



Pedagogical Approaches to Diagnostic Imaging Education: A Narrative Review of the Literature



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Received 4 August 2015; received in revised form 21 September 2015; accepted 23 September 2015

Key indexing terms:

Curriculum;
Chiropractic;
Teaching;
Diagnostic imaging;
Education

Abstract

Objective: The purpose of this study was to examine literature on how radiology is taught and learned by both radiology residents and undergraduates in the health professions.

Methods: A review of the literature was performed using relevant key words. Articles were retrieved through December 2012 using PubMed, ScienceDirect, ERIC, Proquest, and ICL databases along with a manual review of references.

Results: Of the 4716 unique abstracts reviewed by the author, 91 were found to be relevant to the purpose of this study. The literature retrieved reported pedagogical approaches to teaching radiology including the following: problem solving, technology as teacher, independent learning tools, visiting lectureships, case based teaching, and conferences. There was some exploration of the relative effectiveness of educational formats. Suggestions for future research identify 7 areas of relative consistency.

Conclusion: Radiology is a clinical skill that requires integration science, clinical information, clinical experiences, and information recorded on diagnostic imaging studies. The research in this area focuses on problem solving, the use of algorithm/scripts, introducing uncertainty in clinical scenarios, incorporating technology in learning environments, active learning techniques, and methods of independent learning. Although the literature in this area is still in its infancy, the research examining the relative effectiveness of these various educational formats is often contradictory, suggesting that this is a complex area of study with numerous factors influencing student learning.

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Introduction

Until recently, only a handful of radiology educators have explored questions relating to how students learn

and how to teach effectively.^{1,2} It is not surprising then that there is little in the radiology education literature exploring these areas of study. This article examines the literature surrounding how radiology is taught and learned by both radiology residents and undergraduates in the health professions because they often share similar needs and use the same resources.³ The purpose of this narrative review is to examine the existing

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literature that explores how radiology is taught and learned by both radiology residents and undergraduates in the health professions.

Methods

A review of the literature was performed focusing on how radiology is taught and learned by radiology residents and undergraduates. Search engines that were searched through December 2012 included the following: PubMed, ScienceDirect, ERIC, Proquest, and ICL databases, along with manual review of references. The comprehensive sampling strategy used the terms *radiology OR diagnostic imaging AND education OR teaching OR resident OR medical student OR chiropractic student OR curriculum OR medical education OR medical school OR medical students OR medical curriculum OR chiropractic education, OR chiropractic school OR chiropractic students OR chiropractic curriculum*. Articles were limited to those in the English language and to humans.

Results

The resultant 4716 unique article abstracts and/or titles were reviewed by the author. All articles that appeared germane to the pedagogy of diagnostic imaging education were obtained and reviewed by the author, which led to the inclusion of 91 articles in this paper.

Discussion

Pedagogical Approach: Problem Solving

One pedagogical area of interest in medical education literature deals with students' ability to solve problems. Radiology is a clinical problem-solving skill that requires students to be able to integrate what they see on the film with their knowledge of anatomy, pathology, and clinical information. This ability, combined with the use of an adaptable radiographic search pattern, has been shown to correlate with successful interpretation of radiographs.⁴ The article "Problem-Solving Model in Radiology for Medical Students"⁵ suggests that the use of algorithms will improve students' ability to develop this skill set. The authors propose that

radiology, with its multitude of rapidly developing imaging techniques and associated escalating costs, demands that students become proficient medical decision makers. Nonclinical issues such as cost-effective use of imaging modalities, safety, and patient comfort incorporated into the clinical decision-making process have been discussed in the literature for some time.^{6–10} A senior-level course, using small groups with faculty guidance to develop investigative plans in imaging, allows the students to learn to develop algorithms designed for specific patients rather than memorizing generalized algorithms that may not be effective for individual patients.⁵ Teaching medical students through the use of algorithms, also known as *scripts*, is based in cognitive psychology and provides the students with prestored knowledge that can be applied quickly and easily in the clinical setting.^{11,12} The Medical College of Georgia compared a traditional observation instructional method to an interactive learning method that involved specific learning objectives and tasks that enabled students to be actively involved in radiology. The results showed that medical students, residents, and faculty preferred involving students in appropriate decision making and problem solving.¹³ Similarly, Erinjeri and Bhalla¹⁴ found that shifting radiology case-based instruction from a passive observational approach to an active learning delivery was beneficial. An interesting article published in 2005 illustrates the importance of clinical histories in the interpretation of radiographs: groups of students examining the same set of radiographs were given different patient histories. The authors posited that different histories will drive the algorithm or script appropriately.¹⁵ A 2012 dissertation found that students find the use of clinical cases to be helpful in learning to interpret radiographs¹⁶ and is consistent with both the adult learning theory and experiential learning theory.^{17,18}

When residents are asked to discuss an unknown case, they are expected to focus on 1 question: what is the abnormality? This question assumes 1 correct answer. Thus, radiology residents, and radiologists themselves, often have an underlying assumption that to be a good radiologist, one has to have the accurate diagnosis every time.¹⁹ Gunderman and Nyce¹⁹ argue that, although this is an important part of being a good radiologist, this need for accuracy can be problematic when no absolute right answer can be derived from a given set of images. Residents need to learn to be active investigators and incorporate clinical information into their evaluation of a case. The authors suggest that residents be encouraged to ask questions and that, when

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