



Improving e-Learning Course Design with Usability Testing

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1. Introduction

The past decade has witnessed a dramatic acceleration in the development and deployment of learning via technology in higher education and professional development. Online learning has become increasingly popular as advances in technology and available bandwidth have allowed more creative and interactive courses. Advances in courseware have offered content experts the opportunity to launch their own courses with lessening dependence on designers and support technologists. These advances have resulted in the dramatic increase in the number of e-learning courses available in both the for-profit and the academic marketplaces.

In the academic market a growing concern is that online course offerings, which now compete openly with traditional instruction, are growing at an exponential rate. The study, *Going the Distance: Online Education in the United States, 2011*, reports that more than 6.1 million students took at least one online class during fall 2010—a 10.1 percent increase over the year before [1]. The reasons for the growing adoption of online learning by students are many. One leading reason is that overall, compared to traditional classroom settings, online learning can provide a more flexible way to advance learning using both synchronous and asynchronous platforms and a blend of the two. However, additional concern is growing as completion rates have not kept pace with enrollment rates. The higher dropout rates and lower content retention exhibited by online learners in comparison to traditional learning [2] is startling, leading to a greater concern regarding quality, value and impact of the offerings.

One response to these growing concerns has been to implement usability testing (UT) with the intention of improving educational experiences, learner outcome, and retention rates. Long used by web developers to assess and improve web sites and applications for e-commerce and other business uses, UT has been gaining traction for evaluating e-learning to improve the learner experience, course effectiveness and completion. Recent studies have pointed to usability as having potential to significantly improve courses for student learning and retention. Ardito, et al., state that poor usability of e-learning platforms disturbs accommodation of new concepts and overall retention. And, they go on to state, UT provides opportunity for course developers to gain insight into how their learners engage to discover ways to avoid learner confusion, frustration and distraction that impedes learning and leads to student dropout [3]. So, as current authoring and learning management systems as well as tools such as animation software, video streaming, and surveying and testing lead to developers delivering more on-line courses in abbreviated timeframes, the challenge is to ensure quality and effectiveness. UT is one answer.

2. Applying Usability Testing to e-Learning

Again, usability testing is not new. Not only has it been used to improve the effectiveness of web sites, web applications, and e-commerce, but also it has played a role in market research [4]. Furthermore, government agencies have applied the principles and practices to assess their web portals, resulting in increased effectiveness. Several recent studies offer insights into progress in this area. The 2008 U.S. States E-Governance report of Holtzer, et al., ranked state websites for privacy/security, usability, content, services, and citizen participation [5].

A striking example of the way in which increased usability can increase citizen interaction and produce a higher value is the website at the Federal Emergency Management Agency (FEMA). Using an iterative, user-centered process, this site was totally redesigned in 2006, after it failed to meet citizen needs during and after the Hurricane Katrina disaster. Comparing the results of user testing on the original site and the redesigned site, FEMA quantified improvements: task success jumped from 44% to 85%; time on task was reduced by over a minute from 2 minutes 36 seconds to 1 minute 32 seconds; satisfaction climbed from 49% to 71 %. The changes made as a result of UT resulted in a site that was more usable for citizens' needs [6].

Transferring UT practices to the e-learning environment is a logical step for educators. UT can yield important information about users' experience of a course, and, more significantly, can uncover design flaws to be remedied before launching the course, which should result in improved usability as well as quality of learning experience, improved learning outcomes, and retention.

According to ISO 9241 usability is defined as the extent to which a product (such as software – or a coffee maker) can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use [7]. The power of usability testing and quantitative measurement can be applied to e-learning by either employing sophisticated and specialized laboratory equipment or less formal observational techniques. Both approaches use the principles of observing and recording users' interaction with the system and produce the same results [8].

When conducting usability testing five quality measures need to be applied, according to Nielsen [9]:



1. Learnability: How easy is it for users to accomplish basic tasks the first time they encounter the design?
2. Efficiency: Once users have learned the design, how quickly can they perform tasks?
3. Memorability: When users return to the design after a period of not using it, how easily can they re-establish proficiency?
4. Errors: How many errors do users make, how severe are these errors and how easily can they recover from errors?
5. Satisfaction: How pleasant is it to use the design?

UT is also effective in determining the value of factors such as formatting, graphic interface, content placement, and degree to which learner interactions achieve outcomes. Nielson's five factors along with these others are valid for online learning as well. Usability evaluations have informed researchers regarding the success of user learning outcomes [10]. UT is a simple way to measure whether the content in a course is effective in helping students learn and meet the intended educational objectives. As such, it needs to be pursued further.

3. Case Study

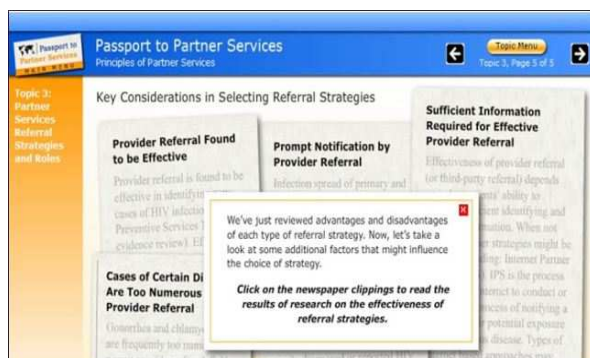
In this pursuit, the Professional Development Program (PDP) at the University of Albany with the mission of *Making Government Work Better*, offers continuing professional education programs for working professionals in the public sector in both traditional and nontraditional modalities. PDP has used its expertise of building e-learning courses to incorporate UT into its processes. Several PDP instructional technology staff with experience in web development introduced UT as it began launching e-learning courses. This paper uses a case study conducted by PDP at the University at Albany for web base training courses developed for the US Centers for Disease Control and Prevention (CDC) to illustrate how at an early stage in the course development process, UT can be an effective tool to enhance learnability.

In 2010, PDP developed a series of web-based training modules for CDC to provide training for public health professionals who work with individuals with HIV and other sexually transmitted diseases to provide referrals and treatment for those with AIDS. Content for the modules was provided by CDC Prevention Training Centers and PDP's task was to turn it into engaging and effective e-learning modules. Much of the content consisted of lengthy guidelines, policies, and research findings. Presenting this content in a learnable way proved to be a design challenge.

In September 2010, staff conducted a usability test of the first module. Five participants were each tested individually. All testing was done on the same day. Participants represented the target audience, which includes both experienced workers and new hires. During each 45-minute testing session, participants were directed to work through the module and encouraged to voice their impressions and "think out loud." The usability testers recorded the learners' comments, observed the way in which they moved through the module, and the time spent on each topic. Test results were compiled in a report, which detailed specific interactions or content pages that test participants glossed over or found confusing. The report also listed recommended changes to address these issues. After reviewing the report, the CDC asked PDP to implement the recommended design changes.

The figures below depict several of the "before" screens that presented some degree of challenge to one or more test participants, along with "after" screens that show the changes that were made to address the challenges.

Before UT



After UT

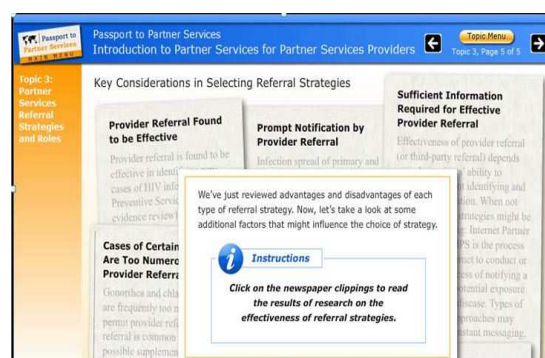


Figure 1a Interactions using clickable graphics Instructions italicized

Figure 1b Implementation of standard design

Testing Observation #1: Instructions were not always noticed. Some test participants did not always notice the instructions on screens with embedded interactions. After testing, a standard design for instructions was



implemented, using an icon to attract attention (Figure1b). Also, the font sizes of the headings in the blue banner were changed to emphasize the title of the current module, rather than the course title.

Testing Observation #2: Learner access to diagram not understood. Figure 2 below is an animated diagram created from a lengthy flowchart. Due to its vertical orientation, it had to be presented in a window that automatically scrolls to show new information. After the diagram is fully revealed, learners can move it manually to review it. Originally, the diagram just started playing without any introduction. Test participants commented that they wanted to be able to reexamine parts of the diagram that had already moved out of view, not knowing that they would be given that opportunity at the end.

After UT



Figure 2. Portion of window with scrolling

After testing, the animation was changed. It now begins with an explanation that tells the learners that they will be able to manually move and examine the diagram after the animation is complete. While the animation is playing, a prompt is also displayed to remind learners of this point.

The learner is instructed to read the research points, then read the three scenarios and match each of them with the most relevant research point. During testing, it was observed that learners had trouble following the exercise because they had to click on tabs to open the research, as well as click on buttons to read the scenarios. The flow of action was not clear. After testing, the interaction was simplified. In the revised version, the research points are already visible and the learner moves through the exercise using only the Next Scenario button (Figure 3b).

Before UT

After UT

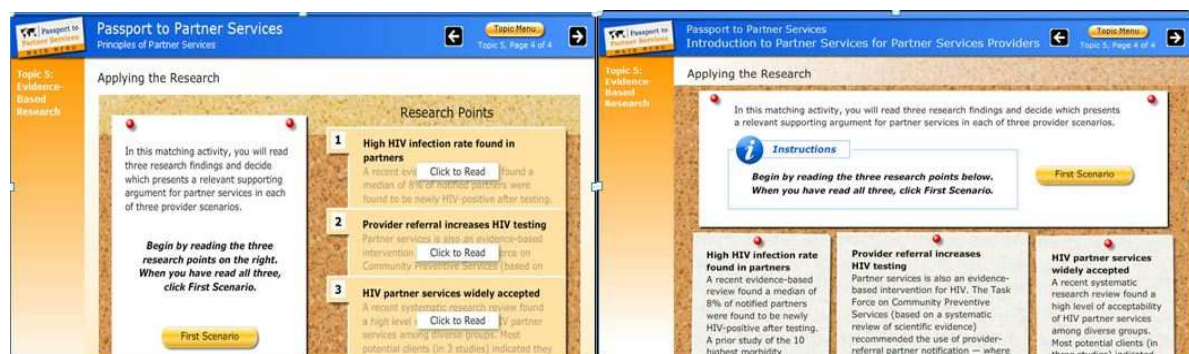


Figure 3a. Initial exercise requiring clicking of multiple tabs. Figure 3b. Simplified exercise provides the scenarios without clicking

Figures 4 a and b below depicts how a lengthy list was treated in the course. Topic points are presented on the right. As each is clicked, an explanation appears in the panel on the left.

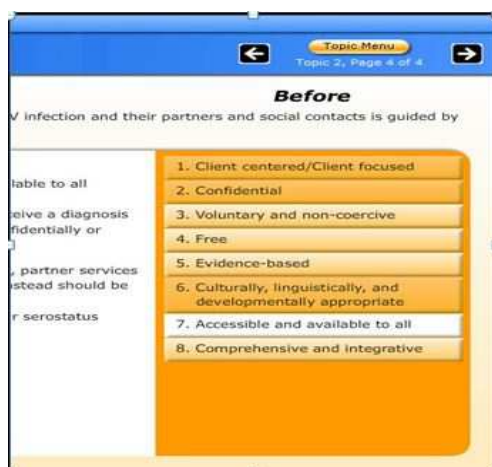


Figure 4a



Figure 4b

Some test participants lost track of which items they had clicked on, although they are depicted in a darker color (left side of image). The reworked screen (right side of image) uses checkmarks rather than color to indicate which topics have been read. This solution, which is now implemented throughout the course, also improves accessibility by not relying on color alone to represent the 'visited' state.

These images provide a sampling of "before" and "after" screens illustrating improvements made after observation of how learners experienced the course module. The course designer, who was present during the tests, found the results informative and had immediate ideas for improvements. Along with test results, suggestions for improved design were presented to CDC, and were readily accepted. These improved design elements were incorporated in subsequent modules as they were developed.

4. Conclusion

The value of UT for e-learning is significant. UT provides course developers with valuable information that can be immediately used to improve course design. Findings also confirm UT as a factor in increasing student learning and retention. Overall, evidence for using UT suggests that the benefits derived for both developers and learners make a strong case for UT to become a standard for e-learning.

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