# e-Learning Usability Instruments: What is being Evaluated?

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**Abstract:** The process of evaluating the usability of e-Learning has included the use of varying instruments. These instruments have myriad factors and foci when attempting to provide an appropriate review of an e-Learning product. The variety of instruments and their embedded definitions creates some ambiguity when there is a need to review a particular e-Learning "unit". The purpose of this paper is to initially provide a guide towards the development of an appropriate instrument to review the usability of an e-Course. This is en route to an instrument that can be manipulated to produce specific guides for the usability of any type of e-Learning product. As e-Learning products may have varying goals, instruments that can be manipulated would prove to be much more appropriate to the usability of all e-Learning products.

#### Introduction

Distance education has a history that is almost two centuries (Spector, Merrill, Van Merrienboer, & Driscoll, 2008). As technology has been enhanced over the decades, different forms of distance education were produced incorporating new forms of communication. E-Learning, an abbreviation for electronic learning, inherits the same principles of distance education but incorporates a delivery system that uses computer technology.

Today e-Learning has vastly grown to accommodate the need for accessible and cost-effective knowledge, while usability evaluation has strained to keep pace. The usability evaluation instruments of such [e-Learning] products have been developed relatively piecemeal, making for a large selection of instruments from which to choose. The usability of e-Learning products should be guided by a users' response to its ability to sufficiently convey its overall purpose for learning. Furthermore, evaluators should have one tool, which can be manipulated to suit the type of e-Learning product. The purpose of this paper is to present exploratory research that will produce an evaluation instrument for an e-Course en-route to a protocol for all types of e-Learning products.

#### Purpose

As e-Learning is adopted and adapted by more educational and business entities, usability evaluations become increasingly important to ensure an appropriate learning interface as well as to promote and facilitate learning. Usability is the effectiveness, efficiency, and satisfaction with which specified users can achieve specified goals in particular environments (Usability Professionals Organization)

While there has been a variety of checklists and evaluation tools to assist in evaluating the usability of online learning environments, definitions of what is meant by *online learning tools, online learning environment*, and *e-Learning* varies. As such, the usability evaluation tools also tend to differ according to their definition. This can make it difficult to determine if an evaluation tool can be used with only one or different types of e-Learning products.

When learning at a distance first began, the term most often used was *distance education*. Now that term encompasses many types of learning at a distance, including e-Learning, but also includes remote learning where a computer may not be involved, such as self-paced study from a text or material. Over time, the term *e-Learning* has come to represent learning associated with the use of computers, various software, and the internet (or intranet), but it still includes a vast array of learning.

Our evaluation focus is an e-Learning course (e-Course), wherein all course content and learning activities occur in the online learning environment that is supported by a Learning Management System (LMS), Course Management System (CMS) or non-commercial website. This definition does not exclude other characteristics that may be applicable to other types of e-Courses, but it is strictly applicable to the type of e-Course that we are

evaluating. Thus, our goal is to create a tool specifically for evaluating e-Learning courses that contain several units or modules of instruction, along with user interactions. To achieve this goal, we examined usability instruments and evaluation studies related to e-Learning. Specifically, we focused on the unit of analysis (i.e. type of e-Learning) and the criteria used for the evaluation.

## e-Learning Definitions

As e-Learning continues to evolve, practitioners and researchers are yet to agree on common definitions and terminologies. A conceptually relaxed utilization of the term e-Learning makes it difficult for researchers to perform meaningful cross-study comparisons, prevents researchers from building on the outcomes from the previous studies, and ultimately contributes to conflicting findings about e-Learning environments. In addition, terms such as e-Learning, online learning, web-based course are often interchanged within descriptions of the same learning environment. While some authors explicitly defined e-Learning, others implied a specific definition or view of e-Learning in their paper. The following describes various definitions of e-Learning:

- Relan & Gillani (1997) Used synonymously with web-based instruction "The application of a repertoire of cognitively oriented instructional strategies implemented within a constructivist ... and collaborative learning environment, utilizing the attributes and resources of the World Wide Web."
- Clark (2002, p. 2) "Content and instructional methods delivered on a computer (whether on CD-ROM, the Internet, or an intranet), and designed to build knowledge and skills related to individual or organizational goals.".
- Rossiter (2002) The development of knowledge and skills through the use of information and communication technologies (ICTs) to support interactions for learning—interactions with content, with learning activities and tools, and with other people
- Nichols (2003, p.2) "Education that occurs only through the Web, that is, it does not consist of any physical learning materials issued to students or actual face to face contact. Purely online learning is essentially the use of eLearning tools in a distance education mode using the Web as the sole medium for all student learning and contact."
- Ellis & Allen (2004) "E-learning covers a wide set of applications and processes, such as Web-based learning, computer-based learning, virtual classrooms, and digital collaboration. It includes the delivery of content via Internet, intranet/extranet (LAN/WAN), audio- and videotape, satellite broadcast, interactive TV, and CD-ROM."
- Koohang (2004, p.1) "Web-based learning, computer-based learning, virtual classrooms, and digital collaboration. Content is delivered via the Internet, intranet/extranet, audio or video tape, satellite TV, and CD-ROM."
- Tavangarian, Leypold, Nölting, Röser & Voigt (2004, p. 2) "All forms of electronic supported learning and teaching which are procedural in character and aim to effect the construction of knowledge with reference to individual experience practice and knowledge of the learner."
- Triacca, Bolchini, Botturi & Inversini (2004, p. 1) "An e-Learning website is a web application which communicates contents and structures the interaction in such a way that facilitates the learning experience."
- Dringus & Cohen (2005) Used synonymously with the term online course

#### **Different e-Learning Characteristics**

The previous list of definitions illustrates several problem in choosing an e-Learning usability evaluation instrument. First, terms such as online, web-based, and e-learning are interchanged when describing the learning environment. Second, some definitions and instruments are based on *a course* (Feldstein & Neal, 2006) or *program* (Reeves & Hedberg, 2003) while others are based on *learning objects* (Nesbit, Belfer, & Leacock, 2003). This second issue leads to problems related to scope and the instructional characteristics that will be embedded based on the type of learning environment. To further understand the important elements to include in usability evaluation, we identified and described related characteristics as follows:

- Learning objects: "A digital resource that can be reused to mediate learning" (Spector et al., 2008, p. 823)
- *Instructor-led*: The instructor/teacher/facilitator leads and guides all instructional content in the e-Learning forum. In addition, the instructor controls the instructional sequencing and pacing.

- *Self-directed*: A mode of learning in which the learner takes on more responsibility for their learning, and "assumes greater control of monitoring and managing the cognitive and contextual aspects of their learning" (Garrison, 2003, p. 50). For our evaluation purposes, this characteristic also represents independent learning with no interaction with other students.
- *Self-paced*: "A mode of learning that enables individuals to study online and in their own time at their own pace and from their own place." (Spector et al., 2008, p. 825)
- Learning Management System (LMS) "A collection of eLearning tools available through a shared administrative interface. A learning management system can be thought of as the platform in which online courses or online components of courses are assembled and used from." (Nichols, 2003, p. 2).
- *e-Course*: the authors define an e-course as a course using some form of computer technology, which is instructor-led and has peer-to-peer interaction. The interaction is implemented with communication tool(s) such as chat rooms, discussion boards, and voice over IP (VoIP). In some courses, materials will include self-paced learning objects, with the option of allowing students to decide the sequence of lessons.

To determine which usability instrument is applicable for an e-Course, we compared several e-Learning usability evaluation articles based on their unit of analysis (i.e., e-course, module, unit, learning object, etc.), e-Learning instructional method (i.e., instructor-led, self-directed, self-paced), and the evaluation tool (see Table 2).

Author(s)	Unit of Analysis	Instruction Method, Type of Interaction	Tool, Evaluation
Miller, 2002	E-course	Self-paced	Usability checklist for e-Learning
Benson, Elliott, Grant, Holschuh, Kim, Kim, Lauber, Loh & Reeves, 2001	e-Learning program	Self-directed	Evaluation based half on Neilson's heuristics, and the other half of the evaluation criteria are based on instructional design.
Nyhof-Young, Walsh & Stewart, 2002	Digital program, which can be used, reused, or referenced during online learning	Self-directed	<ol> <li>Think aloud</li> <li>Focus group</li> <li>Semi-structured questionnaire</li> <li>Log file analysis</li> </ol>
Reeves & Hedberg, 2003	e-Learning program, which can be a course or a series of courses. The course can include learning objects, modules	Self-directed	Heuristic Evaluation using Nielson's protocol as the foundation
Vargo, Nesbit, Belfer, & Archambault, 2003	Learning objects	Self-paced Self-directed	Focused on usability, feedback, and adaptation in the LORI assessment for interaction
Rentróia-Bonito, Guerreiro, Martins, Fernandes & Jorge, 2004	LMS with interaction	Self-directed or instructor-led	Online questionnaire indicating user opinions about using tools
Triacca, Bolchini, Botturi, & Inversini, 2004	e-Learning web application	Self-paced, self- directed, or instructor- led	MiLE is a scenario-driven inspection technique that uses a list of heuristic checklists to evaluate the application as the evaluator performs a task.
Dringus, 2005	E-course with interaction	Instructor-led	Checklist with 13 heuristic categories
Krauss & Ally, 2005	Learning Object	Could not determine	LORI evaluates learning objects

Author(s)	Unit of Analysis	Instruction Method, Type of Interaction	Tool, Evaluation
Mehlenbacher, et al., 2005	Learning course with interaction	Instructor-led	Heuristic Evaluation using Nielson's protocol as the foundation
Ardito, Costabile, De Marsico, Lanzilotti, Levialdi, Roselli, Rossano & Lanzilotti, 2006	E-course	Self-directed or instructor-led	Think aloud, interviews, and checklist (pedagogical usability)
Feldstein & Neal, 2006	Self- paced e- Learning/course	Self-directed	Heuristic testing
Ssemugabi & Villiers, 2007	E-course on the course website with interfaces usability and interaction	Self-directed or instructor-led	End-user evaluation via surveys, heuristic evaluation

#### Table 2: Comparison of e-Learning Evaluation Methods

Table 2 reveals that e-Learning usability evaluation studies ranged from learning objects or modules to an entire e-Learning program or e-Course. Determining whether an e-Learning environment is instructor-led versus selfdirected is important for understanding usability issues related to student-to-student, instructor-to-student, or student-to-content interaction. For example, an instructor-led course that is project-based and group-based may require students to collaborate online and submit documents for assessment. The e-Learning interface will need to have appropriate functions that require a minimum number of steps within one location of the learning environment. Most notably, the e-Learning usability evaluation methods differ, from solely focusing on heuristics, incorporating instructional design evaluation, to student surveys asking about perceptions of experiences. User satisfaction is one component of usability evaluation, along with measuring how users interact the interface while performing task.

## e-Learning Usability Instrument Categories

Given the differing units of analysis of the tools and their differing purposes, our goal is to create a tool that can be used to evaluate an e-Course that is supported by a LMS, CMS, or an online learning environment that combines several communication technologies to support instructor-led learning activities. Based on elements from the evaluation instruments in Table 2 and the authors' practical experience with e-Courses, the following categories were deemed important for our e-Course usability evaluation:

- User Experience The e-Course interface provides flexibility and support based on the user's experience with an online learning environment.
  - Example: Orientation activities for the learning environment
  - Example: Hints or Tips for how to navigate the interface.
- Information Organization The content of the e-Course is logically organized into modules or units.
  - Example: The user can easily determine the sequencing of content and instructional activities to support learning objectives
  - Example: Flexible organization scheme that provides links to content from multiple locations
- Tools The e-Course utilizes appropriate tools to support course management, communication, and completion of assignments.
  - Example: An instructor's ease of use when creating content or assigning student groups.
  - Example: The ease in setting user preferences for how and when information is displayed.
  - Example: The ability to search for content
  - Visual design The e-Course employs Web site interface standards and easy navigation
    - Example: Color, spacing, font, icon, and information mapping provide the ability to scan and identify important information
    - Example: Interface provides breadcrumbs, title location, and visited links to indicate location and what content has been visited

- Media The e-Course provides different formats of content to support different learning styles
  - Example: Provide PDF, Web Page, audio, video, or flash formats
  - Example: Support learners of various learning styles with different format of the same content
- Interaction The course organization, navigation, and tools support peer-to-peer, peer-to-content, peer-to-instructor, and instructor-to-peer interaction
  - Example: The ease in uploading and downloading files for assignments
  - Example: The ease in submitting assignments within a minimal amount of steps
  - Example: The ease in creating organizing content with activities that must be submitted
- Instructional strategies The methods used to facilitate and support learning.
  - Example: The ease in supporting group-work activities such as sharing and editing documents, and discussing issues.
  - Example: The ease in participating in synchronous lecture-based delivery of content

By combining related characteristics and dimensions from the instruments we have reviewed, we will be able to create an instrument that can be directly applied to an e-Course in a university setting. Our goal is to use this instrument for evaluating current courses, and using the findings to new and existing courses. In the end, we believe that our work will be beneficial for instructors creating similar types of courses, and for evaluating commercially built courses that universities may be considering adopting.

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