# The Evolution of Filmless Radiology Teaching

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*Purpose:* The transition from hard-copy film to the picture archiving and communication systems (PACS) arena is often a long and difficult path, but the complete transformation to the digital environment does not end with the successful clinical practice utilizing PACS. The next hurdle for academic institutions is similar changes in the teaching field. The loss of hard-copy films can greatly hinder the radiology teaching file and teaching conference experiences. The next step in our growth is the conversion to digital teaching files and conferences. The original work 10 years ago with utilizing computers linked with laser disks and magneto-optical media, have now evolved into complex networks with expanding and relatively cheap storage media, such as CD-ROM and easily to navigate graphic-user interfaces such as hypertext markup language (HTML) and extensible markup language (XML), for use with multimedia teaching tools. *Conclusions:* The transition into the digital arena for radiology education and interdepartmental conferences can be accomplished through several different paths. These include direct transfer of images into a presentation program, as well as exportation of images into suitable image file formats for later use. There is also the ability to expand the PACS network to include conference rooms. Similar training and teaching can allow radiologists to transition into the digital environment for future digital teaching file creation as well as correlative radiology interdepartmental conferences.
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CONTINUED DEVELOPMENTS in the computer industry, with increasing speed and decreasing costs, have allowed many radiology departments to transition into the digital realm. One example of this new technology is the increasing use of hypertext markup language (HTML) and the internet for display and storage of digital teach-

ing files.[1-3] A majority of this technology has primarily focused on the diagnostic implementation of picture archiving and communication systems (PACS), with increasing network speeds, various compression algorithms, and data storage.

However, as a radiology department evolves into a filmless world, there is often an initially unexpected problem of the transition of conferences and teaching files to a digital environment. There can be a great deal of unwillingness and uncertainty with the suggested loss of hard copy teaching files, as well as the transition of radiology conferences to filmless. This aspect of the digital transition is clearly not anticipated when discussing the change from hard-copy film to PACS.

## MATERIALS AND METHODS

The ability to quickly and easily transfer images from the PACS environment into a suitable image display program, such as Powerpoint (Microsoft, Redmond, WA) can assist with both the creation of digital teaching files and conference presentation use. The simple ability to take advantage of the "print screen" function or the clipboard in both Windows (Microsoft) and Mac OS (Apple, Cupertino, CA) based PACS platforms can easily serve this purpose. It is important, however, for the user to be aware of the spatial resolution and contrast when copying and pasting from the clipboard. These files may not be suitable for use later in print media, however, and the ability to export individual images as a tag(ged) image file format (TIFF) file or another image file format can assist with this purpose.[4]

Another option for radiologic conferences is the expansion of the network running PACS, to include workstations in the conference rooms in a limited format, or web-based systems on the network. Often a relatively low-resolution web-based system with access to the PACS archive can be sufficient for viewing purposes in most conferences.

## RESULTS

Initial training for some radiologists to utilize PACS for diagnostic purposes is complicated by the introduction of computers, essentially similar to reluctantly learning a foreign language. After clearing this hurdle, many radiologists are originally surprisingly resistant to the notion of giving up their privileges for printing hard copy film for teaching cases. In addition, they clearly do not understand how the teaching conferences and various tumor board and radiologic-pathologic conferences could possibly exist in a "filmless" institution.

The training for the inevitable adoption of PACS is clearly needed for the similar transition to teaching in the digital environment. The majority of conferences involving radiology involve showing cases either on a view box in small groups, or with an overhead projector for larger conferences. This involves a great deal of time with collecting and transporting hard-copy cases, and often reprinting "lost" films.

## CONCLUSIONS

With a relatively small amount of effort and training, department personnel can be introduced and familiarized with the ability to create digital teaching files quickly and easily while working at the PACS workstation. These digital files obviously require a far different organizational system in comparison to hard-copy films. This file structure can be individualized as a simple or extremely complicated hierarchical system.

The creation of these digital teaching files, as well as the deployment of computers with software integrated with the PACS network at specific conference rooms enables these filmless conferences. This adaptation allow cases to be shown at these conferences with liquid crystal display (LCD) projectors, just as easily as reviewing cases in the reading room on a full PACS workstation.

## ACKNOWLEDGMENT

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