The Radiology Resident iPad Toolbox: maximizing tablet potential to improve clinical education

Incorporation of the tablet computer into radiology resident education with an organized implementation strategy has provided a single comprehensive collection of educational, clinical, and communications tools at the fingertips of residents to improve and simplify learning from day one.

As mobile computing becomes more pervasive throughout our home and professional life, we looked for ways to utilize this technology to improve the education and clinical efficiency of our residents. Tablet sales have been growing exponentially over the past several years with over 100 million units sold in 2012 [1]. Medical professionals have been rapid adopters of this new technology with 79% reporting use of the iPad (Apple Inc, Cupertino, CA) for work and, more specifically, 37% of radiology residents owning tablet devices [2, 3]. Almost certainly, these numbers have increased in the year following their publication. In addition, 68% of residents owning an electronic mobile device reported use for learning radiology and 81% reported that they would spend more time studying radiology if provided with a tablet device [3].

Identifying the most useful electronic resources is a challenge, especially for an incoming radiology resident. Rather than simply giving or allowing residents to purchase a tablet and providing no direction in terms of the available resources, at the University of Colorado our goal was to create an organized implementation strategy that maximized the potential of the device in resident education [4]. We envisioned the creation of a single portable resource that provides access to all educational, clinical, and communication resources necessary for a four year radiology residency, the “Radiology Resident iPad Toolbox”. Utilizing this organized approach, residents shifted from utilization of print materials to use of the electronic resources with post-implementation increases in studying efficiency and access to educational materials.

IMPLEMENTATION
A design and implementation strategy for tablet use was constructed by a small technology committee at our institution. Initially, a review of available operating systems and hardware was performed. Currently, the major operating systems include iOS (Apple Inc), Android (Google Inc), and Windows 8 (Microsoft Corporation). After review of available hardware and operating systems, the iPad with iOS was selected on the grounds of the product reliability, user friendly interface, screen resolution, mobile device management options, number of available applications, warranty service, and available support staff familiar in multi-user educational environment setup.

Content for the devices was divided into three major categories: Education, Clinical, and Communications. Selections in each category were made with regard to hospital system compatibility, most frequently used and most highly regarded resources based on discussion with experts and personal experience, and resident preference.

A wide variety of educational material was desired to fit multiple different learning styles. Educational resources included lecture videos, eBooks, case files, journal access, and lecture notes. Amazon.com and the associated Kindle application (Amazon Inc) had the largest variety of radiology related eBooks at the time of project design. Currently, 21 eBooks have been purchased for the devices with a reserve fund set aside to purchase certain popular radiology texts as they become available. The goal was to have one reference text and one review text in each subspecialty. The eBook version of Fundamentals of Diagnostic Radiology edited by Brandt and Helms was also provided as a general text. Departmental lectures, recommended articles, and other relevant files were shared with users using the Dropbox (Dropbox Inc) and Blackboard (Blackboard Inc) file sharing applications. The popular University of California San Francisco Radiology Review video lectures [5] were loaded on the devices after purchase of a group license. Radprimer and StatDx (Amirsys), a case based testing application and a radiology reference encyclopedia, were provided to residents with links on the iPad. E-anatomy (IMAIOS) was provided as a tablet based anatomy atlas. Journal applications by the RSNA for Radiology and Radiographics, as well as multiple other links and applica-
tions to radiology specific journals were incorporated on the device along with an RSS reader which can help stream articles and news to the device as it becomes available. Additional educational applications included Radiology 2.0, Radiopaedia, CTisus, the AIRP syllabus, Apple office applications, a note taking application, and a PDF reader/editor.

Clinical resources in addition to the educational references described above included a DICOM viewer, Citrix Receiver (Citrix Systems Inc) and Epic Canto (Epic Systems) for remote access to PACS and EMR, Amion (Doximity) call schedule application, and the clinical toolbox application Radtools Pro (Softcode Systems Inc).

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Communications tools in addition to the packaged email and instant messaging capabilities included Cisco Webex Meeting (Cisco Systems Inc) for video conferencing capability to make our daily didactic and case-conference lectures available to any resident with an internet connection regardless of location, and the ResponseWare app (Turning Technologies) to allow audience response during lectures in order to help engage residents and incorporate questions which reflect lectures in order to help engage residents and incorporate questions which reflect the changing ABR board format.

A small scale test phase was then performed by the technology review committee in which a base station was used to create a template containing all selected resources which were then mirrored across four devices. During the test phase applications/resources, hardware, basic layout, and overall functionality were evaluated with necessary adjustments made prior to widespread implementation of the devices. Thirty four radiology department-owned pre-loaded iPads were then loaned to each member of the residency class. Supporting documents handed out with the iPads included our own personally created setup guides and user agreements. This technology committee is also charged with continual evaluation of the iPad program and adding new useful resources when they become available.

Including hardware and purchased electronic resources, the pre-loaded iPads cost approximately $1300 USD (approx € 1000) per resident. If a similar set of features were set up on an individually purchased iPad, the user would need to spend over $3700 USD (approx € 2750) to obtain equivalent hardware and software. [4]

RESPONSE
The response from the 34 University of Colorado radiology residents was overwhelmingly positive. Three months after iPad distribution, an anonymous survey was conducted in which a significant shift from use of printed materials to electronic resources was demonstrated [4]. After introduction of the iPad “Toolbox”, 65% of the residents spent 6 hours or more per week learning from electronic resources [4]. Electronic textbooks and anatomy atlases were reported to have the greatest impact on radiology resident learning [4]. Seventy-four percent of residents reported the iPad facilitated access to educational materials to a high degree, 88% reported that the iPad increased studying efficiency to a high or moderate degree, and 100% reported that they would recommend the device to a colleague [4].

DISCUSSION
The tablet device has been working its way into radiology resident education over the last several years. Korbage and Bedi have reported positive experiences at Tufts Medical Center Department of Radiology [3,6]. Our survey results demonstrating increased preference for electronic resources over print materials are concordant with results in the second publication by Korbage and Bedi[6]. Berkowitz et al. at the Beth Israel Deaconess Medical Center/Harvard Medical School have also published recent data regarding frequency of use of the tablet and applications after distributing a non-preloaded iPad to all radiology residents [7].

The benefit of a tablet-based learning tool is that a small easily portable device can take the place of many heavy print books and journals, incorporate learning tools such as case based review questions and audience response capabilities geared toward the changing board exams, allow communication with colleagues from almost anywhere, and remotely access hospital PACS and EMR when necessary. Having all necessary educational resources for an incoming resident available in a small tablet has markedly improved our resident educational experience.

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In the near future, it is likely that electronic books, apps, and other resources will continue to proliferate. Several publishing companies are currently developing more interactive books that will increase user involvement and improve the educational experience. These educational, clinical, and communication resources are not confined to resident education and can be applied to a similar program for practicing radiologists. Continual evaluation and dissemination of these resources within the radiology community will increase the quality of the educational experience for trainees and practicing radiologists.

REFERENCES