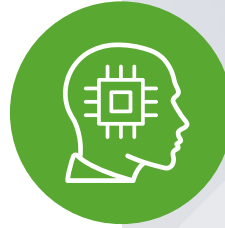


# Learning Science

## Active Learning

Augmenting Students Engagement and Understanding



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### The Learning Science team

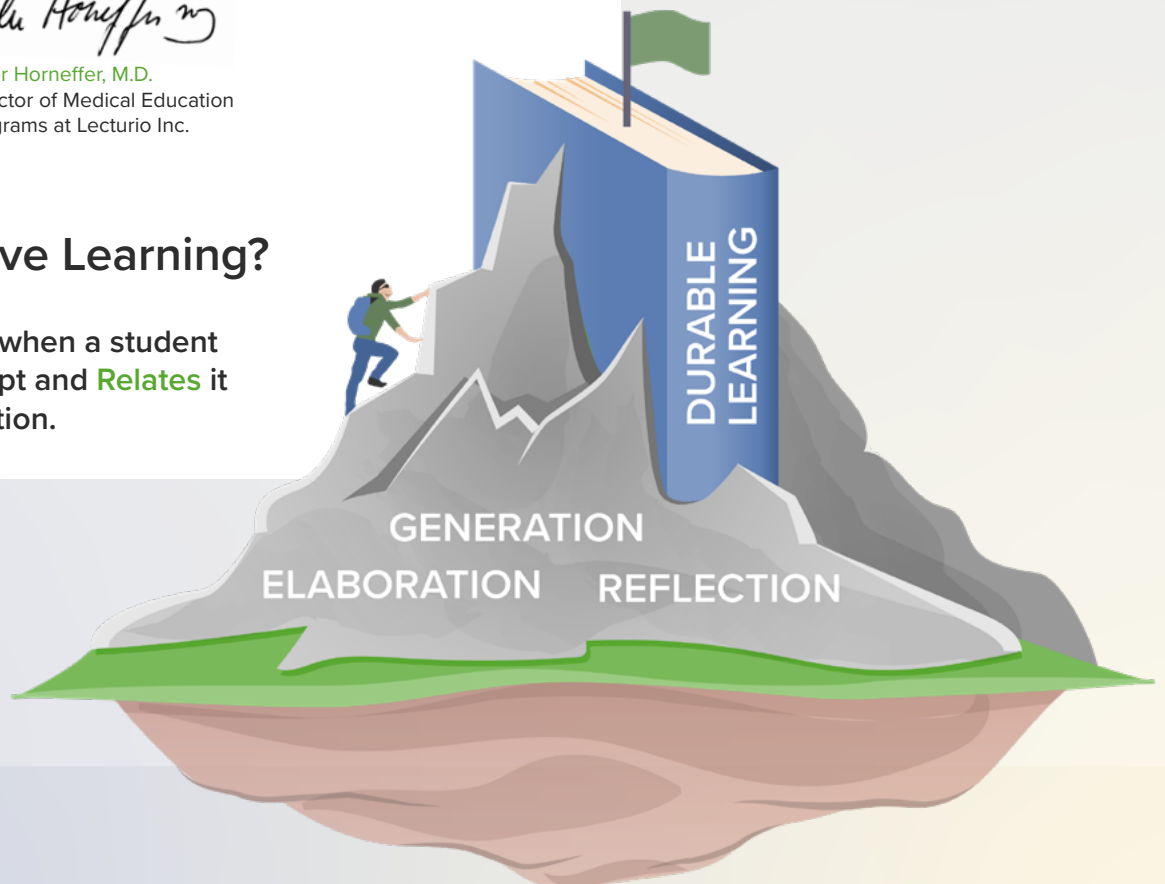
We are pleased to share this summary information from our recent seminar “Active Learning: Augment Students Engagement and Understanding” with our educator community. We hope that by reading this material you will be inspired and better equipped to implement these helpful learning methods into your teaching practices.



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

### What is Active Learning?

Active learning is when a student **Retrieves** a concept and **Relates** it to known information.



## Data

### Where do the participants of the Active Learning seminar come from?

**13.9%**

Europe

**18.5%**

South America & Caribbean

**12.6%**

Asia & Pacific

**6.0%**

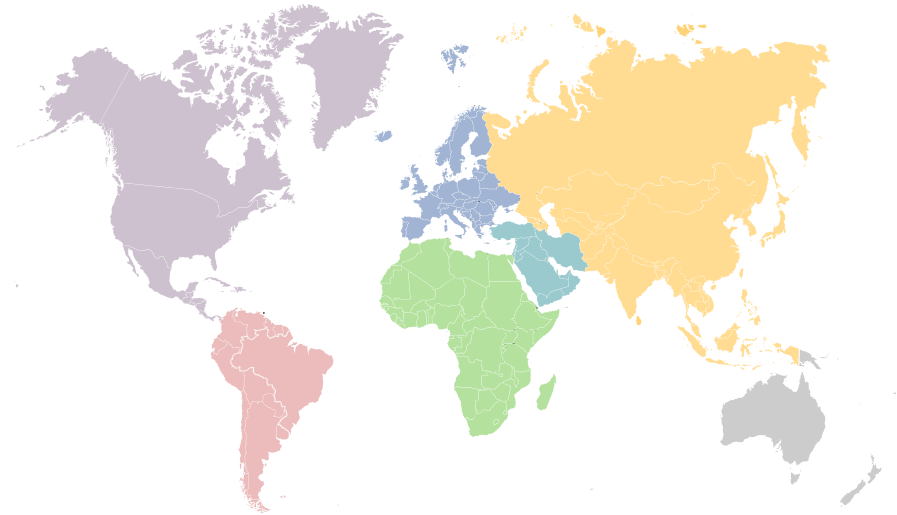
Africa

**44.4%**

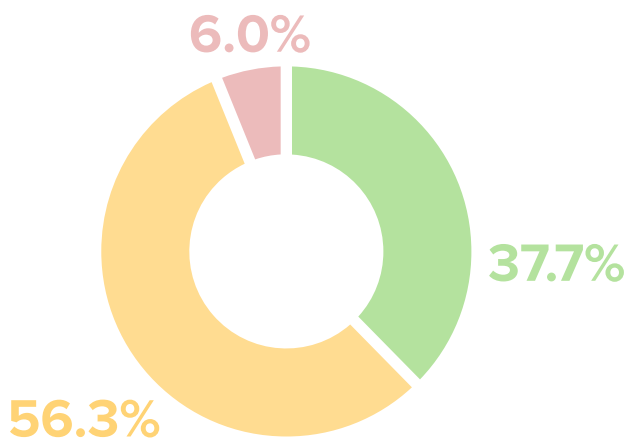
North America

**4.6%**

Middle East



### Do you use active learning in your classes?



- Yes, I use active learning strategies in all of my classes.
- I use active learning strategies in some of my classes.
- No, I am not currently using active learning strategies in my classes.

Nearly 94% of our participants responded that they use active learning strategies at least sometimes in their classes. Participants were able to answer in more detail about the strategies they use in Padlet and in breakout sessions. See data below.

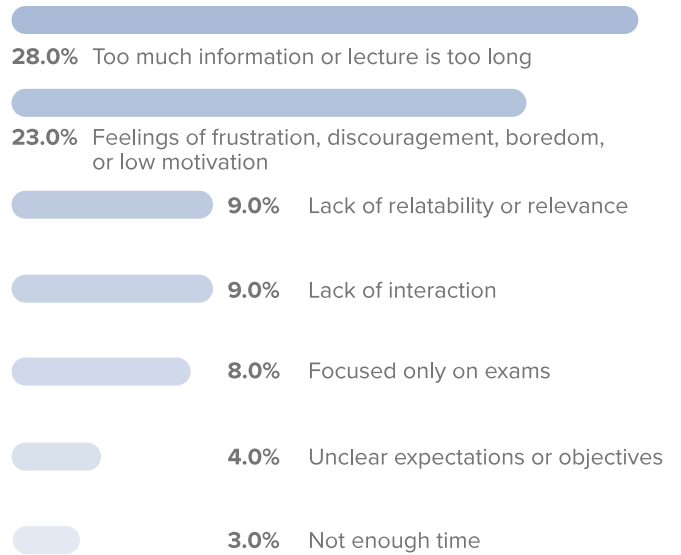
## The Case Study

Participants were presented with a case study, a colleague named Dr. Z who wants to improve his classes. He wants to engage and motivate his students. He wants them to do better and feel more confident when taking his tests. We asked our participants to help Dr. Z with his course. They were given three questions so that they could practice their own generation, elaboration, and reflection about teaching strategies.



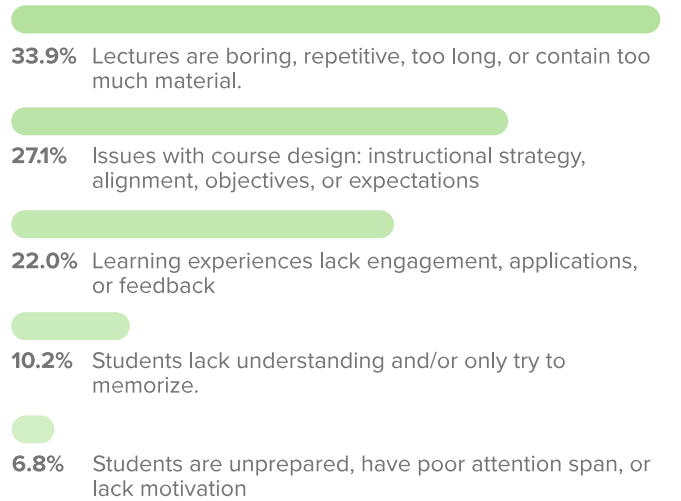
## 1 What are some common causes of loss of motivation and disengagement in students?

Participants reported that they feel students become disengaged for a variety of reasons. The majority of respondents felt that too much information, long lectures, and students' feelings of frustration, discouragement, boredom, or low motivation can cause them to become disengaged. Participants cited lack of interaction as a common cause of student disengagement. Students might feel the material lacks relevance to their needs or for their exams. Students may become frustrated with courses that have unclear expectations or misalignment with objectives. Finally, students and educators may feel there isn't enough time.



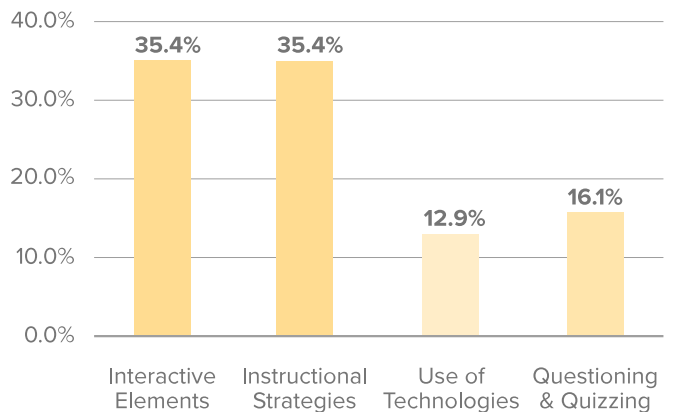
## 2 Why do you think Dr. Z's students lose focus and find his examinations too difficult?

In helping Dr. Z identify why his students may lose focus and find his exams too difficult, respondents identified potential sources. Many (33.9%) felt his lectures might be boring, repetitive, too long or contain too much information. Others (27.1%) felt there may be issues with the course design - his instructional strategy, the alignment of materials, or his objectives and expectations. Participants also felt Dr. Z's learning experiences might lack engagement, applicability, and feedback for improvement. Some felt the students themselves might be resistant to understanding, preferring to memorize instead, or that they might be unprepared, have short attention spans, or lack motivation.



## 3 If you encountered the challenges faced by Dr. Z, how would you try to solve them?

Participants had many suggestions for Dr. Z to help improve student engagement. Interactive elements suggested include using a flipped classroom, making exercises interactive, use of case studies and role play, use of reflections and discussions, and using small groups. Instructional strategies discussed include aligning tests to objectives, collecting student feedback, using clear communication, reducing the content, using repetition, sharing research on medical education, focusing on concepts, and being prepared before class. Technology suggestions included gamification and polling. Some respondents encouraged asking students questions, having students create their own questions, and using a quiz to start class.

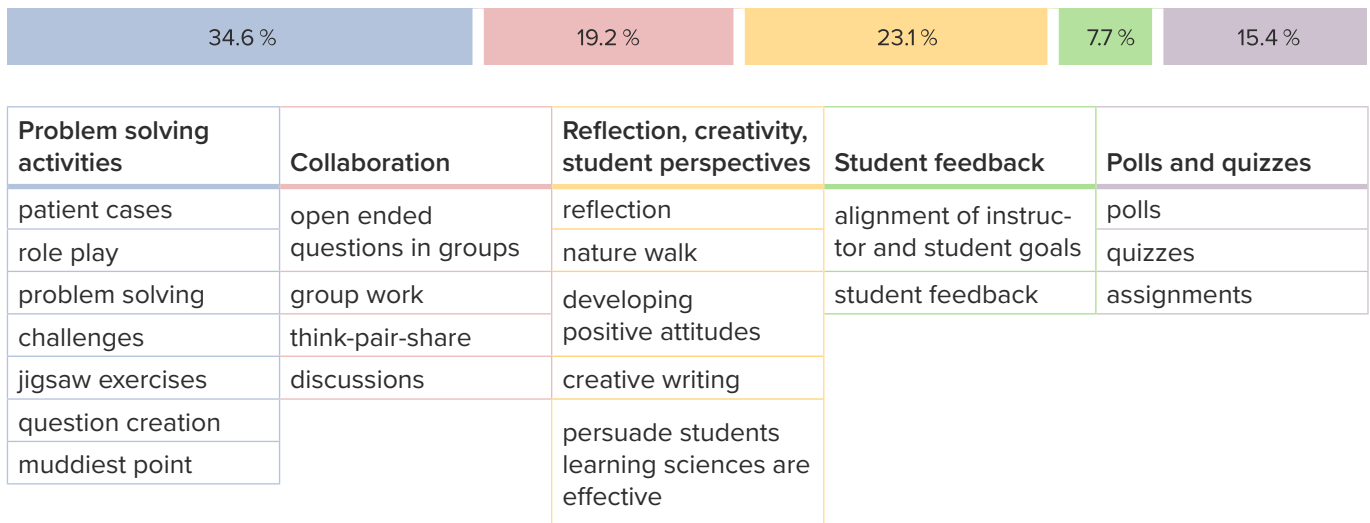


# Breakout Sessions

## 1 What active learning strategies do you use, and how might you apply them to motivate and engage students in your classroom?

Participants shared in both the Padlet and during breakout sessions a variety of strategies that they use in their classrooms. Some used activities that had students analyze or create solutions such as cases, role play, problem solving, challenges, jigsaw exercises, question creation, and muddiest point. Some preferred a reflective or creative approach to explore student perspectives such as

reflections, nature walks, exercises to develop positive attitudes, and attempting to persuade students that the learning science strategies are effective. Some respondents shared they use active strategies to garner student feedback and help align goals. Finally, some kept students engaged with questions, polling, quizzes, and other assignments.



## 2 What challenges have you encountered when applying active learning strategies in your classroom?

Participants cited some common issues they encounter when implementing active learning strategies. These tend to fall into two categories: **(1)** limitations due to skills and attitudes such as limited participation and student resistance, and **(2)** limitations in resources such as lack of time and resources to create a suitable learning environment.

Limitations due to skills and attitudes	Limitations due to resources
Student resistance	Not enough time
Inconsistent participation	Need to create suitable learning environment
Lack of participation	Too much work
Varying skill levels	Need smaller groups or more staff
Faculty resistance	Limits of available resources

# Resources

### Seminars

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

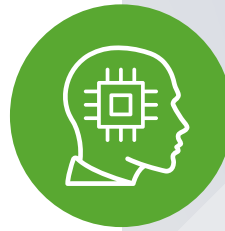


### Articles

- [Active Learning: Augmenting Student Engagement and Understanding](#) ▶
- [Retrieval-Based Learning Strategies in Medical Education](#) ▶
- [Interleaving: How to Mix Related Concepts to Make Learning in Medicine More Durable](#) ▶

Learning Science

# Active Learning Strategies for Medical Education



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## ACTIVE LEARNING STRATEGY

## BRIEF DESCRIPTION

### Elaboration & Generation

#### Illness scripts<sup>(1)</sup>

1. Instructors organize students into small groups to present a patient case.
2. Students are assigned resources (e.g. IsabelDX or UpToDate) to create an illness script (cognitive organizer table for pathophysiology, history, exam, labs/imaging/treatment), which includes the group's top 3 differential diagnoses.
3. Each student group prepares an assessment for the patient and presents it to the rest of the class.

#### Summary sheet<sup>(2,3)</sup>/ "Distillation notes"

1. Instructors encourage elaboration by challenging students to create a "summary sheet" on a topic,
- Or
2. Students are asked to condense materials from lectures/labs/major assignments/readings by creating "distillation notes" for which they selectively compact and elaborate/generate on concepts from broad topics to produce a 1-2 page overview document.

#### SEE-IT method<sup>(4)</sup>

Instructors choose a topic and have the students (individually or in groups):

1. State the idea clearly
2. Elaborate on the idea
3. Exemplify (for example...)
4. Illustrate the idea with a metaphor or image
5. Talk with a partner and share your idea

#### Jigsaw<sup>(5)</sup>

1. A topic is divided into smaller, interrelated concepts.
2. Each member of a home team becomes an "expert" on a different concept and may meet with other "experts" on the same concept using instructor-provided materials.
3. Students go back to their home teams, and each expert on the concepts peer-teaches the other students on the home team their specific "jigsaw puzzle piece" of the topic using elaborative/generative strategies.

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**Sabotage/Sequence reconstruction**<sup>(6, 7)</sup>      **1.** After teaching a concept and/procedure, the instructor purposefully removes a step/instruction or other deliberate errors from a document/slide.  
**2.** Students are asked to generate the corrected item.

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**Annotation of an image/drawing**      Students are given an anatomical image and are asked to annotate it with functions of each structure in their own words (generation) or make connections with other organs in the organ system, other tissues, or specific cellular function, etc. (elaboration).

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**One minute writing**<sup>(8)</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. Depending on the prompt, this could be an elaboration, generation, or reflection exercise.

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**Questioning**<sup>(5, 7, 9)</sup>      **1.** Instructors can create a “Socratic classroom” by first identifying specific learning objectives and goals.  
**2.** Instructors then develop questions based on these learning objects/goals to engage students in active learning.  
**3.** Alternatively, instructors can provide students with Bloom’s Taxonomy and challenge them to create questions based on learning goals at targeted domains (remembering, understanding, applying, analyzing, evaluating, or creating).

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**Anticipatory set**<sup>(2, 10)</sup>      **1.** Instructors utilize generation by asking students at the beginning of a lesson to predict and try to explain beforehand what the topic will entail or the problem which will need to be solved.  
**2.** After the information has been presented, students will be better equipped to get meaning out of the concepts by having predicted or attempted to work out the problem on their own.

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## Reflection

**Team-based learning exercises**<sup>(5)</sup>  
(includes problem-based and case-based learning)      **1.** Preparation - instructors provide students with learning objectives and resources needed for learning exercises.  
**2.** Readiness assurance- individual & team readiness can be assessed by individual readiness assurance test (iRAT) and group readiness assurance test (gRAT) or other methods.  
**3.** Exercise application - student teams work on the same challenge, which should be significant in scope, involve specific choices by the team, and be revealed simultaneously upon completion.

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**Think Aloud**<sup>(9)</sup>      **1.** Used primarily as an active learning reading scaffold, Instructors can pose sentence stems to students such as “I think this is...”, “Where did...?”, “How did...?” “I realized that...”, or “This is similar to...” either before, during, or after reading assignments to help with metacognition and activating prior knowledge.  
**2.** Students can complete sentences stems orally or in written form.

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**Concept Maps**      Students (individually or in groups) are asked to design a diagram/graphic organizer/map that depicts relationships between concepts by utilizing the practice of reflection, elaboration, and generation.

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**Reflection journals**<sup>(8)</sup>      **1.** Students can reflect on assignments, lectures, classroom/clinical experience, etc by writing, blogging, creating a video, and/or collaborating with a discussion forum.  
**2.** Reflection journal writing can be a single assignment or used as a portfolio of reflections for a whole course/semester/year

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**Reflection breaks**<sup>(8)</sup>      Instructors can help to establish a framework for reflection by providing time for focused thought during lectures, or at the beginning or end of class.

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<b>Post assessment reflection<sup>(8)</sup></b>	Instructors can ask students to submit a reflection with an assessment and resubmit until they achieve mastery of the content.
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## Technology-enhanced active learning

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<b>Poster creation</b>	Instructors can challenge students (individually or collaboratively) to create a virtual “poster” using <b>Padlet</b> or other online platforms to elaborate, generate, or reflect on a topic or content area.
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<b>Interviews</b>	Instructors can utilize platforms such as <b>FlipGrid/VoiceThread</b> to allow students to respond to specific instructions to elaborate, generate, or reflect on a question or use peer/team interview questions.
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<b>Polling/clickers/online discussions<sup>(11)</sup></b>	Instructors can ask students to elaborate, generate or reflect using polling, clickers, or social media (#topic Twitter) applications.
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<b>Simulations and video case presentations</b>	Instructors can utilize medical simulations and video case presentations and then ask students to give elaborative, generative, or reflective feedback.
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<b>E-learning platforms (Lecturio example)</b>	Lecturio’s performance center for users allows learners to self-assess and monitor their mastery of different topics, facilitating the application of reflection in their learning process.
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## Some Inputs from our Webinar Breakout Rooms

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<b>Muddiest Point<sup>(12)</sup></b>	<p>This technique helps students list concepts that are most unclear for them during the teaching session, first pioneered by Frederick Mosteller in 1988. It not only helps students identify and work on difficult concepts, but also facilitate faculty members in understanding challenges faced by students and adjust their teaching plans based on that. An example of how it can be implemented:</p> <ol style="list-style-type: none"><li>1. Instructors provide a method of input for students to share their individual muddiest points</li><li>2. The points should be filed anonymously sometime before the end of the class</li><li>3. The instructor collects and tabulates the responses to identify recurring themes</li></ol>
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<b>Patient Cases / Case-Based Learning (CBL)<sup>(13, 14, 15)</sup></b>	Defined by Thistlewaite as a technique “...to prepare students for clinical practice, through the use of authentic clinical cases” which “...links theory to practice, through the application of knowledge to the cases, using inquiry-based learning methods <sup>(13)</sup> . In medicine it can happen through sharing a prompt for a medical case with certain symptoms, followed by a teacher guiding the care process of the patient, engaging the students’ clinical reasoning and knowledge to decide on history taking steps, what tests to order, develop differential and come up with a treatment plan for the patient. <sup>(15)</sup>
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<b>Role Play<sup>(16, 17)</sup></b>	Cited to have been useful as a tool to teach patient communication with medical education <sup>(16)</sup> , it promotes active learning and can also be used to incorporate curricular items in a clinical rotation <sup>(17)</sup> . Joyner and Young shared 12 tips for a successful role play, which includes, among other things, to be prepared, have clear learning objectives, create challenging cases, to be inclusive in its delivery. Using a structured assessment form also allows for clear debrief and feedback to participants, leading to the high educational yield of this technique. <sup>(17)</sup>
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<b>Polls, Quizzes, and Assignments</b>	The use of polls, quizzes, and assignments as a means to deliver generative, elaborative, or reflective questions is a great way to incorporate the techniques shared in our webinar with your students. They can be incorporated as a pre, durante, or post class exercise, through various different online means such as interactive quizzing applications and platform based learning tools (e.g., Lecturio), as well as offline means such as take-home essay creation assignments.
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<b>Think-Pair-Share</b>	Instructors pose a question and students first think independently about the answer, then discuss answers with another student, and lastly share their responses with the class.
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## References

1. Moghadami M, Amini M, Moghadami M, Dalal B, Charlin B. Teaching clinical reasoning to undergraduate medical students by illness script method: a randomized controlled trial. *BMC Med Educ.* 2021 Dec;21(1):87.
2. Brown PC. *Make it stick: the science of successful learning.* Cambridge, Massachusetts: The Belknap Press of Harvard University Press; 2014. 313 p.
3. Kupper-Tetzl C. Factors Of Effective Note-Taking: Application Of Cognitive Load Theory [Internet]. 2018 [cited 2021 Jan 27]. Available from: <https://www.learningscientists.org/blog/2018/9/13-1>
4. Stern J. What Is Schema? How Do We Help Students Build It? *Education Week* [Internet]. 2019 Oct 20 [cited 2021 Dec 3]; Available from: <https://www.edweek.org/education/opinion-what-is-schema-how-do-we-help-students-build-it/2019/10>
5. Fornari A, Poznanski A. *How-to guide for active learning.* 2015.
6. Gierasimczuk N, Kurzen L, Velázquez-Quesada FR. Learning and Teaching as a Game: A Sabotage Approach. In: He X, Horty J, Pacuit E, editors. *Logic, Rationality, and Interaction* [Internet]. Berlin, Heidelberg: Springer Berlin Heidelberg; 2009 [cited 2022 Jan 27]. p. 119–32. (Lecture Notes in Computer Science; vol. 5834). Available from: [http://link.springer.com/10.1007/978-3-642-04893-7\\_10](http://link.springer.com/10.1007/978-3-642-04893-7_10)
7. Active Learning | Poorvu Center for Teaching and Learning [Internet]. [cited 2021 Dec 13]. Available from: <https://poorvucenter.yale.edu/ActiveLearning>
8. Michael J. Where's the evidence that active learning works? *Adv Physiol Educ.* 2006 Dec 1;30(4):159–67.
9. Armstrong P. Bloom's Taxonomy [Internet]. Vanderbilt University Center for Teaching. 2010 [cited 2022 Jan 27]. Available from: <https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/>
10. Oakley B, EdD BR, Sejnowski TJ. *Uncommon Sense Teaching: Practical Insights in Brain Science to Help Students Learn.* New York: Tarcher-Perigee; 2021. 336 p.
11. Bowman JD. Facilitating a Class Twitter Chat [Internet]. 2017 [cited 2022 Jan 27]. Available from: <https://www.edutopia.org/article/facilitating-class-twitter-chat>
12. Carberry A, Krause S, Ankeny C, Waters C. "Unmuddying" course content using muddiest point reflections. In: 2013 IEEE Frontiers in Education Conference (FIE) [Internet]. Oklahoma City, OK, USA: IEEE; 2013 [cited 2022 Feb 4]. p. 937–42. Available from: <http://ieeexplore.ieee.org/document/6684966/>
13. Thistlethwaite JE, Davies D, Ekeocha S, Kidd JM, MacDougall C, Matthews P, et al. The effectiveness of case-based learning in health professional education. A BEME systematic review: BEME Guide No. 23. *Medical Teacher.* 2012 Jun;34(6):e421–44.
14. McLean SF. Case-Based Learning and its Application in Medical and Health-Care Fields: A Review of Worldwide Literature. *Journal of Medical Education and Curricular Development.* 2016 Jan;3:JMECD.S20377.
15. Case-Based Learning | Poorvu Center for Teaching and Learning [Internet]. [cited 2022 Feb 3]. Available from: <https://poorvucenter.yale.edu/strategic-resources-digital-publications/strategies-teaching/case-based-learning>
16. Nestel D, Tierney T. Role-play for medical students learning about communication: Guidelines for maximising benefits. *BMC Med Educ.* 2007 Dec;7(1):3.
17. Joyner B, Young L. Teaching medical students using role play: Twelve tips for successful role plays. *Medical Teacher.* 2006 Jan;28(3):225–9.