

# Interactive Radiology Case Conference Utilizing Flipped Classroom



Walter Reed  
National Military  
Medical Center



USU

Uniformed Services University

Michael Berge MD<sup>1</sup>, Scott Dalane DO<sup>1</sup>, Stephen Savioli MD<sup>1</sup>,  
Steven Gibson BS<sup>2</sup>, David Lieb BS<sup>2</sup>, Justin Taylor MD<sup>1</sup>, John P  
Lichtenberger III MD<sup>1,2</sup>

1. Department of Radiology, Walter Reed National Military Medical Center, Bethesda, MD
2. Uniformed Services University of Health Sciences, Bethesda, MD

The authors do not have any financial or industry disclosures.

The views, information, or content and conclusions expressed herein are those of the author(s) and do not reflect the official position or policy of the Departments of the Defense, Navy, Army, Air Force, or the U.S. Government, nor should any official endorsement be inferred by the Departments of Defense, Navy, Army, Air Force, or the U.S. Government.

The use of industry names or logos imply no endorsement of the authors or above organizations. All screen captures obtained by the authors.



Walter Reed  
National Military  
Medical Center



USU

Uniformed Services University

# Summary

- Adapting new education paradigms and adding modern technology to a classic radiology training method, we present an innovative approach to interactive case conferences
- We describe our process, along with its promise, challenges, and limitations



Walter Reed  
National Military  
Medical Center



USU

Uniformed Services University

# Traditional Radiology Case Conferences

- Fixture of Radiology resident education, modeled after the format of prior oral certification boards
- A small set of curated images are presented to a resident, who must make the findings and provide a differential diagnosis (as appropriate)
- A very useful tool for teaching residents to describe findings and organize a differential diagnosis
- However, this does not teach residents to “Practice like you Play”
  - An increasing reliance on cross sectional imaging requires focused teaching and assessment of the ability to make the pertinent findings and present them in a succinct and accurate way
  - The speed and accuracy of this particular skill is a large part of junior resident education



Walter Reed  
National Military  
Medical Center



USU

Uniformed Services University

# “Flipped Classroom” Objectives

- “Flipped classroom” is popular concept in education literature, with various meanings
- In general, refers to assigning didactic content and reading outside of class and using classroom time for interactive practical exercises
- Traditional radiology conferences already use some aspects of flipped classroom paradigm
- Our goal was to increase the interactive nature of the classroom sessions using mobile computing and networking technology



Walter Reed  
National Military  
Medical Center



USU

Uniformed Services University

# Goal of Interactive Case Conference

- Increase resident engagement and participation through interaction with imaging content on their personal devices
- Train and assess residents' ability to make and communicate the pertinent findings while reviewing a complete cross-sectional imaging study.
- Allow greater opportunity for team-based learning in Radiology resident education.



Walter Reed  
National Military  
Medical Center



USU

Uniformed Services University

# Team-Based Conference Setup

- Team approach allows for mentorship by senior residents as well as greater inclusion of medical students/rotators
- Each team is given small number of cases with a short period of time to review together before presenting
- Variations:
  - One team describes the findings to a second team that is tasked with providing a differential diagnosis
  - Informal score-keeping can promote good-natured competition.



Residents and medical students work in teams to review and present the assigned cases using the DICOM viewer on their tablets



Walter Reed  
National Military  
Medical Center

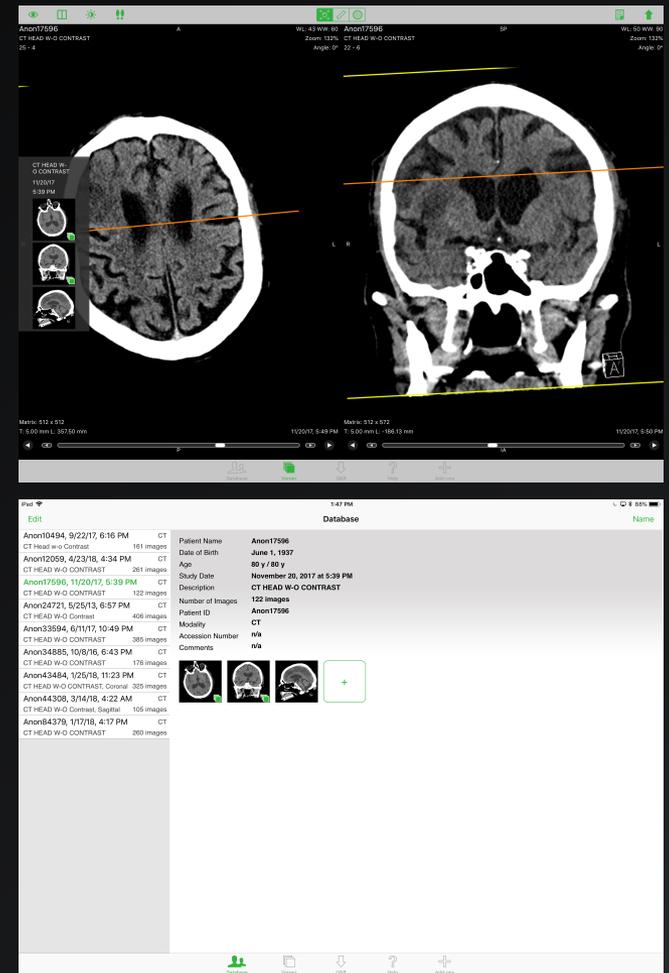


USU

Uniformed Services University

# Device selection and DICOM viewers

- If a wireless option for connecting to a local PACS from mobile devices, this may be ideal as content would not need to be exported
  - Network speed and graphics processing is likely a limiting factor, however
- In our case, the majority of residents use the OsirixHD app for iPad (\$49.99) or OsirixLite app for MacOS (free), both by Pixmeo SARL ([www.osirix-viewer.com](http://www.osirix-viewer.com))
- Most DICOM viewers will work, and in our setup some residents have used other DICOM viewers for windows-based devices



Screen captures from OsirixHD application for Apple iOS



Walter Reed  
National Military  
Medical Center

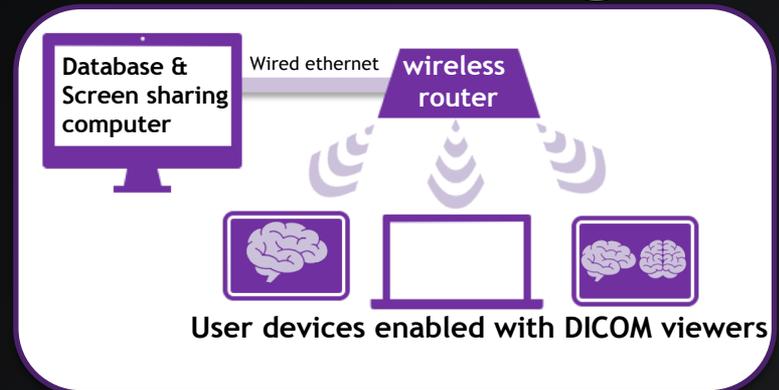


Uniformed Services University

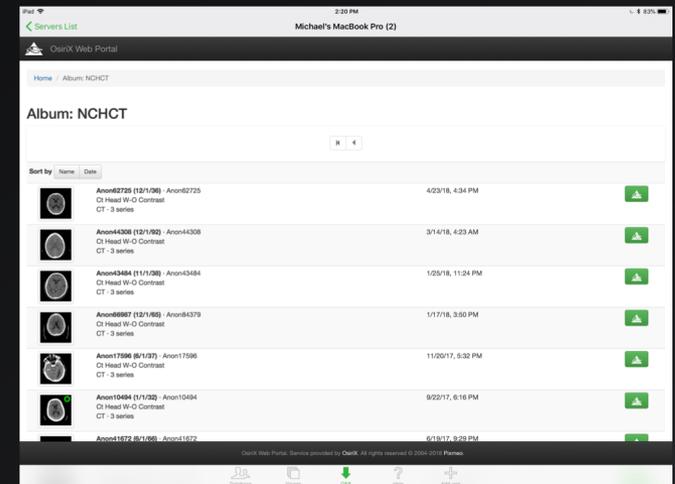
USU

# Wireless Local Area Networking

- A wireless local area network (WLAN) allows for much faster communication and data transfer between devices if all content is held locally
- DICOM files may still be stored on the web, but must be downloaded to the devices prior to screen sharing
- Once screen sharing is to begin, all of the devices log onto the same WLAN
- If DICOM files are stored locally, they can also be transferred over this WLAN
- Very robust connections to the internet may allow for use of a wide area network, however, router firewalls may limit file sharing



WLAN Established for screen and file sharing



Screen capture from OsirixHD app on iPad demonstrating ability to pull from local or remote Osirix Web sharing sever



Walter Reed  
National Military  
Medical Center



USU

Uniformed Services University

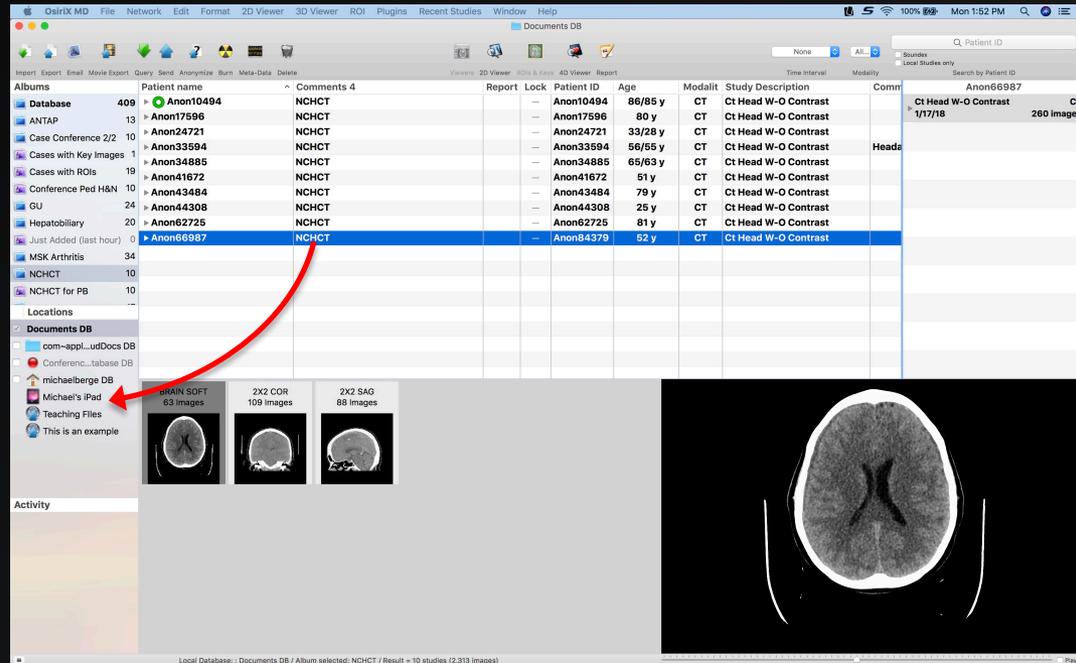
# Content – Anonymization and Storage

- Some PACS have integrated connections for exporting anonymized teaching cases to web-based hosting platforms (e.g. PACSbin.com), making this process much easier

- In our case, anonymized cases are burned to CD and uploaded to local computer (off hospital network), where the cases are curated and organized into groups for specific conferences using DICOM editing software (OsirixMD by Pixmeo)

- Cases may also then be loaded for resident download. Options include:

- Dropbox.com
- PACSbin.com
- Osirix Webserver



- OsirixMD application screen capture demonstrating cases organized for an upcoming conference
- Note: Drag-and-drop is available for file transfer over WLAN (arrow), but we have found having the residents downloaded the cases prior to conference to be quicker and more reliable



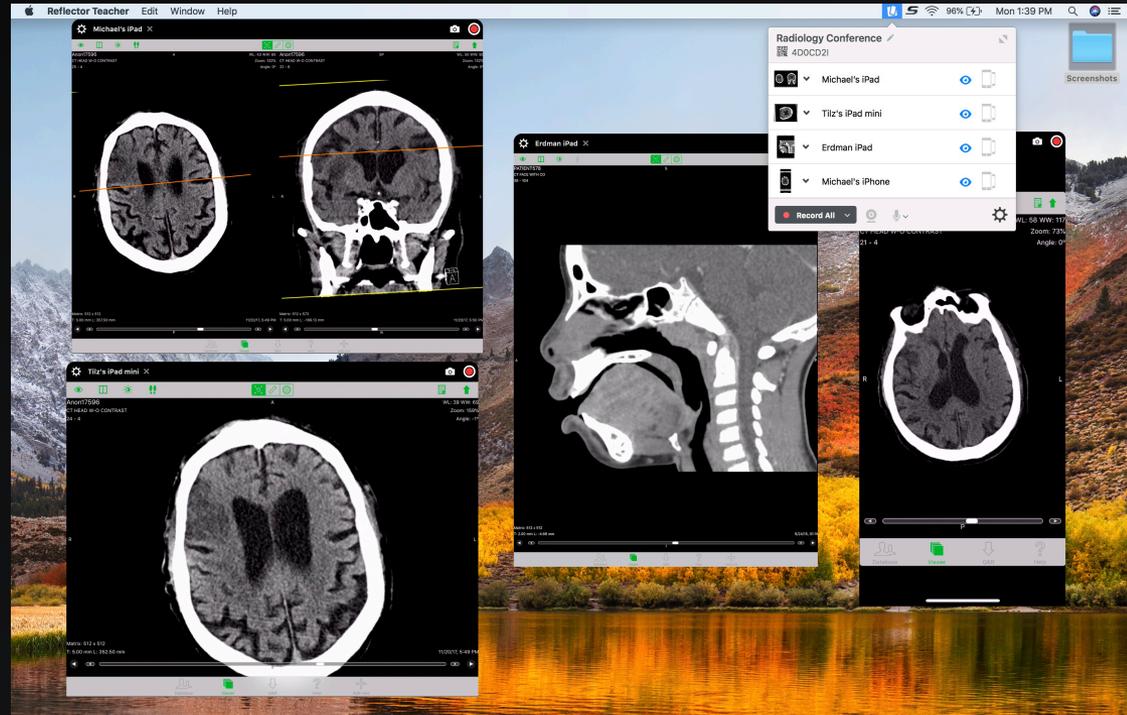
Walter Reed  
National Military  
Medical Center



USU  
Uniformed Services University

# Screen sharing

- Web-based meeting tools (e.g. GoToMeeting) would be effective but depend on a robust internet connection
- Local screen sharing options such as AppleTV and Google Chromecast are effective but limited to one shared screen at a time
- We use MacOS-based screen sharing program called Reflector Teacher (\$14.99, Air Squirrels, [www.airsquirrels.com/](http://www.airsquirrels.com/))
  - Allows for sharing of multiple screens from Apple, Android, Chromebook or Windows
  - The instructor can fluidly switch between multiple simultaneously-shared screens



Screen capture of Reflector Teacher application for MacOS, demonstrating the ability of the conference director to choose between multiple shared devices simultaneously (multiple devices currently displayed, but normally switched to just a single device)



Walter Reed  
National Military  
Medical Center



USU  
Uniformed Services University

# Screen Sharing Explained

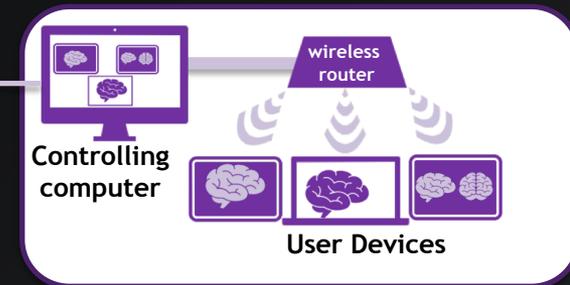
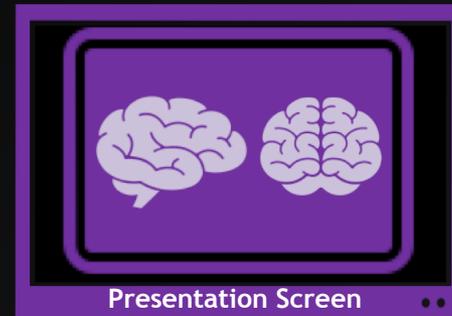
- Various screen sharing technologies are available (generally proprietary such as Apple AirPlay® and Google Chromecast®)

- Dual output from personal device is achieved

- One output to personal device screen
- Second output to data stream for sharing
- Data is then transmitted to a receiving device, which must have the appropriate protocol keys
- On some modern devices, this can be sent with or without a wifi network

- Receiving devices include

- Proprietary devices such as AppleTV®
- Third-party platforms which turn desktop computer into screen sharing platform (e.g. Reflector software)



## Limitations:

- The bottleneck is often the connection between transmitting and receiving devices
  - Dedicated local wireless router makes this most feasible
- If you intend to share multiple screens, the controlling device must have fast graphics processor



Walter Reed  
National Military  
Medical Center



USU

Uniformed Services University

# Outcomes

- The majority (82%) of all residents felt that the interactive case conferences were superior to traditional case conferences
- Of residents who were present before and during this project, the majority (71%) believed that this system had a positive impact on the overall quality of academic case conferences within the program
- The remaining residents were neutral with no negative respondents
- The most common aspects of the interactive case conferences that residents believed made them superior to traditional case conferences included:
  - Increased ability to interact with imaging content
  - Better at preparing residents to take independent call
  - Better at developing practical image interpretation skills



Walter Reed  
National Military  
Medical Center



USU  
Uniformed Services University

# Next steps

- Continue to use interactive case conferences as part of an organized curriculum
  - An excellent way to teach and test basic anatomy and normal structures
  - Continue to use for call-preparation/emergency radiology conferences
- Continue to also use traditional case-based conferences as well, which allow for covering a higher volume of cases/pathology
- Now that we have developed an effective system, we plan to design objective educational effectiveness studies to validate the technique, possibly through involving other learners in similar interactive conferences (medical students and non-radiology residents)
- We hope to streamline the somewhat onerous process of anonymizing, exporting, and uploading the cases to our database



Walter Reed  
National Military  
Medical Center



USU

Uniformed Services University

# References

- AirSquirrels, “Wireless Screen Mirroring: An Explanation.” <http://www.airsquirrels.com/reflector/faq/wireless-screen-mirroring/>. Accessed 07May2018.
- Apple AirPlay website, <https://support.apple.com/en-gb/HT204289>. Accessed 07May2018.
- Gillispie V, “Using the Flipped Classroom to Bridge the Gap to Generation Y.” *Ochsner Journal* 16:32–36, 2016.
- Lew, EK. “Creating a contemporary clerkship curriculum: the flipped classroom model in emergency medicine.” *International Journal of Emergency Medicine* (2016) 9:25.
- Liebert CA, Lin DT, Mazer, LM, Bereknyei S, and Lau JN, “Effectiveness of the Surgery Core Clerkship Flipped Classroom: a prospective cohort trial.” *The American Journal of Surgery* (2016) 211, 451–457.
- O’Flaherty J and Phillips C, “The use of flipped classrooms in higher education: A scoping review.” *Internet and Higher Education* 25 (2015) 85–95.



Walter Reed  
National Military  
Medical Center



USU

Uniformed Services University