Introduction

Medical education is a lifelong process. There is too much information and not enough time. Often, the response to this continuous explosion of knowledge is to try to shoehorn the maximum amount of content into every minute of every presentation and into every corner of every figure and every page. This attention to subject matter content is understandable but can often be self-defeating. It can even lead to inadvertent "audience abuse." That is, more content can actually lead to less learning if the content is made available but is not well designed. The point is not to present information but to get learners to remember and use it.

This book will consider whether the focus of medical education should be the medical content, the medical educator who does the presenting, or the learner. The perspective here is that the focus of medical education should be the learner and that the content should be structured and executed in a manner that facilitates learning instead of inhibiting it. However, the current system of medical education is often deficient in that it provides its instructors with only some of the skill set necessary to deliver the medical education needed. That is, plenty of attention is given to "what is said," but often little consideration is given to "how it is said." Evolving principles from communications science now inform us that such an approach can needlessly compromise the potential benefit of any educational effort for those it is intended to inform.

What a paradox that a field whose goal is to communicate science to its practitioners would not apply communication science in doing it. It is also illogical to expect those tasked with delivering the education to do so effectively with little to no exposure to the science that would empower them to do it in the most effective manner. A misplaced focus on content to the exclusion of the learner often lies at the heart of ineffective medical education, so changing that focus to the

learner can bring about much-needed improvement in medical education from the learner's perspective.

This book was thus developed to be a tool for all those who undertake the task of helping other clinicians hone their skills through medical education. Specifically, we discuss how to apply the principles of communication science and propose some tips for how an instructor can develop best practices in medical education. This book supplies scientific tools and knowledge that can:

- Elevate and differentiate an instructor's skills
- Assist in the effective transfer of knowledge and skills from an instructor to a learner
- Increase the influence and impact of an instructor's presentation
- Create greater demand for an instructor and elevate the direct and perceived value of the education the instructor delivers

The excitement that comes from new levels of understanding and the increased proficiency associated with putting that understanding to work are benefits that both the medical instructor and the audience will share. Medical educators in fact are increasingly being made accountable for demonstrating that these new levels of understanding have occurred and that they have been put to work in the learner's medical practice. Documentation of the outcomes of medical education is the new standard that is evolving in this field, and it serves to make educators accountable for the effectiveness of their programs. Accountability for the results of a medical education program, however, does not rest solely on the shoulders of the instructor conveying the content but also on the shoulders of those who develop, design, and regulate the content to be covered.

Many of those with whom we have worked in live programs have shared with us that the communication principles to which they were introduced have influenced not only the effectiveness of their presentations but also their professional satisfaction from teaching others. We have distilled these principles in this book, and it is our goal to help as many as possible have a similar experience.

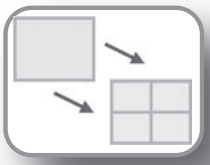
1

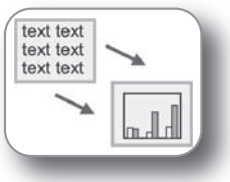
Applying the principles of adult education to the designing of medical presentations

Chapter overview

Chapter 1 introduces several critical learning principles that can be applied when designing a medical presentation and that have the potential of increasing the impact of individual slides, entire slide decks, and even entire educational events (see Stahl and Davis, 2009a).

The first section discusses storyboarding, with emphasis on **previews and reviews**. A preview facilitates learner achievement by acting as a roadmap to alert audiences about important topics to come. Repeated reviews help ensure that messages are clearly delivered by providing a second chance for learning, by helping learners consolidate information, and by clarifying outstanding issues.

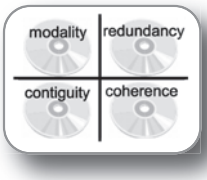


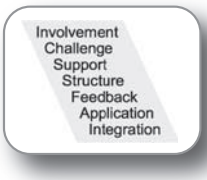


Between previews and reviews, delivering information in **small multiples** gives learners manageable packets of data and helps them to see differences as well as similarities between conditions. The second section discusses how to organize the words of text and especially images as a sequence of small multiples to enhance impact.

The majority of audience members prefer visual components in their learning materials, so adding relevant images and figures can increase learning impact. The section on **visual additions** discusses how to provide visual cues without distractions or data decorations.

Principles of multimedia learning can help guide instructional design to best utilize these technologies. To increase the impact of presentations, information can be presented in both auditory and visual channels in ways that eliminate





interference from the textual channel, present related information in close spatial and temporal proximity, and eliminate extraneous information.

Educational design principles suggest advantages to delivering information in order to gain and control attention, describe expected outcomes, and refer to previous learning – all of which would ideally be addressed before new information is presented. Then, after new information is presented, impact is heightened by medical educators supplying guidance for learning, appraising performance, giving feedback, and providing for the transfer of knowledge into clinical practice.

The classical **conditions of learning** are involving learners and getting them to invest in their own learning by challenging their knowledge, yet providing support within a structured format, generating feedback, and supplying opportunities for practical application. These facilitation techniques help learners to integrate their current knowledge with new information.

Providing feedback to learners helps them assess their own learning and is an extremely important milestone in adult education. An **audience response keypad system** can provide appropriate feedback. Small, portable systems are now available that link to PowerPoint and do not require a technician. When properly designed and executed, audience response questions can increase learning, generate interactivity, and measure progress.

Once a high-quality presentation is developed, working with a second medical instructor, as discussed in the section on **team and tandem teaching**, can make an educational event more engaging for the audience and help accommodate attention spans.

Medical educators may wish to move away occasionally from traditional lecture presentations to even **higher-impact learning formats**, which can be incorporated into an educational event to increase effectiveness. Research into instructional design has suggested that educational formats that are more active and less passive for the learners may result in the learners' greater understanding, longer retention, and increased enjoyment.

One tactic for creating a learning format with demonstrated superior efficacy in medical

education is to **design and facilitate workshops or discussion groups**. Workshops involve putting content into the hands of the learners and asking them to examine and contribute to the material. When properly managed by an effective facilitator, workshops can create a more effective learning environment than traditional lectures or presentations. In addition, they can elevate the audience's perception of both the instructor's competence and the presentation's value.

A **progress check** section is included to allow review and application of the key principles of adult education that are explored in Chapter 1.

Introduction

Rationale and benefits

It's all in the setup

To paraphrase the baseball great and folk philosopher Yogi Berra, teaching is 90% preparation; the other 50% is execution. This chapter will emphasize preparation – namely, those scientific principles that can guide the designing of medical presentations. Later chapters will deal more directly with the execution of medical presentations.

Essentially all medical educators communicate scientific information and data because they are recognized content matter experts. However, many medical educators are not necessarily experts in the scientific principles of adult learning because in medicine, most experts are not taught how to teach per se.

"See one, do one, teach one" is the basic tenet. "Understand first, then as an expert, one can be understood as a teacher" is the classical notion in medical education. Many effective medical educators simply follow personal instincts and thus design educational programs intuitively while adapting the educational style and principles of mentors who were influential in their own careers.

This approach works for many, especially those with natural talents and charisma. However, there exist numerous scientific principles based upon data from educational research studies that, if applied, can raise the effectiveness of any teacher. This chapter is about those principles. In other words, here we discuss how to communicate the science by using the science of communication.

What is the focus?

Preparation begins with answering this question. The explosion of information in medicine and the sheer volume of information cause the focus of most medical

education programs to be **content**. Some estimates are that every year, trillions of new statistical graphics are printed (Tufte, 1983).

Content often flows from carefully constructed curricula and is chosen to foster the development of experts by exposing participants to the best, the most up-to-date, and the most important content. This is done by giving participants the greatest breadth and depth of content exposure, limited only by the time available.

If it's all about the content, then the more content, the better. However, poorly designed graphics often distort the data, leaving the wrong impression. Also, cramming too much content into slides and too many words into a rapid-fire lecture can cause audience frustration due to the participants' inability to process or retain the vast volume of information presented.

One creative solution to the problem of too much information was witnessed by one of the authors recently. He arrived at a large hall, expecting to give a guest lecture in basic pharmacology to a class of 150 medical students. But only a dozen students were in the audience. One prominent audience member sat in the middle of the front row with an MP3 recorder and a horde of handouts. When questioned, the student said that the class had determined that the most important aspect of the lectures were the handouts because these formed the basis of exam questions. Students believed that lectures were generally given too fast and in too disorganized a fashion for effective learning. Thus, they had determined that the option of being able to play back some lectures at a later time, after previewing the relevant handouts, and with the ability to replay important points at one's own learning pace, was the best way to learn the material. So they all took turns recording lectures and procuring handouts, allowing them the freedom of spending the lecture time more productively studying by themselves.

This may be an extreme example, but it could cause a medical educator to wonder whether less content is, in fact, actually more in terms of learning. Indeed, principles of adult learning underscore that this is true, as will be discussed in subsequent chapters.

The question is, then: If content should not be the focus, what should be?

Presenter focus. One solution is to have a "presenter focus" to education, letting the expert choose the topic and the manner of presentation. Content matter experts in medical topics are rare, busy, and highly sought after. This solution is sometimes the only way to cajole these experts into giving a presentation. In academic medicine, education is often neither respected nor richly rewarded. Some say that in medicine, research flies first class, clinical care and administration fly coach, and education is often just cargo. Perhaps this is also the basis of the adage: "Those who can, do; those who can't, teach."

A presenter focus to medical education can work well if there are enough experts with natural teaching skills available, but it can also yield some off-beat presentations. The expert may enjoy the ease of preparation but the curriculum and the learners may not be well served.

Also, such presenter-focused experts may assume that others learn in the same way they do, so they will teach the same way they learn. In later chapters, this book will cover the flaws in this rationale, showing that, in a typical audience, many have learning styles that differ from those of the presenter.

Participant or learner focus. If the purpose of medical education is not only exposure to content but also learning and using the content, then a "participant focus" or a "learner focus" could be the best option. This means there is more work to be done after the content has been selected. The presenter will also have the task of organizing the content to maximize the number of participants in the audience who will learn the material, retain it, and apply it.

Ironically, successful presentations designed with a participant focus are likely to be even more content-focused and presenter-focused than presentations designed from only one of those perspectives. What good is exposure to content if it is not remembered? What is the value of a presenter who designs lectures that are easy and interesting for the lecturer but fails to convince a participant to use the information? How successful is a presenter who is unable to assist a participant to develop a new skill or to change and upgrade clinical practice behaviors? In the participant-focused presentation, all three aspects can come together for greatest effectiveness.

To create a participant-focused presentation, a presenter can apply the general principles of adult learning to the overall design of presentations. This chapter introduces these principles and also suggests specific tweaks to slides, such as visual optimizations, that can enhance learning. Tips are given as well for using an audience response keypad system to document learning. A brief discussion of other education tactics such as converting lectures into workshops or team teaching is also included (see Stahl and Davis, 2009a).

Section 1

Storyboarding a medical presentation as a three-act play using previews and reviews

Lectures can be arranged as a dull recitation of facts or as a story that makes the facts come alive. Generally speaking, a participant is less interested in hearing the facts that an instructor has to present than in hearing a story the instructor has to tell. Organizing content into a "three-act play" can make a presentation memorable and its lessons practical. Some experts explain the three parts as: "Say what you're gonna say; say it; then say what you said." More specifically, the previews are the first part, the presentation itself is the second part, and the reviews are the third part of this structure.

Adding previews and reviews is one of the easiest ways to enhance the impact of a presentation. This can be done simply by following the old saw: "Begin with the end in mind." This involves previewing what the outcome of the presentation should be, then giving the lecture, and finally, emphasizing the key points and expected outcomes from the presentation with reviews.

Previews

The standard format for the first "act" of a presentation is to list the objectives of the presentation. However, it is also possible to incorporate much more powerful previews or "hooks" that can propel the participant headfirst and with eagerness into the content that is about to follow.

When given previews, learners may perceive a medical instructor more positively because they see evidence of preparation (Chilcoat, 1989). The simplest place to start is to insert an outline slide at the beginning of the presentation. Then, have the outline recur at appropriate points throughout the deck to remind the audience of the topics ahead as well as those already discussed. The outline slide serves as a route map at the start and as a signpost at key intervals along the learning path.

Previews can also include a clinical anecdote, especially one from the presenter's own experience, that shows why the material is important or relevant.

Another option is to hook the audience in three steps: issue, action, and benefit. That is, state what the **issue** will be in the upcoming content, explain what **action** the participants should take, and finally, convince them to take this action by clearly showing the **benefits**.

This approach of preparing an intriguing first act with previews can prime the audience for the second and main act of the storyboard, namely, the content itself.

Reviews

Reviews provide a second opportunity for learning. They allow an opportunity to clarify material for those who did not completely understand, to link cumulative presentation elements, and to help the audience members consolidate what they have learned (Chilcoat, 1989). Insertion of a summary or conclusion slide at the end of each section is the simplest way to address this tactic. A more elegant way is to remind the audience of the issues that were discussed, the actions that they should take, and why, by emphasizing the benefits to them of these actions.

Section summary: storyboarding a medical presentation as a three-act play using previews and reviews

Previews facilitate learner achievement and may help learners view a medical instructor more positively; reviews also help consolidate audience learning and ensure that messages have been clearly delivered and received (see Stahl and Davis, 2009b).

Section 2

Organizing content as small multiples

The main part of the presentation, coming after it has been set up with a preview and a hook, is the body of the presentation itself. This content portion is the second and longest act of the three-act play.

BIOBOX 1-1

Edward R. Tufte

- Born 1942
- BA and MS in statistics from Stanford University
- PhD in political science from Yale University
- Professor of Political Economy and Data Analysis at Princeton University
- Currently Professor Emeritus of Statistics, Information Design, and Political Economy at Yale University
- Author of several books on information design and the visual presentation of data
- Called the "da Vinci of Data" by *The New York Times*

Graphical excellence

As mentioned, if knowledge transfer rather than simple exposure to content is the goal, then it is important to optimize the visual presentation of data while avoiding overwhelming the audience with too much information all at once.

Edward Tufte is considered the champion of how best to represent data visually (BioBox 1-1). His 1983 book, *The Visual Display of Quantitative Information*, was named one of the 100 most important books published in the twentieth century.

Tufte is also credited with discovering why scientists did not foresee the Challenger space shuttle disaster, even though the data that predicted the failure of the famous o-rings were in plain sight of some of the smartest people in the world prior to the launch. They missed the predictable disaster because of the wrong graphical presentation of their data. Tufte discovered that when the data on o-ring damage were sequenced by date of launch, as they were prior to the fateful launch, this obscured the possible link between temperature and o-ring damage. When the evidence was placed in order by temperature, it was obvious that o-ring damage increased as temperature decreased. This was especially significant at temperatures below 65 degrees Fahrenheit, increasing damage progressively as temperatures declined to 52 degrees, the lowest temperature tested (Tufte, 1997). The scientists, however, missed this relationship and approved the launch at a temperature between 26 and 29 degrees, with catastrophic outcome. This is a powerful lesson in the value of graphical representation of data.

Some of the principles of graphical excellence proposed by Tufte are listed in Table 1-1. One of the central notions here is the emphasis on "data ink" (i.e., dots,

TABLE 1-1: Excellence in graphical displays

- Use complex ideas communicated with clarity, precision, and efficiency.
- Draw the viewer's attention to the sense and substance of the data.
- Show the data with a high proportion of data ink.
- Emphasize data ink (such as dots, lines, and labels; the nonerasable core of a graphic; and the non-redundant ink arranged in response to variation in the numbers represented).
- De-emphasize non-data ink (such as the title, the abscissa, the ordinate, and their labels).
- Change data ink as the data change.
- Induce the viewer to think about substance rather than methodology, graphic design, the technology of graphic production, or something else.
- Avoid distorting what the data have to say.
- Maximize data density and the size of the data matrix, within reason.
- Make large data sets coherent.
- Encourage the eye to compare different pieces of data.
- Reveal the data at several levels of detail, from a broad overview to the fine structure.
- Serve a reasonably clear purpose: description, exploration, tabulation, or decoration.
- Be closely integrated with the statistical and verbal descriptions of a data set.

(Tufte, 1983)

lines, and labels; the non-erasable core of a graphic and the non-redundant ink arranged in response to variation in the numbers represented) and the de-emphasis of "non-data ink" (such as the title, the abscissa, and the ordinate and their labels), while changing the data ink as the data change. Tufte cites two relevant aphorisms in his 1983 book: "For non-data ink, less is more; for data ink, less is a bore."

One of the best ways to apply these principles of graphical excellence is not simply to trim the volume of content but to present the information that has been selected as "small multiples." To do this, an instructor can look for information that can be grouped together. As each new multiple of knowledge is added, emphasis is then placed both on its difference from and its similarity to the previous multiple. This tactic helps link the separate pieces of information (Tufte, 1983, 1990).

Small multiples can apply not only to data graphics, but also to text and to pictures. By far, the most elegant visual examples of how to present data as small multiples come from Tufte's books, but a few useful and simple examples of organizing a presentation's data, text, and pictures as small multiples follow.