Online resident learning of chest x-ray interpretation:
A study of mixed versus blocked practice

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Background

Chest X Ray (CXR) interpretation is a complex skill that is important for the practice of internal medicine. Its complexity makes it a difficult skill to acquire. Instructional design choices, such as mixed versus blocked practice, may facilitate the learning of complex visual diagnostic skills including CXR interpretation.

In blocked practice the trainee is asked a set of questions related to one concept, whereas mixed practice provides questions that represent several concepts.

Eliminating cueing and emphasizing contrasting features are proposed benefits of mixed practice. However, a trainee may require a basic foundation of knowledge of the concept being learned before benefitting from mixed practice.

On the other hand, contrasting numerous elements simultaneously during mixed practice may increase cognitive load and hamper learning.

Objective

This study aims to examine whether residents, who have a basic approach to CXR interpretation, should focus on learning common elements through blocked practice or distinguishing features through mixed practice.

Methods

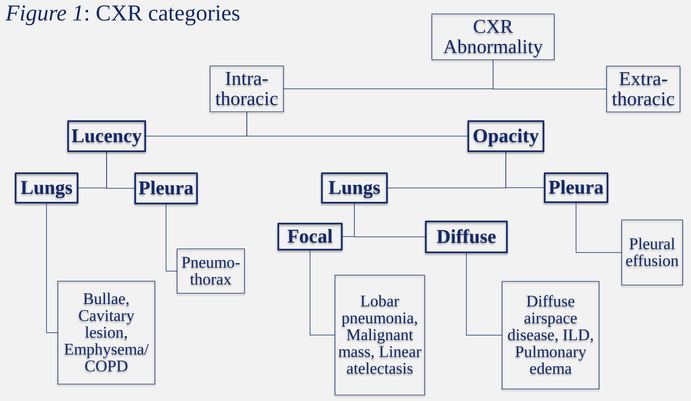
POPULATION:
Core internal medicine residents (years 1 – 3) from the University of Toronto.

STUDY DESIGN AND INTERVENTION:
Participants were randomized to one of two self-study CXR modules that cover identical content but differ in the practice phase. The modules focus on intra-thoracic diagnoses divided into 5 categories based on the following features: location, lucency vs. opacity and focal vs. diffuse (Fig. 1). The blocked module presents practice CXRs after each category is taught, while the mixed module presents the same images in random order after all categories are taught. Participants interpreted 20 novel radiographs immediately and 2-weeks after module completion.

OUTCOMES:
Primary outcome:
- diagnostic accuracy

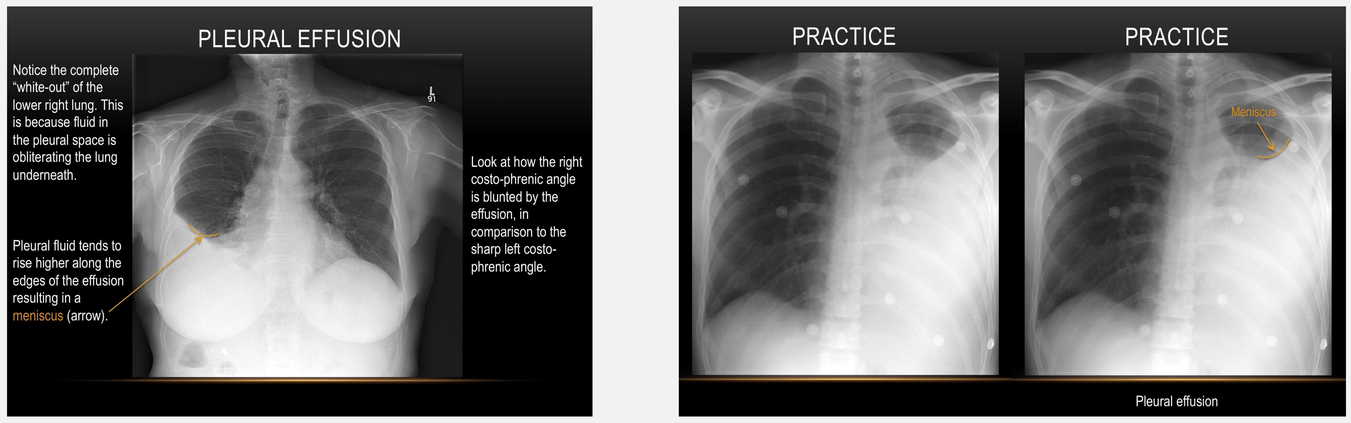
Secondary outcomes:
- completion time
- module difficulty

Figure 1: CXR categories



Results

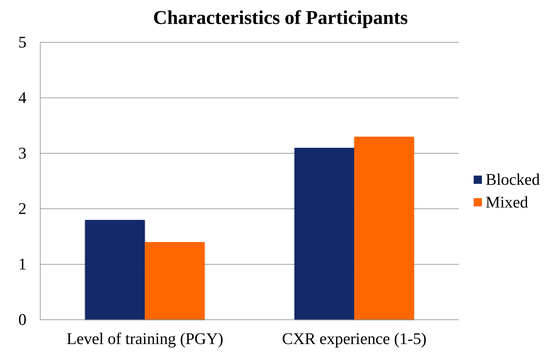
Figure 2: Example of a teaching slide and corresponding practice slides

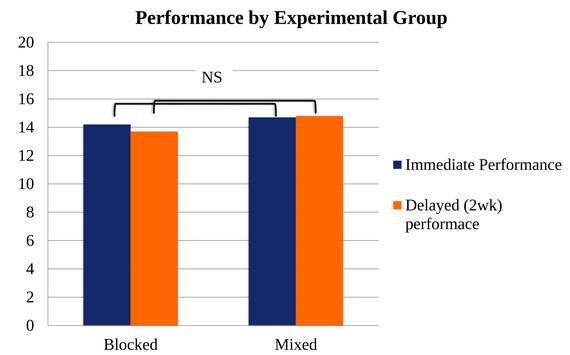


44 internal medicine residents participated: 21 in the blocked and 23 in the mixed group. 33 residents completed follow-up at 2 weeks: 17 in the blocked and 16 in the mixed group. Level of training was modestly higher in the blocked group (1.8 vs. 1.4; p = 0.05), but CXR experience was similar between groups (3.1/5 vs. 3.3/5; p = 0.2).

PRIMARY OUTCOME:
We found no significant difference in mean diagnostic accuracy between the blocked and mixed groups on immediate testing (14.2 vs. 14.7/20; p = 0.5). The difference in mean diagnostic accuracy scores remained non-significant on testing at 2-weeks follow-up (13.7 vs. 14.8/20; p = 0.16).

SECONDARY OUTCOMES:
Reported module difficulty was similar between blocked (5.0/9) and mixed (5.2/9) groups. Post-test scores and level of training showed no correlation (R = -0.02; p = NS). Similarly, there was no correlation between post-test scores and module completion time (R = -.05; p = NS).





Conclusion

Mixed practice was similar to blocked practice in improving performance on CXR interpretation for internal medicine residents.

Similar performance on CXR interpretation between groups suggests that even at the resident level, mixed practice may produce cognitive overload from contrasting numerous elements simultaneously.

Alternatively, two-week data may indicate a small benefit from mixed practice, which this study was underpowered to detect.

References
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