How People Learn: Implications for Health Sciences Education

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Science of Learning

Learning is an active, constructive process

(Chi, 2009; Freeman et al., 2014)

Prior knowledge shapes learning

(Bransford et al., 2000)

Context and transfer are key

(Barnett & Ceci, 2002; Perkins & Salomon, 1992)

Deliberate practice matters

(Ericsson et al., 1993)

Feedback guides improvement

(Hattie & Timperley, 2007; Shute, 2008)

Attention and engagement are essential

(Sweller et al., 2019)

Self-Regulated Learning

(for a review, see Kim et al., 2023)

Metacognition

(Flavell, 1979; Dunlosky & Metcalfe, 2009)

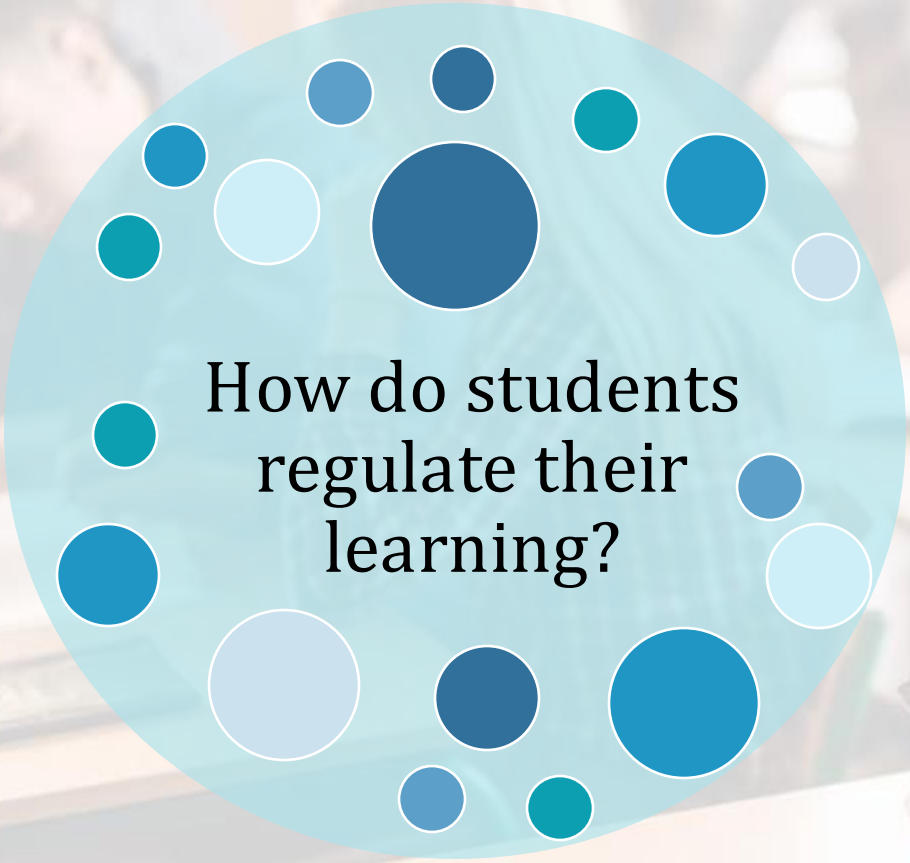
Motivation and beliefs

(Eccles & Wigfield, 2002)

Social and emotional factors

(Pekrun & Linnenbrink-Garcia, 2014)

Central Questions



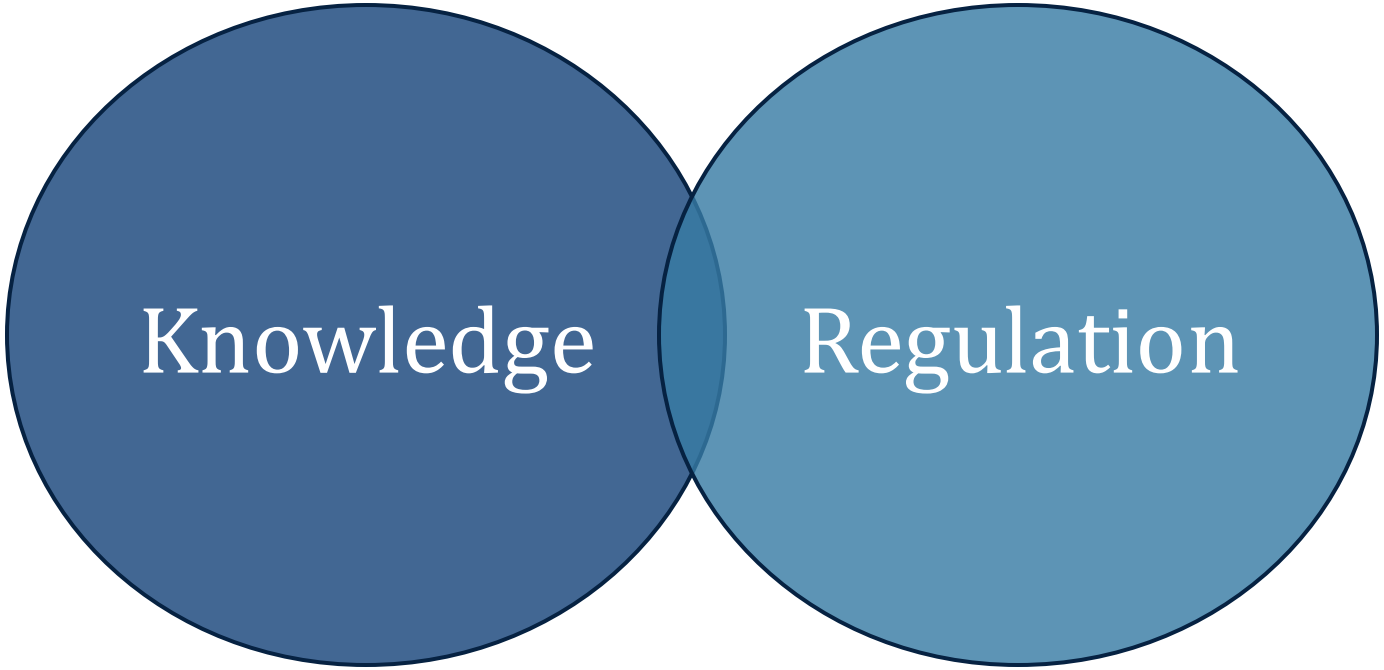
How can we support students to effectively regulate their learning?

How can we do so equitably and inclusively?

Metacognition

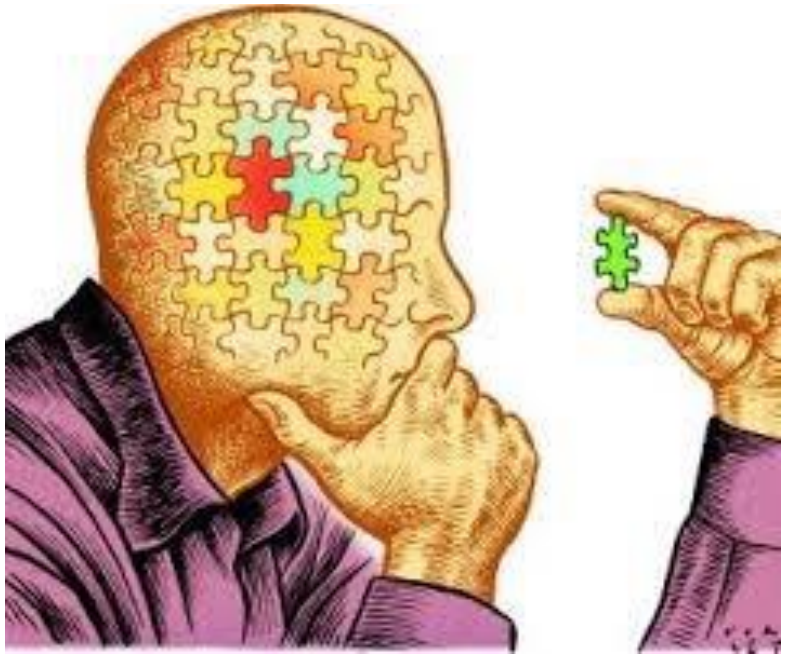
"Thinking about thinking"

"Knowledge and regulation of one's thinking"



(Brown, 1987; Flavell, 1979; Schraw & Moshman, 1995)

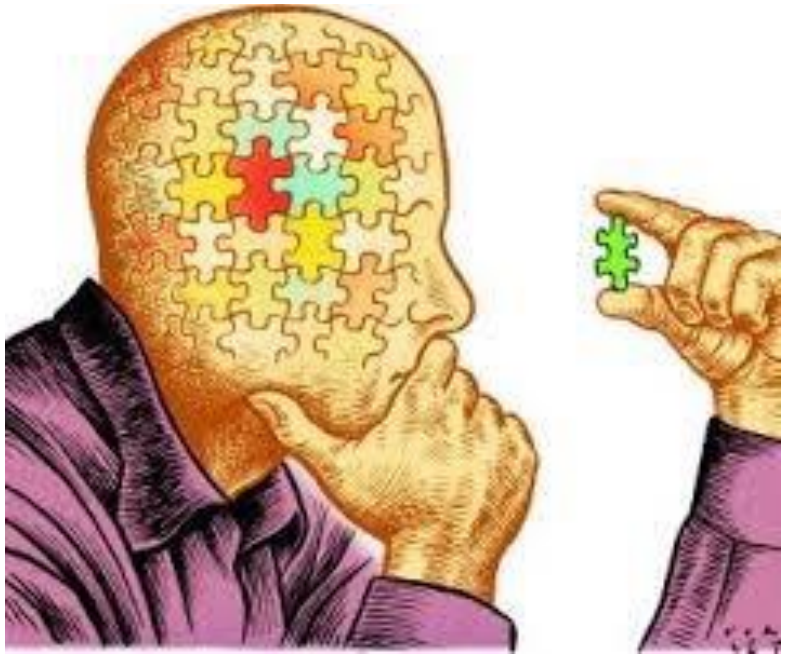
Metacognitive Knowledge



1. Declarative – “What”
2. Procedural – “How”
3. Conditional – “When and Why”

(Schraw & Moshman, 1995)

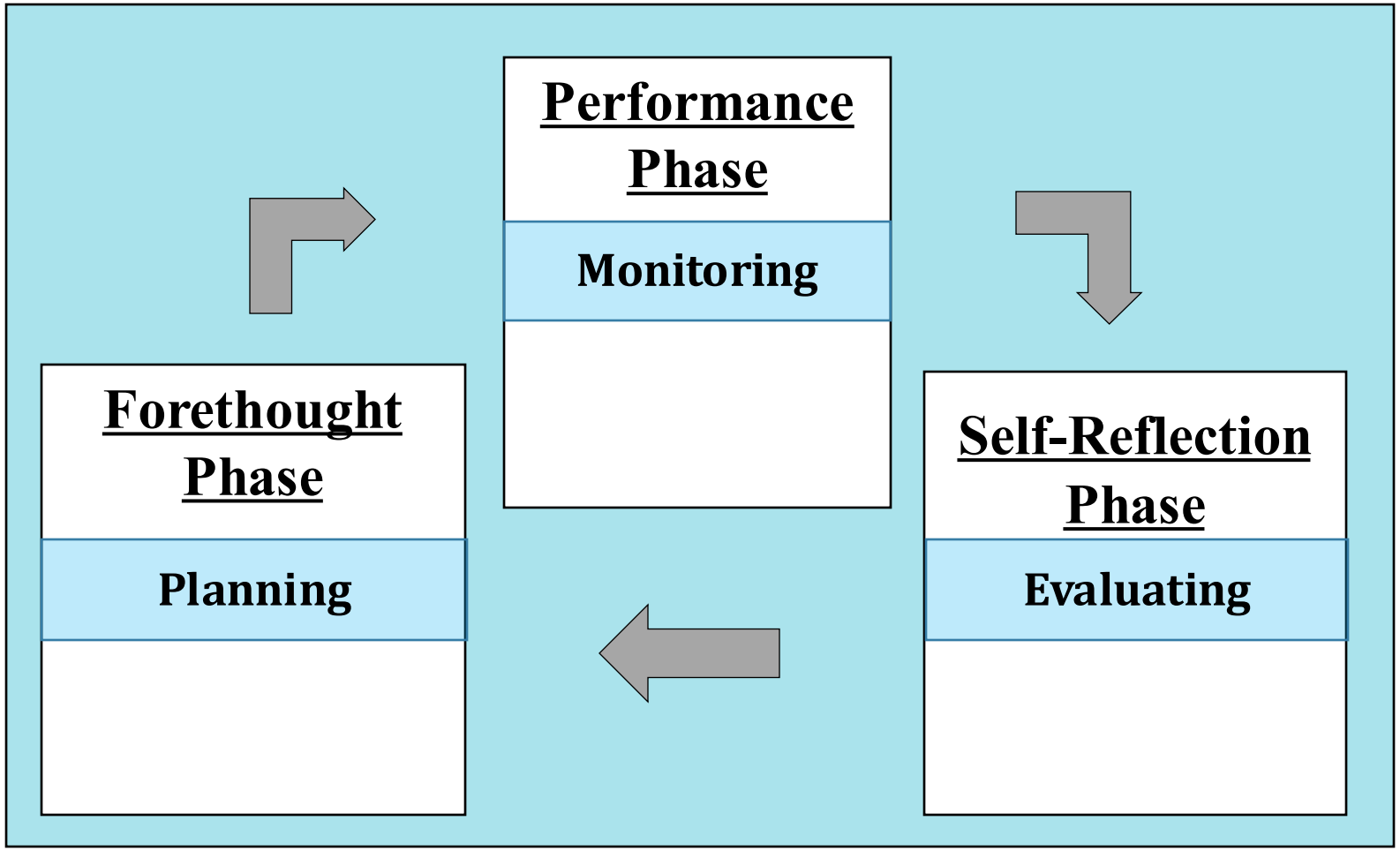
Metacognitive Regulation



1. Planning – setting goals, selecting strategies, and organizing before the task
2. Monitoring – checking one's understanding and progress throughout the task
3. Evaluating – reflecting after the task to determining effectiveness of strategies, understanding, and performance

(Brown, 1987; Flavell, 1979; Schraw & Moshman, 1995)

Self-Regulated Learning



Metacognitive Study Strategies

Do students use effective learning/study strategies?

How do we support them to use effective strategies?

How do students think they study?

Metacognitive Study Strategies

Research has identified several effective learning/study strategies (Dunlosky et al., 2013)

- Retrieval practice, self-explanation, comparison, spaced practice

But! Students have "metacognitive illusions" and inaccurate "metacognitive judgments" about strategy effectiveness (McCabe, 2011)

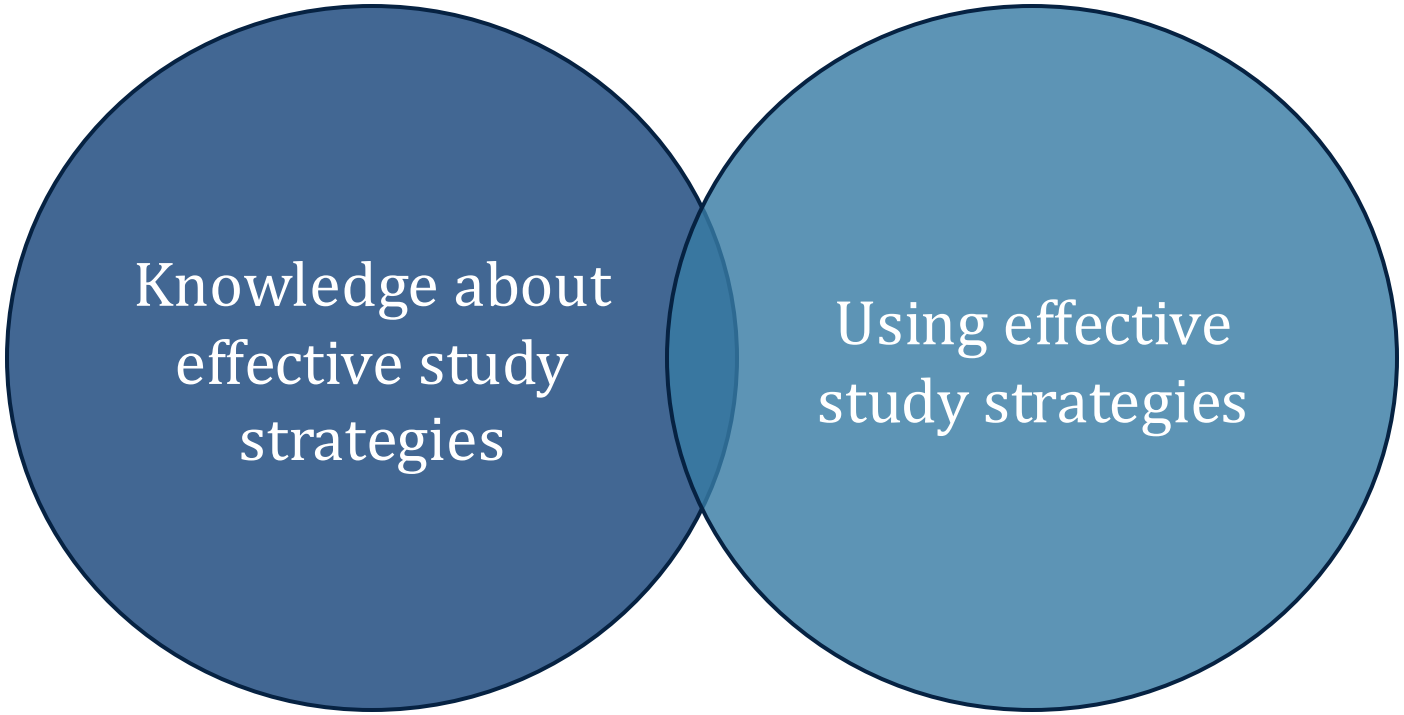
Metacognitive Study Strategies

Students also tend to use more ineffective strategies (e.g., Hartwig & Dunlosky, 2012)

- Highlighting, rewriting notes, rereading

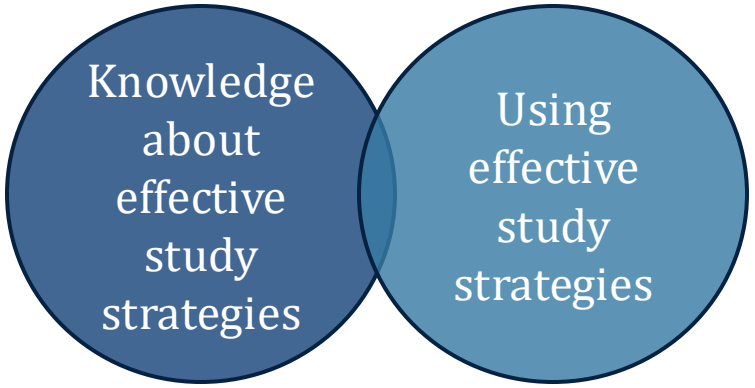
Why? Because they feel more fluent than effective strategies. Effective strategies feel more difficult and the benefits aren't immediately clear (McCabe, 2011)

Metacognitive Study Strategies



"Desirable Difficulties"

(Bjork, 1994)



Supporting Students to be more Effective

- The tell them approach (Dignath & Büttner, 2008; Donker et al., 2014; Kirk-Johnson et al. 2019; Zepeda et al. , 2020)
  - Often increases knowledge, but not sustainable
  - Need sustained training and reasons why it is beneficial
  - Seems to be less effective at the college level
  - Knowing is one thing, but being motivated to do it is another

- Embedding strategies into course structures (Agarwal et al., 2012)
  - Low-stakes quizzes (spaced retrieval practice)
  - Retrieval prompts

In Health Sciences Contexts – How can we support metacognition?

- Tell them what metacognition is! And why it is important

- Modeling and integrating into practices
  - Plans before clinical rotations/interactions with patients
    - Examples of what it can look like
    - Explicit that they are required
    - Feedback on what can make them better

In Health Sciences Contexts – How can we support metacognition?

- Modeling and integrating into practices
  - Support through your prompts/ discussions

"What are you unsure of how to do?"

"Why did you make that decision?"

"What was confusing or difficult about today's lesson?"

"What did you learn today/yesterday?"

"What could you have done differently?"

"What would you do differently next time?"

In Health Sciences Contexts - How can we support metacognition?

- Diagnostic error debriefs
  - E.g., case-based discussions to highlight how their reasoning led to errors
- Reflective practices
  - E.g., journaling
- Peer teaching
  - E.g., collaborative activities, skills training
- Pause and predict exercises
- Structured feedback
  - E.g., learner self-assesses and then the educator provides feedback to increase calibration

In Health Sciences Contexts – How can we support metacognition?

- Reflection Practices integrated into Simulations

Transforming Experiences into Expertise: Leveraging Event Cognition to Support Self-Regulation in a Practical Learning System

Maddie Lee Mason, PhD
Postdoctoral Fellow
2025 NLN Emerging Nursing Scholar Award

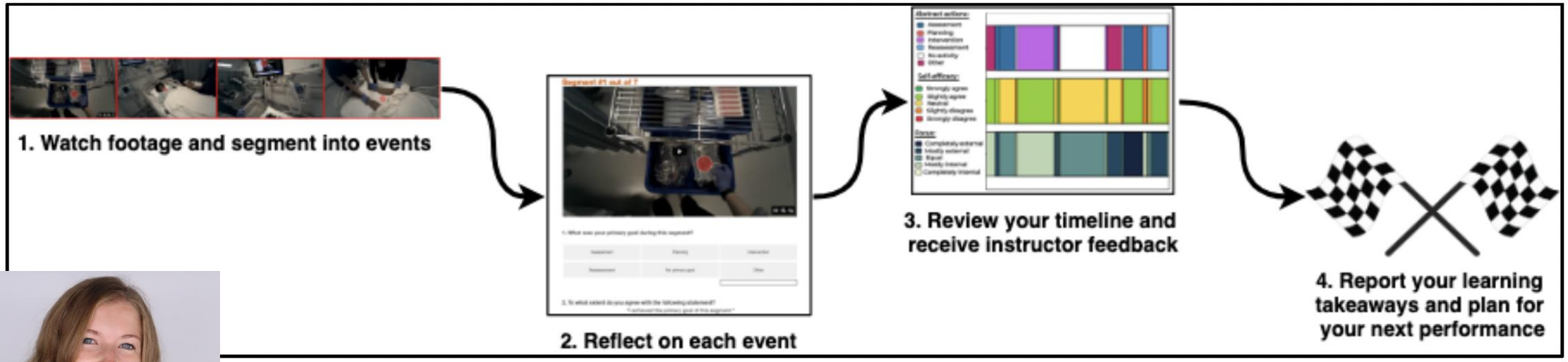
Developed a **personalized guided-reflection tool** to be used **after clinical simulations**, intended to complement (not replace) standard debriefs in nursing education

Improved nursing students' confidence and metacognitive judgment accuracy

Work is ongoing and collaborative with folks at the nursing school

What did the Reflect System do?

Provide a structured, personalized reflection experience



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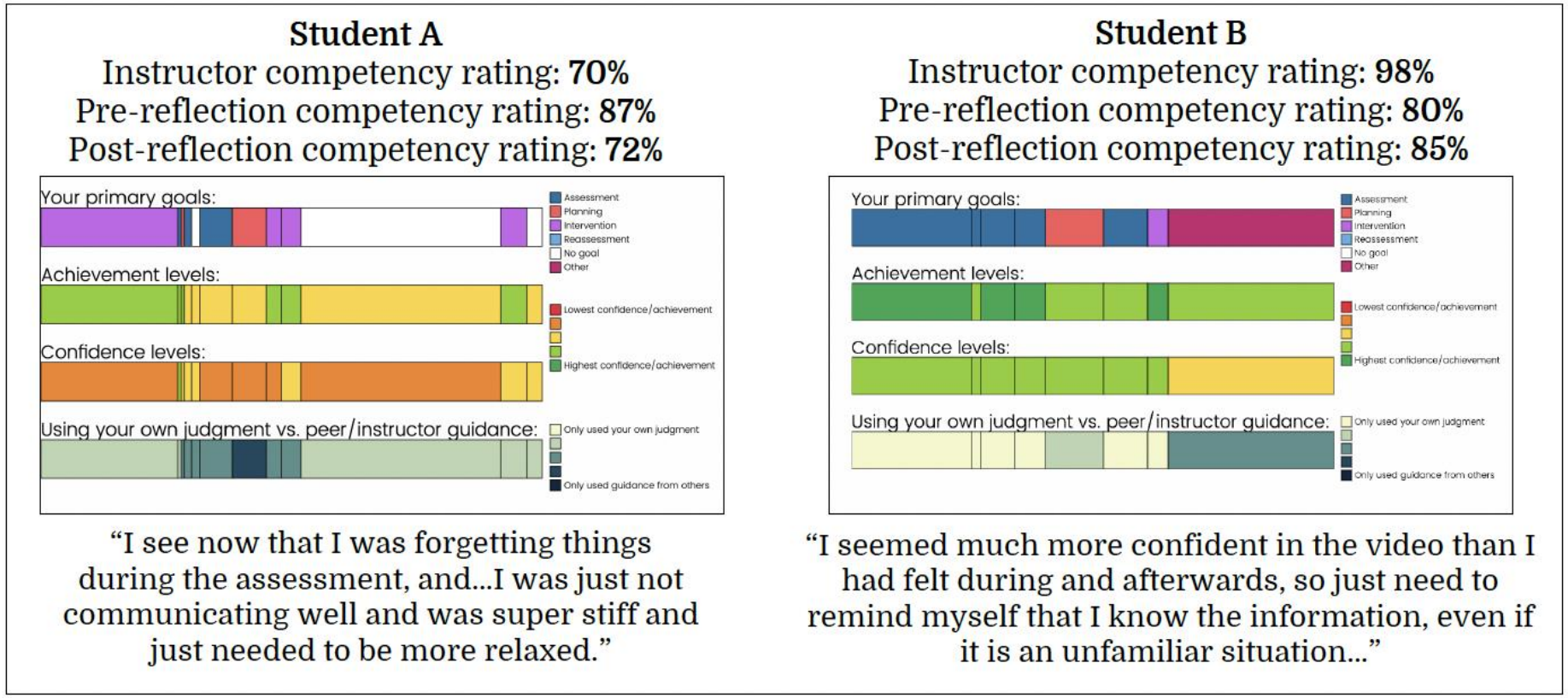

Figure 23. Illustrative examples of the impact the Reflect System had on metacognitive judgment

Maddie Lee Mason, PhD
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2025 NLN Emerging Nursing Scholar Award

Capturing Metacognition

THINK ALOUDS

SELF-REPORTS

OBSERVATIONS

LEARNING ANALYTICS

Capturing Metacognition

THINK ALOUDS

Having them say everything they are thinking as the complete a task

Probing them to say what they are thinking during particular points of an activity

Allows you to see their thoughts and logic, challenging to do at scale

Capturing Metacognition

SELF-REPORTS

Have them respond to a validated scale (general use, use for problem-solving tasks)

Ask an open-ended question

Have them rate their confidence in how they performed a task, or how well they think they will do at a task

Give vignettes with scenarios and ask them to state their metacognitive processes (e.g., plan, tracking progress, evaluating)

Capturing Metacognition

OBSERVATIONS

Think alouds are observational

But you can also have them observe others as well as themselves

When they observe themselves, the scenarios you pick can be common places people make mistakes, a place they didn't feel good about, an error that you caught as it was happening, etc.

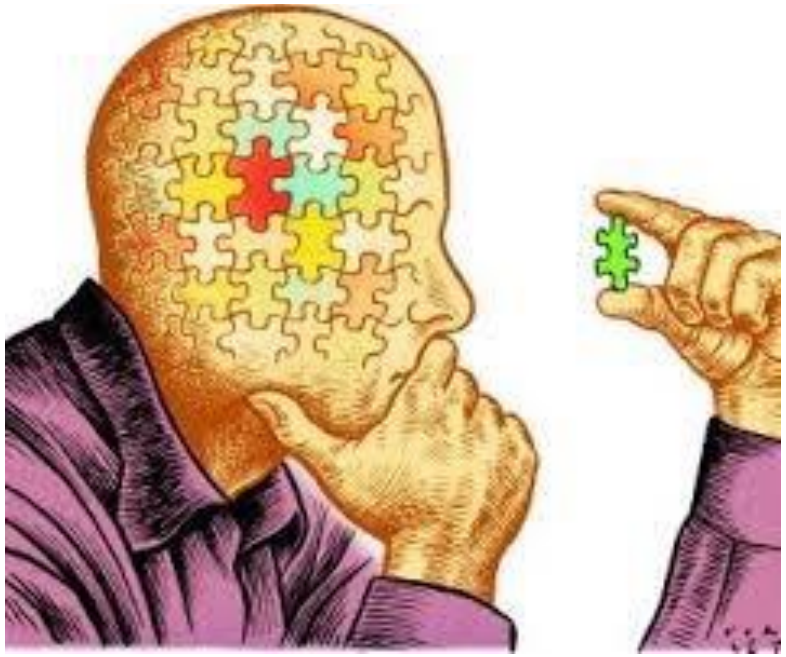
Capturing Metacognition

LEARNING ANALYTICS

Track behaviors through behavioral log data in online systems (learning management system, virtual reality exercises, simulations, training modules)

Remember though – just because someone says it captures metacognition, doesn't mean it is the right fit, you still have to evaluate it

Metacognition is just one piece of the puzzle



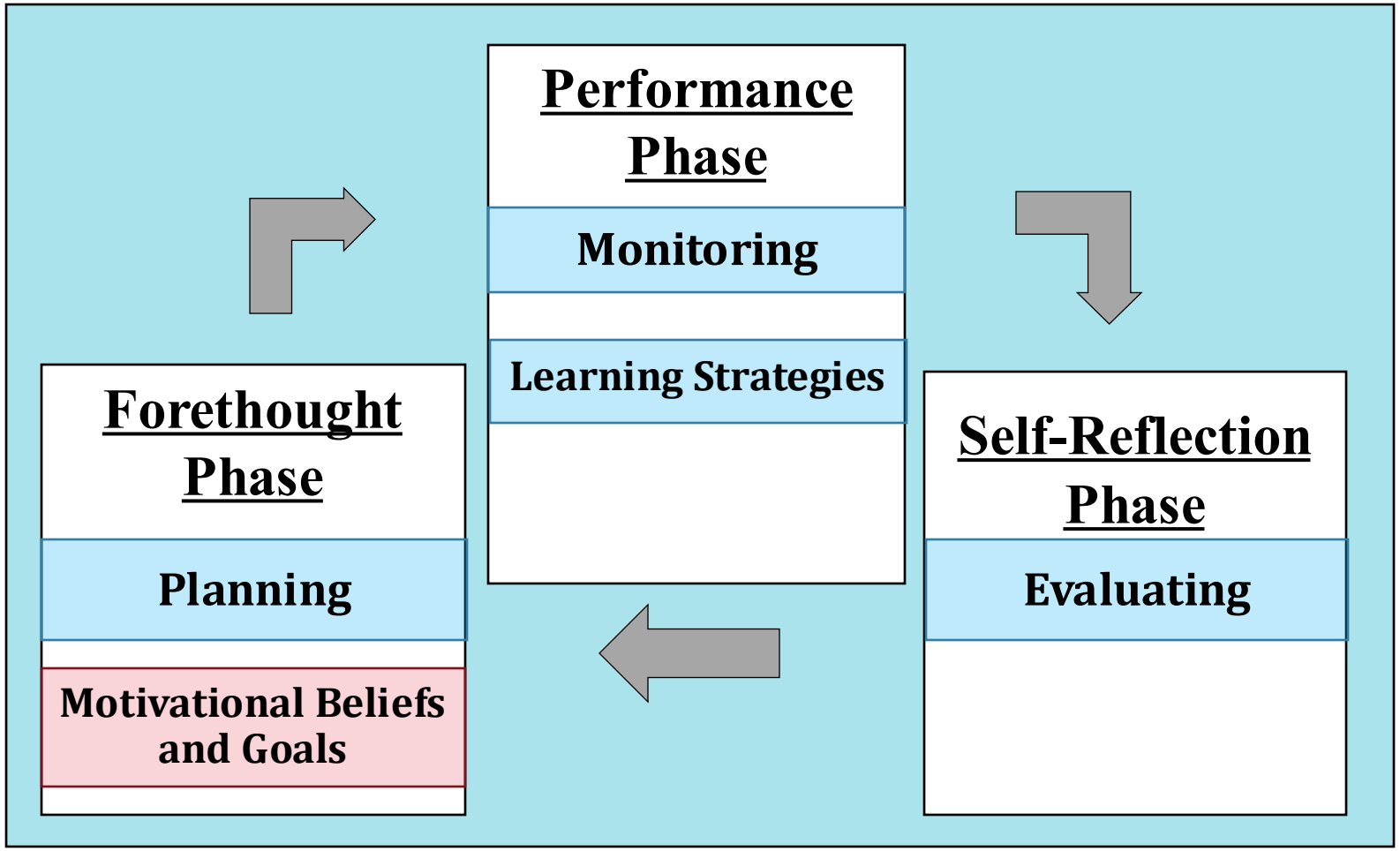
"Heads and Hearts"

"Seed and the Soil"

Motivation is another critical aspect in terms of them using effective strategies and persisting

(Theobald et al., 2020; Walton & Yeager, 2020)

Self-Regulated Learning



Five Areas of Motivation Research

FIND VALUE

REDUCE COST

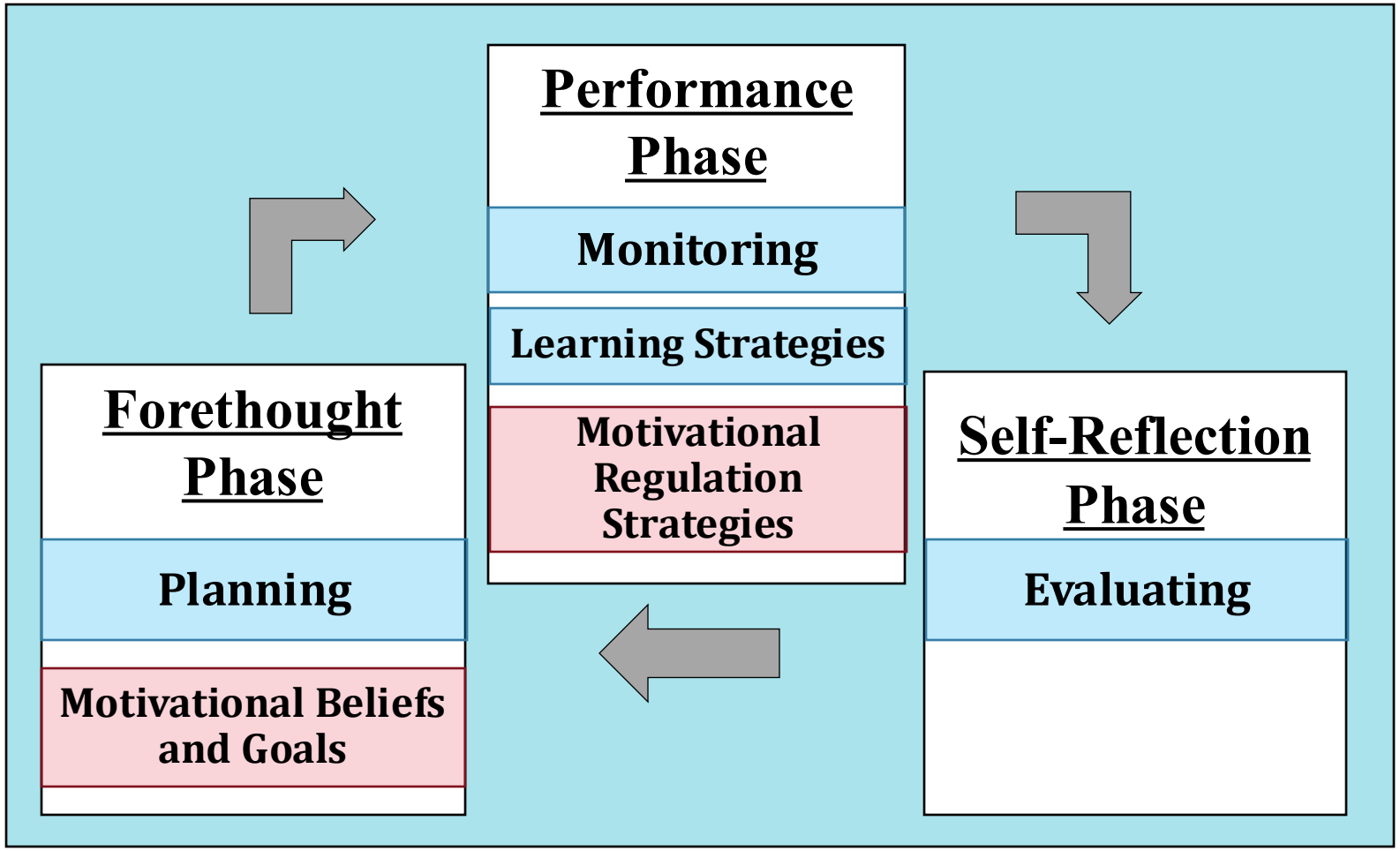
RE-FRAME APPRAISALS & ATTRIBUTIONS

CREATE APPROPRIATE CHALLENGES

PROVIDE CHOICE

Zepeda et al. (2020)

Self-Regulated Learning



Motivational Learning Strategies

Mastery-approach self-talk

"I persuade myself to work hard just for the sake of learning"

Performance-approach self-talk

"I try to make myself work harder by thinking about getting good grades"

Utility-value self-talk

"I tell myself that it will help me reach my career goals "

Self-consequating

"I make a deal with myself that if I get a certain amount of work done, I can do something fun afterwards"

Proximal goal setting

"I break down the workload in small segments so I get the feeling that I can handle it more easily"

Interest enhancement

"I think of a way to make the work seem more interesting"

(Schwinger, Laden, & Spinath, 2007; Wolters, 1999; 2003)

If that isn't complicated enough, let's add in AI…

Studies are still coming out on what the implications mean of having access to large language models

Metacognition is even more critical and being able to evaluate the information for accuracy

But, it also has advantages – adaptive learning, learning analytics, virtual learning/practice

Takeaways

- Students regulate their learning through various strategies that can work together

- As educators we can support the use of these strategies in how we structure our courses and interactions – types of activities, feedback, and assessments

Takeaways

Medicine's complexity demands **adaptive expertise** (Hatano & Inagaki, 1986), not rote recall

Metacognition is the **engine of adaptive expertise** and motivation **sustains it** — essential for lifelong learning, reflective practice, and reducing errors

As educators, we should teach *how to learn*, not just *what to know*

Food for Thought

Remember to consider individual differences

- Consider the societal pressures, expectations, and responsibilities of an individual
- Consider the prior experiences or lack thereof

❖ Illusions of knowing: fluency, familiarity, and ease mislead judgments (Bjork et al., 2013)
❖ Cognitive load and stress: reduces monitoring capacity (van Merriënboer & Sweller, 2010)
❖ Feedback deficits: learners often receive outcome feedback, not process feedback
❖ Cultural barriers: "confidence as competence" norms discourage uncertainty and reflection

Thank you!

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