

Self-Directed Online Learning During a Radiology Elective Improves Medical Students' Diagnostic Accuracy for "Must-See" Images: A Pre-Post Assessment

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Background

Radiology is central to modern clinical decision-making, yet fewer than 20% of U.S. medical schools require a dedicated radiology clerkship in the core curriculum. (1)

A 2022 competency-based radiology clerkship by Agarwal et al. demonstrated substantial diagnostic gains using a structured, didactic-rich model with formal teaching sessions and pre/post assessment. (2)

In contrast, radiology electives vary widely in structure, incorporating differing combinations of self-directed learning, clinical exposure, and formal didactic teaching. For programs with limited faculty availability or competing clinical demands, greater reliance is often placed on self-directed and resource-based learning; however, the effectiveness of these lower-burden approaches in improving diagnostic accuracy remains unclear.

References

- 1: Association of American Medical Colleges. Clerkship requirements by discipline. Accessed March 27, 2026. <https://www.aamc.org/data-reports/curriculum-reports/interactive-data/clerkship-requirements-discipline/>
- 2: Agarwal A, Jennings SG, Gunderman RB. Development of a competency-based radiology clerkship using categorical and statistical analysis of assessment. *J Am Coll Radiol.* 2022;19(4):567-575.
- 3: Gay SB, Olazagasti J, Higginbotham JW, Gupta A, Wurm A, Nguyen J. Chest radiology: learning objectives. Introduction to Radiology. University of Virginia Department of Radiology. Accessed March 22, 2026. <https://introductiontoradiology.net/courses/rad/cxr/objectives.html>

Methods

Pre-post observational study of fourth-year medical students enrolled in an optional 4-week radiology rotation at Loma Linda University during the 2024–2025 academic year.

Students attended daily reading-room shadowing from 8:00 a.m. to 12:00 p.m., 5 days a week, for 4 consecutive weeks. In addition, they were expected to complete all modules of the online resource "Introduction to Radiology", a University of Virginia Department of Radiology resource (QR Link). (3)

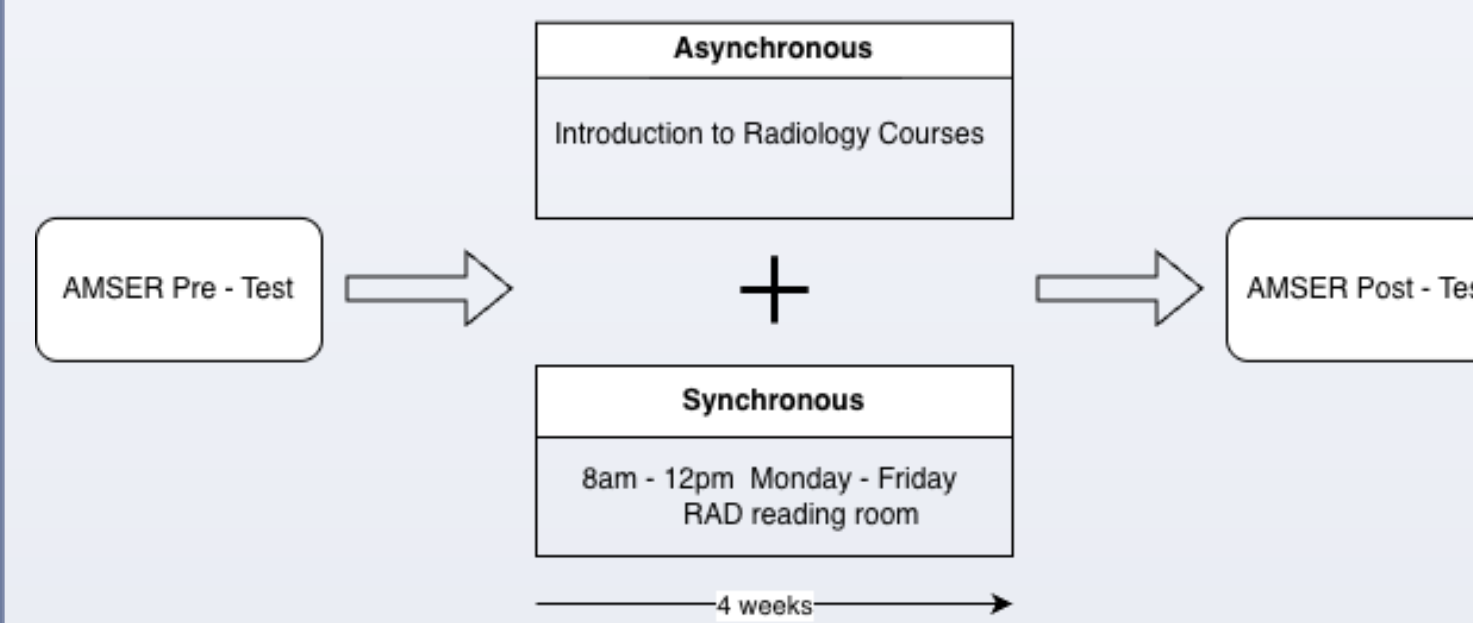


Diagnostic accuracy was measured using a 26-item multiple-choice exam featuring X-ray and CT cases aligned with "Must See" images from the AMSER National Medical Student Curriculum in Radiology. Images were sourced from LLU's department of Radiology (example).

The identical exam was administered as a pre-test (within the first week of the rotation) and post-test (by rotation completion, no more than 34 days later), delivered online, unproctored, and not used for grading.

59 students completed the pre-test; analyses were restricted to 44 students who completed both pre- and post-tests within the specified time window.

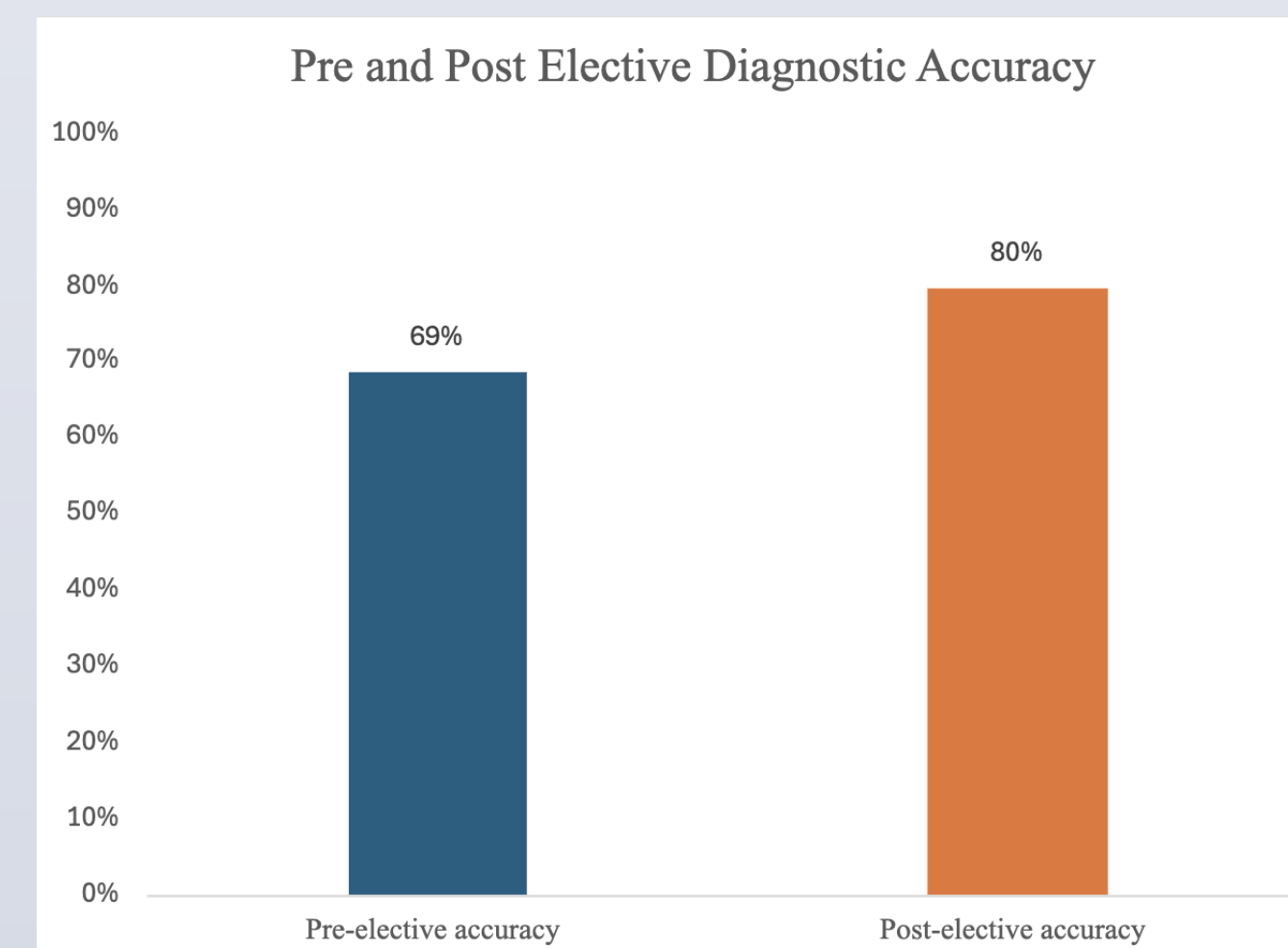
Study Outline



Results

Pre- and post-elective scores were compared using a paired t-test, with statistical significance set at $p < .05$.

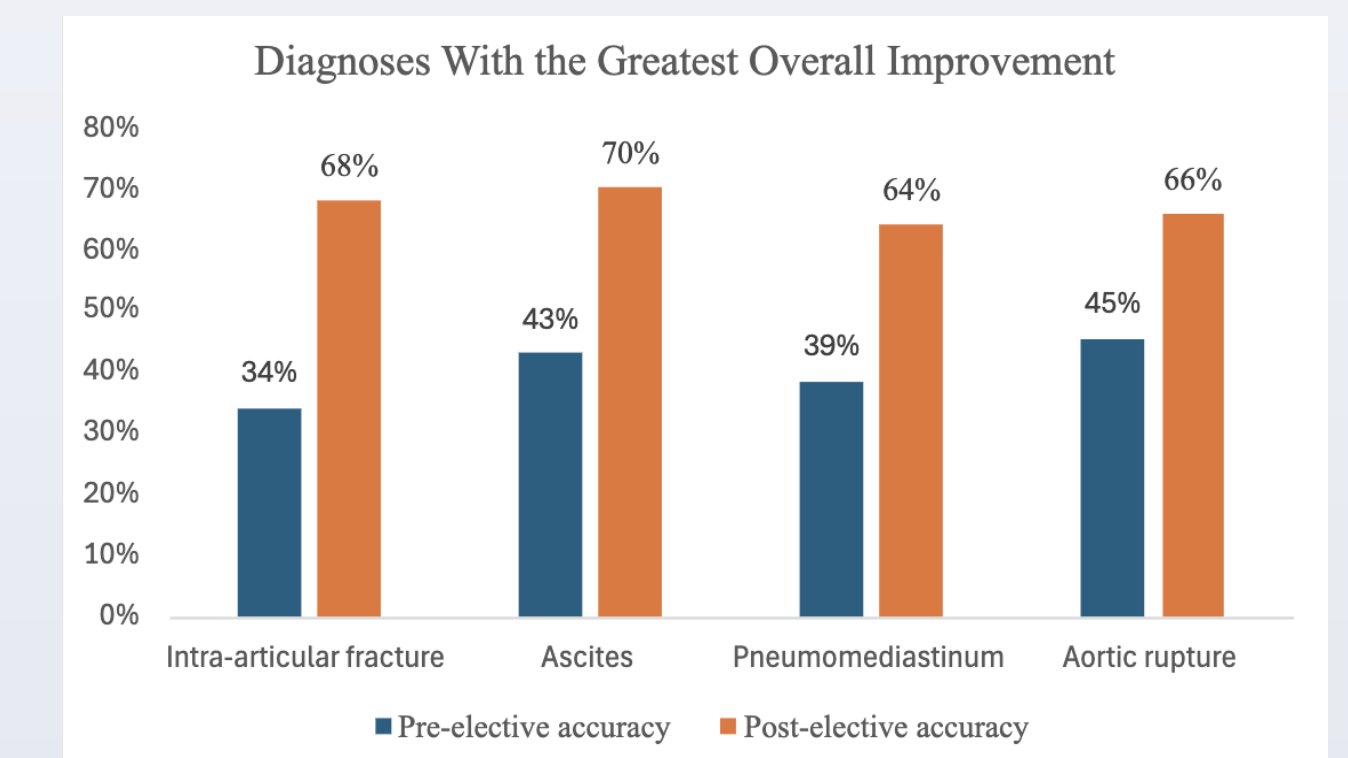
Average test performance increased from 69% pre-elective to 80% post-elective, an 11% absolute gain ($p < 0.001$).



Improvement was seen across nearly all subspecialties, with the largest gains in musculoskeletal, abdominal/GI, and chest/thoracic diagnoses.

The top individual improvements were intra-articular fracture (+34%), ascites (+27%), pneumomediastinum (+25%), aortic rupture (+21%), and cecal volvulus (+18%).

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A full breakdown of pre/post scores for all diagnoses is available via the QR code.



Conclusion

This study demonstrates that a low-burden, self-directed learning model paired with shadowing-based clinical exposure can significantly improve fourth-year medical students' diagnostic performance for AMSER "Must See" images. This model appears effective even without formal structured didactics, making it a practical option for programs with limited faculty time or teaching resources.

The approach may be especially valuable for small or resource-constrained radiology electives, where scalable, low-infrastructure teaching methods are needed.

Overall, these findings support resource-light radiology education as a practical way to strengthen student learning while minimizing the instructional burden on faculty.