferences, learning in the clinical setting, and supplementation by book learning. In our society, electronic media platforms are rapidly replacing paper-format textbooks and print media; medical education was forced to adapt. Stanford School of Medicine provided iPads to all students beginning in 2010, citing "efficient, mobile, and innovative learning" and the ability to "access high-quality information at any place, at any time" as the motivation.[1]

Resident physicians are adult learners, and considerable research has been done illustrating 5 principles of adult learning. These principles are problem-centered learning,

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Correspondence: Inquiries to Christiana M. Shaw, MD, MS, 1600 SW Archer Road, Box 100109, Gainesville, FL 32610-0109; fax: (352) 265-1060; e-mail: Christiana.shaw@surgery.ufl.edu

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learning in a supportive environment, experience-oriented learning, delivery of feedback, and active learning.[2,3] In response, many medical schools have subsequently shifted from the use of pedagogical methods toward incorporating more androgogical methods, frequently through problem-based curricula.[4]

In addition, most current residents are part of the Millennial Generation. This generation is often described as thriving on the constant availability of portable electronic information and active users of technology.[5] In a study performed in 2011, 88.4% of residents used a smartphone for medical purposes, including 98.1% of surgery and surgical subspecialty respondents, 51.9% specifically using smartphone apps in clinical practice. When asked which category of apps residents desired more, "in-training examination or Board study material" ranked second only to textbook/reference and was requested by more than 57% of respondents.[6] If we are to adapt to the learning preferences of residents today, many of whom are not only technologically savvy but technologically dependent, we must evolve to provide information that is portable and electronic. Combining portability with an engaging adult learner–centered format is the logical next step in education.

We hypothesized that an improvement in use of educational tools could be achieved with portable, standardized electronic information based on adult learning principles. This would appeal to the Millennial generation of residents, provide an educational medium that is effective despite duty-hour restrictions, and provide standardized information. To test this hypothesis, we developed a prototype smartphone application that sent 2 questions daily to residents, with immediate, real-time reply of correct answers. After implementation, we aimed to determine if the use of the smartphone application correlated with the American Board of Surgery In-Training Examination (ABSITE) scores.

MATERIALS AND METHODS

After Institutional Review Board approval with consent waiver was obtained, we conducted a preliminary study on the surgical residents at a university-based surgical residency program to determine whether actively engaging the residents with 2 questions per day, sent via e-mail, would be viewed as beneficial to the residents. Questions were selected from a general surgery educational database to which the residents subscribed. The study was conducted for 8 weeks, and all residents received 2 multiple-choice questions per day. They were given 24 hours to respond to each question with an answer. Correct answers were sent after 24 hours. Resident participation was encouraging, with more than 50% of the residents replying each day. The senior residents (Post Graduate Year 3 (PGY 3) and above) were more responsive than junior residents (PGY 1 and 2) were. On a final survey, most of the residents found this exercise useful and educational and wished that it continued through the year.

Based on this information, an update to the original protocol was approved by the Institutional Review Board. The UF Surgery App (App), which is a smartphone application, was developed to deliver 2 questions from the same pre-existing general surgery database. The cost of App development was negotiated to $3000 for educational and creative purposes. The investigators participated in designing the App with the developer to ensure that certain features were available and practical. A notification alarm sounded every morning and a reminder icon was present to encourage active learning. Instant feedback was incorporated, as the correct answer with an explanation was made available as soon as the response was entered (Fig. 1). Questions and answers were available for review by correct/

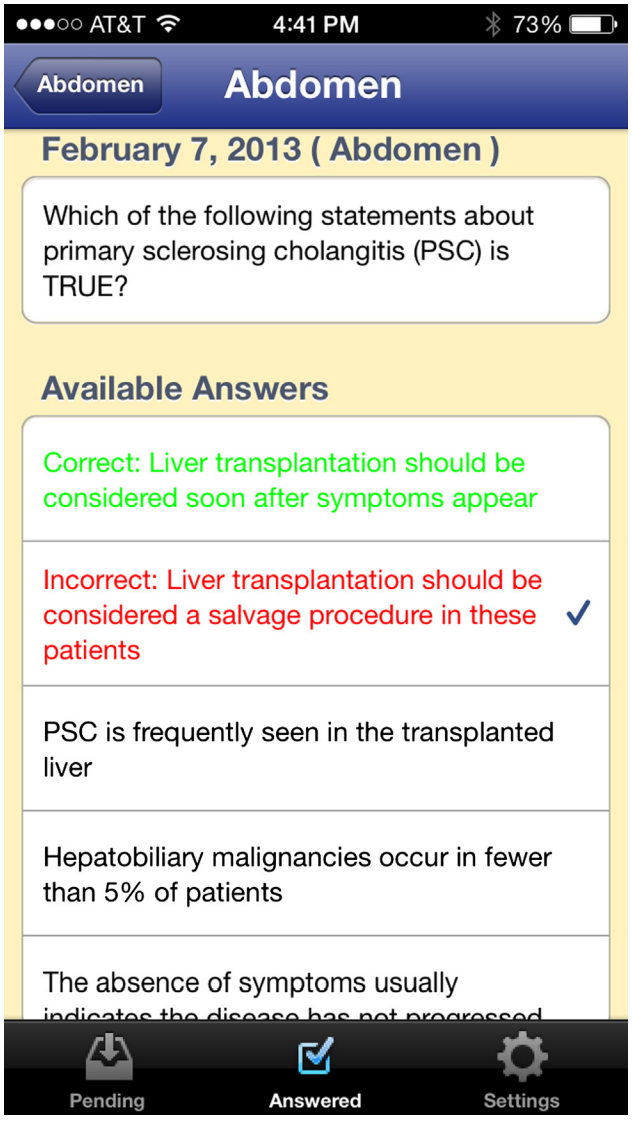

FIGURE 1. App Screenshot.