

Medical Students' Reflections on Case-based Problem-solving: Tracking Progress and Exploring Connections Between Metacognitive Engagement and Performance on Block Exams and Case-based Instruction scores

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Introduction

Reflection in and on the practice of medicine is an important tool for professional practice that may be cultivated in medical students through repeated practice¹.

The UA College of Medicine uses a structured, five step approach to medical problem-solving (*frame the problem; hypothesize with articulated rationales; strategize; narrow diagnoses; and reflect*) that intends to promote student reflection on cases before, during and after they participate in facilitated sessions with a small group (7-9) of peers. Students use an online tool to articulate their thinking for each step and receive additional case information after step 2 (complete patient history) and Step 3 (results of the physical exam).

At the close of each session, students submit written individual reflections using the online tool addressing possible error, challenges and strategies for overcoming them and any other relevant issues.

Research Questions

1) How do medical students' post-case reflections demonstrate metacognitive engagement in medical problem-solving? How are these various types of thinking related?

2) Do metacognitive/reflective behaviors correlate to student performance on block examinations?

Methods

Grounded theory² guided a systematic, qualitative analysis of students' post-case reflections³. Thematic coding and categories of thinking was based upon two primary dimensions of metacognition (knowledge and regulation of cognition),⁴ and Bloom's revised taxonomy^{1,4}.

We identified verbs and prepositions that would indicate both awareness of thinking (knowledge) and regulation of thinking, such as comparative analysis, self-assessment or synthesis of what is learned to offer self-advice. Coded instances were quantified for frequency of occurrence per post-case reflection for an entire class (n=113).

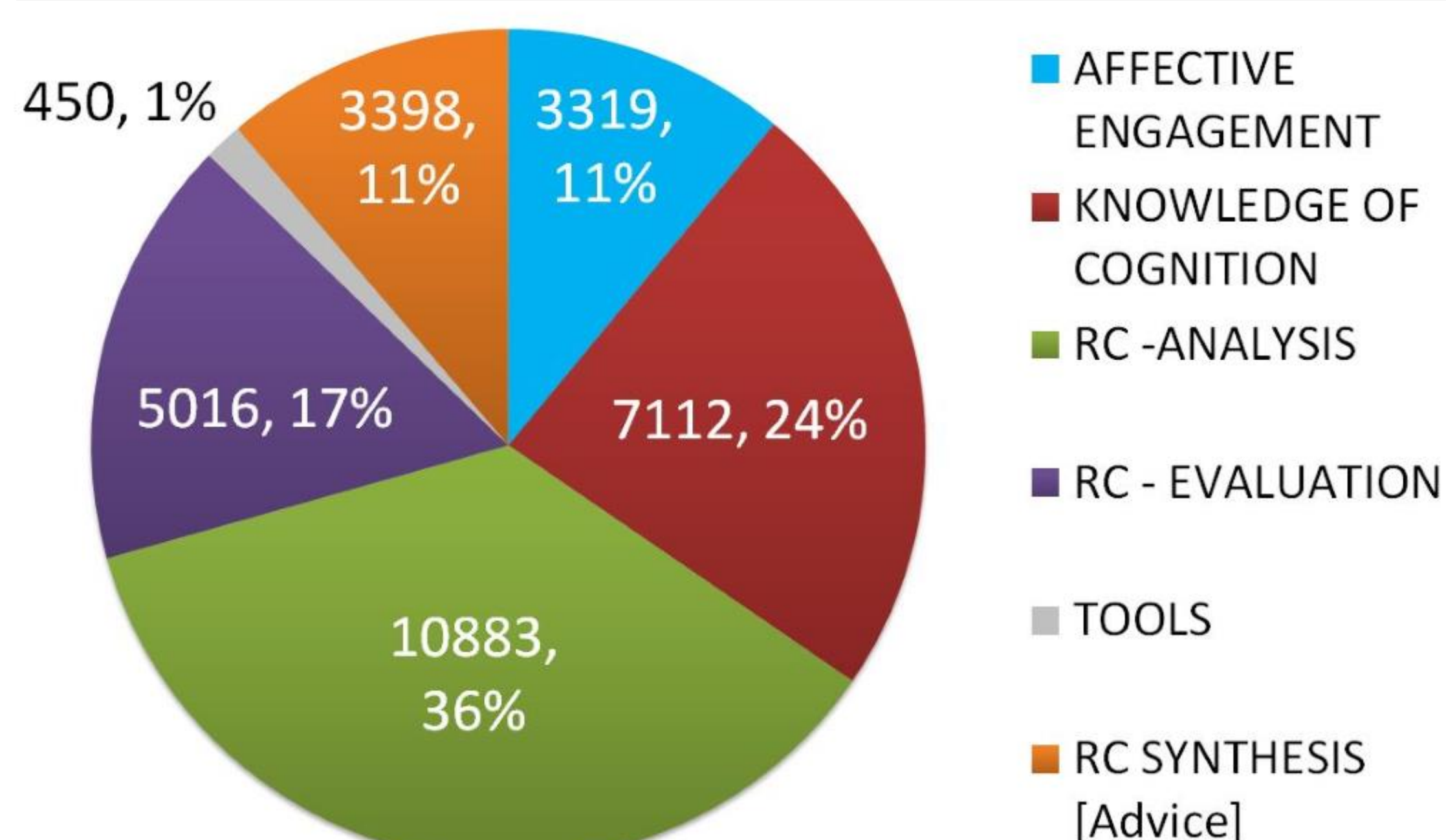
Statistical analysis included three blocks from year 1 and 2 from year 2.

We examined correlations among types of metacognitive engagement as well as student performance on block examinations and CBI scores are in process.

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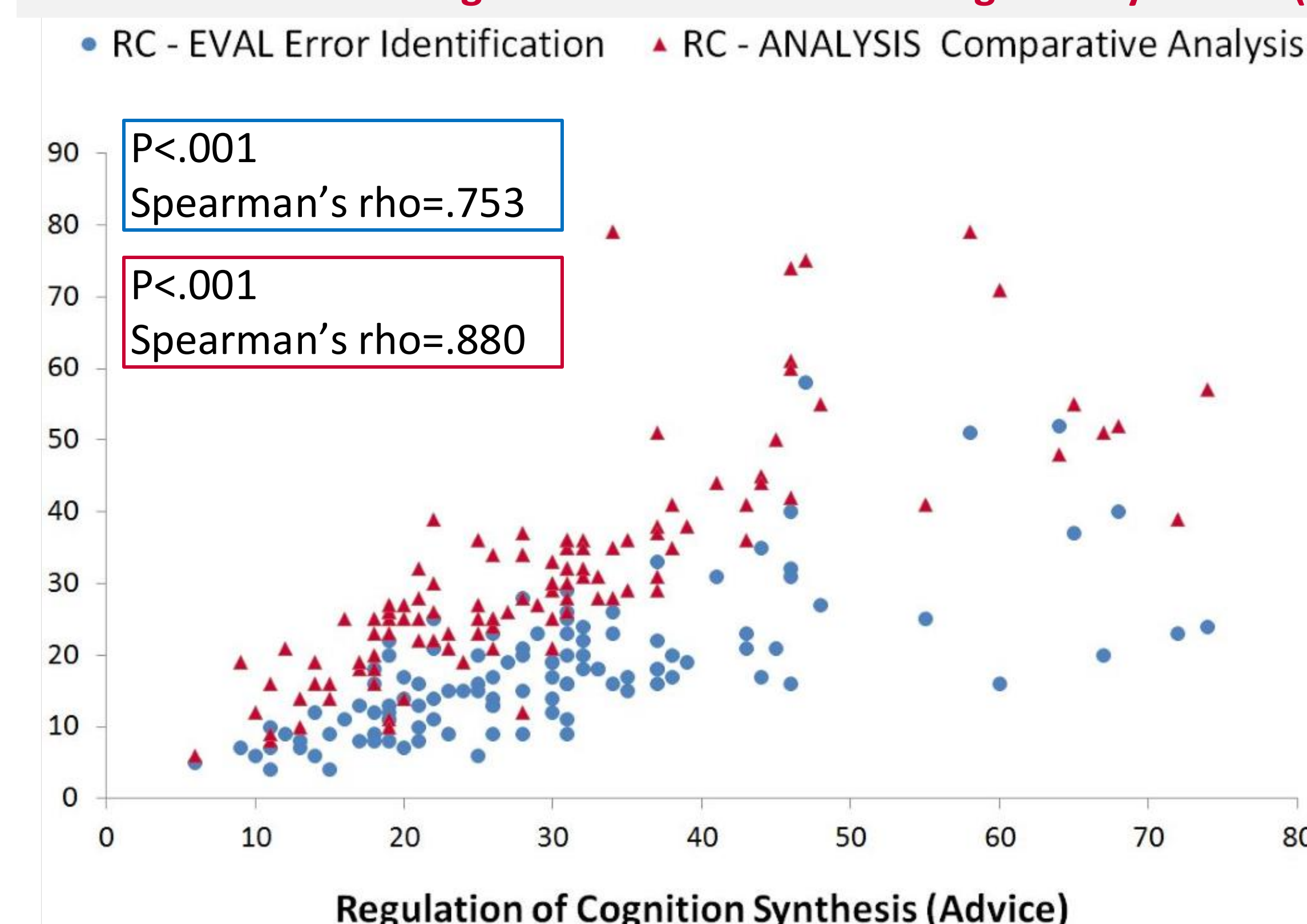
Results

Relative Frequency of Categories of Reflective Thinking [n=113 students]



*RC = Regulation of Cognition

Correlation of Sub-categories of Reflective Thinking with Synthesis (Self-advice) [n=113 students]



Sample Post-case Reflections

- [Year 1, Foundations] I felt that the structure of [the online tool] really helped me lay out my thought process in a very systematic way. **Reviewing classmates' hypotheses, and researching the diseases they hypothesized, really assisted in my learning** of a larger variety of disease than class discussion has previously done. Personally reading about the individual diseases revealed more details allowing me to better rule out diagnoses and better see how things relate to each other. I feel like this really helped my process of coming to a more precise diagnosis. **A problem I realized** in constructing my own hypothesis after reviewing my classmates' responses was **that I initially allowed myself to narrow down my diagnosis before being presented with many facts. Next case I will emphasize starting far more broad in my initial thought process.**
- [Year 1, Musculoskeletal] This was an interesting case for me. **There was a lot going on and it was difficult at first to decide what diseases would cause what symptoms for her.** For instance, she has osteoporosis but **something is causing that and what could it really be?** And then it became that osteomalacia was causing the osteoporosis **but what was causing this condition?** That is where I got stuck and didn't continue and wish I did continue. **In the future, I need to think about what underlying cause would be contributing to these symptoms. ... [I] did not even think that there was another single main thing that was doing it.**
- [Year 2, Infection & Immunity] **Wow, I totally went down the wrong path on this one. This was the hardest CBI for me in any block to date.** For one thing, I didn't see the "mild nuchal rigidity" on physical exam (should've read more carefully!), so I ruled out meningitis when I should've still been considering it. I also **didn't realize how much CLL could affect the serological tests** - while I knew that CLL would cause low B cell function and thus less antibody production, **I didn't make the connection** that this would result in apparently negative serological tests which could actually be positive. ... This was a very complex case and **in complex cases in the future, I need to do a better job of making the connection between patients' medical conditions and how they would affect the test results. ...**

Discussion

Although post-cases reflections are written in the last few minutes of small group sessions, participants reflected meaningfully on case-based medical problem-solving during preclinical years, and exhibited a wide variety of types of thinking along the dimensions of knowledge and regulation of cognition.

Frequency of comments on the online tool between the first and second semester blocks declined, showing quick uptake of the online tool for a structured approach to medical problem-solving.

Self-advice for approaching future cases is highly correlated with engagement in comparative analysis of ideas, error analysis and identification.

Mixed methods approach to exploring the types of metacognitive engagement in post-case reflections enabled us to determine the types of thinking pertinent to self-regulation in the form of giving advice for improving their approach to future medical problem-solving.

While it is difficult to teach students how to give themselves advice, this study shows that any instructional approach to teaching clinical reasoning should incorporate methods and tools that encourage a systematic or structured approach, articulation of reasoning throughout the process, and development of a habit of writing post-case reflections that acknowledge error and explore decision-making.

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