Information Presentation for Effective E-Learning

A unified approach to the presentation of information for online learning can inform the creation of pedagogically effective web pages

By **Richard Kordel**

In moving information onto a computer, people generally assume that the format and presentation have little effect on the information itself. Every online educator should consider the effect on students of the electronic presentation of information, however, as that assumption is questionable. Although many writers have investigated the computer as a *learning* medium, few have addressed the computer screen as a *communication* medium.

We Learn What We See

Web pages created to teach something can and should be evaluated on their ability to teach. That ability depends on how well several underlying and previously unassociated elements of educational presentation are woven into the page design.

Many authors have contributed different ideas to the discussion. I have grouped these concepts into four categories that I believe provide a balanced method for evaluating a learning-oriented web page:

1. Creation of a learning model of the subject
2. Communication of that model
3. Web readability
4. Usability

Each category addresses an aspect of how a web page organizes and presents content to learners. The different aspects interact with each other in providing a balanced and usable presentation.

Creation of a learning model considers how well the web page promotes the art and science of learning and thinking, and how people react to the content and presentation of information on the page. *Communication of that model* is not something that educators should take for granted. Effective communication involves general principles of good design, applying them to the illustrations used by the course designer. *Web readability* acknowledges that the computer presents us with the problem of how to define literacy when traditional definitions no longer serve. The reader of a web page must be able to understand the text, text links, the use of graphic hot spots, and other nontraditional methods of encoding information on the page. *Usability* is often expressed in terms of software or hardware, but it also covers both general and educationally specific usability of the learning system interface. How easily can a student perform common learning-related tasks? Included in this concept is *learnability*, the ability to intuitively comprehend the tools presented on the screen for using the system.

To date, these elements have been isolated in separate and unrelated discussions that would benefit from a more holistic view of the learning environment. The goal of this article is to knit those four previously independent categories into a single unified and usable knowledge base that exceeds the sum of its parts. I view this effort as the first step in a conversation that can improve the way we view, evaluate, and use computerized learning.

Note that this article refers only to visual presentation, which neglects issues of concern to visually impaired educators and learners. I would like to see a parallel article focused on effective presentation of web-based learning material for visually impaired students. All students face challenges when participating in typical online classes, however. See the sidebar for a quick look at a student's experience of online instruction.

A Learning Model of the Subject

The logical entry point to the integrated view of web learning I am proposing concerns the learning model of the topic under study: How can web pages be used to create an effective model of an idea or process, one that allows a learner to grasp the essence of the idea or process without limiting his or her ability to later extrapolate the information into the larger universe? In addition to presenting information clearly, the learning material must use the available elements to create a representation that guides the learner into a usable and retainable model. Such a model allows the topic to move from raw data to retainable information while fostering the construction of a personal understanding of the topic.

Several guideposts mark this path. For example, Mayer[1] conducted research that revealed key elements of a good mental model: concise, concrete, coherent, and correct. On the other hand, starting with McLuhan[2] and Arnheim,[3]

authors have observed how media can actually alter the way people think. The presentation of information visually—in this case, on the web—changes the nature of the information and therefore might change the way we perceive it, learn it, and retain it.

The challenge is to look at web pages and determine whether they simply move previous learning materials from one medium to the next, without alteration, or take advantage of the unique features of the computer environment to encourage student participation and learning. Often, the computer as learning platform has not been considered from the view of a media-rich environment. Rich media is more than the simple idea summarized by the use of the word multimedia, and it differs significantly from the ideas suggested by usability. We need to consider the effect of presenting information to the learner using various types of media simultaneously.

Communication of the Model

Ideally, a well-constructed graphic can illustrate something so well that the graphic itself becomes almost invisible and the information behind it becomes both obvious and intuitive. While illustrators have attempted to reach this goal this for centuries, the inspiration for looking at graphic design this way comes from the work of Tufte.[4] His books refer to graphics in broad categories such as "graphic nouns," which present objects, and "graphic verbs," which present actions.

There is nothing computer-centric about Tufte's work, although his thoughts on PowerPoint are especially relevant. One of his central ideas is that clarity of thought and clarity of presentation are related. When both are present, as in his often-cited example of Minard's illustration of Napoleon's attack on Moscow, the result breathes life into cold statistics. When clear thought and presentation diverge, as seen in the graphics used to make the decision to land the Space Shuttle Columbia, disaster can result.[5]

Tufte advises keeping the intelligence

The Student Experience Online

When a student participates in a typical online class, the learning management system (LMS) provides a digital corollary to the standard classroom. The logistics of the course must be converted to an online version and presented, the actual lessons of the course must be taught, topical discussions related to the lessons will transpire, assignments will be handed in, and some form of test will be administered.

Most online courses rely on PowerPoint presentations—that is, bullet-point slides that could serve as lecture outlines if there were actually lectures. A notable element of PowerPoint (and all such systems) is the astonishing lack of informational density, yet few protest the reduction of a calculus or statistics lesson to relatively uninformative slides.

Unfortunately, discussion forums can provide an even worse learning experience. Consider, for example, one LMS that provides facilities for taking part in online discussions. A student planning to post a comment clicks a link to open the comment screen. That screen offers multiple links to other pages—so many, in fact, that it seems to exist mainly to provide links elsewhere, not to aid in posting a comment. A small text-entry box occupies about 10 percent of the total screen area. The post that inspired the comment is no longer visible, eliminating context. If the student takes too long to compose the comment, the system times out without warning, losing the student's work.

This LMS is hardly unique, typifying several such systems in both educational and corporate settings. So many factors contribute to their ineffectiveness that I am not sure which baffles me more: the poor screen design, the inadequate interaction options, or the curious reaction of users who acknowledge the deficiencies but simply shrug when asked what to do about them.

One problem is that when the appropriate technical people are consulted, discussions tend to focus on the technical minutiae: how pages are put together, how data are stored, or how computer systems work. While these issues are necessary components of online learning, the critical element should be how *people* use the system to learn and to teach. Evidence shows that learning and information-processing styles affect how people interact with a learning system and might determine whether they can learn at all. Understanding that fact is vital.

of the audience foremost while producing graphics that communicate accurate and concise information. Criteria do exist for the evaluation of instructional images, along with tools for that evaluation. The online educator should look carefully at what is being communicated through the use of images. Does there exist on the page a clear presentation of information that will provide the learner with a clear understanding of that information, or is the information muddy and the graphics mere decoration?

Readability

Determining the difficulty of a passage of text based on the number of words and sentences is an idea now so commonplace that word processors calculate readability. The idea may need updating, however, if we accept that the concept of literacy is expanding.

When using web pages as teaching tools, the ability to decode the page might no longer be synonymous with the ability to decode the text on the page. Most web pages present information in multiple layers of text and graphics. Text

can be subdivided into standard text, hyperlinked text, and *hover text*—text in a window that hovers over an element of the page. The actions of hyperlinks vary. A web page might include links to text on the current page, links to a new web page in the same browser, links that open a new browser, and still others that have the curious and unpredictable effect of opening a browser diverted to either a deleted page or an unrelated pop-up advertisement—for all intents, links to nowhere.

Graphics can provide visual explanations of concepts or processes explained on a page. They can either clarify or confuse the learner. For example, they might contain video, animations, sounds, or other functions that make the decoding of embedded content straightforward or difficult.

Illustrations can provide image maps (hyperlinked graphic areas) that might or might not be synonymous with text links on the page. Common functions coded as icons, from the generic browser environment or from the specific LMS, provide speedy access to commonly used actions. Unfortunately, they are often labeled with arcane and obscure symbols, although holding the cursor over an icon usually reveals explanatory text.

A concept new to the electronic presentation of information is the idea that a page might have a transitory state. The cursor might change from arrow to hand to text-entry tool depending on where it is placed on the page. There is no corollary to this in any paper-based medium.

The purpose here is not to object to any of these elements but to advance the idea that the concept of literacy needs to be redefined. Along with it, online educators should revisit what they assume of learners as new students enter a class.

Usability

While it is critical that learning-centered web pages adhere to the general principles of clear navigation and good presentation, I suggest looking at those pages with a focus on *learning-centered usability*.[6] When a student views a web page, is that page usable as a learning
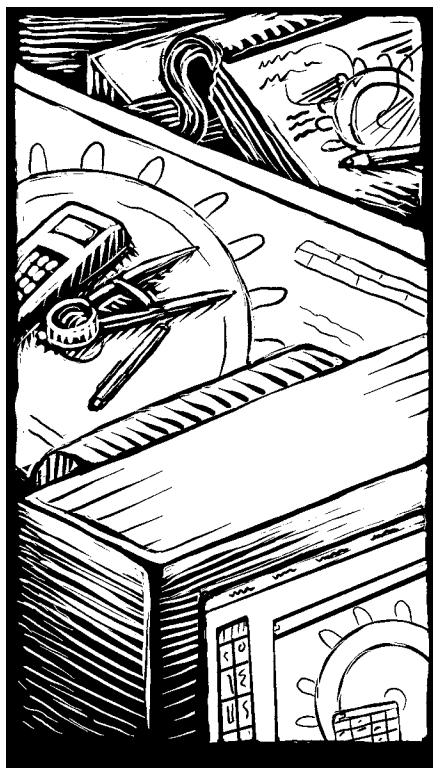
Graphics might contain video, animations, sounds, or other functions that make the decoding of embedded content straightforward or difficult

tool? Can a learner, without much effort, navigate to the pages needed and return to previously viewed pages easily? Can a student do what he or she needs to do once there? Navigation on an educational website should support students in learning, not demonstrate the web designer's creativity. Usability addresses the issue of how well students can use a site for the purpose of learning.

Although a potentially confusing word in the current context, the term *learnability* can be borrowed from software engineering to describe a subset of usability that specifically addresses the user's ability to learn how to use the software intuitively. In this context, when a student views a page, a lesson, or a unit, does navigation work as expected, or does it leave the learner wondering what to do next?

Conclusions

Some readers might suggest an overlap between the four categories. I readily acknowledge that point. Certainly the creation of a learning model and the communication of that model interrelate, although I believe they differ enough to warrant separate discussions. Readability and usability likewise provide two different but related ways to consider the accessibility of learning. In truth, I see the borders between the categories more as transition zones than walls. In evaluating a web page targeting online learners, its specific purpose or context might stress one factor more than others. This is normal.

My purpose here is to establish guideposts that will give educators the tools they need to improve the design of learning-centered web pages by creating a vocabulary that can be used to describe them. If we can describe good learning design, we can improve the educational experience of everyone who uses computers to learn. *e*

Endnotes
1. Richard E. Mayer, "Models for Understanding," *Review of Educational Research*, vol. 49, no. 1 (1989), pp. 43–64.
2. Marshall McLuhan, *Understanding Media: The Extensions of Man* (Cambridge, MA: MIT Press, 1964).
3. Rudolf Arnheim, *Visual Thinking* (Berkeley, CA: University of California Press, 1969).
4. See the following books by Edward R. Tufte, all published by Graphics Press in Cheshire, Connecticut: *Envisioning Information* (1990); *Visual Explanations* (1997); *The Visual Display of Quantitative Information*, 2nd edition (2001); and *The Cognitive Style of PowerPoint* (2003).
5. For Tufte's discussion of the Space Shuttle disaster, see http://www.edwardtufte.com/bboard/q-and-a-fetch-msg?msg_id=0001yB&topic_id=1.
6. Sarah Horton, *Web Teaching Guide: A Practical Approach to Creating Course Web Sites* (New Haven, CT: Yale University Press, 2000).

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