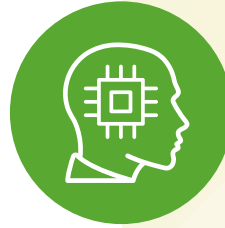


## Learning Science Metacognition

Do You Know What You Think You Know?



lecturio   
www.lecturio.com

### The Learning Science team

is pleased to share this summary information from our recent seminar “**Metacognition: Do You Know What You Think You Know**” with our international educator community. We hope that by reading this material you will be inspired and better equipped to implement these helpful learning methods into your teaching practices.



*Peter Horneffer, M.D.*

Peter Horneffer, M.D.  
Director of Medical Education  
Programs at Lecturio Inc.

### What is Metacognition?

The term “metacognition” refers to thinking about cognition, or to the knowledge, monitoring, and evaluation of one’s thinking.



## Data

### Where do the participants of the Metacognition seminar come from?

**8.0%**

Europe

**16.0%**

South America & Caribbean

**13.0%**

Asia & Pacific

**8.0%**

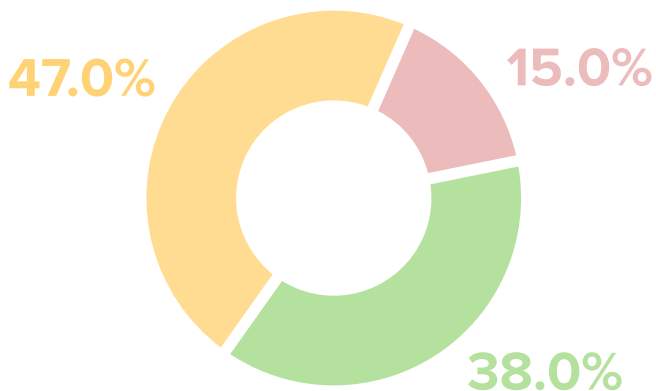
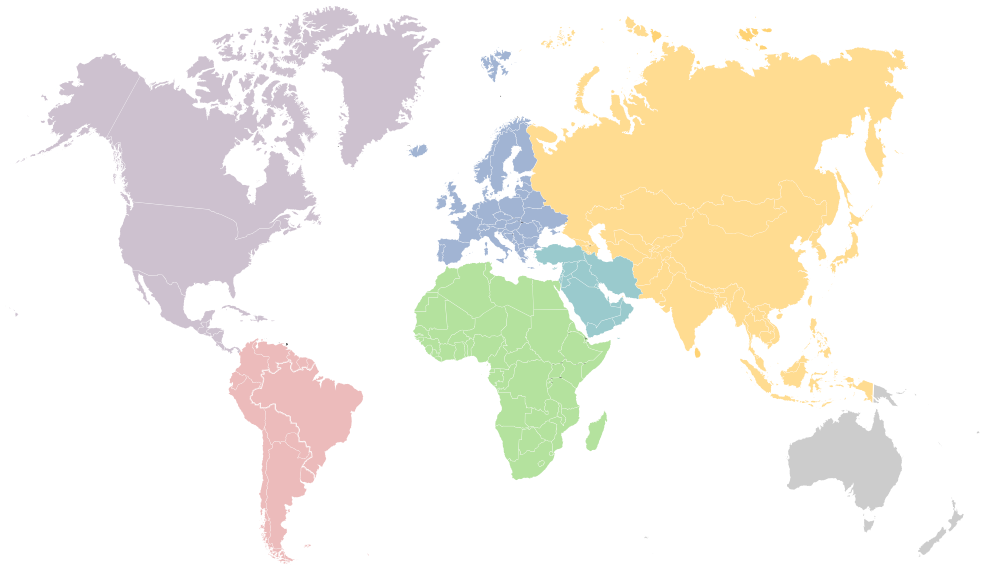
Africa

**49.0%**

North America

**6.0%**

Middle East



### Use of metacognitive strategies

At the start of the session, participants were asked if they teach their students about the importance of metacognition.

- Often
- Sometimes
- Not at all

### Types of metacognitive strategies

Participants were asked to share what types of metacognitive activities they used in their courses.

Other strategies and activities participants reported using included the use of LMS and course data to identify and mentor struggling students, the use of problem-based and case-based learning (which have been shown to increase metacognition in medical students), recall of previously learned material, goal setting, and self/peer quizzing.

(Source: survey and padlet)

**17.0%** Graphic organizers

**20.0%** Personalized learning plans

**33.0%** Reflection

**20.0%** Think Alouds

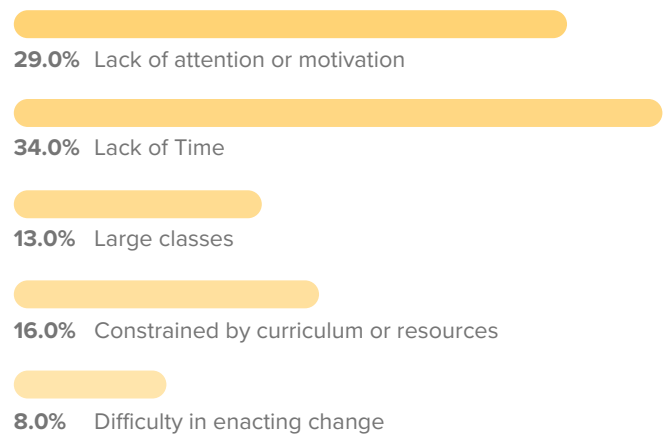
**10.0%** Other

## Difficulties in incorporating metacognitive strategies

We asked participants what difficulties they face when implementing metacognitive strategies in their own courses.

The most common difficulty cited was time, class time or time to prepare. Some felt it was too difficult to get students to pay attention or stay motivated without a grade or assessment. Others felt constrained by a high student-faculty ratio, curriculum demands, lack of resources, or general difficulty in enacting change.

(Source: survey)



## Resources

### Seminars

- [Online seminar library for health professions educators](#) ►
- [Educational webinars for health professions students](#) ►



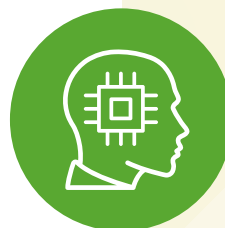
[Lecturio platform demo request](#) ►

### Articles

- [Metacognition: Do you really know what you think you know?](#) ►
- [Active Learning: Augmenting Student Engagement and Understanding](#) ►
- [Retrieval-Based Learning Strategies in Medical Education](#) ►

Learning Science

# Metacognition Strategies for Medical Education



lecturio   
www.lecturio.com

## METACOGNITION DOMAIN

## BRIEF DESCRIPTION

### Metacognitive Knowledge

#### One minute writing<sup>(1)</sup>

After an instructor sets a timer for one minute, students are asked to create a short essay, audio recording, or video on a topic. Students could be asked what they already know about a topic, their strengths and weaknesses, and their planned study strategies for the new topic.

#### Graphic organizers

Graphic organizers can help students identify what is known, what is not known, and help them plan learning strategies. Graphic organizers such as concept maps show relationships among multiple concepts. For example, students might diagram the relationships among normal organ function, dysfunction, clinical presentation, and diagnostic tests that can be used<sup>(2)</sup>. Creating graphic organizers has proven to alter student study habits by encouraging them to plan early and monitor their progress throughout learning<sup>(3)</sup>.

### Planning

#### Explicit learning objectives<sup>(4)</sup>

Having clear objectives help prime students for learning. It helps them plan for the topic ahead and primes them for what information is most important.

#### Create a personalized learning plan

Encourage students to make personalized learning or mastery goals. This will make learning relevant for them and studies show students who have mastery goals have increased metacognition, decreased procrastination, and increased help-seeking behaviors<sup>(4,5)</sup> over students who have performance-oriented goals.

SMART goals (specific, measurable, attainable, realistic, and timely) can help learners attain their goals<sup>(6,7)</sup>

#### Create a study plan

Students who space out their learning and practice have higher durable learning than those who do not but many students fail to plan and end up cramming at the last minute. The creation of regular study groups, study sessions, or a personalized study plan helps students regulate their learning.

#### Pre-tests

Pre-tests help learners identify important concepts that are upcoming and help them identify what they do and don't know about the new topic. Pre-tests can take the form of quizzes or generative questions.

## Monitoring

<b>Five Whys<sup>(8)</sup></b>	When presented with a problem, students challenge themselves to ask why five times. This process can challenge assumptions and reduce cognitive bias.
<b>Muddiest Point<sup>(9)</sup></b>	At the end of a lesson, students identify concepts they found difficult. They can also be asked to rank these in order of difficulty. Not only does this help students monitor their cognition, but provides feedback to educators on student progress.
<b>Think Aloud<sup>(4,10)</sup></b>	Have students reason through a case, a problem, or other scenario in pairs or small groups. Thinking aloud helps students identify any gaps in their thought processes and listening to others models different ways of thinking. Instructors can also practice thinking aloud to model expert thought processes for the students.

## Evaluating

<b>Reflection</b>	After an assessment, have students reflect on their performance and their methods for preparing <sup>(11)</sup> . Identify places where they can change their study habits. Having a post-test review session can provide immediate feedback so that students can discuss their thought processes <sup>(12)</sup> .
<b>Feedback</b>	Have students reflect on feedback given to them, whether the feedback is in the form of a grade, rubric, or performance assessment. Reflect on possible causes of overconfidence.

## Technology-enhanced Metacognition

<b>Low or no stakes quizzes</b>	Practice and feedback give students a chance to test their knowledge and make corrections before summative assessments. Giving students a chance to “calibrate” their expectations vs their performance can help reduce issues of overconfidence (poor performers) and underconfidence (high performers) as well as raise performance for both groups <sup>(13)</sup>
<b>Polling/clickers</b>	The use of polling or clickers during class can give students a non-threatening way to participate and monitor their knowledge, especially for lower to middle performing students who may be more reluctant to perform in front of peers <sup>(14)</sup>
<b>E-learning platforms and LMS<sup>(15,16)</sup></b>	Platforms and LMS can be used to gather data about student behavior and progress. Instructors can monitor the student use of spaced retrieval and interleaving which have been shown to help students improve metacognition and retain their learning. Platforms allow for consistent collection of performance data to inform educational design of future sessions.

## Some Inputs from our Webinar Breakout Rooms

<b>Self-quizzing and peer quizzing</b>	Creating quiz questions help students determine what they already know and test their knowledge. Peer quizzing can help learners in the same way as think aloud activities, by having learners share thought processes.
<b>Recall of previous material</b>	Like the one minute writing activity above, participants cited methods to recall previous material as valuable in helping students assess their metacognitive knowledge.
<b>Use of LMS and course data</b>	Some programs monitor LMS and other course data to identify students who may need additional help or mentoring
<b>Engaging in direct discussion and evaluation</b>	Some discussion participants proposed being transparent with students and explaining clearly what metacognition is and how they can regulate it in their learning. They also suggested that educators actively engage their students in self-evaluation of these techniques and discuss how it can be implemented better depending on the results of these evaluations.

## References

1. Michael J. Where's the evidence that active learning works? *Adv Physiol Educ*. 2006 Dec 1;30(4):159–67.
2. Khine. Utility of concept mapping as a tool to enhance metacognitive teaching and learning of complex concepts in undergraduate medical education [Internet]. [cited 2022 Feb 25]. Available from: <https://www.amhsjournal.org/article.asp?issn=2321-4848;year=2019;volume=7;issue=2;spage=267;epage=272;aulast=Khine>
3. Chen W, Allen C. Concept Mapping: Providing Assessment of, for, and as Learning. *Med Sci Educ* [Internet]. 2017 Jun [cited 2022 Feb 25];27(2):149–53. Available from: <http://link.springer.com/10.1007/s40670-016-0365-1>
4. Medina MS, Castleberry AN, Persky AM. Strategies for Improving Learner Metacognition in Health Professional Education. *Am J Pharm Educ* [Internet]. 2017 May 1 [cited 2022 Feb 10];81(4). Available from: <https://www.ajpe.org/content/81/4/78>
5. Artino ARJ, Dong T, DeZee KJ, Gilliland WR, Waechter DM, Cruess D, et al. Achievement Goal Structures and Self-Regulated Learning: Relationships and Changes in Medical School. *Acad Med* [Internet]. 2012 Oct [cited 2022 Feb 10];87(10):1375–81. Available from: [https://journals.lww.com/academicmedicine/Fulltext/2012/10000/Achievement\\_Goal\\_Structures\\_and\\_Self\\_Regulated.20.aspx](https://journals.lww.com/academicmedicine/Fulltext/2012/10000/Achievement_Goal_Structures_and_Self_Regulated.20.aspx)
6. Reed VA, Schifferdecker KE, Turco MG. Motivating Learning and Assessing Outcomes in Continuing Medical Education Using a Personal Learning Plan. *J Contin Educ Health Prof* [Internet]. 2012 [cited 2022 Feb 23];32(4):287–94. Available from: <https://journals.lww.com/00005141-201232040-00009>
7. Lawlor KB. Smart Goals: How the Application of Smart Goals can Contribute to Achievement of Student Learning Outcomes. *Dev Bus Simul Exp Learn Proc Annu ABSEL Conf* [Internet]. 2012 [cited 2022 Feb 23];39. Available from: <https://journals.tdl.org/absel/index.php/absel/article/view/90>
8. Colbert CY, Graham L, West C, White BA, Arroliga AC, Myers JD, et al. Teaching Metacognitive Skills: Helping Your Physician Trainees in the Quest to 'Know What They Don't Know.' *Am J Med* [Internet]. 2015 Mar [cited 2022 Feb 21];128(3):318–24. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0002934314009723>
9. Carberry A, Krause S, Ankeny C, Waters C. "Unmuddying" course content using muddiest point reflections. In: 2013 IEEE Frontiers in Education Conference (FIE). 2013. p. 937–42.
10. Tanner KD. Promoting Student Metacognition. *CBE—Life Sci Educ* [Internet]. 2012 Jun 1 [cited 2022 Feb 10];11(2):113–20. Available from: <https://www.lifescied.org/doi/10.1187/cbe.12-03-0033>
11. Liao J, Kunberger T, Papkov GI, Badir A, O'Neill R, Nguyen LD. Exam Wrappers, Reflection, and Student Performance in Engineering Mechanics. In 2018 [cited 2022 Feb 23]. Available from: <https://peer.asee.org/exam-wrappers-reflection-and-student-performance-in-engineering-mechanics>
12. Poorman SG, Mastorovich ML. Using Metacognitive Strategies to Help Students Learn in Pretest and Posttest Review. *Nurse Educ* [Internet]. 2008 Jul [cited 2022 Feb 28];33(4):176–80. Available from: <https://journals.lww.com/00006223-200807000-00011>
13. Callender A, Franco-Watkins A, Roberts A. Improving metacognition in the classroom through instruction, training, and feedback. *Metacognition Learn*. 2015 May 7;11.
14. Brady M, Seli H, Rosenthal J. Metacognition and the influence of polling systems: How do clickers compare with low technology systems. *Educ Technol Res Dev*. 2013 Dec 1;61.
15. McKenna K, Pouska B, Moraes MC, Folkestad JE. Visual-Form Learning Analytics: A Tool for Critical Reflection and Feedback. *Contemp Educ Technol* [Internet]. 2019 Jul 12 [cited 2022 Feb 16];10(3):214–28. Available from: <https://www.cedtech.net/article/visual-form-learning-analytics-a-tool-for-critical-reflection-and-feedback-6244>
16. New method of studying is improving microbiology students' grades: U-Behavior developed by CSU professor and researcher [Internet]. College of Health and Human Sciences. 2022 [cited 2022 Feb 16]. Available from: <https://chhs.source.colostate.edu/new-method-of-studying-is-improving-microbiology-students-grades-u-behavior-developed-by-csu-professor-and-researcher/>