

# Creating and Presenting an Effective Lecture

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**Abstract** Lectures are a key tool for large group teaching in continuing professional development and continuing medical education within the health care professions. However, many practitioners who deliver lectures have not had the time or opportunity to participate in formal training on how to give an effective presentation. In this article, we will provide a comprehensive guide for creating and presenting an effective lecture. We will discuss evidence-based principles of effective teaching, slide organization and design, active learning, and public speaking.

**Keywords:** lecture, presentation, medical education, PowerPoint, slides, active learning

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## PROBLEM STATEMENT

Lectures are a key tool for the medical educator to deliver content to multiple levels of learners as part of continuing professional development and continuing medical education. However, many educators have not had the time or opportunity to participate in formal training on how to give an effective presentation. Although there are multiple common criticisms of the traditional lecture, if done well, the lecture can still be a vibrant and engaging educational tool. Many educators and health care practitioners are not aware of the evidence-based principles that guide the creation and presentation of an effective lecture.

## SOLUTION

In this article, we provide a comprehensive guide for creating and presenting an effective lecture using evidence-based principles of effective teaching, slide organization and design, active learning, and public speaking. We reviewed the education literature broadly (both within and outside the health professions) to derive this set of best practices. The contents of this article can be used as a toolbox by practitioners at all levels and across all specialties of practice who give lectures or implement educational programs.

There are multiple criticisms of the traditional lecture: that it is passive, static, “one-size-fits all,” not learner-centric, uninspiring, and can lead to less knowledge retention than other methods of instruction.<sup>1-3</sup> However, lectures are not “dead” and are still an important and effective means of delivering curriculum in various settings, including in continuing medical education.<sup>4-8</sup> Specifically, lectures provide an efficient method for delivering substantial amounts of factual information to

a large group of learners, can be effective at providing inspiration to further interest in a given subject, and can be recorded and made available to learners at a future date.<sup>6,9</sup> If done well, lectures can be interactive and engaging,<sup>1,4,8</sup> and many of the criticisms mentioned previously can be mitigated by using best practices for creating and delivering an effective presentation, as will be outlined in this article.

## Preparation and Effective Teaching

The main goals of a lecture in the health professions are to transmit information to learners and inspire them about the topic.<sup>1,4,9</sup> In essence, an effective lecture is a memorable lecture; however, it has been shown that learners capture less than half of a lecture in their class notes and even worse and remember less than 10 percent of a lecture several weeks later.<sup>10</sup> Then, how can we create lectures that will be memorable?

To set the groundwork for how to construct a memorable lecture, it is important to review briefly the theory behind memory formation, learning, and effective teaching.<sup>10-12</sup> There are three core components of the learning process: attention, comprehension, and integration (Figure 1A).<sup>10,11</sup> First, to focus the audience’s attention, you can start your lecture with questions, case scenarios, personal anecdotes, powerful quotes, or illustrations. Second, you can facilitate comprehension by creating a “roadmap” to understanding with thoughtful consideration of a presentation’s title, outline, and learning objectives. These first two steps help the learner create short-term memories. However, to form long-term memories, you must also foster integration by creating opportunities for the audience to relate new information to existing information through application and review. You can ask the audience to use information from your presentation to apply to a case scenario, use it to solve a problem or dilemma, or have them compare and contrast concepts. Opportunities for review may be difficult if you will not be with the audience after the lecture; however, you can still prime the audience for review by summarizing important points, closing the presentation with instructions on how to apply material from the session, and by providing a handout or identifying resources that allow the audience members to revisit key concepts from your presentation.

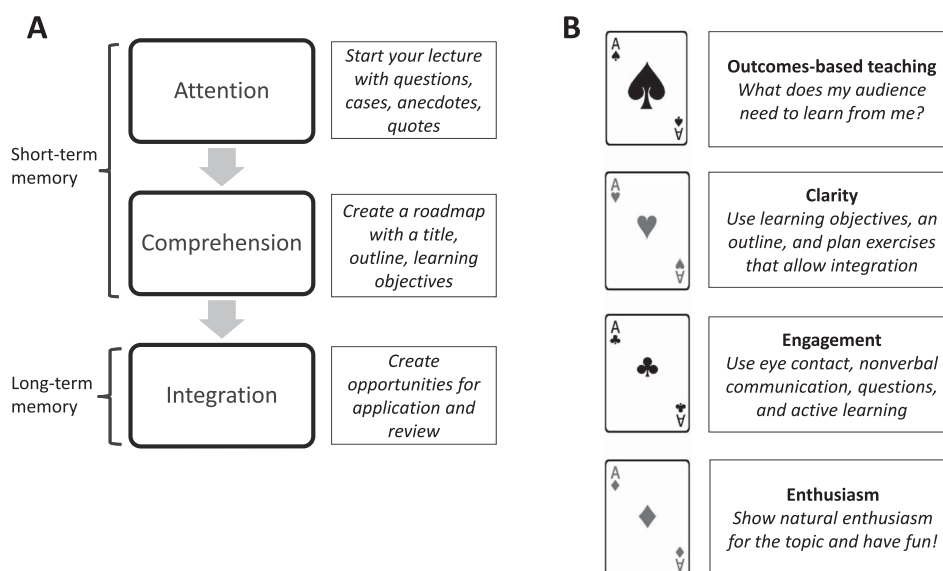
The main principles of effective teaching are linked to these core components of learning. Bulger described these principles as the “four aces,” and they are linked to increased retention of

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**FIGURE 1.** Frameworks of learning, memory, and effective teaching. A, The three core components of the learning process (attention, comprehension, and integration) are shown along with their relationship to memory formation. Examples of how a lecturer can facilitate these steps are shown in italics in the boxes on the right. B, Bulger's four aces of effective teaching are shown, along with examples in italics of how to implement each "ace."

information (Figure 1B).<sup>12</sup> The first "ace," outcomes-based teaching, is a reminder to start with the outcome in mind. You should ask yourself, "What do my audience members need to learn from me?" and "What do I want them to be able to do?" A critical component is to "know your audience" so that your outcomes are appropriate: are the learners new to the topic or are they experts? Stay learner-focused by asking key questions to facilitate understanding and to put topics in context.<sup>12,13</sup>

The second "ace" is clarity and centers around organization and restraint. Thoughtful learning objectives can help you organize information and should be specific and measurable. They should answer the question: "Who will do how much (and possibly how well) of what by when?"<sup>14</sup> For example, "At the end of this lecture, attendees will be able to identify three risk factors for *Clostridium difficile* infection." You can also organize information through the use of a thoughtful outline and by asking conceptual questions to organize your presentation. For example, instead of stating, "We will discuss mechanisms of antibiotic resistance," you can ask, "How do bacteria become resistant to antibiotics?" This will immediately begin to engage your audience and stimulate them to start thinking about the topic. Finally, plan your time and be mindful of your audience's attention span. This is where restraint and avoiding "information overload" come into play. Plan to group or "chunk" information in your presentation and incorporate exercises that allow time for review, reflection, and integration. Spaced repetition, where concepts are periodically reviewed, is a technique that has been shown to enhance retention of information. This can be done by summarizing concepts and revisiting key take home points throughout your lecture.<sup>12</sup>

The third "ace" is engagement.<sup>12</sup> To engage with your audience, think of your presentation as a conversation rather than a one-way street. You can do this through eye contact, nonverbal communication, posing questions to the audience, and most importantly, by incorporating active learning. Active learning is defined as anything that involves learners in doing things and thinking about the things they are doing.<sup>15</sup> It has been shown to increase retention of information for several reasons: not only

does it create a mechanism for the audience to engage with the material and transition from a passive to active mindset but also it breaks up the presentation into bite-sized, manageable, and memorable portions.<sup>15</sup> We will discuss specific active learning strategies and examples in more detail below.

The fourth "ace" is enthusiasm, which is somewhat related to engagement. Consider how you naturally convey enthusiasm for a given topic and build off of that. In essence, be yourself and have fun.

### Slide Organization and Design

The first step in organizing your lecture is to map out the key points you want to deliver that are in alignment with your learning objectives. It can also be helpful to plan out how many slides you will use over the entire lecture to convey these points. There are no data to support a "right" number, but a good rule of thumb is to limit yourself to one slide per minute (or less) and keep your content at one idea per slide. The key here is to show restraint (this can be hard) so as to not overwhelm your audience with information. If you have trouble cutting down the number of slides, make sure you are adhering to the learning objectives for your lecture. If you have slides that you want your learners to use as a reference, put them in an appendix or syllabus for reference but leave them out of the presentation itself.

When constructing a lecture, it is helpful to organize it into three main parts: an introduction, content sections, and a conclusion. To highlight this organization, you should use section headers or outline slides to "signpost" each section so the audience can keep track of where you (and they) are in the lecture. These are both examples of the signaling principle, one of Richard Mayer's research-based principles for instructional design: People learn better when essential material is highlighted using an outline and headings.<sup>16</sup> When mapping out the three main parts of your lecture, the introduction should establish a welcoming and safe climate for learning and get the audience's attention with a personal story or emotional hook. Your content should then be organized into 10- to 18-minute sections. This short length is because during a lecture, students

have a lapse in attention after just 10 to 18 minutes.<sup>17</sup> In fact, TED talks are designed as 18-minute presentations for precisely this reason.<sup>18</sup> Finally, wrap up with a conclusion where you summarize the main points and provide closure.

When choosing a slide template, it is important to consider basic color design principles. First, use a simple template to highlight your content but not distract from it. Text over graphics and patterns can be very hard to read, so it is wise to avoid their use as backgrounds. Using a photograph as a background can occasionally be a nice touch but only if there is very little text on top of it. Second, use colors that contrast by setting dark colors (blue, black, or purple) against light ones (beige, white, or gray). Backgrounds can be dark with light-colored text or vice versa; however, if a meeting room is brightly lit, then a light background with dark text will be easier to read. Third, avoid using strong colors next to each other as these will clash (eg, bright red and bright blue). Similarly, avoid putting red and green together as members of your audience who are color-blind will have difficulty distinguishing them.

A key principle in slide design is to limit clutter on your slides. Edward Tufte, who has written extensively about the visual presentation of information, said, “clutter and confusion are failures of design, not attributes of information.”<sup>19</sup> Think of your slide as a blank canvas, where the blank space should highlight the important information on the slide. In short, you want to limit how much is on the slide to limit extraneous overload (where too much processing of extraneous material interferes with learning). This is the foundation of Mayer’s coherence principle: People learn better without extraneous, irrelevant material.<sup>16</sup>

The challenge is creating a slide that contains all of the information you want to deliver but also adheres to the coherence principle. We propose three main ways to accomplish this: (1) Turn text into visuals. This not only helps to avoid clutter but also improves retention. Mayer’s multimedia principle is informed by research showing that people learn better from words and pictures than from words alone.<sup>16</sup> For example, using an instructional strategy of adding visuals to words can improve recall from 10 to 65% at three days after a presentation.<sup>20</sup> We outline a number of strategies for using visuals effectively in Table 1. (2) Although the amount of text on slides does not necessarily impact learning outcomes, it does contribute to increased cognitive load.<sup>21,22</sup> As such, it is helpful to limit the text to key points and then use the notes section to store text that you want to remember to say. In this way, you will have clean slides but still have all of the information in the notes, both for practicing as well as for reference the next time you want to give the lecture. (3) Finally, you can put extra information into an appendix slide, handout, or syllabus. Handouts and supplementary materials can be particularly helpful tools that allow your learners to revisit material or have an opportunity to thoroughly examine subject matter at a later date.

A few other tips for text are to use at least 24-point font size, preferably larger, and to use a simple font such as Arial or Calibri. Finally, use animation thoughtfully. Although it can help to animate within a slide that is particularly busy, always consider if there is a way to de-clutter the slide or use less text. When animation is used, choose a simple animation function such as appear or disappear and avoid distracting animations like spinning and flying.

### Active Learning Techniques

As you are thinking about how you will incorporate active learning, take a moment to think about how you will create

**TABLE 1.**  
Strategies for Effective Use of Visuals on Slides

Strategy	Example
Use graphs to replace text	Use a pie graph instead of a list to show the most common causes of chest pain
Use photographs as examples	Show examples of physical examination findings (eg, a rash or swelling of an extremity) or diagnostic testing (eg, blood smears, culture results, imaging results, or pathology).
Use photographs to highlight a point	Show a photograph of a small girl at a petting zoo with her hand in her mouth to illustrate the infectious risks of petting zoos. This is much more powerful and memorable than just making the statement!
Embed videos	These can be of teaching strategies, echocardiograms, physical examination findings, etc.
Use visuals to organize text	Powerpoint has a SmartArt tab with templates which can help organize text in a way that can enhance your point. You can use venn diagrams, timelines, and other graphics as a way to organize your text and move away from bullet points.
Avoid outdated graphics	Outdated graphics can be found with earlier versions of slide presentation programs. These are distracting in the current era where high-resolution images and graphics are the norm.
Make your own tables	When showing tables from papers, in almost all cases, it is better to remake the table with the data of interest rather than showing the entire table (which will usually project in 6 point font!). Try to avoid ever saying “you probably can’t read this slide” or “the text is probably too small for you to see” or “this is a really busy slide but . . .”

a safe learning environment. One way to do this is to set expectations (nobody likes a pop-quiz). Let your audience know what you will be asking them to do, and remember that the size of the group matters. For larger audiences, you may want to pose lower stakes questions such as asking your audience members to reflect on an experience (rather than asking them a question that has only one right answer).

As a rule of thumb, plan to incorporate an active learning activity at least once every 15 to 20 minutes because, as mentioned previously, the average attention span of a given audience member is less than 18 minutes.<sup>17,18</sup> However, if someone has been in several teaching sessions throughout the day (eg, during a continuing medical education course), you can expect that their attention span will be even shorter. In those situations, you may want to incorporate an active learning technique even more frequently (eg, every 10 minutes) depending on the teaching session, audience, and subject matter.

There are a variety of active learning techniques that can enhance your teaching sessions, and we give specific examples and implementation tips for various techniques in Table 2.

### Pause Procedures

Pause procedures are periodic breaks during lectures that allow learners an opportunity to relate to, review, clarify, and/or integrate information. During the pause, you can ask your audience to quietly reflect on a key point, jot down their response to your question, or “pair-share.” A pair-share activity involves audience members turning to their neighbor

**TABLE 2.**  
**Strategies for Effective Use of Active Learning Techniques**

Technique	Specific Activities	Examples	Implementation Tips
Pause procedures	Individual reflection Written response Pair-share	Reflect on and share experiences Answer questions Teach-back information Discuss unclear concepts or the “muddiest point”	Try out different combinations of active learning techniques. For example, reflection exercises can be combined with pair-share activities.
Audience response questions	Show of hands Audience response system Web-based polling systems	Multiple-choice questions True/false questions	If you are using the “high-tech” version of ARQs, be sure to have a backup plan, just in case!
Audience-panel engagement	Convene panel, pose question, have audience discuss and commit to an approach, and then listen to panelist responses	Interprofessional topics Ethical considerations Clinical conundrums Diagnostic dilemmas	By having audience members make a commitment before hearing what the panelists have to say, the session will be much more memorable.
Small group discussions	Discuss cases  Solve problems  Develop application strategies	Explore different aspects of larger topic (eg, sections of a fishbone diagram for a root cause analysis discussion) Learn about a topic in depth and teach to large group Role play	Be prepared to sacrifice breadth to some extent, but this is an activity where genuine application of new information can really take place.
Games	Jeopardy Bingo Pictionary Charades Heads up	Reinforce concepts Assess level of understanding Introduce new topics Springboard for discussion	You can incorporate traditional games—such as jeopardy, bingo, or pictionary or entirely new games that directly pertain to your topic. This is really an opportunity for you to be creative!

ARQs, audience response questions.

and discussing their responses. Depending on the amount of time you have, you may or may not ask them to share what they discussed with the larger group. If you are asking them to share, you can consider asking them to discuss points from your presentation that were unclear (the “muddiest points”) to offer you an opportunity to clarify concepts. Pauses can be 30 seconds to 3 minutes in length and have been shown to both enhance retention and increase audience satisfaction.<sup>23</sup>

### **Audience Response Questions**

These are a specific type of pause procedure, which are commonly used and deserve dedicated consideration. Audience response questions can help you to dialogue with your audience and can either be “low-tech” (show of hands) or “high tech” (using an audience response system, software, or web-based technology). Be sure to consider the time allotment you will need to pose the question, allow the audience to respond, and then debrief the responses. Plan to discuss the reasoning behind both the correct and incorrect answers.<sup>24</sup>

### **Audience-Panel Engagement**

Another technique is to turn a panel discussion from a passive experience to an active one by using the audience-panel engagement strategy. This technique works well for interprofessional learning or when a variety of perspectives would be helpful. Consider inviting three or four faculty to be on your panel. During your teaching session, pose a question or a scenario to both the panel and the audience, but do not let the panel answer right away. Pause and have audience members discuss and commit to a response. Then, have the panelists answer and allow your audience to see how their response matches up.<sup>25</sup>

### **Small Groups**

Small group discussions or breakout sessions can be used in smaller, less formal environments. Your audience can discuss cases, solve problems, and perhaps formulate an action plan on how they will apply information from your session at home. These small group discussions are helpful tools to teach about a given topic in depth.<sup>26</sup>

### **Games**

One reason to consider incorporating games is that they are fun. These are best suited for less formal sessions and can be used to reinforce principles, as a springboard for discussion, and even to encourage a little friendly competition. Examples include playing jeopardy-style quiz games or pictionary-based drawing games on the topic of interest. You can split the room into small groups or larger teams, depending on the game, and even play for prizes. Games are widely used in medical education, so many of your audience members may be familiar with the concept already.<sup>27,28</sup>

The size of your audience and the formality of your presentation will inform which specific active learning strategies you may want to incorporate. For example, for very large and formal presentations, you may choose pause procedures and audience response questions. For less formal sessions, you may choose to incorporate audience-panel engagement activities, small group discussions, and/or games.

### **Public Speaking**

If you think back on a memorable speaker, what did he or she do to be so effective? Nonverbal communication (ie, body language) and confidence are important components of giving an effective presentation and have been linked to higher scores for presentation performance and teaching effectiveness.<sup>29,30</sup>

EFFECTIVE LECTURE CHECKLIST		
	SUCCESES	AREAS FOR IMPROVEMENT
<b>PREPARATION</b>		
<i>Outcomes-based Teaching</i>		
<input type="checkbox"/> I based my presentation on key questions		
<input type="checkbox"/> I planned activities to foster integration (application, review)		
<i>Clarity</i>		
<input type="checkbox"/> I organized the presentation into a logical outline		
<input type="checkbox"/> I based content on 3-5 specific, measurable learning objectives		
<i>Engagement</i>		
<input type="checkbox"/> I planned to have a conversation with my learners		
<i>Enthusiasm</i>		
<input type="checkbox"/> I reflected on ways to demonstrate enthusiasm		
<b>PRESENTATION</b>		
<i>Slides</i>		
<input type="checkbox"/> I included an appropriate number of slides ( $\leq 1$ per min)		
<input type="checkbox"/> I organized my slides		
<input type="checkbox"/> I used visuals (pictures, graphs, tables)		
<input type="checkbox"/> I used a font that was minimum 24 point, Arial or Calibri type		
<input type="checkbox"/> I used a simple template with contrasting colors		
<i>Techniques to Create Long-term Memories</i>		
<input type="checkbox"/> Focus Attention: I began with a technique to focus attention		
<input type="checkbox"/> Comprehension: I explained the framework or “big picture”		
<input type="checkbox"/> Integration: I used pauses effectively for review, integration		
<input type="checkbox"/> Integration: I used activities for learners to apply information		
<i>Active Learning</i>		
<input type="checkbox"/> I created a safe learning environment		
<input type="checkbox"/> I used at least one active learning technique every 15-20 min		
<i>Public Speaking</i>		
<input type="checkbox"/> I conveyed confidence and enthusiasm		
<input type="checkbox"/> I knew the content well (did not just read my slides)		
<input type="checkbox"/> I engaged my audience		
<input type="checkbox"/> I ended on time		

**FIGURE 2.** Effective lecture checklist. This rubric is a summary of the principles of learning, memory, instructional design, and public speaking discussed in the article. It can be used as a checklist for self-improvement when creating, organizing, and presenting an effective lecture. Each item has a box that can be checked if it was included in your presentation, and there are columns to note particular successes or areas for improvement for each item.

Important components of nonverbal communication include an open posture, relaxed stance, expressive gestures, inclusive eye contact, and warm facial expression; confident behaviors include making good eye contact, using a strong voice, appearing relaxed, and having a manner that conveys authority.<sup>30</sup>

Teacher enthusiasm is also highly linked to teaching effectiveness and increasing learner intrinsic motivation and engagement; importantly, this is not a fixed characteristic but rather is something that can be learned.<sup>31</sup> Enthusiasm can be shown by varying tone and pace of voice, using movement (walking around, making eye contact, and avoiding standing behind the podium), and humor (although know thyself). If you cannot avoid the podium (eg, in a large lecture hall), try to still move around a little and avoid gripping the sides of the podium, as this can make you look nervous.

Two other ways of engaging the audience are notable: (1) When using slides, your audience will naturally be drawn to these. When using PowerPoint, if you want to shift the focus off your slides and onto you as the speaker, you can press the “B” key on your keyboard and it will turn your screen black. (2) Tell stories that stick by using a detailed story with an emotional hook.

Many people have a fear of public speaking; in fact, in one study, more people were afraid of public speaking than were afraid of height, insects, and even death.<sup>32</sup> You can overcome this fear of public speaking by recognizing how common it is, by practicing your presentation, and by scouting the room where you will be giving your lecture so there are no surprises when you arrive. Practicing a lecture so that you know it cold allows you to use your energy to engage the audience rather than worry about what you are going to say. It will help you avoid “reading your slides” (a common criticism of lecturers) and allow you to time your presentation appropriately so that you end on time or, preferably, even a bit early. You want to start your lecture strong with introductory remarks that will hook the audience—practice these. These are often given without a slide and practicing what you will say will give the audience a great first impression.

Finally, it is critical to get feedback on your presentation. Many institutions now have formal peer teaching observation programs, but informal feedback can also be very helpful. Have a colleague or mentor give you feedback or videotape yourself. Carefully read any written feedback you may get. This can

allow you to identify blindspots: for example, physical and verbal mannerisms of which you may not be aware.

## CONCLUSION

Being able to deliver an effective lecture is a critical part of the medical educator's toolbox. The lecture, if done well, can be an engaging, vibrant, interactive, and effective means to deliver key information in continuing professional development. The tools for constructing and presenting an effective presentation that we have outlined here are all derived from the education literature and incorporate evidence-based principles of learning, memory, instructional design, and public speaking. Taken together, they form a rubric that can be used as a checklist for self-improvement when creating, organizing, and presenting an effective lecture (Figure 2).

### Lessons for Practice

- Base your presentation on key questions and use specific, measurable learning objectives to frame the content of your lecture.
- Organize your lecture into sections and use an outline with signpost slides.
- Avoid clutter on slides by limiting text and adding visuals.
- Use a simple slide template with contrasting colors.
- Create a safe learning environment for active learning and use at least one active learning technique every 15 to 20 minutes.
- Project confidence and enthusiasm.
- Practice, practice, practice, and get feedback.

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