The Radiology Resident iPad Toolbox: An Educational and Clinical Tool for Radiology Residents

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Tablet computing and mobile resources are the hot topics in technology today, with that interest spilling into the medical field. To improve resident education, a fully configured iPad, referred to as the "Radiology Resident iPad Toolbox," was created and implemented at the University of Colorado. The goal was to create a portable device with comprehensive educational, clinical, and communication tools that would contain all necessary resources for an entire 4-year radiology residency. The device was distributed to a total of 34 radiology residents (8 first-year residents, 8 second-year residents, 9 third-year residents, and 9 fourth-year residents). This article describes the process used to develop and deploy the device, provides a distillation of useful applications and resources decided upon after extensive evaluation, and assesses the impact this device had on resident education. The Radiology Resident iPad Toolbox is a cost-effective, portable, educational instrument that has increased studying efficiency; improved access to study materials such as books, radiology cases, lectures, and web-based resources; and increased interactivity in educational conferences and lectures through the use of audience-response software, with questions geared toward the new ABR board format. This preconfigured tablet fully embraces the technology shift into mobile computing and represents a paradigm shift in educational strategy.

Key Words: iPad, tablet, resident toolbox, education, e-books

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INTRODUCTION

Tablet use is growing exponentially, with sales increasing from 19.4 million units (2010) to 107.4 million units (2012) in just the past 2 years [1]. This rapid evolution from the use of desktop and laptop computers to tablet devices is being reflected in the medical community. Recent surveys have reported that up to 79% of health care professionals may use the iPad for work [2]. Tablet devices enable greater portability and mobile access to various types of media (books, journal articles, video, etc.) that are particularly useful to radiologists.

Applications useful in medicine range from informational disease and drug databases to remote access capabilities for electronic medical records. Clinical radiologists benefit from a number of decision support resources and mobile access to reference data. The incorporation of mobile education technologies and the effect on learning is an area of active research [3]. Specifically in radiology residency education, there are myriad potentially useful websites, applications, and media sources. Identifying the most useful resources remains a challenge for radiology residency programs, trainees, and practicing radiologists. Recent reports have begun to study the relative usefulness of some generic resources [4]; however, a detailed description of available resources and a method of implementation of these resources has yet to be discussed.

At the University of Colorado, we undertook a project to embrace the power of mobile computing technology and digital educational materials. We envisioned creating a single portable resource that contains or provides direct access to all educational, clinical, and communication resources needed for a 4-year radiology residency. In this paper, we present the process we used to develop, deploy, and assess the impact of the "Radiology Resident iPad Toolbox," a fully configured iPad containing a carefully selected suite of tools, that we have given to each resident in our program with the intent that it serve as a "one-stop shop" for all things radiology.

DEVICE SELECTION

Evaluation of tablet devices should be based on operating system and device hardware. Although multiple tablet devices are available on the market, iOS (Apple Inc, Cupertino, California) and Android (Google Inc, Mountain View, California) operating system devices are dominant. In our evaluation of operating systems, we favored iOS because of its simplicity and user-friendly structure, operating system stability, number of available tablet optimized applications, quality of applications, and easily integrated mobile device management suite. Apple has more available resources to aid setup in an educational environment, including specifically dedicated resource guides and technical support staff. These available resources make it simple to set up a base station with multiple preloaded iPads, which also provide some individual-user functionality. In addition, through production of both the hardware and software, there is, at least theoretically, more quality control and assurance of compatibility, and hardware and software support are simplified with Apple devices. Conversely, because multiple hardware producers use Android, competition is higher and prices are generally more affordable for similar hardware with the Google operating system. This multimanufacturer system can create some drawbacks, as there are many more versions of the same operating system and greater variability in functionality from device to device.

Hardware evaluation is much simpler and, for the most part, similar hardware specifications can be found on both Android and iOS devices. The few hardware specifications that were important to us included a high-resolution screen for imaging applications, a frontward facing video camera for videoconferencing, long battery life, and a large enough storage capacity to fit all multimedia and applications we preloaded onto the device, with room to spare for future additions. We also considered device reliability and the reviews and ratings of specific hardware from known resources, such as Consumer Reports, PCmag, and CNET.

Additional thought was given to brand familiarity across our residency and quality of the warranty and technical support. Although we do not specifically endorse any device, after consideration of all of these factors, the decision was made to purchase the Apple iPad (specifically, the new third generation iPad 32 GB Wi-Fi version with retina display).

CONTENT

Content purchases and downloads were divided into 3 broad categories: educational, clinical, and communications. Specific selections were geared toward maximizing each potential use of the iPad. Given the numerous available applications, resources were evaluated individually with only the most useful content preloaded onto devices. Initially, this was performed during a multimonth testing phase, where specific applications were chosen based on resident recommendation, specific need, avail-

able information and recommendations in the radiology literature and online, and user reviews in the Apple app store. Afterward, additional applications were added from the app store using keyword searches. Before widespread implementation, a limited iPad rollout, discussed in further detail below, was performed in which all of the selected applications were reviewed by a small test committee comprised of 2 second-year and 2 third-year technology-savvy radiology residents. Future additions or deletions will be made after review by an elected educational technology committee. The educational technology committee consists of 2 upper-level resident cochairs, a faculty advisor, the residency director, and at least one interested resident per class.

Education

A large variety of educational material was desired to fit various learning styles. With this in mind, a combination of textbooks, case files, journal access, lecture notes, and lecture videos was selected to be preloaded onto the iPad. Electronic textbooks or e-books have many benefits over print media, including their portability, durability, and the ability to make nonpermanent notations. Additionally, an electronic library bypasses the need for complicated and cumbersome library management policies. The greatest variety of radiology e-books can be found on Amazon.com (Amazon.com Inc, Seattle, Washington) and displayed on the iPad with the Kindle application (Amazon.com Inc. There is currently limited availability of radiology textbooks; however, the number is rapidly increasing. For e-book selection, a general guiding philosophy of one reference text, one basic text, and one review text per subspecialty was employed. Fifteen entire textbooks were purchased initially (Table 1) with enough copies purchased on the university-established Kindle accounts to make them available on all the university-owned devices. In addition to Amazon's Kindle eBooks, Apple iBooks were created by several faculty members at the University of Colorado who took the initiative to create them with the free iBooks Author software.

Departmental lectures, recommended articles, and other relevant files were made available through the Dropbox (Dropbox Inc, San Francisco, California) and Blackboard (Blackboard Inc, Washington, DC) file-sharing applications. A group license for the popular University of California San Francisco Radiology Review video lecture course [5] was purchased and installed on the iPads, providing over 80 lectures in all areas of radiology. Radprimer (Amirsys, Salt Lake City, Utah), a case-based testing software with over 2,000 learning files, was purchased for each resident. Additional case-based learning files are available through the preloaded apps Radiology 2.0 and Radiopedia (available through the Apple iTunes app store) along with an embedded link to the ACR Case-in-Point. A group license for the E-anatomy application (www.imaios.com) was purchased to provide a detailed cross-sectional anatomy reference. Available