

Theory-to-Practice

Effective Online Learning: Recognizing E-Learnability

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Abstract

There has been an increasing emphasis in recent years on the use of online learning for adult education. As a result many adult educators are feeling inspired—or pressured—to begin using online learning alongside traditional classroom approaches or to move to online learning entirely. Whether adult educators create online learning materials themselves or purchase them from outside vendors, they increasingly need to differentiate effective from ineffective online learning. However, many adult educators lack the background, formal or otherwise, to make such judgments with confidence. This article presents a series of guidelines to help adult educators with such determinations. The guidelines are organized under four headings: usability, effective use of multimedia, effective design of practice exercises, and effective use of collaboration.

What makes an effective online course for adults? In short, the same elements that make for an effective face-to-face course for adults. According to Knowles's (Knowles, Holton, & Swanson, 1998) model of andragogy, a course for adults should take into account adults' need to know why they are learning, readiness to learn, self-directedness, experience, desire for immediate application of learning, and internal motivation for learning. At first glance online learning, which can allow learners to pursue topics on demand, in community with others who share their interests, from anyplace they have internet access, would seem to provide a great opportunity for learning along androgogic lines. Unfortunately, most commercially available online learning is anything but androgogic. Online modules created by major online learning vendors typically present screen after screen of text followed by quizzes.

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This “page-turner” model fails to take advantage of adult learners’ readiness to learn material that helps them cope with their social role and provides little opportunity for self-direction, application of life experience, or application of knowledge. The best we can say is that such online learning does ask for a high degree of internal motivation to learn—as is evidenced by attrition rates for online courses that may exceed 40% (Carr & Ledwith, 2000; Martinez, 2003; on the correlation between course completion and self-motivation, see Diaz, 2002).

Given the great promise of online education, why are adult educators creating or buying online learning that contradicts the field’s most widely known theory? In some cases adult educators may have been left out of purchasing decisions or may have responded to pressure to “move the training online.” These are serious problems, but even when adult educators are involved and empowered to make decisions about online education, they may have difficulty recognizing effective online learning when they see it. This difficulty arises in part because the online learning environment is so different from the classroom and field situations with which we are all familiar.

For instance, the conversion of Microsoft PowerPoint slides into online learning is often presented as an easy first step for those wishing to make the leap from classroom to online education (and several vendors make software tools to ease this process). However, online materials created in this manner are almost always ineffective—whether or not the original presentation was well or poorly designed. PowerPoint was designed as a *supplement* to live presentations and classroom activities led by an instructor. Online materials, on the other hand, *are* the learning activity. Online materials *stand in for* the instructor and, as such, require much more careful development than an in-class PowerPoint.

The guidelines offered below will help adult educators new to online learning distinguish between better and worse online learning materials. It is also helpful to keep in mind a rule of thumb: Most poorly designed online learning evinces the common misperception that learning is simply a matter of delivering information; promotional materials for prepackaged online learning often tout the ability to “deliver learning” to students. In truth, however, only information can be delivered, not learning. Hence, the best rule of thumb for evaluating online learning is to ask: (a) What does it ask learners to do? (b) Is that activity likely to lead to the desired results?

Effective Online Learning: Four Things to Look For

A more detailed evaluation of online learning materials should examine four general areas: usability, effective use of multimedia, effective design of practice exercises, and effective use of collaboration. The guidelines below are organized according to these headings.

Usability

Web usability is a topic infrequently addressed in the online learning literature but one that adult educators would do well to investigate. Usability originated in the field of product design, as is evident in the term's definition: "The extent to which a product can be used by specified users to achieve specified goals with *effectiveness*, *efficiency*, and *satisfaction* in a specified context of use" (International Organization for Standardization, 1998; emphasis added). Since the late 1990s designers of commercial Web sites have seized upon usability as a key strategy for winning market share: "Bad usability means no customers" (Nielsen, 2000a, p. 14). For instance, at a site such as Amazon.com (<http://www.amazon.com/>), usability means being able to find just the book you want (effectiveness), quickly (efficiency), and to feel pleased enough with the experience that you come back again (satisfaction). When any of these three elements is lacking, customers are less likely to come back.

Students are not customers. Nonetheless, usability issues affect online learning. If students cannot locate needed content, if they cannot figure out how to take an online assessment, or if the online learning environment discourages the use of important learning tools, learning will suffer, a fact that is beginning to be recognized by online learning developers (Downes, 2004; Feldstein, 2002; Notess, 2001; Quigley, 2002; Zaharias, 2004). In general, experts recommend assessing Web usability by observing at least five users as they carry out tasks on a Web site (Nielsen, 2000b). When such testing is impossible (which may be more often than not), the following guidelines can help adult educators detect major usability issues in online learning materials.

Guideline 1. Design for the available technology. Slow connections to the internet remain one of the most important usability issues. Studies have shown that response times—the time it takes for new content to appear after the learner clicks a button or link—need to be under one

second to avoid interrupting learners' flow of thought. When response times are greater than ten seconds, learners' attention is likely to wander (Nielsen, 2000a, p. 42–44). This information needs to be considered in light of learners' typical Internet connection speeds: 61% of adults in the U. S. connect to the Internet at home with speeds of 56 kilobytes per second (KBps) or slower (Horrigan, 2004). Since actual connection speeds for 56KB modems are typically in the 40KBps–44KBps range, online learning should be divided ideally into chunks no bigger than 40 kilobytes (KB) if we wish to avoid interrupting the learners' flow of thought. The upper limit for keeping learners' attention would be around 400KB (i.e., 40KBps \leftrightarrow 10 seconds = 400KB). When content is larger than 400KB, it is best to ask learners to download all the content beforehand so that they can work without interruption. Streaming media, which can respond to learners before it finishes downloading, is also an option.

Similarly, online material should be viewable at users' typical screen sizes. While many Web sites are designed for screen with a resolution of 1024 \leftrightarrow 768 pixels or greater, as of October, 2004, 35% of users were viewing the Web with a resolution of 800 \leftrightarrow 600 pixels (W3Schools, 2004). As a result, learners may see less of the page at a time and may need to scroll down (or sideways) to see important information. User research has shown, however, that perhaps as many as 90% of users do not scroll to see “off-screen” information (Nielsen, 2000a, p. 112–14).

Guideline 2. Provide adequate navigation. Online learning materials often allow learners to follow hyperlinks from one section to another at will. This sort of non-linear access to Web pages and learning materials is called navigation. Because learners may not experience learning material in a linear fashion, every screen of online learning content needs to answer three basic navigational questions. (a) “Where am I?” There needs to be some indication of which module, section, or page a learner is viewing currently. (b) “Where have I been?” Learners need to know which parts of a module they have already visited or completed. (c) “Where can I go?” Learners need to know where else they can travel from their current location (Nielsen, 2000a, p. 188).

Guideline 3. Write for the screen. People reading from computer screens read about 25% more slowly than people reading from a page; many users describe screen reading as uncomfortable (Nielsen, 2000a, p. 101). As a result, learners tend to skim, rather than read, online text. Reading can be encouraged by providing information in smaller chunks:

Short paragraphs, frequent headings, and lists make pages more conducive to scanning and help learners find the information they need. Longer texts may need to be provided in printable form for reading offline.

Guideline 4. Make content accessible. Online learning content should be accessible to the disabled. In some cases accessibility is a legal requirement. Federal law now requires that all electronic materials provided to the federal government be accessible to users with visual, hearing, and mobility impairments as well as to users with learning disabilities (Section 508 of the Rehabilitation Act, 1998). Web accessibility is assessed typically by reference to one or more standards; most of these standards are subsets of the Web Content Accessibility Guidelines established by the World Wide Web Consortium (Chisholm, Vanderheiden, & Jacobs, 1999). Applying the standards can be tricky, however. While there are several online services, such as Bobby WorldWide (<http://bobby.watchfire.com/>), that attempt to assess compliance with accessibility standards automatically, a thorough assessment of accessibility can be a lengthy process. Adult educators are best advised to ask vendors about their level of compliance with accessibility standards. (For those wishing to know more, Moss, 2004, provides an overview of the issue; Clark, 2003, provides the best guide for developers).

Usability issues do not apply only to learning content. To ease the process of getting learning materials online, many institutions have invested in content management systems (CMSs; WebCT and Blackboard are popular choices). These systems—too frequently designed from the perspective of the system administrator and not the learner—may present usability problems of their own. Downes (2004) points out that the design of many CMSs

reinforces the idea that discussion is not central to the course, that it is something tacked on. One “leaves” the course material (usually via the main menu) to go to the “discussion area” (imagine, by analogy, if once a professor finished his lecture the entire class got up and walked across the hall to the “discussion room”). (§ 19)

In cases such as this a lack of usability clearly has a negative effect on learning. Unfortunately, rectifying these problems generally means upgrading the CMS or changing to a different CMS entirely. Either path represents a major investment of time and effort, and many adult educators

will not find themselves in a position to make either change happen very quickly.

Effective Use of Multimedia

Multimedia—combining text, sounds, images, animation, and/or video—is a defining aspect of online learning and often the first feature advocates point to when describing its benefits. There is good reason for the excitement: multimedia can help learners learn more. A series of ten studies conducted by Mayer (2001) found that learners viewing a multimedia lesson (combining words and pictures) scored, on average, 89% higher on a posttest than did learners who received only a text-based lesson. The median effect size over the ten studies was an impressive 1.50. However, the use of multimedia does not lead automatically to better learning. Poorly designed multimedia can actually *diminish* learning by presenting more information than learners can process at one time (Mayer, 2001). Adult educators, then, must learn to recognize well-designed multimedia when they see it—a task that is by no means easy, even for experts in the field. Among the most useful guidelines for making such determinations are those provided by Clark and Mayer (2003). Their six “Media Elements Principles,” based on empirical research, are summarized below.

While a full discussion of these principles—some of which may be counter-intuitive—is beyond the scope of the present article, a basic understanding of Mayer’s cognitive theory of multimedia learning can help adult educators better apply the summaries provided below. The assumptions of Mayer’s theory are that:

1. Human memory has two channels for information processing: visual and auditory.
2. Human memory has a limited processing capacity.
3. Learning occurs by active processing in the memory system, resulting in the learner’s construction of a mental model in long-term memory.
4. Knowledge and skills must be retrieved from long-term memory for transfer to the job. (Clark & Mayer, 2003, p. 35)

According to this theory, then, multimedia learning must avoid overloading either of the two channels for information processing. Figure 1 depicts a situation in which graphics, text, and audio are being used simultaneously. If the graphics used are explanatory—that is, they help

learners understand the material explained in the text—this might be a successful learning situation. On the other hand, if the graphics are merely decorative (adding only “visual interest”) or if the same words are presented simultaneously on screen and as audio narration, working memory may be overloaded, decreasing learning.

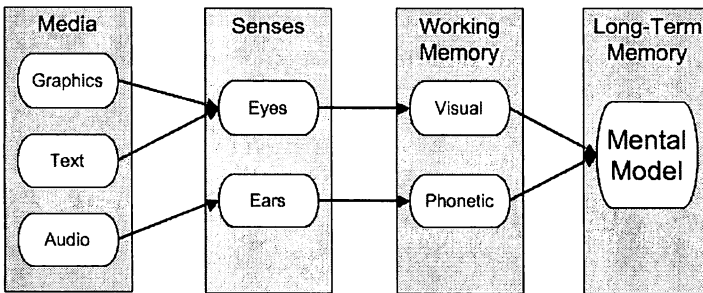


Figure 1. Cognitive theory of multimedia learning (adapted from Clark, 2001, p. 44).

Guideline 5. Use words and graphics rather than words alone (Multimedia Principle). Online learning should use both text and graphics. However, to be effective, graphics should be explanative, not decorative. Explanative illustrations are those that help learners understand the material to be learned. Decorative illustrations, which merely add visual interest, can actually decrease learning (Clark & Mayer, 2003).

Guideline 6. Place corresponding words and graphics near each other (Contiguity Principle). Text and graphics that explain each other should be placed near each other on the screen. Learners should not have to scroll or move to another screen to see the captions that explain an image—or vice versa (Clark & Mayer, 2003).

Guideline 7. Present words as audio narration rather than onscreen text (Modality Principle). When a graphic or animation is being described, it is best to present the description as audio narration rather than on-screen text (Clark & Mayer, 2003). Note, however, that accessibility

standards require that a written description of the graphic or animation be available.

Guideline 8. Presenting words in both text and audio can hurt learning (Redundancy Principle). It is best to avoid presenting words simultaneously on screen and as audio narration, especially when a graphic or animation is the focus of attention. Exceptions to this guideline may occur when no graphics are present, the presentation pace is slow, or spoken words are difficult for the learner to understand—for instance, when presenting an unfamiliar or foreign term (Clark & Mayer, 2003).

Guideline 9. Adding interesting material can hurt learning (Coherence Principle). While online learning should be interesting, the interest should be generated through interaction with the material to be learned. When extraneous materials—background music, sound effects, decorative graphics, anecdotes, trivia—are added, learning will be diminished (Clark & Mayer, 2003). Adult educators considering the purchase of online learning materials should be wary of “interesting material” that has been added, not for the benefit of learners, but to impress those making purchasing decisions.

Guideline 10. Use conversational style and virtual coaches (Personalization Principle). While academic practices often call for the use of an impersonal, third-person writing style, research shows that learning is increased by the use of a personal, conversational style (i.e., first and second person). Clark and Mayer’s (2003) research even suggests the use of *pedagogical agents*: on-screen characters that coach and advise learners as they work. Such agents may be effective provided that their words are presented as audio narration, not text; that they use a conversational style; and that they have voices that sound human, not speech-synthesized.

Effective Design of Practice Exercises

The quantity and quality of practice is a key feature of online learning. While the marketing of online learning materials often focuses on eye-catching multimedia features, the ability to provide much more practice than the adult educator could personally provide, and to customize that practice to student needs, is one of online learning’s real

strengths. For this reason adult educators should seek out online learning that includes large quantities of high-quality practice. When assessing the quantity of practice available in online learning materials, keep in mind that an online lesson may require two to three times as many practice exercises as a comparable face-to-face lesson. When assessing quality, the following guidelines will help identify well-designed practice:

Guideline 11. Integrate practice into the lesson. Online learning of the “page-turner” type tends to relegate practice to the end of each module: information and concepts are presented, then learners complete practice exercises or quizzes to test their knowledge. The implication is that practice is (a) secondary and (b) something that happens after learning. Purchasers and designers of online learning would do better to consider learning to be something that happens during practice and seek out or design online learning that tightly integrates practice into the lesson. At the very least, practice exercises should be the default navigation option, so that learners who simply click the “Next” button after each screen are automatically routed to practice exercises (Clark & Mayer, 2003). Alternating screens of content and practice can be effective for this purpose. Designers of online learning may wish to investigate instructional design models, such as the 4C/ID model described by van Mariënboer, Clark, and de Croock (2002), that invert the page-turner model by presenting practice as the main learning activity with content playing a secondary, supportive role.

Guideline 12. Design practice using the Media Elements Principles. Practice exercises should follow the principles of good multimedia design, as described by Clark and Mayer (2003) in their “Media Elements Principles” (see Guidelines 5 – 10, above). It is particularly important that practice exercises display directions, questions, responses, and feedback at the same time to learners (Clark & Mayer, 2003). By having all four elements of the exercise visible simultaneously, learners do not need to dedicate working memory to keeping track of the question that has been posed or the answer they chose, thereby reducing cognitive load and allowing a better focus on the material to be learned.

Guideline 13. Give more practice on critical tasks. The more critical the task to be learned, the more practice online learning should offer (Clark & Mayer, 2003). Online learning designed to help medical personnel

distinguish the sounds of normal and anomalous heartbeats should provide practice doing just that, providing audio recordings of various heartbeats with which learners can practice. Unfortunately, tools currently available for online learning sometimes have the unfortunate effect of emphasizing those components of a critical task that are most easily transferred to online format. For instance, creating vocabulary quizzes is quite easily accomplished using standard online learning tools; recording heartbeats and integrating the results into online learning practice exercises is more difficult. For this reason, adult educators should not be surprised to find online learning that emphasizes background knowledge (the vocabulary) over critical tasks (distinguishing the sounds of different heartbeats). Such materials should be avoided or supplemented with more appropriate practice.

Guideline 14. Make practice mirror the performance desired afterward. Practice in online learning should present job-specific and context-specific problem solving processes that use practice tasks that are as similar as possible to the performance desired afterward (Clark & Mayer, 2003). Providing an “authentic” experience (to the extent possible online) accords with guidance commonly given to adult educators: learning materials for adult learners should be relevant. Doing so enhances transfer, helping learners to understand why they are learning and to apply what they learn. For instance, a geometry lesson for carpenters should avoid abstract examples of calculating area and volume in favor of practice exercises that ask learners to use geometry to complete carpentry projects. If learners are being trained to use Boolean logic to search databases, the practice should ask them to perform searches—not to describe Boolean logic. As in face-to-face learning, what learners do is what they learn. Unfortunately, because online learning materials can be expensive to produce, economies of scale often dictate that online learning materials be usable by a large audience. This circumstance often results in the development of decontextualized practice exercises that make it more difficult for learners to transfer knowledge and skills to new contexts. Adult educators using such materials will want to supplement them with context-specific practice.

Guideline 15. Try replacing some practice with worked examples. When the performance desired of learners after training is complex—for instance, it requires problem solving or the integration of knowledge,

skills, and attitudes—practice that mirrors this task easily can become overwhelming for novices. Novice learners who are overwhelmed by the complexity of a task are less likely to learn how to improve their performance (van Merriënboer, Kirschner, & Kester, 2003). For this reason, it can be helpful to provide worked examples—“step-by-step demonstrations of how to perform a task or solve a problem” (Clark & Mayer, 2003, p. 175)—in place of some practice exercises (Clark & Mayer, 2003; van Merriënboer, Clark, & de Croock, 2002). Providing examples of how an expert would go about solving a problem allows learners to focus on strategies for problem solving (e.g., what steps to take when a patient complains of dizziness) and avoid getting bogged down in the details of implementing that solution (e.g., using a blood pressure cuff properly, recording results on the patient’s chart, etc.). However, it is important that worked examples be designed so that learners take the time to study them. Learners may be required to answer questions that require study of worked examples or asked to complete partially worked examples (Clark & Mayer, 2003). Gradually increasing the amount of work learners must do to complete each example may be a valuable strategy for managing the transition from worked examples to whole tasks (van Merriënboer, Kirschner, & Kester, 2003).

Guideline 16. Encourage learners to reflect on their problem-solving processes. Current e-learning tools can encourage the development of practice that is all too mechanical: answer a question, read the feedback, then move on. Such problems can occur even when the guidelines presented above are followed. Deeper understanding of learned material and increased transfer can be encouraged by asking learners to reflect on their own problem-solving strategies. Asking for reflection can be especially helpful to novice learners, who may have poor metacognitive skills (Clark & Mayer, 2003). Asking students to explain why an expert chose a particular solution for a worked example, to explain their own strategies, and/or to compare their strategies to those of experts encourages the development of schemas and mental models that allow for transfer of skills to new contexts. Such assignments make excellent material for collaborative assignments.

Effective Use of Collaboration

It is in the realm of collaboration that online learning distinguishes itself from other computer-based methods of instruction. Readers may

have noticed already that the guidelines laid out thus far are not particular to *online* learning and could be applied easily to learning using CD-ROMs, DVD, or any interactive, multimedia environment. Indeed, other learning environments have an advantage when it comes to multimedia, since they do not have to contend with the connection problems and bandwidth limitations inherent to online learning.

Online learning, of course, brings its own advantages, including the ability to update materials, record scores from tests, and access remote databases. However, collaboration is the particular strength of the online environment. At least one study has suggested that small group learning, a standard practice for many adult educators, was improved significantly when training was delivered by computer (Lou, Abrami, & d'Apollonia, 2001). This effect may be related to the way online communication—more formal than conversation but less formal than standard writing—seems to lead to deeper communication than is typical in the classroom (Jonassen & Kwon, 2001). When possible—that is, when a cohort of learners is using online learning materials simultaneously—adult educators should consider using collaborative activities.

Even when pre-packaged online learning materials are purchased, the design and implementation of online collaborative activities are largely the responsibility of the individual adult educator. As with a good classroom discussion, adult educators can and should structure online collaborative assignments carefully in advance, but learners will take a well-designed collaborative assignment in directions for which the adult educator cannot easily—and probably shouldn't—plan. Pre-packaged online learning materials may provide suggestions for collaborative activities; in selecting or designing collaborative activities for online learning, keep in mind the following guidelines:

Guideline 17. Use the right communication technology. There are a great many collaborative tools available, and choosing the correct one can make or break a collaborative assignment. A key concern is whether to use *synchronous* or *asynchronous* technologies. Synchronous technologies, such as chat or instant messaging, require that all learners be online at the same time. Asynchronous technologies are appropriate when learners will not access learning materials at the same time, due to work schedules or time zones. In many cases a combination of technologies is most effective. A weekly chat session can build community amongst learners, who may feel isolated, especially if they are new to

online learning. E-mail and message boards encourage reflection and ongoing conversation.

Guideline 18. Structure collaborative assignments carefully. Just as with face-to-face group work, online collaboration needs to be structured carefully: learners need to know what to do, how to do it, what to expect from others, and when the deadlines are. The adult educator should seek to design collaboration so that interaction between learners is maximized. Clark and Mayer (2003) suggest adapting classroom techniques for online use and organizing collaborations around either products or processes. Product-oriented collaborations, such as jigsaw or structured controversy, focus on the production of a tangible product, such as a report, Web site, or presentation. Process-oriented collaborations, such as problem-based learning or peer tutoring, focus on “the learning that can be gained from structured group interchange” (p. 208).

Guideline 19. Provide good support resources. Adequate support resources—online materials that help groups complete their work—are needed for successful online collaborative activities. Such support is necessary especially when learners are taking on tasks that are unfamiliar to them. When collaborative activities aim at helping learners carry out complex tasks, van Merriënboer, Clark, and de Croock (2002) suggest that two types of support material are needed. *Supportive information* helps learners construct schemas or mental models that can aid in the performance of non-recurrent aspects of the task (e.g., knowing the structure of data fields in a library’s online card catalog can help a researcher formulate a more effective search query). *Just-in-time information* helps learners acquire expertise in the recurrent aspects of the task—that is, those aspects that are the same every time (e.g., operating the software that allows users to search the online card catalog). An effective option for the use of re-packaged online learning materials—especially those of less than optimal design—is to use them as support resources for learners’ collaborative activities. Collaboration, rather than the passive viewing of online documents, then becomes the focus of the course.

Conclusion. Adult educators seeking more guidance on using online collaborative activities are advised to consult the growing literature on this topic. White and Weight (2000) or Hanna, Glowacki-Dudka, and Conceição-Runlee (2000) are good places to start.

E-Learnability

The guidelines listed above outline an area of practice with which adult educators increasingly will need to be familiar: We might call this area of practice *e-learnability*. We can define the term provisionally on the model of usability and say that e-learnability is *the extent to which online learning can be used by specified learners to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use* (see Feldstein, 2002, for a definition of “learnability,” a concept similar in intention to this one). To put it a different way, adult educators need to become more savvy about what kinds of online learning work and what kinds don’t. This is by no means an easy question. Quigley (2002) notes that “established sets of principles of what ‘works’ for online learning, based on research findings or industry best practices, do not yet exist” (¶ 3). While progress has been made in the last year, much research remains to be carried out by adult educators. The guidelines presented above only scratch the surface of e-learnability.

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