
HOW TO
SHORTEN YOUR
LECTURE...
...without short-changing learning!
Richard Van Eck, PhD
Associate Dean for Teaching and Learning
A TLAS Workshop
February 24, 2022
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At the end of this presentation, you will be able to:

- Define at least one thing that can help design a lecture to fit the allotted time.
- Define the sequence of steps to do before creating your PowerPoint slides for a lecture.
- Define one PowerPoint design technique that will help learners manage their attention.
- List two things to do during a lecture to improve learning.

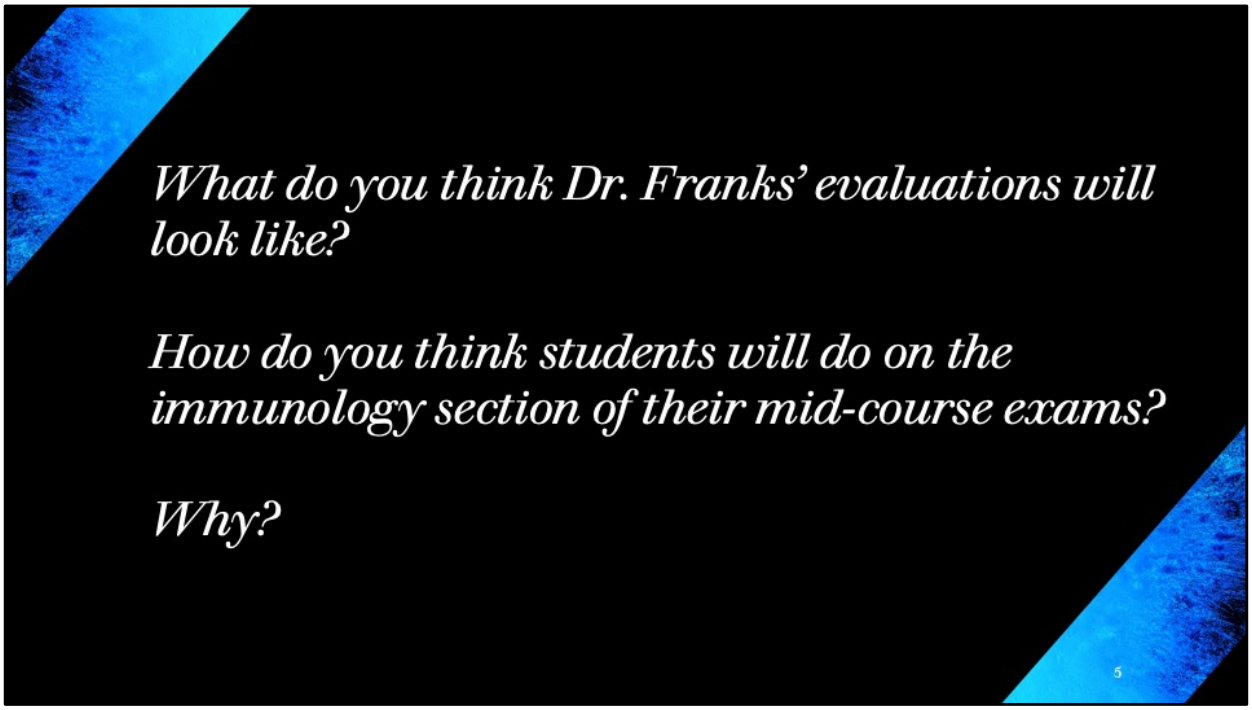
Slide 2 of 25

Quick Quiz

Dr. Franks has been asked to deliver a 1-hour lecture on his area of expertise to first-year medical students. This is a daunting task because the topic is complex enough to warrant a dozen lectures. Determined to convey all the content students will need to know, he begins by reviewing critical texts and builds his PowerPoint as he reads.

His initial PowerPoint has 123 slides, so he reduces the font size and combines a few slides and gets it down to 90. which gives him about 40 seconds per slide: if he doesn't take a break, he should be able to get through all the slides in 60 minutes.

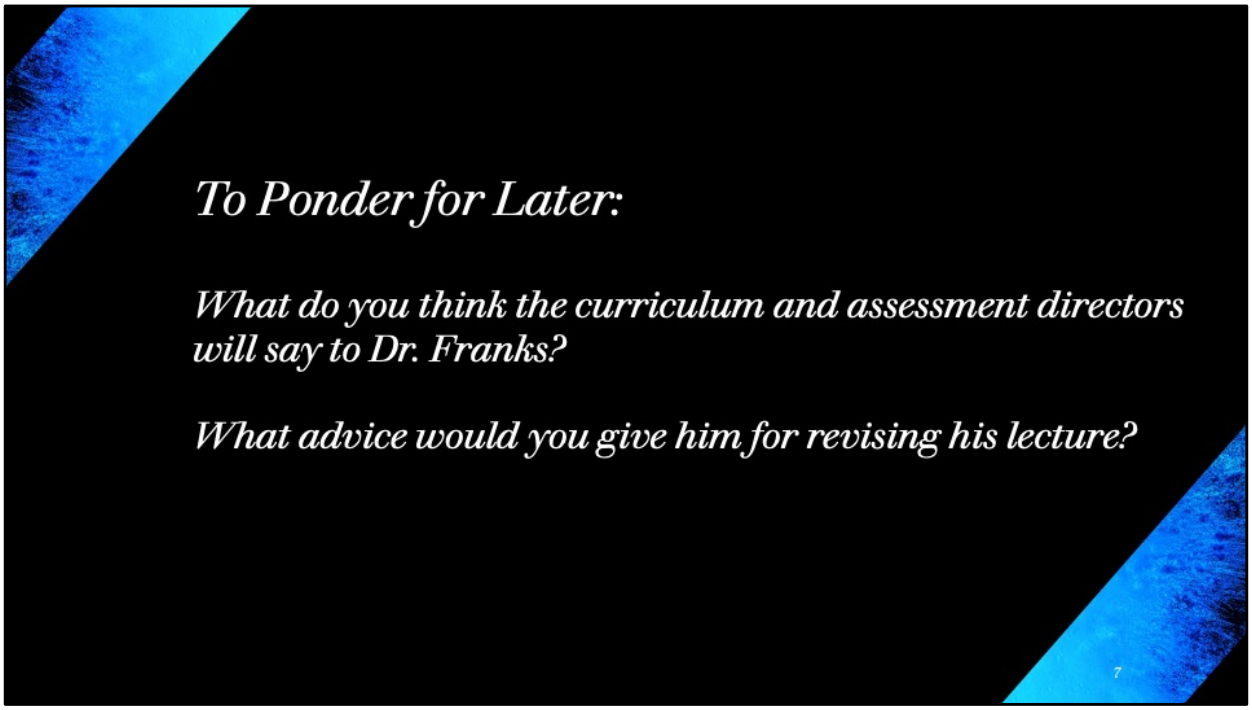
On the day of the lecture, he is pleased to see that the students appreciate the complexity of the topic and remain quiet and attentive. Although he ends up going 3 minutes over (63 minutes total), he is pleased that his time estimation was reasonably correct. He covered everything the students will need to know for their exams, and now that he has done the hard work up front, he will be able to easily give the same lecture next year and the year after, with minor updates based on changing science, of course. He looks forward to the student evaluations and their results on mid-course exams.


What do you think Dr. Franks' evaluations will look like?
How do you think students will do on the immunology section of their mid-course exams?
Why?
5

Dr. Franks is stunned and dismayed to see that evaluations of his lecture show that students felt his lecture was confusing and hard to follow. They report spending hours reviewing the lecture recording—far more than for other lectures. They are also unhappy that the lecture went 13 minutes over time ("not true!" he thinks to himself), complaining that they did not have time for restroom breaks or to make it on time to their next lecture.

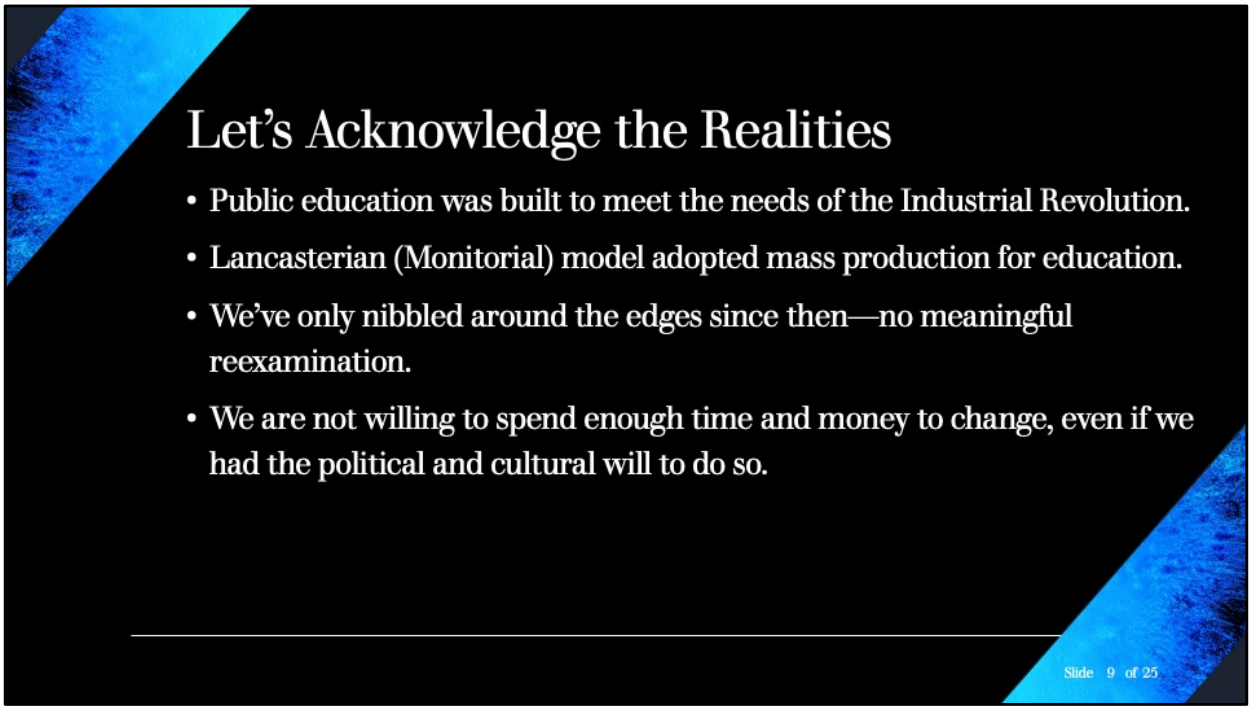
The analysis of the exam questions related to his lecture also show that high-performing students struggled with the questions on the exam.

The criticisms seem unfair; he worked hard on that lecture, the topic is complicated, and they only gave him an hour to cover everything! He is not sure he even wants to give the lecture again next year.


To Ponder for Later:
What do you think the curriculum and assessment directors will say to Dr. Franks?
What advice would you give him for revising his lecture?
7

Let's Acknowledge the Illogicalities

- The education system assumes that:
  - *Most learners come in with identical prerequisite knowledge.*
  - *Lectures are the most appropriate modality for most learning.*
  - *Most content takes 50 minutes to teach.*
  - *Most learners will learn the same amount in 50 minutes.*



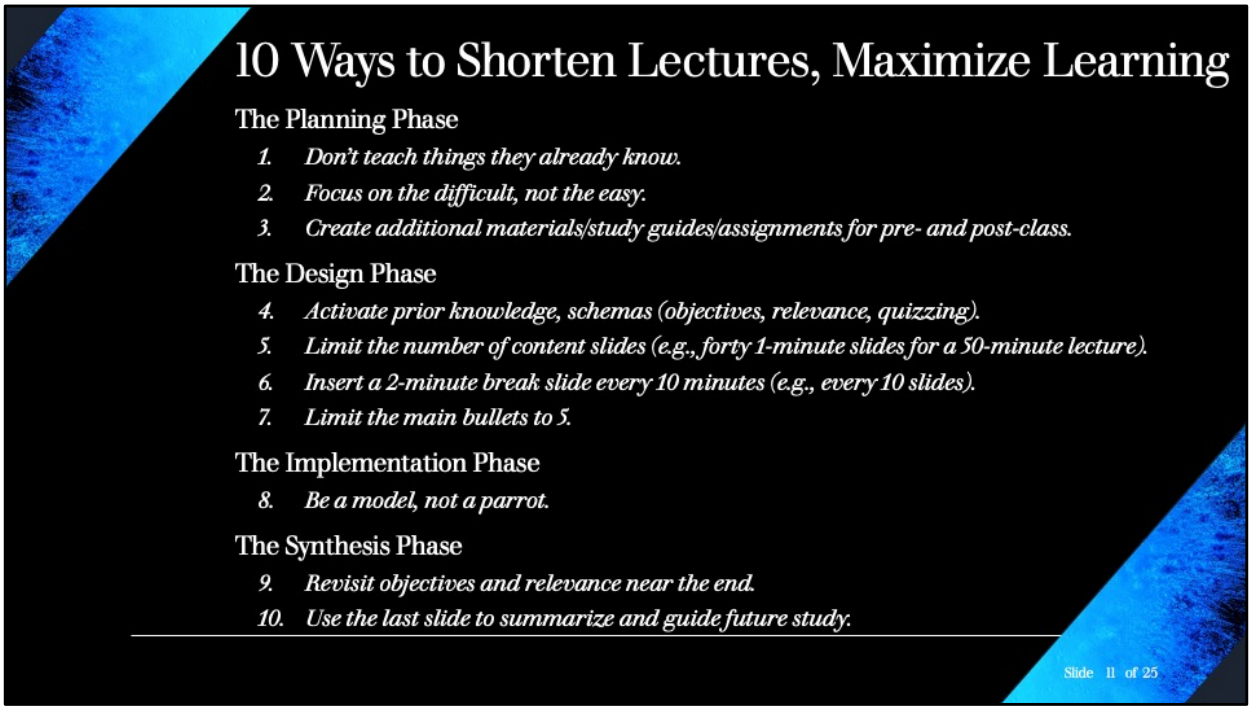
https://en.wikipedia.org/wiki/Monitorial_System

Constraints-Based Analysis

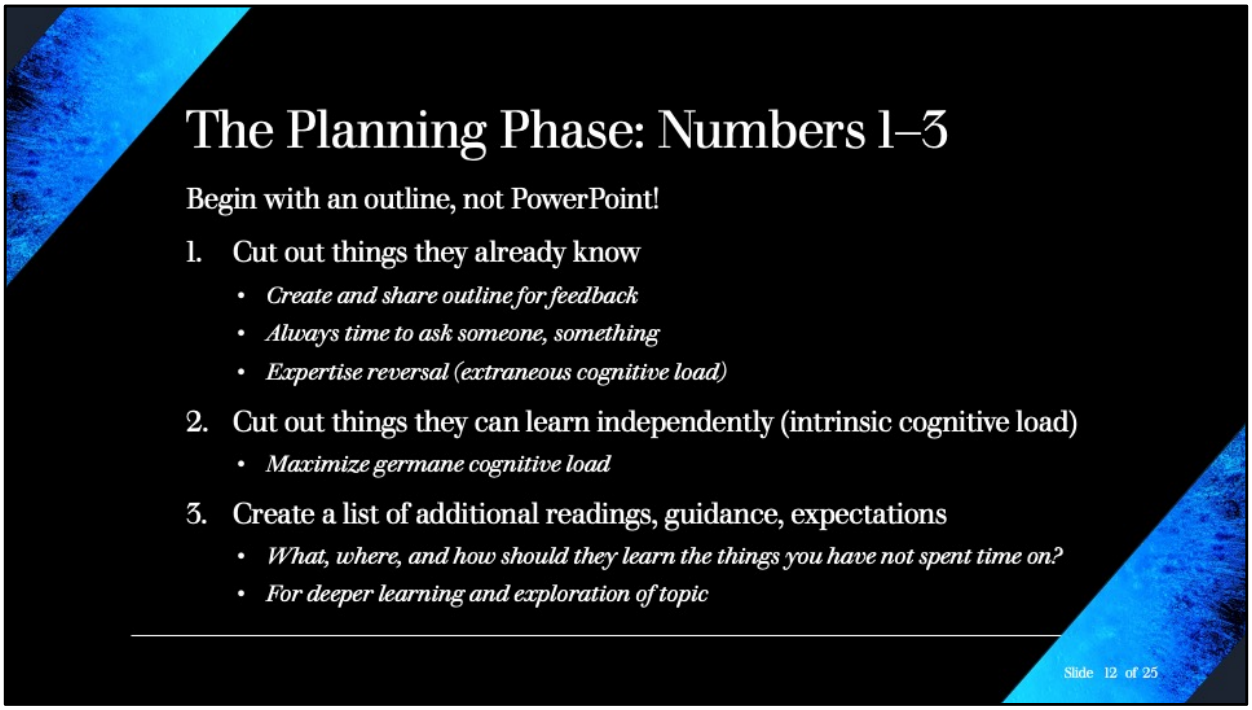
- This presentation is not about active learning in lectures
  - *TLAS webinars & readings packet*
- Most lectures are still limited to 50 minutes
- How do we minimize Blithwapping our lectures?
  - *Active learning*
- How do we make ROOM for active learning?

Slide 10 of 25

https://med.und.edu/education-resources/repository.html#activelearning



Many of these steps may be familiar or obvious to you already, but you may not always do ALL of them.



If you do all of these things and STILL have too much content for the lecture, you need more time to teach in the curriculum and should discuss with your program designers.

Expertise Reversal Effect:
Kalyuga, S., Ayres, P., Chandler, P., & Sweller, J. (2003). The Expertise Reversal Effect, *Educational Psychologist, 38*:1, 23-31, DOI: 10.1207/S15326985EP3801_4

Cognitive Load Theory

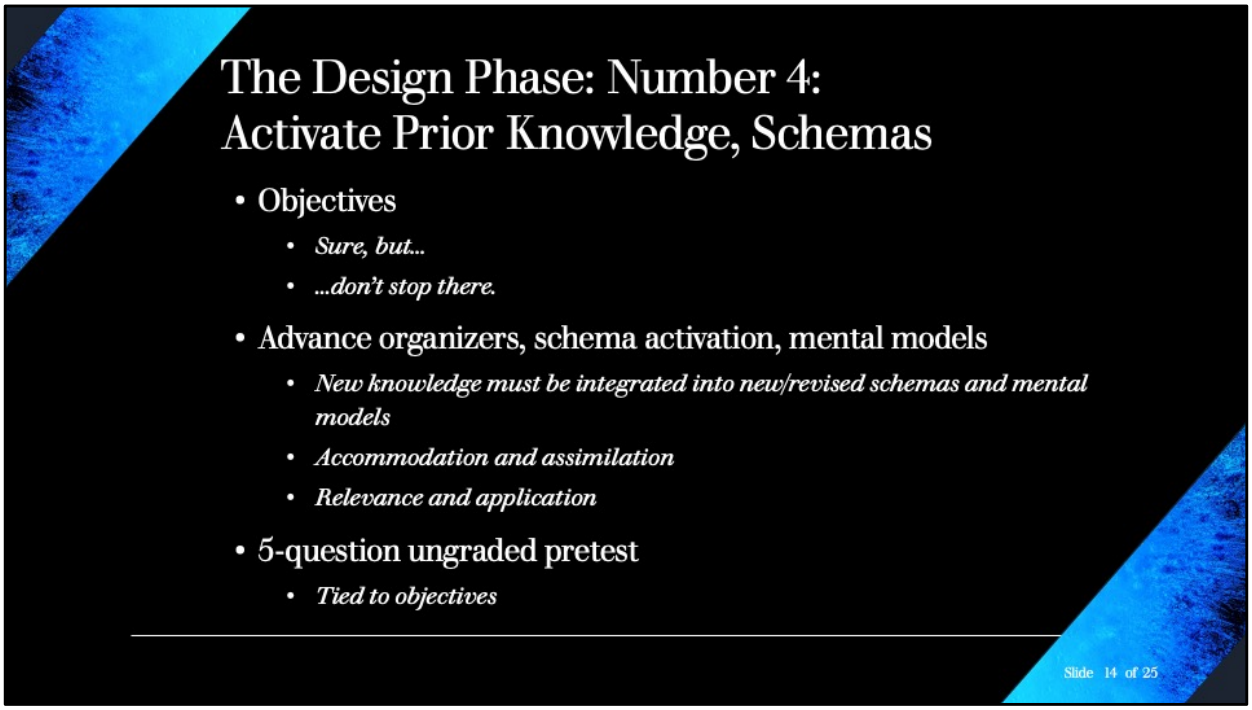
Chandler, P., & Sweller, J. (1991). Cognitive load theory and the format of instruction. *Cognition and Instruction, 8*(4), 293–332. https://doi.org/10.1207/s1532690xci0804_2

Sweller, J., & Chandler, P. (1991). Evidence for Cognitive Load Theory, *Cognition and Instruction, 8(*4), 351-362, DOI: 10.1207/s1532690xci0804_5

Sweller, J. (2010). Cognitive load theory: Recent theoretical advances. In J. L. Plass, R. Moreno, & R. Brünken (Eds.), *Cognitive load theory* (pp. 29–47). Cambridge University Press. https://doi.org/10.1017/CBO9780511844744.004

Breaks are not just for attention resetting!

They are a great way to make “space” for active learning, like knowledge checks, questions, and discussion.



Readings on Advance Organizers, Schema Activation and Mental Models

Ausubel, D. P. (1968). Educational Psychology: A Cognitive view. New York: Holt, Rinehart, and Winston.

Mayer, R. E. (1979). Can Advance Organizers Influence Meaningful Learning? *Review of Educational Research*, *49*(2), 371–383. https://doi.org/10.2307/1169964

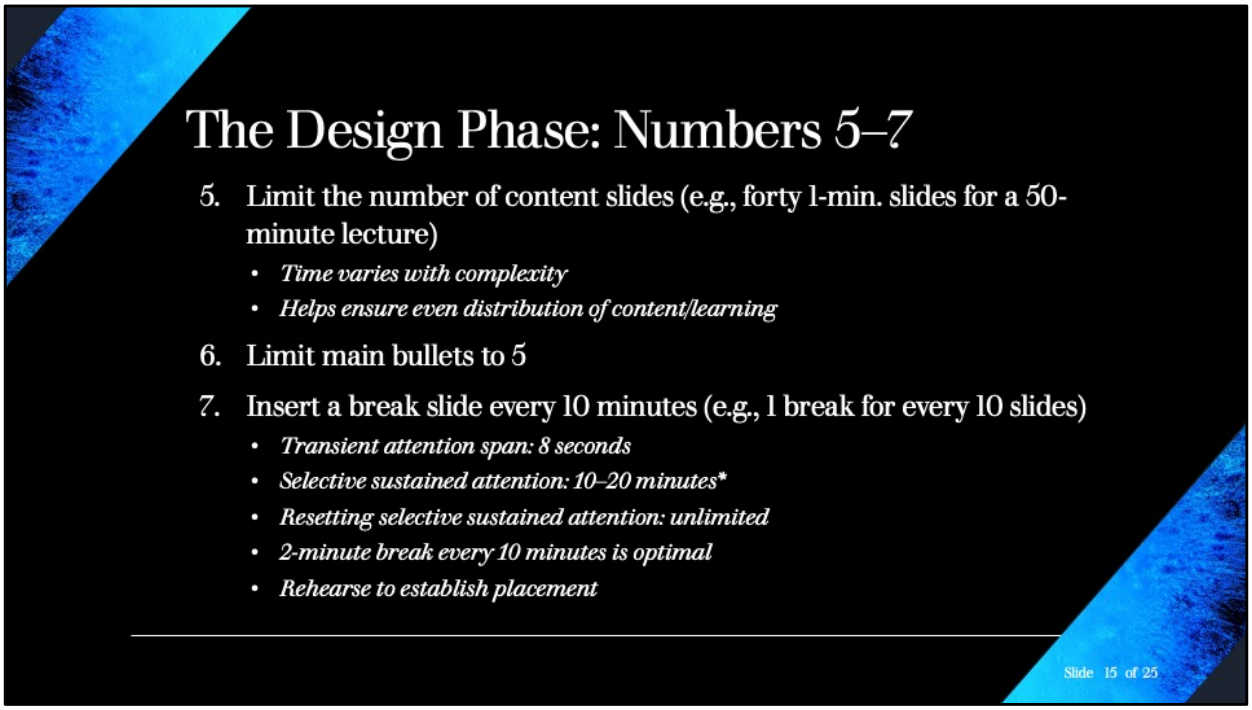
Anderson, R. C., Spiro, R. J., & Anderson, M. C. (1978). Schemata as Scaffolding for the Representation of Information in Connected Discourse. *American Educational Research Journal*, *15*(3), 433–440. https://doi.org/10.2307/1162496

Ausubel, D. P. (1980). Schemata, Cognitive Structure, and Advance Organizers: A Reply to Anderson, Spiro, and Anderson. *American Educational Research Journal*, *17*(3), 400–404. https://doi.org/10.2307/1162624

Research on Ungraded Quizzes

McDaniel, M. A., Agarwal, P. K., Huelser, B. J., McDermott, K. B., & Roediger, H. L. (2011). Test-enhanced learning in a middle school science classroom: The effects of quiz frequency and placement. *Journal of Educational Psychology*, *103,* 399-414.

Roediger, H. L., Agarwal, P. K., McDaniel, M. A., & McDermott, K. B. (2011). Test-enhanced learning in the classroom: Long-term improvements from quizzing. *Journal of Experimental Psychology: Applied*, *17*, 382-395.



* In reality, it is dependent on the quality of the teaching method—but we do reset.

Attention Span Readings

Hartley J, Davies, I.K. (1978). Note taking: A critical review. *Program Learn Educ Tech* 15: 207–224.

Bradbury, N. A., (2016). Attention span during lectures: 8 seconds, 10 minutes, or more? Advances in Physiological Society, https://doi.org/10.1152/advan.00109.2016
https://en.wikipedia.org/wiki/Attention_span

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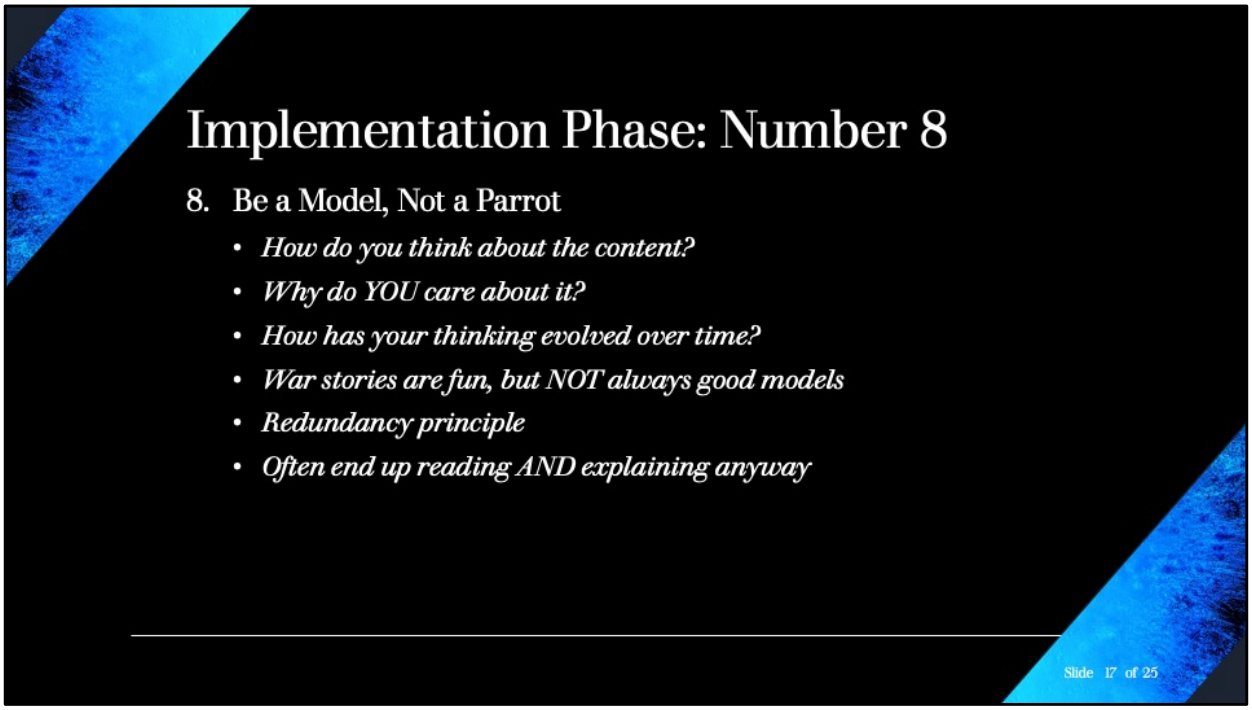

For additional readings on redundancy principle see Chapter 7 (pp 133–150) of:
Clark, R. C., and Mayer, R. E. (2011). E-Learning and the Science of Instruction. San Francisco: Pfeiffer

See also, extraneous cognitive load in cognitive load theory readings, slide 12.

The Synthesis Phase: Numbers 9 & 10

9. Revisit objectives and relevance near the end
   - *Revisit the case/relevance*
   - *Repeat pretest*
   - *Review mental model/schema*
10. Use the last slide to summarize and guide future study
   - *Synthesis*
   - *Emergency rip-cord*

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Quick Quiz

Objectives
At the end of this presentation, you will be able to:

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- Define the sequence of steps to do before creating your PowerPoint slides for a lecture.
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Would Your Advice to Dr. Franks Be Any Different?

Dr. Franks is stunned and dismayed to see that evaluations of his lecture show that students felt his lecture was confusing and hard to follow. They report spending hours reviewing the lecture recording—far more than for other lectures. They are also unhappy that the lecture went 13 minutes over time ("not true!" he thinks to himself), complaining that they did not have time for restroom breaks or to make it on time to their next lecture.

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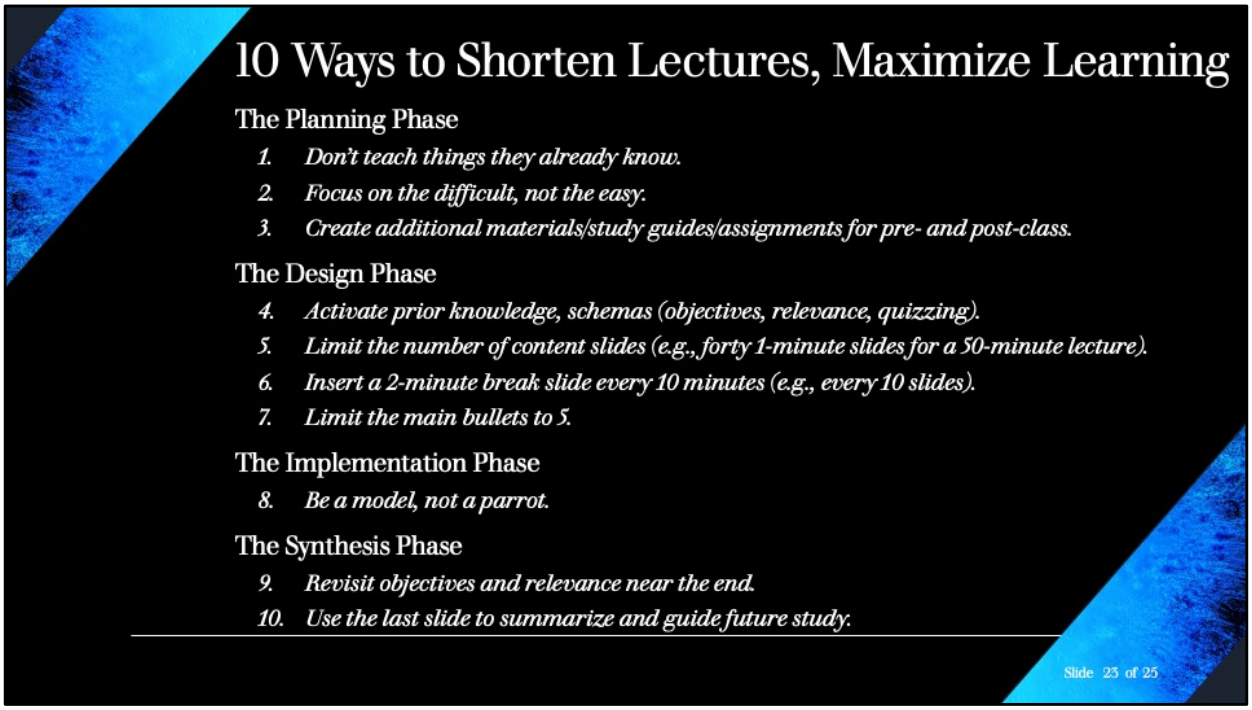

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Final Questions?
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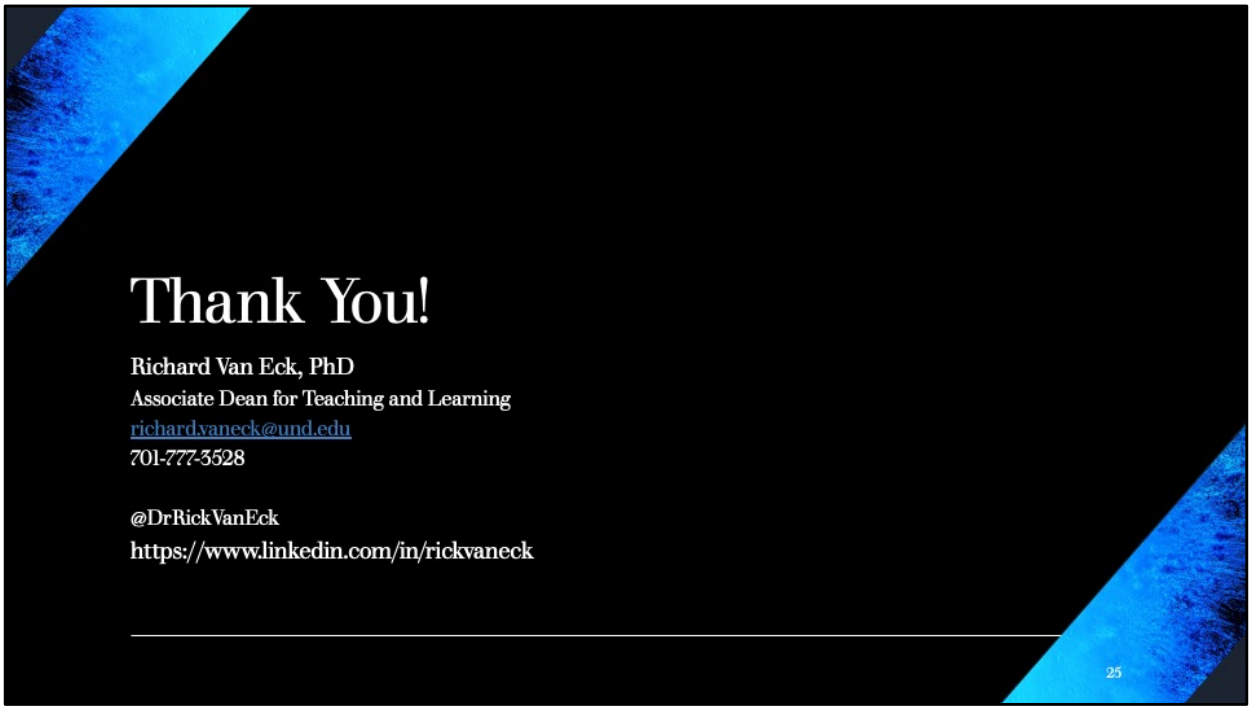


Additional Readings on Lectures and Active Learning Included in Readings:

ER Corner: Are We Ready for Active Learning

ER Corner: What Is Active Lecturing?

Saying Goodbye to Lectures in Medical School: Paradigm or Passing Fad?

ER Corner: In Defense of the Lowly Lecture

ER Corner: Are We Ready for Active Learning?

Richard Van Eck, PhD
Associate Dean for Teaching and Learning

Welcome to the first ER Corner: a column about innovative approaches to teaching and education scholarship. Future articles will focus on a variety of teaching and educational scholarship topics, including the three-legged stool of outcomes, objectives, and assessment; the nine events of instruction; gamification; eLearning; and many others. In this article, however, I'll focus on Active Learning (AL).

Some might argue that the title of this article puts the cart before the horse, and I would agree. The first thing we should do when considering any instructional intervention is to ask what evidence there is to support its use, what problems it solves for what kinds of learners and content, and whether we face those same problems and learners. Accordingly, I will address these questions (briefly, but definitively) before describing the results of the AL conference we held for SMHS and UND faculty and staff on January 6 and where the SMHS is headed vis-à-vis AL. First, though, I want to establish some fundamental premises in order to place what I have to say in context.

First, **AL is not always the "right" approach to teaching.** Nor are lectures or textbooks "wrong." These are strategies for teaching, and good instructional design mandates that we choose the best strategy for a given set of goals, objectives, learners, and environmental conditions. We would never rely solely on an audiotape to teach someone how to simultaneously manage pitch, altitude, and speed in a commercial plane, nor would we use AL to teach someone the multiplication tables (flashcards would be the best approach). That does not mean that those strategies would *never* play a part in teaching those kinds of competencies, however, only that we select the right strategies for the right outcomes and conditions. That is why health professionals engage in clinical experiences (the highest form of AL) rather than only reading about them in textbooks. Like a good chef or carpenter, we build a collection of specialized tools and select them based on their ability to meet the goals we have set, be it a gourmet dinner or a new set of cabinetry.

Yet, an examination of public education in the United States paints a different picture. A representative sampling of 1000 students recruited at birth from 10 U.S. cities was observed in more than 2500 classrooms in 1000 elementary schools from 400 school districts over the course of 5 years in grades 1, 3, and 5. Among the findings were that more than 90% of class time is spent listening to the instructor (lecture) or working independently on workbook problems or assignments (Pianta, et al., 2007). Similar findings have been reported across all later grades. There is a saying that if the only tool you have is a hammer, every problem looks like a nail. It is no wonder that, being products of a lecture-driven curriculum, we are most comfortable using the lecture as a teaching tool. The big idea behind AL is really about adopting some additional tools to supplement (not supplant) the lecture. The SMHS is already much further along in adopting AL approaches than other schools and colleges—the second 2 years of the medical curriculum are largely clinical experiences; the first 2 years are a mixture of PCL (intensive AL strategies), clinical, and basic science lectures; and the health science programs across the school make significant use of AL approaches, like the team-based learning (TBL) in Physical Therapy, the scenario-based approaches in Medical Laboratory Science, or the mixture of TBL, problem-based learning, and early clinical experiences in Sports Medicine.

Despite our successes in these areas, there are always opportunities to be even better, and that is the purpose behind much of the design of the new SMHS building and the corresponding faculty development being offered over the next year and beyond.

So, what evidence is there that AL can be effective? I will provide some data here and refer you to the AEIS page and AL Lib Guide assembled by Annie Nickum for further reading. Over the last 15 years, there have been hundreds of studies with thousands of students across the U.S. which have shown consistent benefits for AL. One NSF study looked at 16,000 students over 5 years and compared well-designed AL science courses to equivalent courses that did not use AL strategies. The study authors measured a variety of outcomes, but focused on rigorous, validated measures of learning (not attitudes), including nationally recognized, discipline-specific tests like the Force Concept Inventory (physics) and the Test of Understanding Graphs (Kinematics). AL courses were found to produce higher scores on national tests, end-of-course exams, and measures of conceptual knowledge; 50% lower failure rates overall and for at-risk students; and higher class attendance (more than 90% in most cases). These results have been replicated in more than 1000 studies over the last 15 years, 382 of which were independently evaluated for rigorous experimental design, equivalent populations, and validated learning results (i.e., not self-report) and reported in one literature review and three meta-analyses (meta-analyses are rigorous statistical measure routinely used in health care research to combine the effects of multiple clinical trials). The results show moderate-to-large effect sizes (a measure of how large the practical effect is from the intervention) across the board in achievement, persistence, application of knowledge, exam scores, and concept inventories. In fact, the smallest effect size observed in hundreds of studies would move a student from the 50th percentile to the 70th, in other words, from failing to passing. The combined weight of these findings prompted the authors of one of those meta-analyses to suggest "If the experiments analyzed here had been conducted as randomized controlled trials of medical interventions, they may have been stopped for benefit—meaning that enrolling patients in the control condition might be discontinued because the treatment being tested was clearly more beneficial." These and other references are available in the Lib Guide put together by Dawn Hackman.

In other words, when well designed and used for the appropriate outcomes, the benefits of AL are undeniable, which is why the SMHS held the first Advancing Educational Innovation and Scholarship (AEIS, pronounced "ace") workshop last month in conjunction with Coming Home and the Office of Education and Faculty Affairs. The workshop was a huge success, with more than 120 attendees from 12 programs in the SMHS and from across the UND campus. More than 90%–95% of the attendees thought the content was useful and presented effectively. We were happy to hear this and concurred that Adam Finkelstein and Cristina Peterson were great presenters who "walked the walk" of AL in the way they presented the workshop.

As nice as it is to hear that people valued the workshop, however, we are aware that self-report is not as valuable as actual evidence derived from validated measures. This was the purpose of the pretest-posttest survey we administered as part of the workshop. Our review of the literature suggested that faculty development in AL strategies is dependent as much on readiness (perceptions and attitudes) about AL as it is about AL strategies themselves. To that end, we identified a validated measure of AL readiness, the Instructors' Attitudes Toward Active Learning (IATL; Pundak, Herscovitz, Shacham, and Wiser-Biton, 2009) and integrated it into our pretest–posttest design. The results are informative and surprising, and I'd like to share some of the highlights with you. On the whole, and as expected, the SMHS is "ready" for AL, in no small part because of the prevalence of these strategies in our various curricula. Participants were

"likely" (M = 5.90 out of 7) to implement active learning at some time during the next year. This number was already so high that it would be highly unlikely to increase, a statistical phenomenon known as a ceiling effect, and although the posttest score was higher (M = 5.94), it was not statistically different.

Where we did see statistically significant changes, however, was in our perceptions and beliefs about what AL is and what it requires. This, according to the authors of the instrument and many other researchers, is what is most important. Because most of us don't have a lot of experience with AL (our survey showed that, on average, we have only "sometimes" experienced AL strategies as students during our own educational experience), we hold many misconceptions. The IATL was designed and validated to measure perceptions of AL. Thanks to the excellent work of the presenters, we all learned a lot about what AL is and, in some cases more importantly, what it is not. There was a significant difference between pre- (M = 10.87, SD = 1.70) and posttest (M = 12.39, SD = 1.94). IATL scores changed significantly from pre- to posttest; $t(40) = -3.65$, $p = .001$). This difference appeared to be isolated to three subscales of the IATL: Large Classes (whether large class sizes are compatible with AL), Independent Learning (whether students can effectively guide their own learning outside of class), and Quantity vs. Understanding (breadth vs. depth of student learning). In each case, the differences were significant at the $p < .01$ level, indicating that conference participants learned that AL is flexible and compatible with a wide range of instructional contexts.

These are just the highlights of the results, of course, and we will continue to study the data, but they are a strong indication that the SMHS is well on its way to adopting new tools to enhance what we do as educators. We also got a lot of great feedback about what people are interested in and/or need in future workshops and we are taking that to heart; the upcoming AEIS workshop on Active Learning for Lecturers will examine five levels of AL approaches that can be incorporated into lectures to make them even more powerful and effective.

We recognize that one instance of training (even one as long as the 8+ hours we all spent on the day of the conference!) is not sufficient to change practice. True learning (and the change in behavior that results) requires exposure to multiple interventions over a significant period of time, which is why many more articles and workshops will be offered over the coming year. The AL conference and this article are only the first steps toward continuous quality improvement in medical and health science education as we continue to make our curriculum even stronger than it already is and continue to produce the highest quality health professionals for North Dakota and the nation.

In Defense of the Lowly Lecture

You are probably wondering why someone like me who has long extolled the virtues of Active Learning (AL) would write in defense of lectures.

Recently, the Washington Post reported that the University of Vermont's (UV's) College of Medicine plans to replace live lectures with videos to be watched outside of class in order to make more room in the curriculum for AL strategies like problem-based learning. This is a good thing, because AL produces higher test scores and 50% lower failure rates. The smallest effect size would move a student from the 50th percentile to the 70th. This move has created headlines and discussions about whether the lecture is "dead," including in the NEJM, where the authors ask whether this is a paradigm shift or a passing fad.

So why would anyone want to defend the lecture?

The language used implies a binary choice: that AL is *always* better than lectures and that lectures have *no* place in the curriculum. In fact, UV's initiative is not "getting rid" of lectures so much as shifting the method and timing of their delivery. What is important is the *format and quality* of the instructional messages conveyed by any approach. Lectures are not *inherently* worse than other strategies; they just tend to be overused and poorly designed. A nationwide study showed that lecture was used nearly 53% of the time in elementary school alone, and the estimates are higher in college. No approach to learning is the ideal format for more than half of all public education.

Lectures are often used for information transfer, with teachers packing information onto slides and reading them fast enough to finish by the end of class. In the future, I will write about Gagné's nine events of instruction, which lie at the heart of all effective learning activities. For now, suffice it to say that information transfer addresses *at most* two of these nine events (inform the learner of the objectives, and present stimulus material), ignoring the arguably more important events of providing guidance, eliciting performance, and providing feedback, which approaches like AL tend to incorporate. But this need not be the case—a well-designed instructional activity will always trump a poorly designed activity, regardless of the approach used.

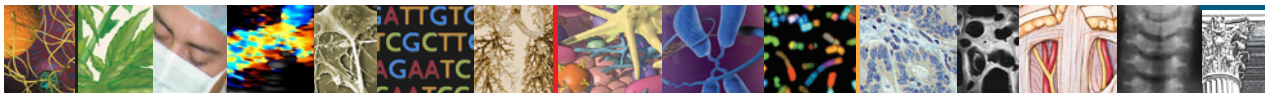
So what are the potential strengths of a well-designed lecture, and where and when should lectures be used? First, lectures can embed any instructional strategy we choose, including AL, as I have written and presented on previously. Mini-lectures are routinely part of AL to reinforce key concepts and activate prior knowledge, and the flipped classroom often consists of recorded lectures.

But lectures can serve even more important learning purposes. Consuming information is not the same thing as understanding what it means, how one idea relates to another, or how that knowledge applies to real-world contexts. Well-designed lectures allow an expert to convey these things through the way he/she organizes, presents, and discusses ideas. They allow us to model how an expert thinks. The inclusion of questions allows us to gauge student learning and

ensure mastery of prerequisite ideas before moving on. And, lectures can be engaging, as anyone who has ever watched a TED Talk knows. They allow the instructor to model his/her passion, which promotes relevance, context, and attitudes that, in turn, promote future learning.

Yes, we use lectures too often and for the wrong reasons, and through poor design they tend to promote fewer of the instructional events than other approaches, but that does *not* mean lectures have *no* value and thus no place in our curriculum. Rather, we must use them (and all instructional approaches!) purposefully.

In many countries, the passing of one monarch and accession of a new one were announced simultaneously: “The king is dead; long live the king!” If the overused and poorly designed lecture has been the king of instruction and our future holds a more balanced curriculum of well-designed strategies, including a good lecture, then I say, “The lecture is dead; long live the lecture!”



The NEW ENGLAND JOURNAL of MEDICINE

Perspective

AUGUST 17, 2017

Saying Goodbye to Lectures in Medical School — Paradigm Shift or Passing Fad?

Richard M. Schwartzstein, M.D., and David H. Roberts, M.D.

"Become a doctor, no lectures required."[1] This headline about the University of Vermont's proposed new approach to medical education generated considerable controversy. Although this proposed change is more drastic than the curriculum reform taking place at other medical schools, the movement away from traditional lecture-based courses has been under way in U.S. medical schools for more than three decades. Transformation began with the introduction of problem-based learning; more recently, lecture-based teaching has increasingly been replaced by team-based learning, interprofessional education, and exercises integrating clinical medicine and basic science. But are the newest proposed changes evidence-based, or are they merely the latest fad in medical education? Are all lectures to be avoided?

Most physicians today readily acknowledge that the biomedical information available exceeds what one person can learn and retain. Questions remain, however, regarding how much content students must learn, whether that learning is best done in traditional classroom settings, and what else is required for medical trainees to become successful lifelong learners and adaptable practitioners. The ubiquitous presence of personal and institutional technology permits rapid access to medical information and enables educators to focus on helping students develop a deeper understanding of human health and disease, problem-solving skills, and the ability to transfer knowledge learned in one context to another situation.[2] Educators giving a traditional lecture with dozens of content-heavy PowerPoint slides may confuse what they teach with what students learn: the fact that a teacher has presented a piece of information does not mean that students have learned it. In fact, cognitive-load theory suggests that our brains are limited in the amount of information they can process at a time[3]; 60 slides in 45 minutes may seem like an efficient way to teach, but it is unlikely to be an effective way to learn.

Students learning new material may be deceived by the illusion of knowing and the fallacy of understanding.[2] When students hear or read material that is fluent and well presented, it is common for them to believe they have now mastered the content.

Faculty and Students Interacting in Learning Studios at Harvard Medical School.
In the "Pathways" curriculum, students focus on the application of concepts to solve clinical problems. Selected lectures remain in most courses to create frameworks for subsequent learning.

Grace Fehrenbach.

When confronted with a problem that requires application of that information, however, they may realize that their understanding is superficial at best.

To promote more thorough understanding and enhance problem-solving skills and self-directed learning — critical skills for a doctor who will be practicing for 30 to 50 years and, in the case of self-directed learning exercises, a new requirement for accreditation established by the Liaison Committee on Medical Education — medical schools have begun emphasizing active learning and team-based activities. Acquisition of information occurs largely outside the classroom: in accordance with principles derived from cognitive science, factual content is presented in study assignments that aren't overwhelmingly long, and the content is interspersed with questions or problems to ensure that students can assess their level of understanding.

In the classroom, learning can be facilitated by the instructor, but it must be driven in large part by the student. Case vignettes are important for establishing the relevance of the material. Questions can be posed in a manner that requires retrieval of information, which solidifies memory but also compels students to view information from a new perspective and transfer it to the context of the given case. Instead of posing questions that begin with "what" (e.g., "What are the causes of hypotension?"), instructors can use "how" and "why" questions (e.g., "How do you think about blood pressure control?"; "Why would this patient be hypotensive under these conditions?"). Asking students to compare a new case or example with one they discussed the previous week further facilitates the transfer of knowledge.[3] Questions for which there can be multiple right answers can be the most compelling because they encourage discourse and generation of contrasting hypotheses. Time must be allowed for students to work in groups to discuss thoughts, test ideas (both theirs and others), and begin to learn how to think like a doctor. These activities require more effort from students than it takes to memorize facts, but they are also more effective for learning and retaining knowledge.[2]

This so-called flipped classroom approach is well suited to students who are members of the millennial generation.[4] These young adults are digital natives — they have grown up with technology and are intimately familiar with it. Raised to be part of teams, they thrive in collaborative environments. They are accustomed to finding information online and learn best from visually appealing content that keeps them engaged and is presented in short segments (such as videos that are less than 10 minutes long). The traditional lecture will quickly lose the attention of many of these students, and an unengaged student is not learning.

The early returns from this approach have been encouraging, particularly in college science courses and in the dozen or so medical schools that are implementing new curricula using these pedagogical methods (see photo). In a randomized, controlled trial comparing an early version of the flipped classroom with traditional problem-based learning tutorials, students found the alternative learning environment to be more engaging and thought-provoking.[5] Students who had performed relatively poorly in prior courses had a statistically significant improvement in their exam scores — possibly because interacting with their peers and sharing their ideas prepared them better. Faculty using a flipped-classroom approach often feel liberated from the tyr-

anny of the requirement to "cover" everything. Since acquisition of information is accomplished by the student outside class, interactions between teachers and students can focus on content that is difficult to understand and on the application of new concepts to real-world problems.

So is the lecture dead? If "lecture" refers to the traditional picture of a professor standing in front of and talking at a large group of students who are passively absorbing information, then yes, we believe medical schools should be largely abandoning that teaching format. But if it describes large-group interactive learning sessions with students who have prepared in advance, with frequent questions directed at the audience, time set aside for group discussion, and use of audience-response systems (to poll students on a question to assess for understanding, for example), then we believe an interactive lecture-style format should remain an option and can be an effective teaching tool.

An audio interview with Dr. Schwartzstein is available at NEJM.org

As we look to the future of medical education, we believe it's important to avoid zealotry with respect to pedagogical approaches, including the insistence that team-based learning methods must adhere to specific criteria or that no deviation from pure problem-based learning is allowed. We can often serve our students best by fusing elements of various methods, such as team-based or case-based learning and interactive large-group learning sessions, rather than feeling obliged to adhere to a particular format. But we must also use evidence-based approaches whenever possible and rigorously evaluate our innovations, acknowledging that important outcomes may include student engagement and problem-solving skills, team dynamics, and the learning environment as much as exam scores. In our daily lives as clinicians, we aim to create a culture of continuous quality improvement. We should strive to create the same culture in our educational lives.

Disclosure forms provided by the authors are available at NEJM.org.

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Medical Education in the Era of Alternative Facts

Richard P. Wenzel, M.D.

Students currently entering U.S. medical schools arrive in an era of increasing distrust of large institutions, expanded use of social media for information, a political lexicon in which uncomfortable facts are derided as "fake news" while fabrications masquerade as reality, and the erosion of truth that such trends entail. The challenges for medical education are imminent and formidable. How do we, as teachers, merit the trust of future physicians? How do we pass on to them science's preeminent legacy of propelling advances in understanding, preventing, and curing illnesses? How do we instill in them a lifelong appreciation for the importance of hypothesis testing, peer review, and critical analysis of research? These questions should prompt an immediate review of the goals and processes of education and the values we need to emphasize in day-to-day interactions with students.

A useful early step in earning the warrants of students is a transparent review of the history of ideas in medicine. Such a survey would make clear that some ideas have worked, some have failed, and some have turned out to be built on scientific fraud — but that developing and testing hypotheses that might not pan out are essential to the scientific method. New ideas have often been rebuffed strongly by people in authority who had reason to fear challenges to the status quo. Some investigators didn't live long enough to see their novel ideas

ER Corner: What Is Active Lecturing? *(hint—it's not a wellness initiative!)*

As I indicated in my last ER Corner, this week's column will discuss how to integrate Active Learning (AL) into "traditional" lectures. I will also hold **a workshop on this topic at noon on Wednesday, November 2.** See below for a link to information about the workshop and how to register and attend in person or online.

Active Learning is a collection of teaching strategies that promote learning as an interactive, two-way process. It can include the use of questions, small-group discussion, problem-based learning, and case-based reasoning. When this is done in large groups, it is sometimes referred to as SCALE-UP (from its origins as a way to address critical thinking in large science courses at the undergraduate level), which is why several SMHS rooms are called SCALE-UP rooms. See Education Resources' AEIS page for further reading on AL and the evidence behind it. So if AL's benefits are so unequivocal, does that mean we have to abandon the lecture? Absolutely not. **AL is not always the "right" approach to teaching, nor are lectures or textbooks "wrong."**

However, I do argue that all good lectures incorporate AL strategies in some form or fashion. In the balance of this article, I will outline five "levels" of AL, from minimal to extensive, that can be integrated into your lecture. The higher the level, the more powerful its effect, the more complex the learning outcomes that can be achieved, and the more effort that is required of the instructor and students. The good news is that ANY level of AL will produce significant and measurable learning outcomes.

Level 1. This level is based on research that shows that the attention span ranges from 8 seconds (continuous attention) to 20 minutes (intrinsically motivated attention). The consensus is that our learners can manage 10 minutes of attention without a "reset" of some kind. From this arises the 10–2 strategy: talk for 10 minutes, break for 2. What you do during those breaks is up to you, but even waiting for students to finalize notes and, hopefully, ask questions, is highly effective and requires no extra preparation, making Level 1 possible for anyone to achieve.

Level 2. Level 2 is an enhanced version of Level 1, in which you use questions before, during (the 2-minute breaks), and/or after the lecture to gauge student learning (how well they truly understand what has just been covered) so you can adjust your lecture on the fly or provide guidance to your students about what you think is most important.

Level 3. Level 3 is a further extension of Level 2, in that you use response systems like *Turning Point*® to ensure student anonymity of responses, which increases participation across the entire class. This gives you more information about class knowledge and ensures that all students benefit from question contemplation AND committing to an answer (research shows that the act of committing to an answer results in better learning than sitting on the fence).

Level 4. This level requires more of you in terms of planning and more of your students during class but is still easily managed. Here, you present a question that requires more than a yes/no

or multiple choice answer (e.g., a case to diagnose; an example to apply the tool you just lectured on) to the students in one of two ways. With the first strategy, called "Fishbowl," you have one group of students (often with support from or participation by you) model the process of answering the question/addressing a case as a group while the rest of the class watches the interaction, with pauses and analysis by you as needed. It is a form of vicarious learning (along with modeling and debriefing), which research has shown results in nearly the same outcomes as full participation. With the second strategy, "Jigsaw," you place all the students into groups (no more than 8 per group is best). Each group independently solves either the same problem or different aspects of the same problem. You reconvene the class after the process to debrief each solution or to integrate and synthesize each group solution.

Level 5. This level is the most complex and thus the least easily conveyable in the space we have here. Suffice it to say that Level 5 is akin to what is sometimes called "the flipped classroom," in which you direct students to learn lower-level outcomes (e.g., verbal information, facts, and definitions) through outside readings and materials you provide, and then you use the live class session for complex, higher-order application questions under your guidance. This level requires a significant amount of work on your part and an adjustment period for your students, so it should be reserved for the most complex outcomes—those not easily achieved through other means.

All five levels are in use right now in our building by your own colleagues in different programs, so you can be assured that you can do so as well. Your students will learn and retain more and, with practice, you will find that the process is rewarding and even liberating in some ways; it is a lot more fun to be the architect of learning than it is to be deliverer of information! If you want to learn more about and gain practice in each of these levels, come to the **AEIS workshop on AL November 2.** For more information on attending this workshop in person, participating live from another campus, requesting a workshop on your campus, or to set up a consultation with Education Resources for teaching or education scholarship assistance, contact Shae Samuelson at (701) 777-6150.