

## **The Next Level of Distributed Learning: The Introduction of the Personal Digital Assistant**

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### **Introduction**

Healthcare Information and Management Systems Society (HIMSS) reported, “nearly 72% of physician offices have doctors who practice medicine with a handheld computer of some type . . .”<sup>1</sup> *The Plain Dealer* of Cleveland Ohio noted in its business section “about one doctor in five now uses a handheld computer as an integral part of daily medical practice. . .”<sup>2</sup> In 2001, The Ohio State University Medical Center (OSUMC) implemented its PDA (Personal Digital Assistant)/handheld program. Initial handheld recipients at the medical center were third and fourth year medical students and residents. With the evolution of the program and joint initiatives, well over 3,200 are now used at OSUMC.

With the handheld, or PDA (these labels are used interchangeably), the medical students and residents are not tethered to a desk for information access. The handheld’s “content and delivery” capabilities facilitate a number of possibilities and opportunities, not only in the clinical area, but also in the medical research and educational environments. Users can transmit needed information to each other, schedule on the fly, record notes, search stored information, download data, respond to test questions, populate databases, and connect to the Internet and local area networks all from the “palm” of one’s hand. Of course, the use of such tools continues

to be aided by the enhancements of its technology and capacity. Some handhelds may come with just 8 – 16 MB of memory, but can be easily expanded. Older models with only 2MB may appear to be limited, but when considering 1 MB equals a 600-page paperback book, there are considerable storage and retrieval prospects. The speed of the PDA's processor is another factor. The processors have continued to improve, thus allowing quicker retrieval of both text and images. It is the application of these capabilities that permit distributed learning to progress to the next level – “anytime and anywhere” access. This was demonstrated by migrating the ambulatory clerkship modules of the Ohio State College of Medicine and Public Health to a mobile delivery format.

## **Method**

### **Third Year Ambulatory Clerkship**

At the Ohio State's College of Medicine and Public Health, medical students are required to do a twelve-week ambulatory clerkship in their third year. During this period, they are given materials broken down into weekly modules/units that are made up of Microsoft PowerPoint slides and text documents. The modules cover a number of disciplines -- Orthopaedics, Ophthalmology, Obstetrics and Gynecology, Geriatrics, Dermatology, etc. Students have the option of accessing the materials via the Internet, and/or through the use of a created in-house compact disk (CD).

During this clerkship period, the students are located at hospitals and healthcare facilities throughout the state. Considering the students' mobility, the objective for integrating the handheld was to create an additional avenue of instructional materials access, which has equal

mobility. The added benefits would be the creation of enhanced distributed learning tools and processes that may be extended to other disciplines and the establishment of a foundation for how a handheld may be used daily in the medical profession. The resulting by-products are not only transportable tools to other areas of study, but also the removal of obstacles or barriers (e.g., Internet and computer availability) for obtaining the materials. Furthermore, the process is inexpensive, and materials are easily distributed and available anytime/anywhere.

### **Handheld/PDA Integration**

With the use of the Internet, one can deliver materials that may not only be viewed on-line, but also retrieved and stored on the PDA for viewing at a later time (such as when a computer may not be available). Interaction with the learning module may be achieved with updates acquired through future synching of the handheld and perhaps expansion/Secure Digital (SD) card storage (media used by the device). The latter may also be used as the media that is distributed to the students for viewing the materials.

Early in the project, it was decided that the handheld integration format for the clerkship modules would follow the same material structure that was found on the CD being made available to the students. This was done for two basic reasons. First consideration was to allow for consistency should a student use more than one means (such as the PDA and CD) to access the materials. Secondly, based on student and staff interviews, there was no indication the material structure needed to be revisited. The goal was for the user (student) to have a considerable comfort level in using the “new” mobile format.

Besides placing the modules in a mobile format, an assessment (questionnaire) element was added to the modules, therefore facilitating possible use of the components as stand-alone “learning modules,” thus permitting flexibility for the modules to be used collectively, or individually. The learning modules may be “extracted” and plugged into another course (within an easily modifiable and usable format) for additional coverage on a particular topic. To aid this portability and use on a handheld, the modules were kept in their weekly format (e.g., the Geriatrics module would be for week “x” and devised so the contents could be reviewed/studied within that time period).

Weekly modules remained accessible on-line and on the CD’s; however, the new mobile format added the “ no longer tethered to a desktop” option. Users were not asked to use one format over another. Instead, they were allowed to gravitate to the one that best suited their needs.

Overall, the process created the desired educational experience of wanting the classroom to consist more of an interactive encounter as opposed to the traditional lecture occurrence. The medical students, with more options of how they could acquire materials (prior to classroom time) allowed them to participate in an active learning environment, essentially replicating the experience they would have when rotating through clinical services.

**“Traditional” BARRIERS**  
(time, access & optimal connectivity)

**BARRIERS REMOVED**  
(no time/access restrictions)

CD



Internet

**Mobile Format** = interaction anytime & anywhere

## **Figure 1** Impact of Handheld Integration

### **Steps**

Integration of the clerkship modules with the handheld involved the development of a standard graphical template to be used in displaying the modules' contents (both images and text). Along the lines of being user-friendly, PDF was tested and found to be the format of choice. Users of the handheld were familiar with the use of Adobe Acrobat and to display the materials would simply require Adobe Acrobat 2.0 or higher to be installed on the PDA.

Running parallel to this project was the evolution of a Web site known as "PDA Central." This site is the central repository of handheld initiatives and information at OSUMC. In addition, it serves as a location of an AvantGo (serves as a conduit in which to display Web-based information on a handheld) channel for OSUMC faculty, staff, residents, and students.

The Internet site was examined as a possible handheld delivery option for the clerkship modules. Basically, a clerkship category (see Figure 2) could added to the secured PDA Central Web site. The clerkship category would, therefore, have all the weekly modules listed with check boxes for what would be downloaded to the device when it was synched.

<b>General Information</b>	<b>Med I Student Resources</b>	<b>Med II Student Resources</b>
COM&PH/OHS Directory <input checked="" type="checkbox"/>	Curriculum	Curriculum
	LD Pathway Overview <input type="checkbox"/>	LD Pathway Overview
<b>General Student Resources</b>	Medical Human Anatomy <input type="checkbox"/>	Pharmacology
Herbal Reference Guide <input checked="" type="checkbox"/>	Listserve Archive - med2005 <input type="checkbox"/>	Physician Development: Physical Examination
Listserve Archive - ALLMED <input type="checkbox"/>		Listserve Archive - med 2004
Medical Student Handbook <input checked="" type="checkbox"/>		
<b>General Clinical Resources</b>	<b>Med III Student Resources</b>	<b>Med IV Student Resources</b>
Non-Approved Medical Abbreviations <input type="checkbox"/>	Curriculum/Clerkships	Curriculum
Approved Medical Abbreviations <input type="checkbox"/>	Overview <input type="checkbox"/>	Overview
OSUMC Scheduling Phone Numbers <input type="checkbox"/>	Intro to Clinical Medicine <input type="checkbox"/>	Differentiation of Care Selectives
Frequently Used Internal Numbers <input type="checkbox"/>	Ambulatory Care Clerkship <input type="checkbox"/>	DOC-1
Internal Consult Numbers <input type="checkbox"/>		DOC-3
		DOC-4

Figure 2 PDA Web site with sample ambulatory clerkship option and check box

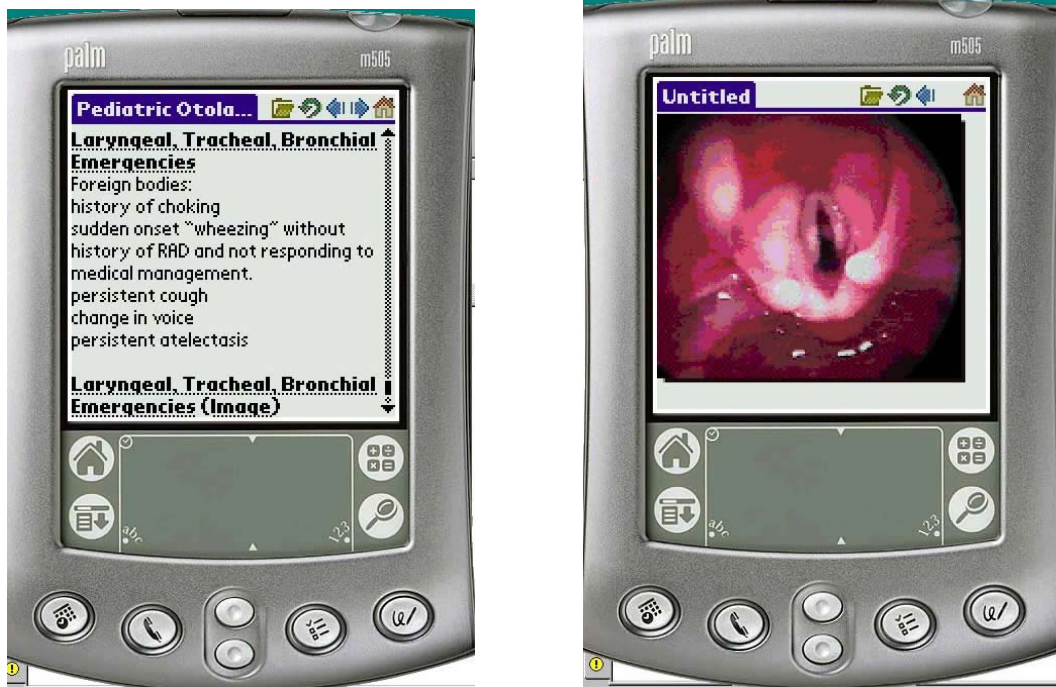


Figure 3 What is seen by the handheld user once synced

The PDA Web option shown in Figure 2 has flexibility and allows updates to be easily pushed. The challenge was the amount of synching time that would be required and the need for a student to most likely expand the memory of their handheld, especially if images are included. Additionally, based on feedback, the solution needed to be relatively high-speed and, in keeping with an “anytime, anywhere” approach, there was the question of one still being tethered to a desktop.

Considering such factors, efforts were turned again on developing a standard template in which materials could be easily updated and stored on an SD card for the PDA. The cards would hold the PDF files and permit users to access the materials/modules anytime they had time with no need for computer (and Internet) access.

### **Challenges and Opportunities**

There are notable challenges when delivering contents typically viewed on a desktop computer screen versus a small handheld device. As noted in *Health Data Management*, contents “aren’t always user-friendly. . . Data entry can be cumbersome on small devices.”<sup>3</sup>

Overall, two basic challenges were presented:

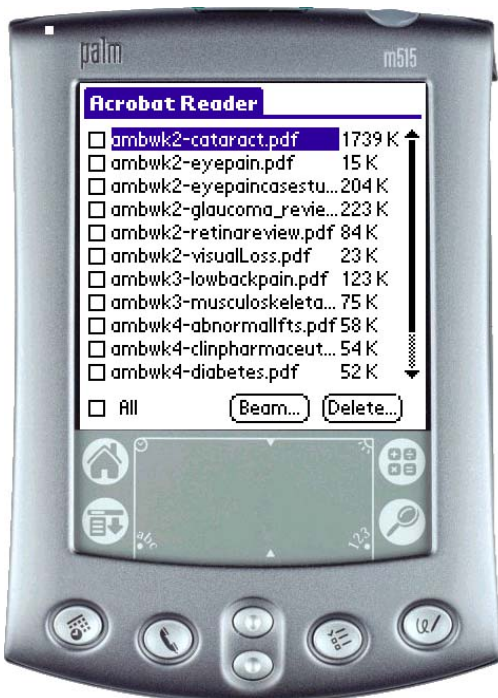
1. Display of data-rich images without compromising handheld performance (e.g., the speed the images load/are displayed).
2. Delivery of a magnification tool that could be used on the handheld for examination of images.

Enhancement of images delivered to the handheld would at times negatively impact the device's performance. It was found, through testing, that storage in a PDF format and on newer handhelds (with faster processors) achieved suitable displays and load times based on users' feedback. Using PDF files also allowed the use of Adobe Acrobat's built-in magnification tool.

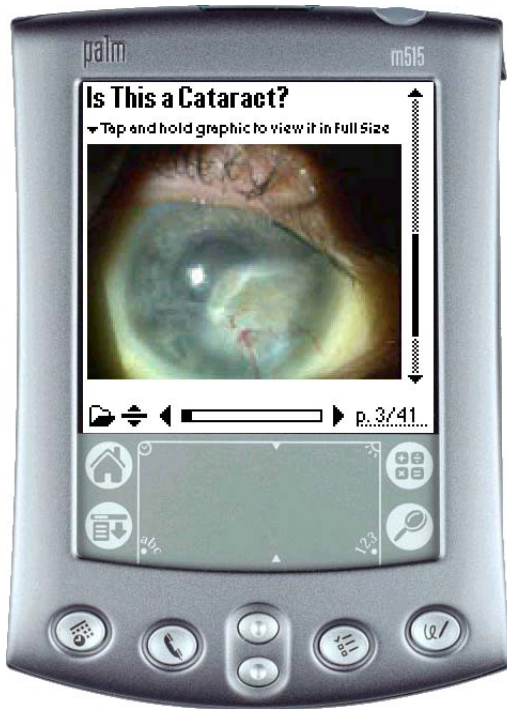
### Assessment

The on-line materials/weekly modules were "re-engineered" so that the display on small screens/handhelds would make sense without requiring complex navigation. It was established that all eleven modules could be stored on one 64MB SD card. Therefore, SD cards were acquired and distributed to the third year medical students doing the clerkship. Adobe Acrobat Reader was also made available, which was needed to view the information on the SD card.

Figures 4 and 5 depict how the modules and resulting images were displayed.



**Figure 4** Listing (by week) of modules as seen using the SD card on the PDA



**Figure 5** Sample of an image on the SD card that may be magnified

This elected method addressed the confronted issues. First, the reworking of the materials along with the use of Adobe Acrobat Reader allowed for a fairly intuitive way of allowing users to move through the materials on the PDA and enlarge images when needed.

To accompany the SD card process, a five-point assessment tool was devised for completion by the users of the re-worked modules. This was done to help in further refinement and, as noted, to set the stage whereas weekly modules may be used independently with accompanied assessments.

The new, mobile approach has been met with much success and appreciation, and it is now part the offered options for material access. One area of concern continues to be the load time

between modules on the handheld. With certain lectures/modules, there is a five second wait. The PDA is not a Pentium desktop computer and the load time may be slower in comparison; however, the time is faster in comparing it with a dial-up connection. It's all perspective, but as seen with tests of the newer PDA models, both resolution and speed have been greatly improved. With feedback and the continued PDA enhancements, it is expected the modules (and others to follow) will continue to improve and meet the expectations of the users.

## **Conclusions**

The evolution of PDA technology will continue to impact such initiatives and raise the bar of what is possible. Moreover, it is viewed that this PDA-based methodology will positively impact other dimensions of the educational, research, and clinical environments.

Currently, quizzes and exams are used to assess the amount of materials students are learning as well as an evaluation of the methods being used. It is targeted that this handheld-based approach will not only embrace the evaluation element, but will inherently provide monitoring capabilities such as lending insight as to how many times materials are being captured for handheld viewing. Although the SD card is being used as the initial method, synching of on-line resources based on one's choices and profile are the next logical stages.

Mobility is certainly key. Setting the stage to have such materials on the go allows for doors of opportunities to be opened as to what other materials and references may be made available. Already, various clinical references at OSUMC are being re-engineered for handheld use. Indeed, the bar of the mobile experience for tomorrow has been raised today.

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