Effective Medical Lecturing: Practice Becomes Theory

A Narrative Review

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Abstract

Effective lecturing stimulates learning, creates a verbal history for our profession, and is a central basis for evaluating academic promotion. Unfortunately, few resources exist in the medical literature to guide the academician toward success as an effective lecturer. Using evidence-based principles, this review fosters adult learning in academic venues by incorporating the latest innovations in educational theory for both online and traditional teaching. The novice or advanced academic teacher will be guided toward critical self-evaluation of current teaching practices and encouraged to replace ineffective methods with ones more likely to be both rewarding and rewarded. By introducing literature-based learning techniques, emphasizing audience targeting, truncating content to an appropriate level of detail, effectively linking images and text, and accepting the brevity of learners' attentiveness, we show that the audience, not the speaker, is the primary educational focus.

Keywords Faculty development · Adult learning · Learning theory · Audience response system

The Challenge

Public speaking is the “ancient pillar” of academic medicine. “Talks” to groups of students and colleagues are a measurable milestone for academic advancement and achievement. This pressure, combined with increasing demands to “educate our students,” has led to the common but paradoxical practice of “ineffective lecturing.” Producing an ineffective lecture is actually quite simple. “Step One” requires creating a PowerPoint presentation with heavily bulleted slides replete with large quantities of information. “Step Two” involves presenting the talk by systematically reading each slide to the audience while reflexively facing the screen to reduce speaker anxiety. Listeners seek refuge from this burdensome endeavor by addressing e-mails, texting colleagues, and often disengaging toward unconsciousness. As the talk ends, the audience politely applauds as is the custom, and then forgets the talk within the hour. The speaker “safely” escapes, ready to “teach” another day. This cycle is repeated in countless centers of academic

learning and, just as often, our trainees complain about unengaging lectures. There is no rationale sufficient to justify poorly designed and delivered talks. With focused instruction and practice, virtually any academician can deliver a more engaging and memorable presentation. This transition to effective teaching is wholly compatible with current theories of adult education as well as current research in human cognition.

The Great Lecture

The components of the “great lecture” were first outlined in the fourth century B.C.E. by Aristotle in his *Rhetorics*. In *Book One* of this treatise, Aristotle described 3 components of an effective presentation: an appeal to reason (*logos*) and to emotion (*pathos*), as well as the speaker's personal characteristics (*ethos*) [26]. These are equally applicable to our current educational mission: an effective talk presents *information* in a logical fashion that stimulates the listener and induces an *emotional* response that allows the information to be embedded in memory. This purposeful reaction occurs in response to an engaging presentation style that includes enthusiasm and the “speaker's fluidity”.

When the subject of the “speaker's personality” is raised, a common defensive retort is that charismatic speakers are clearly charlatans using “smoke and mirrors” to hide their lack of

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content expertise or are mere *entertainers* rather than educators. The naysayers posit that a *good* presentation is simply a straightforward presentation of most up to date and factual material and that, beyond this, all else is a “popularity contest” irrelevant to effective education. This commonly held belief supports countless ineffective lectures in academic, business, and governmental settings. More importantly, it serves as the excuse to avoid engaging, memorable presentations.

The “Dr. Fox Experiment” seemed to support this preeminent attitude. In 1973, a psychological experiment was conducted wherein a “Dr. Myron Fox” presented a talk to a group of educators entitled “Applying Mathematical Game Theory to Medical Education.” Dr. Fox was in fact an actor who provided a warm, funny, and engaging style lecture, the content of which was gibberish. As might be expected, the audience favorably responded to Dr. Fox. This contributed to the “charlatan” theory of engaging lectures by concluding that a “good” lecturer fools an audience into appreciating a false narrative [20]. However, a subsequent experiment conducted in 1975 confronted this conclusion. In this scenario, several lectures were given with a variable amount of educational content. Each talk was delivered by two speakers: one with an engaging style and another with a straightforward but unengaging style. For both speakers, the engaging style resulted in greater content retention by the audience after high- and low-content lectures. This observation suggests that content is more effectively transmitted to an audience by a “good speaker” and translates to significant educational benefit [28], a finding subsequently replicated by others [18]. The key to engaging the audience mandates attracting and holding their attention. Unfortunately for educators, the adult attention span is limited to 10 min [5, 15], complicating the speaker’s task of sustaining engagement for the classic 50-min lecture. Moreover, the studies that demonstrated this “10-min” attention span were conducted before the era of smartphones and social media, and it is believed that today’s listeners have an even shorter attention span. Fortunately, audience attention span can be periodically “reset” by varying format, adding interactive features discussed below, and re-iterating key teaching points throughout the lecture.

Lecture Time Management

“Time” itself is the vital ingredient for preparing an effective presentation but, unfortunately, is least available. Multiple stimuli, including competing academic priorities, vacuum away the time for selecting lecture content appropriate content for the audience, identifying learning objectives, drafting and refining an effective slide set, and adding a pinch of reflective or active learning breaks, leaving inadequate practice time to deliver the lecture in an easy, conversational style. This daunting grocery list of “lecture to-dos” causes even well-

intentioned educators to travel the “path of least lecture resistance” by piling information into each slide and then reading them aloud to the audience, effectively guaranteeing that our audience ignores our lecture efforts.

Academic reality, a tradition of unengaging talks, and the view that effective lecturing cannot be mastered all sustain our lecturing status quo and inevitably lead to the creation of “bad talks.” Since time cannot be created *de novo*, it is quite tempting to open PowerPoint with a sense of urgency, skip educational goals, pile factual information onto enough slide to fill 50 min, ignore slide design, forego learning-enhancing images, omit audience invitations to actively reflect or participate, and then, for the “sake of time,” exclude a lecture summary. Admittedly, a “bad talk” can be prepared in a remarkably short time but with predictable results.

Our challenge is to change behavior despite the palpable historical pressures that sustain it. We propose that in following a simple set of lecture preparation guidelines, lecturers will instantaneously change the preparation process by replacing it with intentional concepts, organization, and design. Suggestions for improving lecture effectiveness and also minimizing the time required to create an effective lecture are summarized (Table 1). Remarkably, this strategy creates a “bite-sized” and disciplined approach to lecture preparation by using a framework based on effective educational principles for adult learners, and with practice eases the preparatory burden such that successful lectures become virtually formulaic and even routine.

Remote Internet teaching, complete with physical distance between students and teachers, raises unique challenges and requires novel solutions to sustain effective teaching. While remote teaching and lecture preparation continue to provide the expected challenges, teaching from a distance complicates feedback and resonance with students, permits listeners to invisibly “check out,” and affords teachers the opportunity to admit defeat, retreating to ineffective teaching methodologies that pre-date Zoom, Teams, and other surrogate Internet media. Since the adult learners and teachers are themselves identical, strategies for engaging remote listeners and

Table 1 Time-saving tips for effective lecturing

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- Preparing 2–4 weeks in advance
 - List 2–6 key teaching points geared to audience (use as slide no. 2)
 - Design slide with largest, uniform font, spacing, and line number (see Figs. 3, 4)
 - Add images to stimulates visual learners (e.g., Google Images)
 - Insert microsummary slides: emphasize content; smooth topic transitions
 - Consider 1–2 audience questions
 - Rhetorical queries simulate reflection; small group discussions actively engage learners
 - Summary slide; mirrors 4–6 key teaching points
 - Practice delivery until each slide is familiar
-

transmitting information that challenges and engages them in a manner that stimulates learning remain a central goal. Based on experiences to date and input from the latest educational literature [4, 7, 21, 22], modest adjustments by the lecturer substantially improve the remote learner's and lecturer's experience (Table 2).

How to Plan Lecture Content

Using principles of adult learning to plan a lecture increases its impact. These principles, articulated by Malcolm Knowles, are a valuable conceptual framework for teaching adult learners. Despite some controversy [19], these principles remain useful for designing effective teaching sessions [14]. An ineffective (Fig. 1a) vs. effective (Fig. 1b) slide listing *Knowles Principles of Andragogy* is shown.

Two adult learning principles are most relevant to creating effective presentations. First, adults request learning that is relevant to their lives and work practices, making it critical that each talk be *relevant* to the audience [15]. This may seem obvious but also at odds with being “authoritative” by providing as much factual information as time permits. A typical disease-specific academic talk is structured to include (in historical order) disease epidemiology, clinical presentation, diagnosis, prognosis, and current therapy. Under each topic heading, a wealth of information is presented as bulleted slides with full sentences or typed paragraphs. Although this approach has a modicum of educational merit, the true question of relevance refers to what the audience *will do* with the presented information in their daily practice. For example, when speaking to a public health audience, emphasis on screening and epidemiology is appropriate, whereas embellishing diagnosis and treatment resonates with primary care physicians. Medical students rarely benefit from an exhaustive discussion of the latest research on a topic. In contrast, this approach is highly effective for topic experts.

Table 2 Effective strategies for remote teaching

- Identify technological setup needs required for teaching session
- Practice screen sharing, slide advancing, sharing videos, and linked resources
- Share preparatory materials and presentation (PDFs are more challenging for students to manipulate)
- Use introduction time to engage learners; define Q/A space
- Breakout rooms and chat space to cross-engage learners promote active learner; allow lecturer to observe/share active learning across “rooms”
- Invite a colleague/student to staff the Chat space to field questions
- Provide online links to lecture resources, tutorials, or other learner resources, to address learners’ question and needs
- Seek students’ feedback and solicit for technologic improvements

a

1. Adults need to know why they should learn something.
2. Adults have a deep need to be self-directing.
3. Adults have a greater volume and different quality of experience than youth.
4. Adults become ready to learn when they experience in their life situations a need to know or be able to do in order to perform more effectively and satisfyingly.
5. Adults enter into a learning experience with a task-centered (or problem-centered or life-centered) orientation to learning.
6. Adults are motivated to learn by both extrinsic and intrinsic motivators.

b

1. “Why” drives adults learning
2. Self-direction facilitates adult learning
3. Distinct adults vs. youth experiences promote learning
4. “Life situations” or “Need to perform” inform adult learning
5. Task-or problem-based focus enhances learning
6. Both intrinsic & extrinsic factors promote adult learning

Fig. 1 Creating effective bullet points **a** An ineffective presentation of *Knowles Principles of Andragogy* with full phrases shown. The slide is intentionally designed to be read, allowing the audience of rapid readers to ignore the presenter. **b** Similar information is presented in effective bullet points that allow the presenter to embellish key teaching points while maintaining audience focus

De-emphasizing the Teacher

In an effective talk, it is not *the teacher and the topic* that are important but rather, the *topic and audience* that require emphasis. With this focus, the speaker provides *less* information but in a more targeted way, avoiding information overload that accompanies ineffective lectures [15]. *Setting audience goals* is the second critical factor in preparing a large group lecture. Goals or “learning objectives” can be either explicitly or implicitly reflected by presentation structure. The third key focus of preparation (and most challenging) is to *limit each presentation* to the 3 to 5 primary teaching points that can be effectively transmitted in a 1-h format. The remaining body of the lecture is simply designed to support these key points. This intentional exercise is a major component of effective teaching as it focuses the audience on key concepts and ideally serves as an intellectual “warm up” to inspire subsequent investigation and learning.

Audience as the Educational Target

An effectively structured lecture benefits from a discussion of *concepts* rather than *facts*. With immediate access to the world’s database using smartphones, portable tablets, and laptop computers, learners instantaneously locate specific facts and online topic summaries. The speaker’s challenge is to present a conceptual framework that enables the listener to *organize* and *use* information being presented rather than provide an updated list of facts. Cognitive science research shows that learning is not the commitment of facts to memory but the

organization of information in memory using schemas. Effective teachers create new schemas to structure their learners' knowledge base and facilitate knowledge retrieval in order to solve a problem or complete a task [22].

Once conceptualized and organized, the listeners can link the content of the lecture to their existing medical knowledge. The speaker's goal is to remind the audience of what they know and then extend and deepen this baseline knowledge [10, 11]. Presenting an unfamiliar topic to a novice audience in a lecture format is challenging. For example, the content of a "hepatitis C" lecture will widely vary depending on the audience composition and diversity: experts in the field, primary care physicians, allied health professionals, trainees, general public, or a diverse mixture. Handouts allow the learner to preemptively review new information before the lecture begins and creates educational value by showing learners that the speaker "knows the audience."

Stories and metaphors that illustrate the targeted concepts, rather than a straightforward presentation of information, facilitate knowledge encapsulation of into long-term memory [30]. Specifically, the inclusion of stories, case examples, and metaphors allows listeners to restructure their knowledge in a novel way. Well-designed lectures enhance this organizational component of knowledge generation and retention to effectively transmit 3–5 primary teaching points. Enthusiasm and emotion make teaching points more memorable [16]. Regardless of the inherent topic novelty, monotony rarely engenders audience interest. Practicing the talk permits the lecturer to present the material using natural flow and in a conversational style in which enthusiasm and emotion are the key ingredients that fuel information retention.

Nuts and Bolts of Preparing PowerPoint Slides

A well-designed PowerPoint slideshow is a critical component of an effective presentation that incorporates two key learning theories. The first concept is that learners simultaneously process visual and auditory information via two channels: the visual channel processes images including the written word, whereas the auditory channel processes speech. When these two channels are complementary, understanding and retention are enhanced [17, 25]. In contrast, discordant channels that result from reading words aloud to an audience cause the listener to ignore the speaker in deference to the more dominant visual channel. Since the audience member typically reads faster than a presenter speaks, reading slides aloud virtually guarantees speaker irrelevance. In contrast, using complementary auditory and visual information channels promotes effective learning [1].

Effective slide design is a predictable and reproducible science. First, *minimize* the number of words on each slide

while *maximizing* the use of images. Images stimulate the visual channel while the auditory channel incorporates the speaker's words. "Beyond Bullet Points" (circa 2010) operationalizes this strategy. For example, a slide title that uses a complete phrase sets the stage for complementary visual and auditory processing of the speaker's point. An image that reflects the slide title provides complementary visual stimulation for the auditory component without reading aloud [27]. An example of a poorly designed slide is shown wherein a two-word title accompanies a long diagnostic list illustrating ineffective slide making (Fig. 2a). The second panel (Fig. 2b) illustrates an effective title that "tells" the audience in words what the speaker will address above an "image of interest" that stimulates the speaker to discuss the associated diagnostic list. Dual-channel theory engages the audience without forcing the speaker to read aloud and avoids the first cardinal teaching sin. Text-heavy slides are occasionally appropriate but pared down text minimizes distractions, fosters topic understanding, and focuses audience attention on the speaker [2].

Effective text slide features are derived from business, education, and medical education literature (Fig. 3) [1, 5, 25, 27]. Font selection affects communication and using fonts ≥ 28 point size serves two functions; first, it allows the audience to recognize screen words irrespective of the venue size; and second, it places an intentional "brake" on information overload by forcing the speaker to limit the words on each slide [17]. Effective slides contain images and only a few words organized as follows: a maximum of six lines per slide with no more than six words per line. Notably, some educators suggest a simpler "4 × 4" format that further limits visual information [23]. The net effect of visual modesty is that the speaker, not the slide, remains the primary audience focus.

The next design principle is to use a single format, font type, and a consistent arrangement between slides. Complex PowerPoint animation or animation coupled to sound effects unintentionally distracts audiences [17], especially when a variety of animation options compromises slide consistency. The optimal slide design minimizes text and adds an informational image while the speaker provides content [16]. On the other hand, "building" a slide by sequentially introducing short text lines is also effective [8]. The later strategy limits words on the screen that could distract the audience. The final recommendation for generating effective slides is derived from design literature regarding "serifs": small points on the ends of letters that are incorporated into select fonts. Popular fonts including Times New Roman contain serifs, whereas Arial is a "sans serif font." Sans serif fonts are easier to read, especially in a large lecture hall, and are strongly preferred for slides [16].

Background slide color is critical for conveying visual information. Surprisingly, optics studies confirm that black text on a white background ("book style") provides the greatest

Fig. 2 Effective imagery for teaching refractory heartburn (**a**): A simple differential diagnostic list for refractory heartburn cannot be easily learned in lecture setting in the absence of imagery, or contextual stories. Endoscopy for alternative diagnoses (**b**): In contrast, an image of an inflamed esophagus invites the learners on a journey into the GI tract that serves as platform for subsequent clinical stories that include the differential diagnosis and the rationale for performing endoscopy in patients with refractory heartburn

a

- Differential diagnosis

- Reflux esophagitis
- Alkaline reflux esophagitis
- Infectious esophagitis
- Eosinophilic esophagitis
- Crohn's Disease

b

visual contrast and is therefore easiest to read. However, the standard format of a dark background with white or yellow text is readable and is also an excellent choice for large lecture halls [8, 17]. If slide color is important, then avoiding clashing colors such as red text on a blue or green background minimizes distraction and enhances readability. Specific avoidance of red and green fonts respects the significant fraction of color-blind men in any audience [25]. In contrast to schemes that use a dark background, a bright background causes pupillary constriction and compromises both image visualization and text readability. Plain, unadorned backgrounds rather than complex ones encourage focus on the speaker. Images superimposed on a dark background or that fill the entire screen with no outside border are equally effective.

- At least 28 point type
- 6 line maximum; 6 words per line
- Single format
- Minimal animation
- Use sans serif font (not serif)
- Utilize full slide height & width

Fig. 3 Features of an effective slide. Simple guidelines effectively convey visual information and enhance educational impact on learners. Consistency between slides allows the learners to focus on content

Point by Point

Bullet points are a ubiquitous thread in most PowerPoint presentations and a key organizational tool. The improper (Fig. 4a) and proper (Fig. 4b) use of bullet points is also

a

- Bullets are really full, long winded English sentences.
- Bullets have a maximum number of words to fill all available space.
- Bullets have non-parallel grammatical structure
- Employ sub-bullets under your existing bullets.
- do not capitalize the first word and use periods or extra punctuation at the end of each text line...!!!

b

- Headlines – not sentences
- Fewest words
- Parallel grammatical structure
- Avoid sub-bullets
- Capitalize first word → no ending punctuation
- Optimize bullet spacing to utilize slide height/width

Fig. 4 Ineffective vs. effective slide texting. Ineffective bullets (**a**): Examples of bullets that with less audience impact resemble a textbook and are visually distracting. Effective bullets (**b**): Effective bullet points create organization and “prompts” for the presenter and invite explanations or add a story that provides context

illustrated. The first shows bullets that are poorly designed, with each one displaying a mistake described in the text. In contrast, the alternative slide is both compact and effective. When text lines are sequentially “built,” the audience focuses on each point in an uncluttered slide as the speaker creates a story that links the text. To summarize, bullets are not full sentences but “headlines” with a parallel grammatical structure. To optimize structure, the first word of the bullet is capitalized and without punctuation. Multiple sub-bullets require smaller fonts, are often hard to read, and can violate the “ 6×6 rule.”

Presentation errors are easily categorized. For example, a complex data table is often accompanied by the phrase “I apologize for this slide” (Fig. 5a). In reality, even a sincere apology is rarely forgiven. Instead, abstraction of key data points from the larger table followed by the creation of a simple graph or chart (facilitated by PowerPoint tools) is preferred (Fig. 5b). Data slides should be straightforward, uncluttered, and without ornamentation.

The central goal of an effective lecture is well articulated by Ronald Harden, a noted Scottish medical educator, in a provocative article entitled “Death by PowerPoint.” He argues

that slides should never stand alone without the speaker. Otherwise, a handout, not a lecture, is the most appropriate educational format. The speaker’s ability to communicate ideas is an ideal focus of a talk and provides an active forum for conveying information. The slides are, in a sense, incidental. This fact is inadvertently tested during technical failures in which the speaker delivers a presentation sans slides. Educational accidents are evidence that the *audience* is the most important component of the talk, followed by the *message*, and only third by the slides [12]. The story, the case, and the metaphor are used by audiences to understand content and initiate behavioral change.

Plot Unfolds

Plot the structure in advance before incorporating specific text and images and before ordering individual slides. A presentation can be outlined using a storyboard format. This approach avoids a key pitfall of organizing primarily with an attractive list of potential bullet points. Left unembellished, and in the presence of too little practice time, bullet points read aloud

Fig. 5 Ineffective vs. effective image selection. Poorly designed data slide (a): This classic “busy” slide invites speaker apology, is of limited value in a lecture forum, and distances learners. Effective image use (b): A simple image with few words illustrates the dichotomy of “good” and “evil” members of the BCL2 protein family focus attentions, and highlights contrast between inextricably linked pro-survival and death proteins

a

b

become the Achilles' heel for the speaker. PowerPoint editing capabilities and practicing allow the presentation to be progressively truncated until only keywords and supportive images survive the finished product. In contrast, the text-heavy versions can be saved as PowerPoint "notes to the speaker" or in an audience handout. At first, this approach seems time intensive but it actively utilizes practice time to serially truncate the text, creating space for the speaker. Although "space" might promote speaker anxiety, the "presenter view" function in PowerPoint versions after 2013 allows only the speaker to see these notes. This feature stimulates the speaker's memory, provides an organized series of "silent" speaker prompts, and maintains a seamless flow of text and images for the audience (Fig. 6).

Stage Presence and Delivery

Once designed, organized, and practiced, delivery takes center stage. Whenever feasible, "checking out" the venue, lighting, screen, and accompanying devices including laser pointers, microphones, and wireless slide advancers facilitates effective teaching. This preemptive approach minimizes venue surprises and ensures optimal connection between the computer and projection system as well as between the devices and the speaker. Rapid projection ensures the correct version of each slide and confirms that inter-platform and software conversions have not surreptitiously altered the format or truncated key images.

An effective speaker privately warms the voice (e.g., by reciting the alphabet aloud) and maintains a conversational tone while studiously avoiding memorizing the text. The presenter should be sufficiently familiar with each slide to be both energetic and confident. A slide that fails to resemble an "old friend" immediately signals to the speaker that additional practice is required. An initial story, especially one with key

facts and emotional content, immediately creates audience rapport and spikes interest in the presentation. The speaker can either "hook" the audience or inadvertently issue an invitation to daydream or facilitate distraction by their personal devices. Brief clinical vignettes, spaced throughout the talk or delivered as an extension of the initial case, ground the talk and create an effective scenario for incorporating facts that systematically guide education by the speaker. Facing the audience rather than the slides sustains this connection. A well-lit venue allows the audience to see the speaker and also facilitates eye contact with audience members.

A wearable microphone allows the speaker to move across the stage, enhances audience interaction, and creates a vibrancy that cannot be reproduced in other educational forums. For many speakers, especially novices, maintaining eye contact may be daunting. By focusing one's gaze on a single audience member in a large lecture hall not only does the individual become more engaged, but a "cone" of approximately 10–15 listeners behind the "target" also experience direct eye contact [6]. Thus, if a speaker selects only a few specific members over the course of the talk, a substantially larger fraction of the group perceives "direct" eye contact. For anxious speakers, making eye contact with the venue's rear wall virtually replicates eye contact for the audience. Avoidance of the podium as the sole visual pivot point also causes the audience to follow the speaker and further engages them.

Voice is the speaker's primary communication tool. Electing not to memorize the presentation allows voice volume and pitch to be varied, adding emphasis. For novices or nervous speakers, the podium can serve as a physical crutch to be "embraced" or leaned upon. This physical dependence creates an awkward physical relationship for the speaker and usually jeopardizes the audience's level of engagement. In contrast, an effective speaker is liberated by a portable microphone and wireless, handheld devices. Podium liberation facilitates hand gestures that create emphasis and focus learners.

Fig. 6 PowerPoint presenter view: Presenter-friendly PowerPoint Presenter Mode allows the educators to see beyond the current slide and rapidly transition between slides in both directions as needed to match the lecture or address audience questions

The average adult learner concentrates for only 10 min [3, 9]. An effective speaker embraces this reality and repeatedly incorporates opportunities to state and re-state key points at the beginning (as *learning goals*), at the middle (as interim summaries), and at the talk's conclusion (final summary). Ideally, the speaker predicts inevitable lulls in audience alertness and maintains cognitive awareness of their attentiveness during the presentation. A combination of strategically placed stories, cases, and summaries recaptures the audience. Humor, images, animation, and marked voice variation also alert the audience to changes that unconsciously stimulate alertness and promote focus, a prerequisite to effective learning [9].

Engagement

Even expert speakers benefit by using established teaching techniques to fully engage the audience (Fig. 7). The simplest way is to ask a rhetorical question that invites the audience to focus and commit without speaking aloud. Effective speakers promote attention by asking medical audiences to “think of a similar case” that parallels the discussion topic. The recently described technique of “Think-Pair-Share” is also effective for increasing audience learning [10, 16]. The exercise begins with a question to be considered for 1–2 min by the audience then turning to an adjacent audience member to share their thoughts for 2–3 min, and finally reporting back to the group [10, 16]. In larger audiences, groups of 4 to 6 individuals (“buzz groups”) serve a similar educational function [29]. This practice creates a comfortable atmosphere for passive audience members and a willingness to present group findings rather than answer a question on their own [13]. An audience response system (ARS) such as *TurningPoint* or *PollEverywhere* rapidly creates anonymous “question and answer break points” within the presentation. Together, these active mental exercises engage the audience, provide focus for critical evidenced-based thinking, encourage shared opinions, and inform the speaker about potential areas of misunderstanding(s) for clarification. Audience education is “paradoxically” enhanced as the speaker becomes less visible and instead becomes an expert guide during the presentation tour de force.

The advent of the COVID-19 pandemic has led to very rapid changes in the delivery of medical education, with the

use of remote teaching strategies coming to dominate the current learning environment. Fortunately, the active learning strategies outlined in this paper are readily adaptable to the remote format, once the educator has familiarized him- or herself with the learning platforms. At our institution, Zoom has been the major mode of content delivery, and our medical school and hospital system continue to develop best practices for these learning spaces. Passive lecturing via Zoom is considered (by our students) to be even less interesting than our usual lectures, so it is even more important to use active learning methods in these large group sessions. It is actually easy to use the method of think-pair-share with Zoom—the session leader can create breakout rooms in which teams of learners can solve problems or work through cases. We have found that small breakout rooms (3–4 learners) lead to the most participation, as larger groups can lead to a few learners doing much of the work with others simply standing by. In addition, the duration of breakouts should be 3–5 min, as longer times tend to lead to more general conversation and less focus on the problem at hand. Once the learners reconvene in the large group, the leader can ask for a few groups to give their responses before continuing with the class; even in large classes (160 in our school), having 5–7 groups speak for a minute each appears to be effective. Having 2 breakout rooms in a 50-min session occupies about 20 min of class time. An ARS is built into Zoom through its polling function. The session leader can create multiple choice questions that can be launched any time within the session, and the aggregate responses are visible to the participants. For short answer questions, the Chat function is very effective, though it helps to have a second person to monitor the chat for the session leader. Thus, it is not difficult to add active learning elements to a remotely delivered large group teaching session.

Conclusion

A strong finish is crucial to an effective presentation. An effective conclusion simplifies and re-states the key message with a new example or story or completes an example case sustained throughout the talk. In an effective parting summary, a high-energy level and an inspiring “call to action” encourage the audience to remember and use key talking points to alter their behaviors after the session has concluded. The first presentation slide (i.e., the title slide) can also serve as the final one, avoiding the reprehensible black “end of slideshow – click to exit” screen. During the re-emergent title slide, the speaker can thank the audience and entertain questions relevant to the audience, further enhancing educational impact.

In summary, the audience, not speaker, is the primary presentation focus. Educational relevance requires purposeful audience targeting, content discretion (i.e., practiced, serial text truncation), acceptance of the cyclical

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- Ask rhetorical questions
 - Make learners “*Think of a case*”
 - Think-Pair-Share
 - Show a brief video
 - Poll the group (e.g., audience response system or ‘ARS’)
 - Have learners write something down

Fig. 7 Increasing interactivity: Maneuvers known to increase audience interactivity with the lecturer. These behaviors facilitate the learners’ engagement and commitment to change

nature of adult learners' attentiveness, informative, evocative images, and techniques that invite the practiced presenter to speak rather than read text. An audience so engaged also recalls content. As humorist Stephen Leacock proffered, "Some people tire of a lecture in ten minutes. Clever people do it in five and sensible people never go to lectures at all." By incorporating simple principles of effective adult learning into future medical presentations, we hope to report the last laugh heard in an educational forum.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval NA

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References

- Atkinson C. Beyond Bullet Points. 3rd ed. Redmond, Microsoft Press; 2011.
- Babik JM, Luther VP. Creating and Presenting an Effective Lecture. *J Contin Educ Health Prof.* 2020;40:36–41.
- Bligh DA. What's The Use of Lectures? New York City: John Wiley and Sons; 2000.
- Britt M. How to Better Engage Online Students with Online Strategies. *Coll Stud J.* 2015;49:399–404.
- Collins J. Education techniques for lifelong learning: making a PowerPoint presentation. *Radiographics.* 2004;24(4):1177–83.
- Craig CP, Olsen T. First-time teaching of a large lecture course: what not to do. *Class Outlook.* 2012;89(3):78–82.
- Dong C, et al. Tips for Medical Educators on How to Conduct Effective Online Teaching in Times of Social Distancing. *Proceedings of Singapore Healthcare.* 2020;29:1–5.
- Evans ML. Polished, professional presentation: unlocking the design elements. *J Contin Educ Nurs.* 2000;31(5):213–9 <http://search.proquest.com/docview/223319449?accountid=15533>. Accessed 30 Oct 2020.
- Gallo C. Talk like TED: the 9 public speaking secrets of the world's top minds. New York: St. Martin's Press; 2014.
- Graffam B. Active learning in medical education: strategies for beginning implementation. *Med Teach.* 2007;29(1):38–42.
- Hansen JE, Fisher J, Bowe CM. The plastic surgeon as lecturer. *Plast Reconstr Surg.* 2013;132(1):236–43 <http://content.wkhealth.com/linkback/openurl?sid=WKPTLP:landingpage&an=00006534-201307000-00045>. Accessed 30 Oct 2020.
- Harden RM. Death by PowerPoint - the need for a 'fidget index'. *Med Teach.* 2008;30(9–10):833–5.
- Jeffries WJ. In: Huggett KN, Jeffries WB, editors. An introduction to medical teaching. 2nd ed. New York: Springer; 2014.
- Kaufman DM. ABC of learning and teaching in medicine: applying educational theory in practice. *BMJ.* 2003;326(7382):213–6 <http://www.bmj.com/cgi/doi/10.1136/bmj.326.7382.213>. Accessed 30 Oct 2020.
- Lenz PH, et al. Practical strategies for effective lectures. *Ann Am Thorac Soc.* 2015a.
- Lenz PH, McCallister JW, Luks AM, le TT, Fessler HE. Practical strategies for effective lectures. *Ann Am Thorac Soc.* 2015b;12: 561–6.
- Lewis PJ. Brain friendly teaching??? Reducing learner's cognitive load. *Acad Radiol.* 2016;23(7):877–80. <https://doi.org/10.1016/j.acra.2016.01.018>.
- Miller CJ, McNear J, Metz MJ. A comparison of traditional and engaging lecture methods in a large, professional-level course. *Adv Physiol Educ.* 2013;37(4):347–55 <http://www.ncbi.nlm.nih.gov/pubmed/24292912>. Accessed 30 Oct 2020.
- Misch DA. Andragogy and medical education: are medical students internally motivated to learn? *Adv Health Sci Educ.* 2002;7(2):153–60.
- Naftulin DH, Ware JE, Donnelly FA. The Doctor Fox lecture: a paradigm of educational seduction. *J Med Educ.* 1973;48(July): 630–5.
- Ozogul G. Best Practices in Engaging Online Learners Through Active and Experimental Learning Strategies. *Interdiscip J Probl Learn.* 2018;12:1–3.
- Qiao YQ, et al. Using cognitive theory to facilitate medical education. *BMC Med Educ.* 2014;14:7.
- Sanders J, Patel RS, Goh PS, Kokatailo PK, Lafferty N. The importance of educational theories for facilitating learning when using technology in medical education. *Med Teach.* 2015;37(11):1039–42. <https://doi.org/10.3109/0142159X.2015.1019438> <http://www.tandfonline.com/doi/full/10.3109/0142159X.2015.1019438>. Accessed 30 Oct 2020.
- Schiano W, Andersen E. 8 tips for teaching online: Harvard Business Publishing; 2019. <https://hbsp.harvard.edu/inspiring-minds/8-tips-for-teaching-online>. Accessed 30 Oct 2020.
- Schmaltz RM, Enström R. Death to weak PowerPoint: strategies to create effective visual presentations. *Front Psychol.* 2014;5:1–4.
- Rapp C. "Aristotle's Rhetoric." The Stanford Encyclopedia of Philosophy (Spring 2020), Edward N. Zalta (ed.). 2020. URL <https://plato.stanford.edu/archives/spr2010/entries/aristotle-rhetoric/>. Accessed 27 Nov 2020.
- Voss D. Points of view: PowerPoint in the classroom: PowerPoint in the Classroom, is it really necessary? *Cell Biol Educ.* 2004;3(3): 155–6. <http://www.lifescied.org/cgi/doi/10.1187/cbe.04-06-0045>. Accessed 30 Oct 2020.
- Ware JE, Williams RG. The Dr. Fox effect: a study of lecturer effectiveness and ratings of instruction. *J Med Educ.* 1975;50(2): 149–56 <https://pubmed.ncbi.nlm.nih.gov/24292912/>.
- White G. Interactive lecturing. *Clin Teach.* 2011;8(4):230–5.
- Zak, Paul J. Why Inspiring Stories Make Us React : The Neuroscience of Narrative. *Cerebrum* (Jan-Feb) 2015;1–13.

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