Abstract - Creating a rich online learning environment is a challenge and requires thoughtful User Experience Planning (UEP) for the effective presentation of the course interface. The user experience of an online course from a human-computer interaction point-of-view is not a naturally occurring process; it must be planned for. Instructors can apply the UEP process with measurable usability attributes and adaptable heuristics to evaluate the user experience in an online course. As a tool, UEP could be used to locate specific usability problems related to navigation, error recovery, locating information, and the selection of hyperlinks. An adaptable usability heuristic checklist for online courses will be presented. The checklist includes 13 heuristic categories, including: Visibility, Functionality, Aesthetics, Feedback and Help, Error Prevention, Memorability, Course Management, Interactivity, Flexibility, Consistency, Efficiency, Reducing Redundancy, and Accessibility.

Index Terms – usability, user experience, user experience planning, online courses, learning management systems, heuristics checklist.

INTRODUCTION

Current learning management systems such as WebCT, Blackboard, and others offer extensive mechanisms for creating and managing online courses. This requires instructors and students to learn new tools and ways of navigating an online course. Creating a rich online learning environment is a challenge and requires thoughtful User Experience Planning (UEP) for the effective presentation of the course interface. The user experience of an online course from a human-computer interaction point-of-view is not a naturally occurring process; it must be planned for. The user experience must be evaluated across several dimensions, including how the online environment as an entity promotes a sense of presence of school or of learning or other relevant metaphors. Usability attributes such as user control, navigability, usefulness, utility, ease of learning, ease of use, and others must be assessed to ensure the quality of the learning experience and of the learning environment that serves as an interface for stakeholders. Other usability attributes that are specific to online courses also include readability, review-ability, flexibility, and visibility.

The premise for this paper is the concern that learning management systems (LMSs) such as WebCT, Blackboard, and others, lack strong support for effective usability. Current LMSs are developed to support a “least common denominator” of user experience in that the user in an online course (e.g., student or instructor) experiences what is essentially a highly modal, “point and click” experience. The “point and click” experience often involves the user to produce multiple clicks to perform several discrete main tasks in the course environment. The user has the burden to discover how and where essential course elements and activities are organized and located when potentially there could be numerous selections of files and links in the course environment. The user has the burden of discovering the functionality of the LMS itself, namely the functions and options that are available within the course environment. The user intensive nature of the course environment often results in students and instructors struggling with interface problems such as difficulty navigating the online course, lack of visibility, consistency, and flexibility, excess functionality, and others. Additionally, students and instructors who struggle with interface problems may not be aware of how these problems may influence the learning and interaction experience in an online course. The authors have extensive teaching experience online (e.g., collectively about 20 years since the mid-80s “pre-Web” days) and 20 years teaching experience in the area of Human-Computer Interaction (HCI). The experience of teaching online and teaching HCI has led to awareness that LMSs are user intensive, and that in this early stage of LMS and online course development, there is an opportunity to embed primary usability strategies into the instructional design process for online courses.

The authors define effective usability in the design and use of online courses from a user perspective – a faculty and student perspective. Some theoretical background on usability is discussed to link the current work to the well-established research on usability by Nielsen [1], Sullivan [2], Hackos and Redish [3], and to previous efforts by Reeves et al. [4] to adapt common usability evaluation heuristics to e-learning. In this paper, the authors address several questions related to user experience and the usability of online courses: (1) How usable are our online courses and the tools that are used to support online learning and interaction? (2) What is ‘good usability’ in online courses? (3) What usability

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problems stand between instructors and students and their ability to interact in an online course?, and, (4) What can be done to minimize the usability problems and enhance online learning and instruction?

The balance of this paper focuses on describing a User Experience Planning (UEP) process for online courses. Instructors can apply the UEP process with measurable usability attributes and adaptable heuristics to evaluate the user experience in an online course. As a tool, UEP could be used to locate specific usability problems related to navigation, error recovery, locating information, and the selection of hyperlinks. The authors present an adaptable usability heuristic checklist for online courses. The checklist includes 13 heuristic categories, including: Visibility, Functionality, Aesthetics, Feedback and Help, Error Prevention, Memorability, Course Management, Interactivity, Flexibility, Consistency, Efficiency, Reducing Redundancy, and Accessibility.

BACKGROUND

Extensive research has been conducted in usability resulting in a large body of literature that defines, measures, and applies usability principles and attributes to the design of user interfaces. Usability is a term coined by Nielsen [1] to describe a “quality attribute that assesses how easy user interfaces are to use.” Nielsen reported five quality components of usability: learnability, efficiency, memorability, errors, and satisfaction. These components involve the extent and success to which a user can perform simple to complex tasks. Hackos and Redish [3] identified characteristics of usable interfaces to include support for the user’s learning style, compatibility in the user’s work environment, consistency of presentation layout, and familiar design concepts that support user recognition of meaningful metaphors, language, and illustrations to support ease of learning. Nielsen [1] identified 10 usability principles that have been applied as an industry standard to user interface design. From Nielsen’s original principles, Nielsen and Mack [5] created a set of 10 usability heuristics or rules that could be used to evaluate the extent of usability. These usability heuristics categories include: visibility of system status, match between system and the real world, user control and freedom, consistency and standards, error prevention, recognition rather than recall, flexibility and efficiency of use, aesthetic and minimalist design, help users recognize, diagnose, and recover from errors, and help and documentation. These usability heuristics have been well-documented in the literature as widely used protocol for evaluating usability and most often have been integrated into usability checklists that apply to various designs from web site design [2] to e-learning [4]. Sullivan’s [2] Reader-Friendliness Checklist subscribes to Nielsen and Mack’s heuristics and also identifies other categories regarding website navigation and readability such as clarity of communication, accessibility, design and maintenance, and visual presentation.

Applied specifically to online learning, Nielsen and Mack’s usability heuristics provide interesting promise to embed primary usability strategies into the instructional design process for online courses. Reeves et al.’s paper [4], is one of the few documented works that begins to apply usability heuristics and heuristic evaluations to e-learning programs. Reeves et al. used the same usability heuristic categories and evaluation protocol as Nielsen and Mack, but addressed heuristics specific to online learning. Reeves et al. also added two heuristics categories, interactivity and message design, because content related interactions and information presentation are important aspects of the online learning experience. Also, Dyson and Campello [6] proposed a framework to consider different aspects upon which Virtual Learning Environments (VLE) can be evaluated. They noted that the nature of evaluations is complex and that there are different evaluation approaches to apply to various technologies. They also noted that it is important to distinguish between usability and learning and how the two concepts should be studied concurrently with each having their own individual measures. After examining the research on usability and online learning, it is hopeful that future LMS design will include a formidable evaluation component for online courses to include usability and its many attributes to enhance the user experience in online courses.

WHAT IS “GOOD USABILITY” IN ONLINE COURSES?

Presently, the question, “what is ‘good usability’ in online courses?” is much left in the open for online students and instructors to determine. The authors of this paper contend that usability versus learning must be considered in an online course. What does it mean to experience the usability of an online course? Why does this matter? This leads to defining usability in the context of the online learning experience. Good usability translates to several key requirements:

- Good usability facilitates learning by having the mechanics of the learning environment transparent to the user.
- Good usability involves easy engagement of the user in the instructional and communication process.
- Good usability involves supporting flexibility for creative endeavors as part of the learning process.
- Good usability involves promoting interactivity among students and between students and instructor.

While good usability is achievable in an online course, many online courses often fall into the “poor usability” category due to a violation of meeting certain usability principles. Poor usability translates to several problems that occur in an online course:

- Functionality that requires an undesired decision or response – drop box date controls such as assignment due dates and multiple submissions, and extensions for deadlines.
The labor intensive design that is pervasive in most LMSs – extensive development/programming is needed to run ‘dynamic’ courses.

Functionality that only works part of the time – lost email, lost discussion postings, other.

Some to no flexibility – forum postings cannot be edited in some environments.

These examples of poor usability translate into usability problems that can stand between instructors and students and their ability to interact in an online course. Shneiderman [7] stated that hindrances such as inconsistencies, unneeded complexities, and hard to find functionality often contribute to poor user performance. Navigation is one area that needs improvement in LMSs and online courses. Such questions are common regarding where essential course elements and activities are organized in the course environment: Where did they put that? What does this icon represent? Why do I have to click here twice to download the file? I forgot to click on the submit button! Instead, navigation can be achieved in an online course by following basic usability principles and heuristics. For example, applying the principle of consistency can result in a user being aware of learnability and ease of use of the system: “Anything I learned to do in the email part of the system had similar functions and tasks in other parts of the system, for example the discussion forum postings.” This example supports the need for User Experience Planning (UEP) whereby instructors can apply the UEP with measurable usability attributes and adaptable heuristics to evaluate the user experience in an online course.

**USER EXPERIENCE PLANNING (UEP)**

Planning ahead for good usability is essential to an online course. A standard UEP process enables instructors to optimize presentation and functionality of the course interface. UEP is primarily a focus on heuristic usability evaluation [5] in several specific categories of online course management. In heuristic evaluation, usability problems are identified by independent evaluators within a short time frame. Each usability problem is connected to a specific usability heuristic. The evaluators then meet and aggregate the list of usability problems found (categorized by the appropriate usability heuristic) into one comprehensive list of usability problems. Severity levels and proposed solutions to correcting usability problems are then discussed. UEP can be effective in helping instructors locate, in their own online courses, usability problems related to navigation, error recovery, locating information, and the selection of hyperlinks. UEP is recommended as part of the development process to minimize usability problems and to enhance the online experience. The authors recommend that an iterative process where usability evaluation occurs throughout the lifecycle of the online course will produce the best results in evaluating the usability and user experience of an online course. Student input is valuable to the process and is highly recommended.

In drawing from Nielsen [1], Nielsen and Mack [5], Sullivan [2] and Reeves et al. [4], the authors of this paper conducted a heuristic evaluation of WebCT from the “user perspective”, including a faculty and student perspective. The authors as online professors conducted a heuristic evaluation of WebCT in which over 100 usability problems were located within an hour. The authors made an independent list of the usability problems found, connected the problems to Nielsen and Mack’s usability heuristics, and then aggregated the two problem lists into one comprehensive list. From the aggregated problem list, the authors identified 13 heuristic categories and specific heuristics that match each category. The 13 heuristic categories are: Visibility, Functionality, Aesthetics, Feedback and Help, Error Prevention, Memorability, Course Management, Interactivity, Flexibility, Consistency, Efficiency, Reducing Redundancy, and Accessibility.

The result of the usability evaluation is an adaptable usability heuristic checklist in its draft stage. Table 1 presents the 13 heuristic categories and corresponding heuristics for evaluating the usability of online courses. It is important to recognize that the draft checklist needs further development, such as validity testing, including content and item validity. The current checklist is a start to help instructors consider a variety of issues that may affect use in their online courses, particularly from a student perspective. The checklist is intended to be “adaptable” inasmuch as instructors are able to select items that they feel are important to their particular usability evaluations. Not all heuristics apply to all environments or all online courses per say; hence, the need for instructors to carefully select their own heuristic items. Also, it is important to recognize that the checklist is not all inclusive, in that new or revised heuristics could be added.

**FUTURE RESEARCH**

In this paper, the authors discuss effective usability in the design and use of online courses. The need to embed primary usability strategies into the instructional design process for online courses is critical to achieve. The Adaptable Usability Heuristic Checklist for Online Courses is a start to offering a comprehensive and expansive list of usability heuristics that can be applied to the usability evaluation of online courses. The heuristic evaluation of WebCT was the impetus for the current work, but such can be extended across various LMSs and online learning environments. This heuristic evaluation of WebCT revealed many usability inconsistencies and assisted in the discovery of usability issues from different perspectives. Future research should determine whether the checklist is best targeted for instructors or a mix of students and instructors. Distinctions should be made between system design heuristics and pedagogical heuristics since system design and pedagogical heuristics are contextually applied differently to the user experience. Also, applying the major usability heuristics does not guarantee perfect usability. UEP and the checklist are intended to help gauge usability so instructors are given insight into how the design and organization of their online courses influence the interaction and learning experience of their courses. Implications for future designs.
### TABLE 1
ADAPTABLE USABILITY HEURISTIC CHECKLIST FOR ONLINE COURSES*

*General usability heuristics based on [1-5] and [2]. Also extends the usability evaluation instrument created by Reeves, et al. [4]. See References.

<table>
<thead>
<tr>
<th>Category</th>
<th>Usability Heuristic</th>
</tr>
</thead>
</table>
| **1. Visibility** | • Does the user know where to start on the main page?  
• Does the order of course listings (e.g., from current to previous) reduce the need for scrolling action to find courses?  
• Does the presentation arrangement assist the user to recognize specific courses by specific terms and course names?  
• Is the user interface functionality properly presented on the main page? Are options (buttons/selections) logically grouped and labeled?  
• Is the intended functionality clear for each option or selection?  
• Is the use of a global calendar for the benefit of the designer or learner? Both? Neither?  
• Is system status of each function clear on the main page?  
• Does the designer know the differences and risks in using various functions?  
• Are functions intuitive to all users accessing the main page? Are they used? If not used, can they be removed/hidden from the page?  
• Does the user understand the graphic symbols given for each course that represent “new” – new email, new discussion postings?  
• Are functions redundant on a page? (For example, how many instances of “bookmarks” are necessary on the main page?)  
• Does the user have to scroll beyond one full screen?  
• Is excessive scrolling needed to find items from one single page or view?  
• Are button labels meaningful?  
• Does the system provide breadcrumbs to indicate where the user is and where the user last was?  
• Is the page length appropriate to the content?  
• If frames are used, are they used effectively to improve navigation?  
• Is it necessary for the designer/instructor to consistently “toggle” from “designer options” to “view” just to expand the homepage view?  
• Is excessive radio button selection necessary to select functions or items that need viewing or require action?  
• Is course content meaningfully arranged in files and links from the homepage?  
• Does the user know where to start on the homepage as in “where do I start with this course?”  
• Can the user visibly discriminate between information and activities arranged on the homepage?  
• Are certain functions or options hidden when they should be visible from the view?  
• Are certain functions or options visible when they should be hidden from the view?  
• Is the presentation of email and discussion messages consistent?  
• Can the user locate a clear communication path to the instructor? Other students?  
• Are “Announcements” visibly presented on the course page? Are announcements current?  
• Does visibility support awareness/perceptions of others?  
• Are meaningful learning metaphors being used to represent content, tasks, or activities?  
• Are pages on the course site easy to bookmark?  
• How many actions or selections does the designer/instructor have to do to complete one main task (e.g., establish an assignment drop box for three assignments)?  
• Does the sequence of completing a main task require repetitive scrolling, repetitive selection, and accuracy of selection for completing one main task (e.g., adding/moving/editing one single text block)?  
• Does the course calendar match the global calendar? Can the global calendar be accessed/used inside the course homepage?  
• How intuitive are button functions without clicking on them first?  
• Does the interface provide adequate back button functionality to return to a previous screen?  
• Is functionality deeply nested requiring a several step selection process for following links?  
• Are there sufficient shortcuts for navigating the activity, function, or action?  
• Are form-fill in screens so cumbersome that multiple selections or actions must be taken to complete a task (e.g., setting the time in assignment box requires input of hour and seconds in separate boxes.)  
• Are there progressive levels of detail in presenting information to the user? |
| **2. Functionality** | • How many actions or selections does the designer/instructor have to do to complete one main task (e.g., establish an assignment drop box for three assignments)?  
• Does the sequence of completing a main task require repetitive scrolling, repetitive selection, and accuracy of selection for completing one main task (e.g., adding/moving/editing one single text block)?  
• Does the course calendar match the global calendar? Can the global calendar be accessed/used inside the course homepage?  
• How intuitive are button functions without clicking on them first?  
• Does the interface provide adequate back button functionality to return to a previous screen?  
• Is functionality deeply nested requiring a several step selection process for following links?  
• Are there sufficient shortcuts for navigating the activity, function, or action?  
• Are form-fill in screens so cumbersome that multiple selections or actions must be taken to complete a task (e.g., setting the time in assignment box requires input of hour and seconds in separate boxes.) |
| **3. Aesthetics** | • Is there sufficient use of white space in the course design? On each page? Across course pages?  
• Is there proper use of color or graphics that enhance navigation?  
• Are items or functions placed in meaningful order?  
• Are buttons and selections of sufficient viewable size?  
• Is text of sufficient viewable size?  
• Is the presentation of the course appealing to the user?  
• Does the course promote a “sense of presence” from an aesthetic point of view?  
• Does the course presentation promote engagement for users?  
• Are screen features adaptable to individual user preferences?  
• Are the screens pleasing to look at?  
• Is good use made of the screen real estate?  
• Are the screens too cluttered or too sparse?  
• Is there too much course content or information on the screen?  
• Is there extraneous information causing user distraction?  
• Are there progressive levels of detail in presenting information to the user? |
| 4. Feedback and Help | • Do buttons and features have “fly over” help or pop up labels that provide meaningful description?  
• Is the user offered sufficient FAQ, system, and human support to obtain necessary help?  
• Is context sensitive help provided?  
• Are colors used appropriately using standard conventions?  
• Status messages  
• Are system messages meaningful?  
• Are status related items consistent across the course interface?  
• Are status messages worded appropriate to the task?  
• Are status messages discernable between informational or action oriented?  
• Is the user provided with sufficient information to know what the system status is and where in the system he/she is? |
|---|---|
| 5. Error Prevention | • Does the user have control over the system?  
• Can the user easily undo selections, actions, errors in arrangement or management of items?  
• Is “undo” an intuitive process?  
• Are errors avoided or minimized when possible?  
• Is there an easy undo feature available at major juncture points?  
• Do error or warning messages prevent possible errors from occurring?  
• Are solutions offered to help users recover from errors? |
| 6. Memorability | • Is the designer/instructor required to essentially memorize the sequence of selections and actions to efficiently complete a task?  
• Is modal selection so extensive that the designer cannot easily remember where he/she started in the process of completing a task?  
• Is cognitive load reduced by providing familiarity of items and action sequences?  
• Can the designer/instructor immediately find the appropriate function to make a modification to a previous setting?  
• Can settings be reused so that designers/instructors are not required to remember processes that are only done infrequently when designing a course?  
• Is there sufficient visibility so the user does not have to look for things and try to remember them?  
• Are meaningful labels and descriptive links used to support recognition?  
• Are objects, actions, and options visible?  
• Is information presented in organized chunks to support learnability and memorability? |
| 7. Course Management | • Are files easy to upload?  
• Are files easy to download and view?  
• Are files easy to organize according to sequence and timing desired by the designer?  
• Is the “back up” file process an intuitive process?  
• Is the “back up” file/course process flexible in the number of times a back up can be made?  
• Can the designer/instructor find the management functions in the control panel arrangement?  
• Is there redundancy in the arrangement of items in the control panel? In the entire panel? In sections of the panel?  
• Do desired management tasks match the function of the tool and the section that function is given in the control panel?  
• Are items in the control panel appropriately arranged?  
• To what extent is “maintenance” a designer’s task or the system’s task?  
• Are maintenance related tasks automated for the designer?  
• Are there simple ways to reuse a course from previous courses?  
• Is attention paid to minimize redundant efforts?  
• Can files easily be shared among courses?  
• Are there options to personalize the “look and feel” of the course?  
• Are standard templates available to select “look and feel” aspects of the course? |
| 8. Interactivity | • Does the arrangement of topics promote class discussion?  
• Can the user follow the progression or flow of discussion of one single topic or across multiple topics?  
• Are messages arranged in numerical fashion? Is this effective?  
• Are messages arranged in an effective threaded fashion?  
• Can selected messages be effectively compiled to read in one sequence?  
• Can subject lines be modified?  
• Can text be edited or modified once posted?  
• Can messages be moved to specific locations to another topic area?  
• Can users delete their own messages or text?  
• Can users obtain “side-by-side” (multiple) views of contributions to follow the flow of discussion?  
• Can users establish a “sense of community” through the arrangement of messages and responses?  
• Can messages and responses in one class be shared for another class with appropriate acknowledgement and citation of origin?  
• Can designers/instructors extrapolate specific postings from individual students from the discussion board transcript?  
• Can the designer/instructor extract statistics from the discussion board transcript to show the patterns of interaction produced from the class?  
• Can users share timely information that can be easily located later for further use?  
• Can users communicate with others outside the course?  
• Are various interaction patterns (one-to-one, one-to-many, many-to-many) supported in the communication tools?  
• Can a “history” of discussion and sharing of resources be captured at any time in the course?  
• Can temporal aspects such timing, pace, and sequencing be used effectively in online discussion tools to promote quality interaction?  
• Can various activity structures be used in online discussion tools? (For example, activities involving individual students,
| 9. Flexibility | - Are templates available for the designer to simply “plug in” course content without time consuming and repetitive action sequences?  
- Are users able to edit messages in email, chat, discussion boards, etc.?  
- Does modifying an action or activity require excessive “redoing” to make a single change?  
- Can designers/instructors modify settings for individual learners that would not affect the settings for the group as a whole? (For example, extending the due date for an assignment in the drop box for an individual student.)  
- Can designers/instructors select information for individual students or group students into distinct groups for various purposes?  
- To what extent is reuse possible without extensive revision or modification to previously used learning objects or course content?  
- Can users establish their own defaults for email, discussion groups, icon arrangement, other?  
- Can users personalize their online learning environment by adding resources, content, learning objects to their own course page? To what extent can users customize their “view”?  
- Are standard templates provided with easy access to personalize or modify things?  
- Can learning objects be created and reused?  
- Can the user modify the defaults and create his/her own style sheets?  
- Does the system support various learning styles?  
- Does the course support various modes of learning – asynchronous, synchronous, hybrid? |
| --- | --- |
| 10. Consistency | - Do all buttons/labels/textboxes/text/ icons/other offer consistent and meaningful information?  
- Do the activity, icon, button, label, and other provide clear purpose/intent that matches the tasks?  
- Are buttons or selections consistently placed on the screen throughout the course?  
- Is there adequate integration of functionality and tasks – does the tool match the desired task? Does the tool match the learning objective?  
- Is there consistent arrangement of course content and interface items that help reduce cognitive load?  
- Does the system operate consistently throughout the course?  
- Are tasks and functions intuitive and follow standard conventions?  
- Is consistent form and style used for various titles and headers?  
- Are colors used appropriately using standard conventions? |
| 11. Efficiency | - Can activities be done logically and easily?  
- Does the organization match the mental model of the user and designer/instructor?  
- Are modal operations reduced, where possible?  
- Does the system provide progressive disclosure, both for the user and the designer/instructor? |
| 12. Reducing Redundancy | - Are items visible in multiple places and from multiple paths?  
- Are learning objects easily created and reused?  
- Can multiple but similar tasks be done easily? |
| 13. Accessibility | - Does the system provide sufficient flexibility for multiple types of users?  
- Are alternative pathways to course content and activities available?  
- Does the course meet minimal accessibility standards (WAI, Bobby, others)?  
- Can content be transcribed to various spoken languages?  
- Has load time been considered in terms of content and various network speeds?  
- Is the course accessible to people with physical impairments?  
- Are buttons and selections of sufficient viewable size?  
- Is text of sufficient viewable size?  
- Are screen features adaptable to individual user preferences? |

REFERENCES


