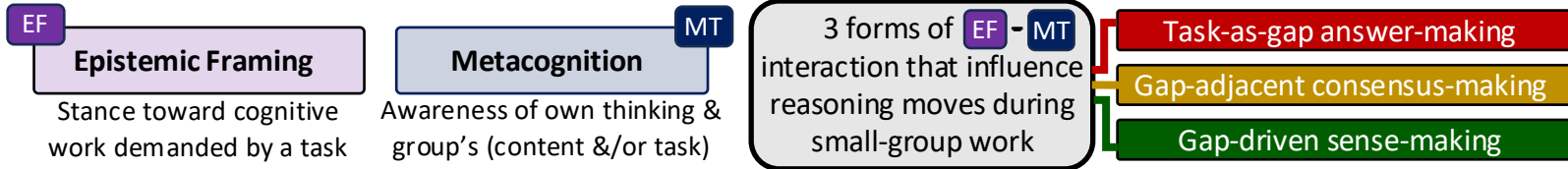


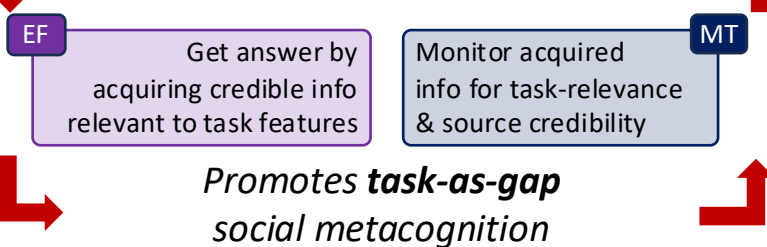
Metacognition and epistemic framing interact to shape biology reasoning moves

#2400797 Investigating How Students Develop Principle-Based Reasoning in Undergraduate Physiology: Mechanisms for Conceptual Change



A Answer-makers monitor information credibility & relevance to task, outsourcing reasoning

Promotes **answer-making** via matching credible info to task

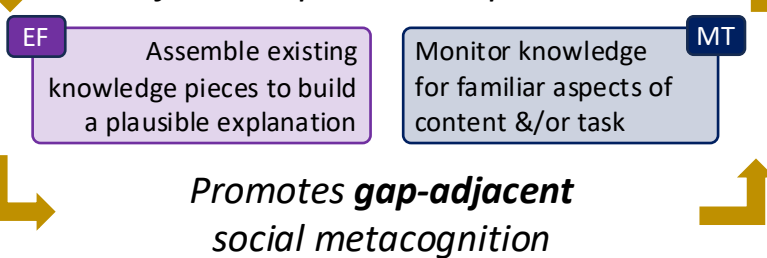


- S1 Maybe the O₂ helps them get back in the game faster?
- S2 Remember the study guide? It said hemoglobin... What do we do with that?
- S3 Would an athlete have wider arteries?
- S1 That's probably something, right?
- S3 I don't know.
- S1 Let's look it up, plus we'll go over it soon.



B Consensus-makers monitor content & task understanding but not gaps, constraining reasoning

Promotes **consensus-making** via familiar, plausible explanations

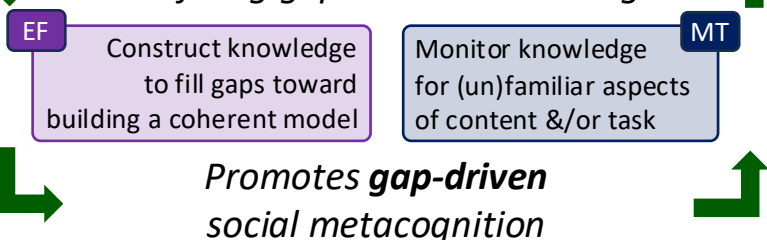


- S4 Air is not 100% O₂, but oxygen masks are pure O₂.
- S5 There's no resistance if it's 100% O₂.
- S4 What? It's beneficial because it's 100% O₂.
- S6 But, does it make sense at sea level?
- S5 What is 100% O₂ actually doing?
- S4 It's 100%, so your pO₂ will increase.
- S5 I guess it should help them recover faster...

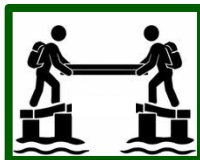


C Sense-makers monitor content & task understanding including gaps, sustaining reasoning

Promotes **sense-making** via filling gaps in understanding



- S7 Wait, let's think about what's affected.
- S8 Yeah, this is a flux question, right?
- S7 I think resistance is affected.
- S8 Flux is gradient over resistance. Pneumonia increases resistance because the O₂ must travel farther. Increasing the gradient will even out the resistance.
- S7 Yes, and pneumonia has no other direct effects on flux.



Scaffolding content & metacognition alone is not enough. Epistemic frames shape metacognitive moves. Context-sensitivity of epistemic frames creates scaffolding opportunities.

Methods:

Qualitative

Longitudinal

- Microgenetic analysis of group work recordings, homework, and exams from 24 bio students in 6 groups
- Think-aloud interviews at start, middle, end of course

Challenge Overcome:

Analysis

Large-scale analysis of cognitive & epistemic resources and their interaction across flux learning contexts, advancing learning theories in biology.