# Radiology in Medical Education: A Pediatric Radiology Elective as a Template for Other Radiology Courses

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## Abstract

**Purpose:** Traditionally, the pediatric radiology elective for medical students and pediatric residents constituted a morning teaching session focused mainly on radiography and fluoroscopy. A more structured elective was desired to broaden the exposure to more imaging modalities, create a more uniform educational experience, and include assessment tools.

**Methods:** In 2012, an introductory e-mail and formal syllabus, including required reading assignments, were sent to participants before the start date. A rotating weekly schedule was expanded to include cross-sectional imaging (ultrasound, CT, MR) and nuclear medicine. The schedule could accommodate specific goals of the pediatric resident or medical student, as requested. Starting in 2013, an online pre-test and post-test were developed, as well as an online end-of-rotation survey specific to the pediatric radiology elective. Taking the Image Gently pledge was required. A scavenger hunt tool, cue cards, and electronic modules were added.

**Results:** Pre-test and post-test scores, averaged over 2 years, showed improvement in radiology knowledge, with scores increasing by 27% for medical students and 21% for pediatric residents. Surveys at the end of the elective were overwhelmingly positive, with constructive criticism and complimentary comments.

**Conclusions:** We have successfully created an elective experience in radiology that dedicates time to education while preserving the workflow of radiologists. We have developed tools to provide a customized experience with many self-directed learning opportunities. Our tools and techniques are easily translatable to a general or adult radiology elective.

**Key Words:** Medical education, residency education, radiology education

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## INTRODUCTION

In light of the substantial health care resources devoted to diagnostic imaging, education in radiology and imaging should be emphasized in medical school curricula. Instruction in diagnostic imaging should increase appropriate, efficient, and safe usage of resources, and could facilitate economical use of health care dollars. However, formal radiology education across medical schools in the United States is lacking. A 2012 survey of the Association of American Medical Colleges (AAMC) and the American Association of Colleges of Osteopathic Medicine (AACOM) revealed that only one-quarter of US medical schools require radiology as a rotation [1]. The survey found that 87% of medical students with required radiology components believed radiology should be required for all medical students, and 63% of students for whom radiology is not required planned to take it as an elective [1].

We describe the creation of a structured elective in pediatric radiology that meets many of the educational challenges set forth by Naeger et al [2]. These challenges include having an attending radiologist responsible for the course, a written orientation, and clear expectations and learning objectives. The nature of the practice of pediatric

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radiology is general; therefore, many of the elements of our curricula can be easily translated to general radiology courses for medical students at any level of training.

## STATEMENT OF NEED

At our institution, radiology is not a required course, but experience in diagnostic imaging is available through a variety of electives offered in the second, third, and fourth years of medical school. For years, the pediatric radiology elective for fourth-year students had a very traditional reading room–based format that was loosely structured and highly variable. The elective was four weeks in length and mainly attracted students interested in pediatrics or radiology. No interaction with participants occurred before the start of the elective, and the course lacked learning objectives, expectations, specific assignments, and assessments. The course offered little opportunity for individualization, so that students might address personal competency and individual goals.

The day was organized into a morning reading-room session, concentrating on radiography and fluoroscopy. The afternoons were designated for self-directed study, mainly focusing on review of the pediatric section of the ACR teaching file in hard copy film format (the teaching file is now available electronically) [3]. Exposure to cross-sectional imaging and the logistics of other imaging modalities was very limited.

## METHODS

Our team of radiologists and pediatricians set out to formalize the curriculum for this elective. The materials we developed are used for both the medical student and pediatric resident electives. We formulated clear goals and objectives to provide a more uniform educational experience inside and outside the reading room. The reading-room experience was expanded to include all imaging modalities and organ systems. This expansion increased participants' exposure to cross-sectional imaging, nuclear medicine, interventional radiology, and neuroradiology. The new format allows for flexibility of individualized learning plans to fulfill personal goals and needs. We developed tools to assess individuals' mastery of the core radiology learning objectives and to obtain real-time feedback about both the course and participant satisfaction.

## CURRICULUM DESCRIPTION AND EVOLUTION

### Introductory Communication and Orientation

The elective was revised in the spring of 2012, with a start date of July 2012. The course director developed an introductory e-mail that was sent to each participant in advance of the start date. This e-mail contains logistic information for the course orientation, the course syllabus, and other electronic modules.

The orientation includes a review of the educational goals and objectives, the required activities, the daily and weekly routines, and conference schedules. Participants are given a tour of the department and are introduced to administrative assistants, faculty members, radiology residents and fellows. This opportunity is used to obtain information from the participant about individual goals and objectives, which are incorporated into their experience. For example, participants interested in pediatric neurology can be placed in additional sessions in neuroradiology.

### Syllabus With Requirements and Educational Goals

The formal syllabus lists the requirements of the elective, which include completion of the pre-test, post-test, and end-of-rotation survey, conference attendance, and taking the Image Gently® pledge [4]. The syllabus outlines available educational tools, including the required textbook reading, electronic educational modules, the scavenger hunt tool, and an online teaching file [5].

### Pre-test and Post-test

In July 2013, our team developed the pre-test and post-test to be used as an assessment tool that encompasses the educational objectives of the elective. Three of the team members have completed training in writing assessment questions, and two of the team members have experience writing assessment questions for the ABR and the ACR.

The pre-test, which is the same as the post-test, is a 26-question test, with 44 possible points. It is administered electronically using the REDCap system, a secure web application for building and managing online surveys and databases [6]. This online electronic format makes the test easily accessible, and the results are easy to collect and analyze. The pre-test is taken before the first day of the elective. The post-test is taken the last week of the elective.

The questions cover a range of topics, including the necessity of providing pertinent background information when requesting studies, the importance of reviewing comparison studies, radiation safety, contrast agents, and pediatric-specific topics, such as timing of screening hip ultrasound. The test was designed to address specific local deficiencies, such as the appropriate indication for Doppler imaging and usage of intravenous contrast material in CT and MRI.

The questions are mostly multiple choice and short answer. Short-answer questions are not open ended. They