Assessing the Efficacy of Distance Learning Alternatives in Boating Education Courses for the Creation of Delivery and Presentation Standards

Final Grant Report
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Introduction

The National Association of State Boating Law Administrators (NASBLA) first developed boating safety education guidelines in the 1970s to promote uniformity and reciprocity among the states. Within the last ten years, states began to include online courses in addition to the traditional 8-hour face-to-face training that was previously used on its own. Currently, there are 12 boating education course providers offering online boating safety courses throughout the U.S. Without any usability research supporting or refuting boater education in this format, there are no standards to which the online courses can be held. Although the content of the courses is driven and controlled by the National Boating Education Standards, the course delivery and presentation varies greatly from course to course. For instance, one course provider incorporates pictorial elements throughout their final exam while the other course providers only have text-based questions and answers. In another course, students navigated through chapters with text and images in a timed format, which required them to remain on each page of the text for a specified period of time before being permitted to proceed on. The majority of the courses contain the text as one complete body of information, which the student may look through in as little or as much time as the student chooses.

The main goal for this grant project was to conduct a research study using established boater safety education materials in distance learning formats to determine the efficacy of online boating safety courses and to create a set of presentation and delivery standards. The project was broken down into four tasks. Each task is listed below with details as to how the work was completed and any resulting findings or products.

Task 1:
Collect course materials for all NASBLA-approved distance learning courses for evaluation in the Information Experience Lab at the University of Missouri.

The goal of the Information Experience (IE) Lab was to evaluate the usability of the boating safety courses, and provide recommendations for information organization and presentation. Usability encompasses navigation, learnability, consistency, and user orientation within the course. For information organization and presentation, we focused on the segmenting and sequencing of course topics and how they can affect the ability to find specific concepts. Presentation relates to the inclusion of media (i.e., audio, video, graphics, animations, etc.) along with essential message design components to ensure that concepts are illustrated effectively.

The evaluation activities involved a myriad of activities that included:
1. Heuristic evaluation
2. Usability testing and perceptions at the Florida and Minnesota Boat shows
3. Usability testing in the IE Lab

The following sections will provide information for each activity.
Heuristic Evaluation

Method
A heuristic evaluation is a method to determine whether an application or website is aligned with recognized and established standards for graphical user interfaces. Although there are several evaluation instruments that have been used for electronic learning (e-learning) situations, we learned that most of the instrument categories did not apply to the boating safety courses. Therefore, the following method was used to create an applicable instrument.

1. Developed the first iteration of the heuristic checklist based on instruments used by other evaluation projects (Dringus & Cohen, 2005; Mehlenbacher, et al., 2005; Reeves et al., 2002).
2. Using the first iteration of the instrument, one course was evaluated as a group. The categories were redefined to make them applicable to boating safety courses, which resulted in a second iteration of the instrument.
3. With the second iteration, the researchers evaluated a second course. The results were discussed as a group resulting in a refined testing instrument.

The third and final version of the heuristic checklist includes the following main categories:

1. User location/orientation within the course
   - User knows where he/she is at all times, and knows what content has been viewed
2. System feedback
   - System displays status of user input, tasks completed, or load status of media
3. Match between environment and the real world
   - Interface utilizes metaphors that are familiar to the learner in terms of traditional learning environment or learning content
4. User control and freedom
   - User can peruse freely in an unambiguous manner, including the capability to go back and review previous sections
   - User can leave, then easily return to the closest logical point in the program
5. Consistency and standards
   - The system includes interactions that are intuitive with respect to common software conventions (e.g. Menu/Navigation on left is the standard)
   - The system adheres to widely recognized standards for interactions: For example, visited links should change from the initial color.
6. Error prevention and recovery
   - The system is designed so that the learner recognizes when he/she has made a mistake related to input rather than content
   - The user receives meaningful feedback concerning the nature of any input he/she makes into the program
7. Recognition rather than recall
   - The interface of the system speaks for itself so that extensive consultation of a manual or other documentation does not interfere with learning
• Icons and other screen elements are designed so that they are as intuitive as possible.

8. Technical performance
• If applicable, media elements load as quickly as possible (e.g., audio, video, flash, etc.)

9. Aesthetic and minimalist design
• The font choices, colors, and sizes are consistent with good screen design recommendations for e-learning programs. For example: san serif fonts, dark font color on light backgrounds, and none to minimal vertical scrolling.

10. System help and documentation
• Help and documentation are available from any logical part of the system.
• A FAQ section is provided for system tasks or for accessing or submitting information

11. Message Design
• The most important information on the screen is placed in the areas most likely to attract the learner’s attention

12. Content
• The content is organized in manageable modules or other types of units.
• The system provides advanced organizers, summaries, and other components that foster more efficient and effective learning.

Sample of Boating Safety Courses
Eight courses were selected for review. Each of these courses were designed differently, and allowed the learner to review the content without having to pay for the course. The following URLs list the courses that were reviewed.

- http://boaterexam.com/kansas
- http://www.boatingcertificate.com
- http://boatingbasicsonline.com
- http://www.boat-ed.com/Pennsylvania
- http://www.boatus.org/onlinecourse/ReviewPages/BoatUSF/Project/section0x.htm
- http://www.americasboatingcourse.com

Results
The following list describes issues discovered among the 8 boating safety courses that are related to the heuristic categories:

1. User location/orientation within the course
   • **Issue1** -> Chapter or unit name did not match the “bread crumbs” (i.e. path indicators that reflect location within the course) on the web page.
   • **Issue2** -> For the main menu, all of the subunits within a chapter were highlighted rather than the specific section within the chapter. To assist the user with knowing which section they were viewing, only the name of that subsection should be highlighted.
• **Issue 3** -> The sub navigation menu does not show visual relationship with the main navigation menu. Meaning, the sub-menu name does not match the name in the main menu. In addition, the position of the sub-menu at the very top of the page is easy to overlook, because the user focuses on the main menu on the left side of the web page.

2. System feedback
• **Issue 4** -> Visited links do not always change colors to inform the user of sections that had already been reviewed

3. Match between environment and the real world
• There were no issues

4. User control and freedom
• **Issue 5** -> For user accounts, the user should be able to go directly to the last visited location after logging into the web site.
• **Issue 6** -> Animation did not allow users to pause, stop, or rewind
• **Issue 7** -> Users must follow a prescribed sequence rather than “review” content areas out of sequence

5. Consistency and standards
• **Issue 8** -> There should be consistent fonts, text size, and organization on each page. When there are extreme differences, a user might believe that he/she is viewing a different web site.
• **Issue 9** -> Clicking on the home link would log-out the user rather than send him/her to the home page
• **Issue 10** -> Browser incompatibility- Different display of information on Firefox, Internet Explorer, and Safari
• **Issue 11** -> Computer incompatibility- Different display of information on Mac and PC-based computers.
• **Issue 12** -> Within a menu, there would be text and an image. The image/bullet beside text was clickable, but the text was not. Typically, users select text not the bullets.

6. Error prevention and recovery
• **Issue 13** -> When the user submits an incorrect answer, the response is in all caps. For example, “WRONG” could be perceived as yelling and cause unnecessary anxiety for the learner.
• **Issue 14** -> When a user clicks “quit” on a test, the window closes without first prompting: “Are you sure you want to quit?”
• **Issue 15** -> For quizzes, empty fields were accepted by the course. Thus, unanswered questions are processed as incorrect.

7. Recognition rather than recall
• There were no issues

8. Technical performance
• **Issue 16** -> Pictures did not always load: Pictures would display with Internet Explorer, but not on Firefox

9. Aesthetic and minimalist design
• **Issue 17** -> Inability to enlarge text for easier reading
• **Issue 18** -> Dark background with white text is more difficult to read
10. System help and documentation
   • **Issue 19** -> Help or documentation for using the web site is not provided

11. Message Design
   • **Issue 20** -> Graphics did not support learning material in a way to assist the learner with comprehension.
   • **Issue 21** -> Help or documentation for using the web site is not provided
   • **Issue 22** -> Web site contained large amounts of content, with minimal use of white space. White space helps to divide the "chunked" portions of the screen so that the information is easier to read and scan for important content.

12. Content
   • **Issue 23** -> The font style and size should be san serif for easier online reading instead of serif style fonts
   • **Issue 24** -> The segmenting or chunking of the content was not always appropriate for the learning objective. There should be meaningful amounts of information to allow the learner to comprehend one learning objective, rather than multiple learning objectives
   • **Issue 25** -> Content should provide summaries of major points of information presented in the module, chapter, or unit.

**Summary**

It appears that all of the boating safety courses present a traditional electronic book (e-book) approach for delivering the content on their websites. While the websites provide meaningful information for boating safety education, in many of the websites the information is presented in a “dense” and un-motivating fashion that can cause learners to skim through the information. In relation to instructional design and message design, improvements could be made to the organization and presentation of website content to motivate and assist the user with learning the content. Message design refers to the manipulation of signs and symbols, such as words, pictures, figures, animation, etc. for modifying psychomotor, cognitive, or affective learner behavior (Fleming & Levie, 1993).

Navigation and consistency were other issues that were commonly discovered as with the websites. For example, a table of contents that also serves as the navigation to the major sections is important for easy access to the information. In addition, the headings for the content being viewed must always match the navigation link that the user chose. This is basic method for helping the user to know where they are located within the website.

Since completing the study, a number of the courses have changed the format and presentation of their content. Some of the courses were in the process of updating their content in order to renew their approval while others chose to update their content or presentation of content for other reasons. The researchers and NASBLA had no control over this.
Usability Testing and Perceptions – Boat Shows

Overview
Usability testing allows representative end-users to explore scenarios, or specific tasks within an application or website. During the exploration, evaluators will be able to determine the functionality and usage patterns from the end-user perspective. The main goal was to observe and record users’ initial reactions to the courses, and their ability to navigate the interface. Data was collected during the Florida and Minnesota boat shows held in January and February of 2009, respectively.

Procedure
The testing was implemented at a booth set up at each of the boating shows. Two laptops were set up for participants to interact with three different online boating safety courses. The laptops were stationed at opposite ends of a long table so that participants could not interact with one another or see one another’s screens. Each laptop contained software to record the participants’ interactions with the boating safety courses that they would see on the laptop.

The researchers and NASBLA staff recruited participants as they were walking through the boat show and provided lunch bag-style coolers as an incentive for their participation. Participants interacted with three of the previously listed online boating safety courses: BoatUS.org, Boaterexam.com, and Boat-ed.com. These courses were selected based on the need to have different presentation and interaction elements in order to compare learner preferences.

Participants were instructed to search for the same information within each of those courses. For example, participants were asked to “Locate the section of the course that provides life jacket information (text and graphics).” Searching for specific information in a course is an appropriate task to determine how users navigate the web site, and recognize their orientation or position within the website.

At the end of the search tasks, participants were asked to provide feedback on navigation, organization, and visual design. In addition, they were asked to provide their preferences regarding media and online test taking. We counterbalanced the process by alternating the order of the courses so that the participants were exposed to the three courses in different orders. See Appendix A for a list of the specific questions that were used for the boat shows.
**Participant Summary**

Participants at the boat shows represent the general population of people that would need to complete the necessary boating safety training in order to obtain a boating certificate. A sample of convenience recruiting approach was implemented by recruiting the people as they walked by the booth. Although a sample of convenience does not represent a specific demographic, it is a common sampling approach in usability studies for uncovering usability issues with different types of people.

The 10 to 15 minutes to complete the evaluation seemed to be a deterrent to some people during the boat shows, yet we were able to recruit 90 participants, which was only 10 less than we had originally planned. However, five participants for a particular type of user is an appropriate sample to uncover the most important usability issues (Tullis & Albert, 2008). Based on the demographics, the main participant groups of interest were: previous Internet experience (intermediate or advanced), minimal Internet experience (nonuser or novice), previous online course experience, minimal online course experience (had taken none or only one), previous boating experience, and no boating experience. With six main groups, we needed a minimum of 30 participants. However, as many participants as possible were recruited during the boat shows. The following results present the number of participants for each category in parenthesis.

1. 90 participants - Age: Mean (46.39), Min (18), Max (70)
2. Gender: Males (56), Females (34)
3. Previous Internet experience:
   - Non-users (11)
   - Novice (15)
   - Intermediate (43)
   - Advanced (21)
4. Previous online course experience:
   - Yes (34)
   - No (56)
5. Preferences for displaying common information such as a topic or lesson that affects the page length
   - All content is segmented into different pages (25)
   - All content is on one page (65)
6. The display preference for online test questions
   - One question displayed on a page, then click next (36)
   - All questions displayed on one page with scrolling (54)
7. The display preference for online test feedback
   - Immediate feedback after each question (46)
   - Feedback at the end of the entire test (44)
8. Re-test preferences when the test questions change each time
   - Review the content first, then take the test (48)
   - Take the test first, then go back to review the content (28)
   - Keep taking the test without reviewing the content until you pass (14)
9. Boating Safety Course Preference
   - BoatUS.org (33)
   - BoaterExam.com (25)
   - Boat-ed.com (32)

A one-way analysis of variance (ANOVA) was used to compare the preferences in regards to the three boating safety courses. There was one significant ANOVA test indicating that non-Internet users tended to prefer the BoaterExam course. Since completing the study, a number of the courses have changed the format and presentation of their content. Some of the courses were in the process of updating their content in order to renew their approval while others chose to update their content or presentation of content for other reasons. The researchers and NASBLA had no control over this.

**Qualitative Findings**

Based on observations and the recorded participant interactions with the three boating safety courses, it was noticed that the following interactions occurred with more than 50% of the participants:

1. The majority of the participants preferred one page of content that involves lots of scrolling for a topic. They did not like clicking or moving to another page to see additional information for the same topic.
2. None of the courses had search capabilities, yet the users indicated that they wanted a quicker way to find information rather than to go through a long index list of chapter headings. Although the general use of the courses is not for reference and users would progress through the course in a prescribed sequence, it was still noted that participants would have preferred a search box for ease in finding information.
3. Boating education courses use official terms, but participants were not always familiar with these terms. For example, Personal Flotation Device (PFD) is the official term for life jackets and this led to confusion among some of the participants who were asked to find information on life jackets within the course.
4. There were instances in which the users did not realize where they were in the courses because the section title did not remain on the page when they scrolled down. When the content becomes long and requires the user to scroll, the section title and navigation should be stationary (always visible) on the page.
5. When beginning from the home page of a course, it was not always obvious to the participants how to start the course.
6. Two of the courses did not provide indicators/signals of content sections that had already been visited. For instance, the text did not change colors or include a symbol to indicate it had already been viewed.
Summary
Although the participants only had a brief interaction with each of the three courses, the evaluation provided valuable insight into user perceptions and navigation habits. The searching task is an opportunity to explore the web site while learning how to use different components of the interface. There were several novice computer and Internet users who were hesitant to interact with the courses, but they eventually became more comfortable after completing the task for the first course.

Since completing the study, a number of the online courses have changed the format and presentation of their course content. Some of the courses were in the process of updating their content in order to renew their approval while others chose to update their content or presentation of content for other reasons. The researchers and NASBLA had no control over this.

Usability Testing – Information Experience (IE) Lab

Procedure
This research was implemented in a usability testing facility that uses Morae, an all-digital, user-experience testing software. The research process began with a participant reviewing the Internal Research Board consent notice then completing a demographic survey (See Appendix B). For part I of the research, a participant was asked to go through the first unit within one of the three courses (i.e., BoatUS.org, BoaterExam.com, Boat-ed.com) being studied as if he/she was a student. Then, the participant was asked to complete a five-question quiz. After their experience with the course, the participant completed a ten-question survey based on usability features. For Part II of the study, the participants reviewed the first unit in a second course and compared the two courses concerning various usability aspects in an exit survey. There were six groups of 10 participants for the study, which allowed for counterbalancing by having each of the three courses as the first and second course during the evaluation. Course evaluations were conducted with individuals, not groups. Morae was used to record the learner’s interactions within the courses and an observer made notes during the session. Each evaluation session lasted approximately 30 minutes.

Materials
Three of the NASBLA-approved online boating education courses were studied. Each of the online courses had different methods for delivering content. Table 1 describes the course differences.

For each of the three courses studied, a short, introductory unit was selected for the participants to complete. Each of the units, regardless of which course was being studied, provided information about the different types of boat hulls as well as other parts of a boat. A quiz was developed and used to test the participants’ ability to learn the content within all three courses. The multiple-choice quiz and answers are available in Appendix B.
While all three of the courses presented content associated with hull types, each of the courses did so in a different way. Table 1 shows how each course employed the use of video, audio narration, animation, real picture, cartoon picture and text as well as the number of pages that participants viewed during the evaluation. Table 2 provides an outline showing where the answers to the quiz questions were located within each course.

**Table 1: Course Elements***

<table>
<thead>
<tr>
<th>Elements</th>
<th>Boat-Ed</th>
<th>BoaterExam</th>
<th>BoatUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading Time Control and Information</td>
<td>Requires a specific amount of time to pass before proceeding to the next section</td>
<td>Provides a recommended time to view content based on the length of narration</td>
<td>No time requirement</td>
</tr>
<tr>
<td>Audio</td>
<td>No narrative text audio, but audio was used with video</td>
<td>Narrative text audio with start and stop control</td>
<td>No audio</td>
</tr>
<tr>
<td>Animation</td>
<td>Interactive learning object manipulated by the student and provided student with feedback</td>
<td>Passive/ Non-interactive Flash Animation – No control given to student</td>
<td>None</td>
</tr>
<tr>
<td>Video</td>
<td>Video with audio-Topic 3 – Boat Length</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Images</td>
<td>Static</td>
<td>Static</td>
<td>Static</td>
</tr>
<tr>
<td>Interactive Graphics</td>
<td>Yes – Drag and drop text identifiers for an image with feedback provided to student</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Course structure information</td>
<td>Location indicator remains on the top explaining the name of the unit and page within the unit</td>
<td>Current page name remains on the top The right hand menu presents course structure, marking current place and previously visited pages</td>
<td>Current unit name appears on the top of current page name under the top unit image, disappears when scrolling down Course main units available on the left and sub-units appear on the top of the page</td>
</tr>
<tr>
<td>Course structure information (continued)</td>
<td>Main menu that reflects the course structure is only accessible from the home page</td>
<td>Color of visited pages changes on the home page</td>
<td></td>
</tr>
</tbody>
</table>
Since completing the study, a number of the online courses have changed the format and presentation of their course content. Some of the courses were in the process of updating their content in order to renew their approval while others chose to update their content or presentation of content for other reasons. The researchers and NASBLA had no control over this.

### Table 2: Content Presentation for each Quiz Question

<table>
<thead>
<tr>
<th>Question 1: On which part of a boat is the hull located?</th>
<th>Boat-Ed</th>
<th>BoaterExam</th>
<th>BoatUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Page A: Text definition and a cartoon static picture of boat with different parts labeled</td>
<td>Page A: Cartoon animation (narration, accompanied by a cartoon picture of boat with hull highlighted) and a cartoon static picture of boat with different parts labeled</td>
<td>Page A: Text explanation</td>
<td></td>
</tr>
<tr>
<td>Page B: A cartoon animation for exercise</td>
<td>Review Page: In text</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 2: The basic types of vessel hulls can best be described using what two words?</th>
<th>Boat-Ed</th>
<th>BoaterExam</th>
<th>BoatUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Page B: Explained in a cartoon animation (audio narration accompanied by on-screen text &amp; cartoon pictures) with text below</td>
<td>Page A: Text explanation (one paragraph has an actual picture of boat and the other paragraph has a cartoon picture)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Review Page: In text</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 3: What type of hull would most likely be found on a sailboat?</td>
<td>Page C &amp; D: Text explanation</td>
<td>Page B: Mentioned in a cartoon animation (audio narration, accompanied by on-screen text &amp; a cartoon picture of sailboat) + Text below</td>
<td>Page A: Text explanation</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Question 4: What type of hull would most likely be found on a speedboat?</td>
<td>Page D: Text explanation within the section on speed. Page E: Indicated in video narration Page F: A table with cartoon pictures and text about different hull types. Indicated in the text about speed</td>
<td>Page C: Indicated in the cartoon animation (audio narration) plus text below about speed Review Page: Indicated in text (using a cartoon picture about the hull) about speed</td>
<td>Page A: A table with cartoon pictures and text about different hull types. Indicated in the text about speed</td>
</tr>
<tr>
<td>Question 5: A planing hull would be found on which one of the following boats?</td>
<td>Page D: Text explanation Page E: Video (audio narration, accompanied by a real picture of PWC)</td>
<td>Page B: Described in the cartoon animation (audio narration, accompanied by on-screen text and a cartoon picture of PWC) plus text below about “rising up” Review Page: Indicated in text about “rising up”</td>
<td>Page A: Described in the text about “rising up”</td>
</tr>
</tbody>
</table>

**Evaluation Objectives**
The goal was to determine the usability of the boating safety courses. Specifically, the focus was on the following factors contributing to the learners’:
- performance in the quiz,
- time spent in learning, and
- satisfaction experiences with the courses
Participant Summary
The target audience was people who needed a boating license. The audience could have a variety of boating and Internet experience. Due to the different types of people that would enroll in a boating safety course, a sample of convenience recruiting approach was implemented by recruiting the general public. Participants were recruited by email advertisements and word-of-mouth. Each participant was given $10 as an incentive for completing the evaluation.

The 30 to 40 minutes to complete the evaluation seemed to be a deterrent to some people, however we were able to recruit 60 participants. Five participants for a particular type of user is an appropriate sample to uncover the most important usability issues (Tullis & Albert, 2008). Specifically, the main participant groups of interest were: online course experience, minimal online course experience (had taken none or only one), previous boating experience, and no boating experience. With four main groups, we would have liked to have had a minimum of 20 participants per group, but as many participants as possible were recruited during the evaluation period.

- 60 participants: (32) Female, (28) males
- Age: (30.4) Mean, (9.5) S.D., (18) Min, (57) Max
- Previous Internet Experience: (1) Novice, (28) Intermediate, (31) Advanced
- Previous Online Course Experience: (41) Yes, (19) No
- Previous Boating Experience or knowledge: (23) Yes, (37) No
- Boating certificate: 1 participant

Quiz and Interaction Time Findings
Quiz results were collected based on the number of correct answers for five questions. Table 3 reveals that participants missed more questions with BoatUS, while the best performances were with Boat-ed. Boat-ed, BoaterExam, and BoatUS had an average score of 4.4. When reviewing the participants that answered most of the questions incorrectly, there was one participant in BoaterExam and one participant in Boat-ed that missed three out of the five questions. For the BoatUS course, a total of five participants missed three out of the five questions and one participant missed four out of the five questions. For the overall course performances, ~13% (8 out of 60) participants had a quiz score of 40% or less.

The amount of interaction time that students had with the first course in the evaluation process was collected. Table 4 shows that students spent the least amount of time in the Boat-ed course. Comparing the data in Tables 3 and 4, it can be assumed that content presentation and organization in Boat-ed may have been more effective for students to quickly grasp the concepts. With the unit of analysis being limited to one unit or chapter, there were variations in organization and presentation for the same content among the three courses. It cannot be determined whether the amount of content per web page or the number of pages were factors for this result, because of the variability. However, the segmenting of the content into learnable units that apply to one or two objectives is easier to learn in a short amount of time than several objectives within the same unit.
Table 3: Number of Incorrect Quiz Answers

<table>
<thead>
<tr>
<th>Course</th>
<th>Question 1</th>
<th>Question 2</th>
<th>Question 3</th>
<th>Question 4</th>
<th>Question 5</th>
<th>Total number of incorrect answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boat-ed</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>BoaterExam</td>
<td>0</td>
<td>2</td>
<td>7</td>
<td>4</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>BoatUS</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>40</td>
</tr>
</tbody>
</table>

N=60

Table 4: Amount of Time Participants Interacted with the Content (minutes)

<table>
<thead>
<tr>
<th>Grouping</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boat-ed</td>
<td>8.8</td>
<td>3.15</td>
<td>20</td>
</tr>
<tr>
<td>BoaterExam</td>
<td>21.09</td>
<td>5.12</td>
<td>20</td>
</tr>
<tr>
<td>BoatUS</td>
<td>9.55</td>
<td>3.15</td>
<td>20</td>
</tr>
</tbody>
</table>

Factors influencing learners’ performance in the quiz

- The average amount of incorrect answers that each participant made was 1.23. BoatUS learners had the most incorrect answers, while Boat-ed learners had the most correct answers. The variance reflects how spread out the data (i.e., quiz scores) are relative to the average. Differences within the courses, such as content presentation, media, organization scheme, etc. were able to explain 25.2% of the variance in the total number of incorrect answers among the three courses.

Correlation analysis was calculated to determine if there were any relationships between different variables. Some of the results are as follows:

- Learner satisfaction level and the time spent learning failed to correlate with quiz performance in a significant way. This means that quiz performance does not have a significant relationship with the time spent in the course or the learner’s satisfaction with the course.

- Demographic factors including age, gender, highest level of completed education, internet experience, previous experience with online courses and previous boating experience did not
Factors influencing the learning time

- The average amount of learning time was 789.11 seconds or a little over 13 minutes. A regression analysis revealed that learners of BoaterExam spent more time within the course, while learners of Boat-ed and BoatUS spent less time studying the unit. Differences in the BoatUS content presentation were able to explain 67.3% of the variance in the time learners spent in relation to the average learning time within the unit.

- Demographic factors including age, gender, highest level of completed education, Internet experience, previous experience with online courses and previous boating experience did not influence the time learners spent in the course.

Factors influencing learners’ satisfaction with the courses

- A regression analysis revealed that learners with previous boating experience were more satisfied with the complexity of the Boat-ed course. However, whether the learners had previous boating experiences or not, the results were only able to explain 5.5% of the variance in learners’ satisfaction with the complexity of the Boat-ed course. Hence, there must be other factors that affect learner satisfaction.

- A regression analysis revealed that BoatUS learners were least satisfied. However, differences in BoatUS content presentation and organization were only able to explain 7.5% of the variance in the learners’ satisfaction with the various usability features.

- A regression analysis revealed that learners with previous online course experience were more satisfied with the overall ease and use of BoaterExam. However, online course experiences were only able to explain 5.4% of the variance in the learners’ satisfaction with the overall ease of the use of the course.

- Based on correlation and regression results, demographic factors including age, gender, highest level of completed education, and Internet experience failed to significantly influence learners’ satisfaction levels.

Exit Survey Results

The first question related to course preference between the first course used to learn the material and the second course that was briefly visited by the learner. The totals that reflect the number of people that preferred each course are:

1. Boat-ed (21)
2. BoaterExam (35)
3. BoatUS (3)
Table 5 represents a summary of the course, visual design, and content organization preferences based on each group of learners. The participants actually read through one unit in the first course in order to learn the material and to complete a related quiz. Next, the participants browsed and briefly read the applicable unit in a second course. By accessing both courses, the participants were able to compare visual design and organization.

**Table 5: Preferences by Groups**

<table>
<thead>
<tr>
<th>Group</th>
<th>First Course and Second Course</th>
<th>Course Preference</th>
<th>Visual Design Preference</th>
<th>Course Organization Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td>*A</td>
<td>Boat-ed</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>BoaterExam</td>
<td>8</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>B</td>
<td>Boat-ed</td>
<td>9</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>BoatUS</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>*C</td>
<td>BoaterExam</td>
<td>7</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Boat-ed</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>D</td>
<td>BoaterExam</td>
<td>10</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>BoatUS</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>E</td>
<td>BoatUS</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Boat-ed</td>
<td>8</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>F</td>
<td>BoatUS</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>BoaterExam</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

*Some participants did not choose a course because they did not have a preference or liked elements of both courses

**Controlling Different Media Elements**
One question focused on the ability to control media elements such as audio, video, and animation. Eighty-eight percent (53 participants) wanted the ability to control media, whereas 12% (7 participants) did not want control. Four learners that had BoatUS as the learning course did not want control of media elements. BoatUS does not have any type of animation, audio, or video that would need controls.

**Text Narration or Text Preference**
Learners were asked their preference in regards to having text narration and text as part of the course. The majority (73%) chose to have text narration and text displayed at the same time, while 20% and 7% chose text only and text narration only, respectively.
Qualitative Findings

The recordings and observations of the participants’ interactions provided insights into how they were navigating through the course website.

Content Presentation

- BoaterExam presented animation to illustrate concepts along with text narration. This course has longer pages when compared to the other courses. Typically, learners did not look at both the animation and the text at the same time when listening to the audio. In many cases, we observed students not scrolling down to the accompanying text while viewing animation and listening to the text narration.

- For BoaterExam, the animations would automatically start when the user viewed the web page. At the end of the animation, an image to represent the Play button would be displayed. When users clicked the arrow, several assumed that it would take them to the next animation/video. However, clicking the arrow actually replayed the current animation. (See Figure 2)

- Boat-ed provides an image beside or below the text. Depending on the screen resolution and size, an image below the text could require some scrolling and the learner would have to keep the text explanation in working memory while reviewing the image. This did not appear to have a significant learning effect, because the segmenting of the page was small enough resulting in minimal amounts of scrolling.

- BoatUS was comprised primarily of text with some static images and some amount of scrolling. Although BoatUS had much less content information than Boat-ed, it actually took longer for learners to complete it. While Boat-ed used bullets for information presentation, learners commented that BoatUS was “text heavy” and less “easy to read”.

Figure 1: Play Button
Information Organization
Overall, learners did not display significant difficulties navigating the courses, such as not being able to move through the content or use the menu options. However, there was confusion regarding their orientation within the course. In other words, several learners did not know the number of sections they were going to review and the current name of the section. This has implications for learners who prefer some type of advanced organizer to describe the overall structure of the courses and outline the number of sections that will need to be completed.

Chapters
After an exhaustive literature search, we were not able to find research stating an ideal number of chapters. The number of chapters depends on the amount of content and number of learning objectives present in the curriculum. The display of the information on the screen is more important than the number of chapters. The content should be organized so that each screen consists of one segment (i.e. lesson) of related information. As a guiding rule, avoid introducing multiple topics, learning objectives or concepts at one time.

Multimedia
BoaterExam provided animation with audio narration, along with text below the animation that essentially contained the same information. Providing a text transcript for video and audio components is important for meeting the following Section 508 standard for accessibility:

§ 1194.22 Web-based Intranet and Internet information and applications.
(a) A text equivalent for every non-text element shall be provided (e.g., via "alt", "longdesc", or in element content). (“Section 508”, 2010)

A transcript of audio content should be a word-for-word textual representation of the audio that includes descriptions of non-text sounds like "ocean waves" or "boat engines." Transcripts of audio content are valuable for people with hearing disabilities. To meet the accessibility standards, all courses must have transcripts for audio.

Practice and Feedback
When evaluating the courses, it was learned that participants wanted more interactive “drag and drop” activities as was represented in Boat-ed. In the first attempt, many learners would drag the relevant text label for a boat part to the correct section. However, the text was to be dragged to the end of a line that was connected to the part of the boat. The feedback indicated an incorrect answer (“Oops! Try Again”), but the error was in the placement of the text, not the answer. In some cases, students would go back to the content to make sure they knew the correct answer. For this situation, the feedback was not appropriate. Solutions to the issue would be to change the location where the text labels could be placed, or change the feedback to match the user interaction.

Robert Gagne’s Nine Events of Instruction (1972) align well with the concept of practice and feedback while learning. Microstrategies are ways to approach instruction for particular topics or learning goals. At this level, the focus is on the lesson or session. Within a lesson, there are “events of instruction” designed to assist learners with proceeding from “where they are” to the
target objective. The events of instruction are very similar for instructional and training environments. Table 6 provides a brief description:

**Table 6: Instructional Events**

<table>
<thead>
<tr>
<th>Typical Instructional Events</th>
<th>Training Environments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gaining attention</td>
<td>1. Gain Attention</td>
</tr>
<tr>
<td>2. Informing the learner of the objective</td>
<td>2. Promote motivation</td>
</tr>
<tr>
<td>4. Presenting stimulus materials</td>
<td>4. Explain and demonstrate knowledge</td>
</tr>
<tr>
<td>5. Providing learning guidance</td>
<td>5. Learner practice with supervisor</td>
</tr>
<tr>
<td>7. Providing feedback</td>
<td>7. Summary</td>
</tr>
<tr>
<td>9. Enhancing retention and transfer</td>
<td>9. Closure</td>
</tr>
</tbody>
</table>

Learner practice and evaluation are instructional events that would be very beneficial for boating safety courses. For example, the inclusion of simulation-type interactions as it relates to handling a boat would provide a practice opportunity that can assist the learner with retaining the knowledge necessary when they are actually driving a boat. Of course, the simulations need to be as realistic as possible for transfer to occur to the actual performance.

**Line Length and Format**

While observing learners interacting with the courses, it was noticed that several of the older learners (40+ age group) moved the mouse cursor or their fingers along the text line with the words while they were reading. Due to font size, sentence length, and minimal white space, some screens were more difficult to read and caused the reader to lose his/her place within the paragraph.

Studies show reading information from a computer screen can be as much as 30% slower than from a printed page (Wright & Lickorish, 1983). There has been research that notes moderate line lengths of 50 – 60 characters per line (cpl) are optimal for reading from screens (e.g. Dyson & Kipping, 1998; Dyson & Haselgrove 2001). For adult learners, research has shown a preference for medium line lengths of 76 cpl (Bernard, Fernandez, Hull, & Chaparro, 2003). The line lengths for Boat-ed and BoaterExam were typically in the range of 70 to 74 cpl. BoatUS had several web pages with line lengths of 122 cpl when an image was not positioned to the right of the text. BoatUS screens were designed with long sentence lines within a paragraph with minimal white space for segmenting common content. A good design strategy would be to minimize line lengths to approximately 60-75 cpl, and to position related media near the text.
Usability Survey Findings
The usability of the boating courses was assessed using a 10-question post-task survey. The questions focused on three usability aspects: satisfaction, expectation, and ease of use (Tullis & Albert, 2008). Table 7 shows the questions and corresponding usability aspect that were assessed. Each question was structured using a 5-point Likert scale where 1 represented Strongly Disagree and 5 represented Strongly Agree. Twenty participants each interacted with Boat-ed, BoaterExam, and BoatUS and then responded to the usability survey. Participants were allowed to spend as much time exploring the courses as they wished. They were also given unlimited amount of time to respond to the survey. The following sections provide the data results and analysis for the aggregate data (i.e., Boat-ed, BoaterExam, and BoatUS) and each respective area.

Table 7. Usability Survey

<table>
<thead>
<tr>
<th>Usability Aspect</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ease of use</td>
<td>1. The course was easy to use and navigate</td>
</tr>
<tr>
<td>Ease of use</td>
<td>2. I was not overwhelmed by the numerous options (e.g., images, animations, buttons, etc.) or complexity of the online course</td>
</tr>
<tr>
<td>Expectation</td>
<td>3. The online course performed the way I expected</td>
</tr>
<tr>
<td>Ease of use</td>
<td>4. I found it easy to determine my location in the online course (i.e., the visited sections and the overall organization)</td>
</tr>
<tr>
<td>Expectation</td>
<td>5. All interaction elements, such as buttons or movable objects, worked as expected.</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>6. The visual design was pleasing</td>
</tr>
<tr>
<td>Expectation</td>
<td>7. The content was easy to understand and was aligned with the purpose of the online course.</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>8. The content was well-organized</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>9. I found the technical functioning very good regarding audio, video, animation speed, and content display</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>10. I am satisfied with my overall experience of completing the task.</td>
</tr>
<tr>
<td>Ease of use</td>
<td>11. The course was easy to use and navigate</td>
</tr>
<tr>
<td>Ease of use</td>
<td>12. I was not overwhelmed by the numerous options (e.g., images, animations, buttons, etc.) or complexity of the online course</td>
</tr>
</tbody>
</table>

Aggregate Analysis for Boat-ed, BoaterExam, and BoatUS
The data showed that the average responses for all survey questions ranged from 4.00 to 4.30 (see Table 8). The average response for all three sites was 4.16. These results indicate that the participants tended to strongly agree that the sites were satisfying, met their expectations, and were easy to use. We have a 95% confidence that the population mean will respond with a 4.16 average. The participants in the Boat-ed group responded the most positively from all three.
groups (m = 4.30). We have a 95% confidence that the population mean is 4.30 plus or minus 0.02, or between 4.28 and 4.32. Meaning, participants will respond within this range. The participants in the BoaterExam group responded with the median positive responses from all three groups (m = 4.18). We have a 95% confidence that the population mean is 4.18 plus or minus 0.02, or between 4.16 and 4.20. The participants in the BoatUS group responded with the least positive responses from all three groups (m = 4.00). We have a 95% confidence that the population mean is 4.00 plus or minus 0.03, or between 3.97 and 4.03.

The following subsections examine the data more closely. Specifically, the group responses to the different usability aspects are analyzed.

**Satisfaction**
The participants’ aggregate mean satisfaction score was 4.19 and site specific average responses ranged from 4.05 to 4.35. These results indicate that participants tended to strongly agree that the boating sites were satisfying. Boat-ed participants tended to be the most satisfied with the BoaterExam and BoatUS participants following closely with 4.16 and 4.05, respectively. Overall, we have a 95% confidence that the population mean is 4.19 plus or minus 0.01, or between 4.18 and 4.20.

**Expectation**
The participants’ aggregate mean expectation scores showed a similar pattern to the satisfaction scores. Specifically, the aggregate mean expectation score was 4.24 and course specific average responses ranged from 4.35 to 4.15. Again, the results indicate that participants tended to strongly agree that the boating sites met their expectations. Boat-ed participants tended to be the most satisfied, whereas BoaterExam and BoatUS participants followed closely with 4.22 and 4.15, respectively. Overall, we have a 95% confidence that the population mean is 4.24 plus or minus 0.01, or between 4.23 and 4.25.

**Ease of Use**
The participants’ aggregate ease of use scores was the lowest among the different usability aspect scores, but still indicated that participants tended to strongly agree that the sites were easy to use. Specifically, the aggregate mean ease of use score was 4.03 as compared to 4.19 and 4.24 for satisfaction and expectation, respectively. The Boat-ed and BoaterExam participants shared very similar experiences with their sites (m = 4.17 and m = 4.15, respectively). The BoatUS

### Table 8. Aggregate Results of Usability Surveys

<table>
<thead>
<tr>
<th>Participant Group</th>
<th>Mean</th>
<th>Std Dev</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boat-ed</td>
<td>4.30</td>
<td>0.16</td>
<td>0.02</td>
</tr>
<tr>
<td>BoaterExam</td>
<td>4.18</td>
<td>0.17</td>
<td>0.02</td>
</tr>
<tr>
<td>BoatUS</td>
<td>4.00</td>
<td>0.22</td>
<td>0.03</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4.16</strong></td>
<td><strong>0.03</strong></td>
<td><strong>0.00</strong></td>
</tr>
</tbody>
</table>
participants rated the ease of use of their site much lower, $m = 3.78$. The confidence interval for all three groups also varied more significantly than the confidence intervals for satisfaction and expectation. Overall, we have a 95% confidence that the population mean is 4.03 plus or minus 0.01, or between 4.02 and 4.04.

Detailed Data Analysis for Boat-ed, BoaterExam, and BoatUS
Although the aggregate analysis shows an overall tendency by participants to strongly agree that the sites were satisfying, met their expectations, and were easy to use, detailed analysis shows potential issues with the usability of these sites. Overall, the graph in Figure 2, indicates that responses to questions 1, 2, 3, 4, 6, and 9 may indicate potential issues with all three usability areas: satisfaction, expectation, and ease of use. Three questions (1, 2, and 4) probe for ease of use, two questions (6 and 9) probe for satisfaction, and one question (3) probes for expectation. Because participants’ responses to these questions ranged between 3 and 4, these responses cannot be viewed as tending to strongly support agreement that the sites were as usable as first indicated by the aggregate data.

Figure 2. Participants average responses to survey questions, by group.

Ease of Use
The BoaterExam and BoatUS participants appear to have issues with the navigability and user options in their sites. Specifically, the BoaterExam participants appeared to feel slightly overwhelmed by the number of options available ($m = 3.85$; question 2: *I was not overwhelmed by the numerous options (e.g., images, animations, buttons, etc.) or complexity of the online*
The BoatUS participants appear to have some difficulty with the overall ease of use and navigability with the site (m = 3.7; question 1: *The course was easy to use and navigate*). They also seemed to have difficulty determining their location in the course (m = 3.35; question 4: *I found it easy to determine my location in the online course (i.e., the visited sections and the overall organization)*).

**Satisfaction**

The BoatUS participants also appear not to be as satisfied with their site as the Boat-ed and BoaterExam participants. Specifically, the BoatUS did not appear to find the visual design as pleasing as the participants of the other sites (m = 3.8; question 6: *The visual design was pleasing*). They also seem to have difficulties with the technical functioning of their site (m = 3.85; question 9: *I found the technical functioning very good regarding audio, video, animation speed, and content display*).

**Expectation**

Both the BoaterExam and BoatUS participants reported that their sites performed differently than expected (m = 3.8; *The online course performed the way I expected*).

**Summary**

The aggregate data results and analysis indicates that participants tended to strongly agree that their sites were usable. A more detailed analysis of the data revealed, however, potential issues with the usability of the BoaterExam and BoatUS sites. These issues focused on the visual design, graphical user interface design, and navigability of the sites. It is recommended that follow up research be conducted to delve deeper into what specific aspects of the site designs contributed to the participants’ experiences.

When comparing the participants’ quiz scores with their usability responses, we found a relationship between them. Specifically, as the participants’ quiz scores declined, the usability scores also declined. Collectively, the Boat-ed group only missed 14 out of 100 (14%) questions and reported higher usability responses for all three usability areas: satisfaction, expectation, and ease of use. The BoaterExam participants collectively missed 20 out of 100 (20%) questions on the quiz and reported moderate usability issues with expectations and ease of use. The BoatUS participants collectively missed 40 out of 100 (40%) questions on the quiz and reported the most issues with all three areas of usability. When comparing the three groups, the BoaterExam participants performed approximately 50% worse on the quiz than the Boat-ed group, and the BoatUS participants performed approximately 300% worse than the Boat-ed group. The quiz performance of the participant groups paralleled their usability experiences; that is, the poorer the quiz performance, the poorer the usability experience. Usability issues may be negatively impacting quiz performance.
Task 2:
Develop a set of delivery and presentation standards based on the outcomes from the Expert (heuristic) Review, User Performance Evaluation, Focus Group sessions, usability standards, and distance learning research.

The main objective of the NASBLA 2009 project was to create a set of online course delivery and presentations standards. The Information Experience (IE) Lab focused on the interface and the learner interactions within the online course design in order to determine whether the currently approved online boating safety courses were effective at conveying the information to the students in a way that allowed the students to learn the content. As part of this, a literature search was conducted to answer the following questions that were posed to the researchers at the beginning of the project.

**Project Questions**

1. **Should online courses have a time limit or require the student to stay on each page for a specific length of time?**
   If a screen contains one lesson or topic, a common design recommendation is to create interaction time of 2-5 minutes (Clark, 2007). The working memory capacity should be considered when including images, audio, text, animation, and video for explaining a “chunk” or segment of information. Ensure that a chunk does not require the learner to hold more than a few things in working memory at one time. Students can learn more from leaner lessons that contain a minimum amount of meaningful text than from a lesson containing significantly more text. (Mayer, 2005).

2. **Should online and home study courses have a longer test (more questions) than a classroom course?**
   Research studies could not be found that addressed this question. Having the appropriate questions that relate to specific objectives is more important than having more questions. In addition, knowing that the course outcome of a boater receiving a certificate after passing the exam, it would be recommended to keep the test length the same. This recommendation would minimize concerns that one method of course delivery has stricter testing requirements with the end result being the same.

3. **Should there be a wait time after a student fails the exam? If so, how long should the wait time be?**
   Research studies could not be found that addressed this question. However, to prevent the student from guessing the correct answers, then a wait time would be appropriate. The goal is to ensure that learners review information before taking the exam again by requiring the student to focus a minimum amount of time in the content sections that relate to the incorrect answers on the tests. Similar to many state requirements for drivers license retests, a minimum time of 24 hours should be sufficient for the learner to revisit the content. A wait time may also encourage the learner to prepare for the test, rather than guessing.
4. Should the number of retakes be limited?
Davidson, House, and Boyd (1984) created a retest policy that encouraged learners to prepare and read the course information before the exam by using weighted scores for the test and retest. If a learner chose to retest, the worst score of the two tests was worth 25% and the best score was 75%. A similar policy might be useful wherein the minimum passing score for each retest would increase. For example, test 1 would be 70%, test 2 would be 75%, etc. This would certainly deter a student from retaking the exam more than once or twice.

5. Should a student be allowed to challenge the exam without taking or reading the course material?
Research studies could not be found that addressed this question. However, there are many examples in the medical and legal field as well as in academia where challenge exams are used to demonstrate knowledge or mastery of a subject without having to complete a course on the subject. Likewise, there are likely instances where a learner will have the necessary boating knowledge before reading the information and taking a course. In this case, it might be useful to allow the student the opportunity to take a challenge exam prior to attempting the course material. During the boat show evaluation tests, 46% of the participants indicated that they wanted to take the exam without first reviewing the content; 28% wanted to take the exam first and then review the content; and 14% wanted to keep taking the exam until they passed. These results reveal that some learners will try to skip through the information, but that the overwhelming majority expressed an interest in being able to test their prior knowledge at least one time. It should be noted that there are many laws and regulations that all boaters must know and the decision to allow challenge exams would be a decision left up to each individual state depending on the legal aspects of obtaining a boating certificate there.

6. Should the challenge exam have more questions than the regular exam?
While challenge exams are used in many areas of study including the medical and legal fields, the practice of how these tests are designed and administered is not the same for all situations because each situation is different. It is recommended that a challenge exam have more questions than a regular end-of-course exam. In addition, it is recommended that a higher passing rate would be required to pass the challenge exam than the regular end-of course exam. Again, as mentioned above, there are many laws and regulations that may play into this decision.

7. Would it be better to have the final exam written so that
   a. all of the questions are shown on the same screen at the same time at the end of the course;
   b. the questions are shown one at a time at the end of the course; or
   c. the exam is broken into segments with a group of questions given at the end of each chapter?
From a usability perspective, option A would allow users to enter all of their answers and review them before final submission. However, this also allows the students to reference information contained in one question to answer another question within the test. If this method is used, the course should automatically save the answers every 5 minutes or provide an option for the student to save them before final submission. This strategy will be helpful in cases where
Internet, browser, or computer issues could cause the page to remove all of the answers resulting in the need for the student to start over.

For Option B, the learner would not be able to review all of their answers before submission. The only benefit to this strategy is to provide feedback after each submission. Specifically, if feedback is provided for incorrect responses, it could encourage the learner to review the related content in the course.

Option C directly links to an instructional design approach regarding the mastery of the objectives before moving to the next section. When there is prerequisite knowledge necessary for learning the content, there can be a minimum passing score before the learner can move to the next section. Similar to a challenge exam, the learner must prove that they have acquired the necessary competencies. If a minimum passing score is important for each chapter, then Option C would be an appropriate strategy.

8. Should the exam grade be shown and updated throughout the exam process or should the score only be available at the conclusion of the exam? 
If students know the passing score that must be obtained, displaying the exam grade before the conclusion could encourage students to stop when a passing score is reached. It could also result in students abandoning the exam if they are failing so that they can study more. Either way, the results would not reflect a complete and accurate perspective of student competencies. Hence, showing the score at the conclusion of the exam would be a better approach.

9. Should NASBLA set a passing score for the final exam? If so, what should that score be? 
An overall passing score may not reflect a complete and accurate perspective of student competencies. An alternative approach could be a minimum score for specific competencies or objectives. For example, if there are 5 questions related to the use of personal flotation devices, there should be a minimum number of correct answers for this competency. Some learning objectives might be more important than others. Thus, there needs to be strategic calculations of the weights for different objectives to determine the number of questions that must be answered correctly.

10. What kind of algorithm should be used to generate online exams so that the questions are different? And, what percentage of the exam questions should be different on each exam attempt? 
The algorithm should generate a specific number of questions based on the learning objectives and their weight. Some objectives might carry more weight than others, thus there should be more questions. For example, if unit one requires 4 out of 5 questions and unit three requires 2 out of 3 questions for mastery of competencies, then the algorithm should always include 5 questions for unit one and 3 questions for unit three.

Research has shown that the learner does not appear to be advantaged by seeing reused questions for the second attempt of an exam (Wood, 2009). However, if it is more than the second attempt,
and there is no wait time, then memorization will likely aid the learner. If there were no wait time, an appropriate strategy would be to change at least one test question for each learning objective. If the learner has more than two attempts, then 50% of the questions should change for each test attempt.

11. Should courses be allowed to employ a “pay only if you pass” type of testing situation or does it matter?
If the learner is able to keep taking the test until he/she passes, and there is no wait time requirements, then it could encourage learners to guess the answers rather than study the material. If this testing situation is coupled with a wait time, and the difficulty of the exam questions increases, then learners would be more encouraged to study the content. A “pay only if you pass” testing situation is appropriate when the test questions change for each test attempt.

12. Is there an agreed upon standard for font styles, font size, background color, animation and graphics for online courses?
For learning environments, it is best to use familiar fonts that are at least 12-points. The fonts should be san serif to assist with online reading of text. In addition, black or dark text color on plain, high-contrast backgrounds can assist with the reading. When there is a lot of content to read, the web site should apply colors to help users understand the grouping of related information, use lower-case fonts, and appropriate capitalization to ensure the fastest possible reading speed.

For animation, there should be options that allow the learner to control the viewing, such as start, stop, and rewind. In addition, if sound is included, the learner should be able control the volume or turn the sound off.

Studies emphasize that graphics and media elements must directly support the text and be used, not for diversion, but for a clear instructional purpose (Cotrell & Eisenberg, 1997). Unrelated graphics that are not associated with the text might actually hinder understanding by creating cognitive "clutter" (Norman, 1990).

Graphics should be optimized for the web site, by sizing the picture to the actual size that will be displayed on the web site. Resizing the picture with the width and height attributes of the html code will slow down the load time. Studies on computer-based training show delays as short as five seconds have a negative impact on comprehension (Spool, 1997).

13. Should there be a critique of exam questions after each question, after the entire exam, or does it matter either way?
Depending on the instructional strategy, each method has advantages and disadvantages. If the goal is provide feedback for each question, the learner can immediately determine the areas that need more attention. However, this is useful if there is prerequisite knowledge to learn before a new section, and the course allows the learner to stop the test procedure and review the materials.
Critique at the end of an entire exam provides an overall summary of their knowledge. The feedback could provide results for each learning objective, which will reflect areas that need more attention than others. If both options require the learner to retake the entire test, then there is no advantage to either approach.

14. Should boating terms be linked or referred to throughout the entire course or only in the first instance of their use?
From a usability perspective, having a glossary of terms available throughout the course would be easier for the learner. For management and update of the content, it would also serve as a more effective solution. If the terms were only linked in the first instance of use, then the learner would have to remember where the term was used. This could be a time consuming task that could negatively affect the satisfaction level with the course.

**Task 3:**
Survey the advisory group of stakeholders to gather their opinions on the proposed delivery and presentation standards.
An advisory group, composed of stakeholders in the field of recreational boating safety education, met with the lead researcher in Lexington, Kentucky on June 30, 2009 to provide their opinions and expertise on the proposed delivery and presentation standards. As the advisory committee began to develop a set of Delivery and Presentation Standards to be applied throughout the U.S., they drew heavily upon the requirements that had already been developed by individual states. In addition, the grant advisory committee requested that a literature search of related research be conducted by the researchers in order to provide any justification for the following requirements which were found in a number of state policy documents related to the delivery and presentation of online boating safety courses. The results of the research and literature search influenced the content of the proposed Delivery and Presentation Standards and proposed additions to the NASBLA Testing Standards. (A full copy of the most recent version of the Delivery and Presentation Standards is provided in Appendix C and the most recent proposed additions to the Testing Standards are provided in Appendix D.)

While researching and developing the Delivery and Presentation Standards, the advisory group posed seven questions to the researchers in order to help drive the content of the new standards. The following section details the findings and discussion that took place between the researchers and the advisory group members.
Delivery and Presentation Standards

1. An online course should be organized into 5-7 chapters. (Chapter is defined as a module, section, unit, or any other segmentation or packaging of materials within a course.)

There is no research to support a course having a specific number of chapters. The number of chapters will depend on the amount of content required to be studied and the level of difficulty of the content in terms of comprehending the information. The number of chapters relates to the segmenting of instructional content as it relates to the overall learning objectives.

2. The credited time on any given content page should not exceed three (3) minutes.

If a screen contains one lesson or topic, a common design recommendation is to create interaction time of 2-5 minutes (Clark, 2007). The working memory capacity should be considered when including images, audio, text, animation, and video for explaining a “chunk” or segment of information. Ensure that a chunk does not require the learner to hold more than a few things in working memory at one time. Students can learn more from leaner lessons that contain a minimum amount of meaningful text than from a lesson containing significantly more text. (Mayer, 2005).

3. The minimum number of content pages for the entire course should be at least ninety (90).

Based on the required content for all boating safety courses, there will most likely be a range for the number of pages that should be created. However, there are a myriad of ways to present the information depending on the information organization, graphics, and media design. The number of pages should be related to the segmenting of the information into applicable chapters and units. If longer lessons are created, then there were will be fewer pages. The goal should be to balance the lesson information into small sub-topics for easier comprehension. However, a specific number can not be prescribed.

4. Whenever a video or animation is used within the course, a written script of the narration should accompany it.

To accommodate learners with hearing disabilities, the transcript of any narrations would adhere to Section 508 accessibility requirements. A transcript of audio content should be a word-for-word textual representation of the audio that includes descriptions of non-text sounds like "ocean waves" or "boat engines." Transcripts of audio content are valuable for people with hearing disabilities. To meet the accessibility standards, all courses must have transcripts for audio.
5. A student may opt to take a challenge exam prior to beginning the course. The challenge exam will consist of at least 100 questions written to the NASBLA test-writing standards. The pass rate will be determined by the state of residency for the student and for which the course is valid and approved. There is no research to support a minimum of 100 questions. However, the challenge exam should be more difficult or have a higher passing rate than the regular exam that a student would take after completing the course. By creating a challenge exam that includes more questions than the regular course exam, the difficulty level can be increased.

There are many examples in the medical and legal field as well as in academia where challenge exams are used to demonstrate knowledge or mastery of a subject without having to complete a course on the subject. Likewise, there are likely instances where a learner will have the necessary boating knowledge before reading the information and taking a course. In this case, it might be useful to allow the student the opportunity to take a challenge exam prior to attempting the course material. During the boat show evaluation tests, 46% of the participants indicated that they wanted to take the exam without reviewing the content; 28% wanted to take the exam first and then review the content; and 14% wanted to keep taking the exam until they passed. These results reveal that some learners will try to skip through the information, but that the overwhelming majority expressed an interest in being able to test their prior knowledge at least one time. It should be noted that there are many laws and regulations that all boaters must know and the decision to allow challenge exams would be a decision left up to each individual state depending on the legal aspects of obtaining a boating certificate there.

6. A student may only take the challenge exam once and, if he/she fails the challenge exam, then the student must take the full course. In many academic and certification environments, students have the opportunity to “test out” of a course if they can demonstrate specific competencies acquired through past courses and training, or practical experiences. In college settings, “test out” exams are often used for basic level chemistry, mathematics, and foreign language courses. The students take the challenge exam before the course semester begins. If there is a passing score, the student receives credit for the course. If the student fails, then he/she must take the course and cannot retake the challenge exam.

Allowing a student to take the challenge exam only once is an appropriate strategy to decrease opportunities for students to continue guessing the answers when allowed to take the exam several times. Various methods can be employed to prohibit the same student from taking the challenge exam more than once. These include collection of personal identifying data as well as establishing a separate higher fee for the opportunity to take the challenge exam.
7. Throughout the online course, an e-mail link or phone number should be provided for students to use to contact the course provider. All inquiries should be responded to within two (2) business days. Automated responses stating that the user’s e-mail has been received will not satisfy this requirement. The provider should indicate his/her normal business hours and the maximum time the student could wait for a response. It is important to include contact information for learners that may need to communicate with authoritative figures related to the course. Learners want to ensure that they are on the correct path and not wasting time, and they also want to ask questions about content that may be confusing. Instructor-student interactions, especially inexperienced online learners, are important components of e-learning that can affect a student’s satisfaction with the course. For the boating safety education courses in which an instructor is not utilized to present the material, providing an email contact for learners to ask someone questions would be a suitable alternative.

**Task 4:**
Present the delivery and presentation standards to the NASBLA membership for their approval.

The delivery and presentation standards (also known as Standard 10) were to be presented to the NASBLA membership along with the revisions to the NASBLA Testing Standards (Standard 9) at the spring Boating Law Administrators Workshop in Washington, D.C. on April 13, 2010. However, a number of outstanding issues still required discussion and the members decided to send the documents back to the working group for additional revisions. Hopefully, the members will be able to vote to approve the changes to Standard 9 and the inclusion of the new Standard 10 as part of the National Boating Education Standards during the NASBLA Annual Conference in September. A copy of the new Standards will be made available on the NASBLA website at that time. In addition, an article outlining the new Standards will be written and published in Small Craft Advisory.
Conclusion

The existing NASBLA-approved online boating safety courses are self-directed learning environments lacking both student-to-student and instructor-to-student interactions. Hence, learners negotiate the meanings and structure of the course without assistance. It becomes very important that the interface is intuitive and transparent by adhering to the heuristic categories. Specifically, the course must be easy to navigate and the information logically organized in appropriate chapters. In addition, all interactions to control media such as sound and animation must be designed to support learner expectations. For example, the ability to start and stop animation rather than be automatically controlled by the web site would allow the learner to control the experience. The learner should not have to spend too much time determining how to use the media interface controls while accessing the instructional content, because it can add to the learner’s cognitive load.

The courses that were studied included several differences in presentation of the same content. The most common presentation was text and graphics, but there was one course that provided animation with narrated text and another course that utilized video elements. Two important features that were not consistently present in the courses were objectives or goals along with a summary at the end of each unit or chapter. Based on Gagne’s Nine Events of Instruction as described in Table 8, the objectives describe what will be learned and the summary should synthesize similar information along with more detail related to the content.

Mandating that all course providers organize and present their course material exactly the same would reduce creativity for some course providers and make it difficult for others that do not have the same technical expertise and resources. However, there are some learning objectives that are best communicated and learned through animation or video rather than by only using text. To maximize learning for all course providers, critical objectives and content should be identified, and then aligned with the media that supports the transfer of knowledge.
References


Appendix A – Boat Show Instruments

Consent Form

You are about to participate in the evaluation of an online boating course. The purpose of this evaluation is to investigate how learners interact with the interface while performing tasks. Findings from the study will provide guidelines to improve online instruction.

For the study, you will be asked to fill out a demographic questionnaire, perform assigned tasks for an e-learning course, and participate in an exit interview after the usability test. There is no time limit for completing these tasks, but in general, it will require approximately 20 minutes.

Your participation is voluntary and your decision whether or not to participate will not affect any of your current and future relations with boating courses you take or the University of Missouri. Even if you decide to participate, you do not have to answer all the questions. You may discontinue participation at any time.

Any information obtained in connection with this study will remain confidential and will not be disclosed. All the identifying information will be removed after data have been collected.

Should you have any questions, please feel free to contact Dr. Joi Moore, the principal investigator of the study. She can be reached by e-mail at moorejoi@missouri.edu or by phone at (573) 884-2797. For any other information regarding human participation in research, please feel free to contact the UM Campus IRB Office at 573-882-9585.

Demographics Survey

1. What is your age?
2. What is your gender?
3. Do you currently have a boating license?
4. In what state(s) are you involved in boating activities?
5. How many years have you been an active boater?
6. What type(s) of boats do you frequently use?
7. Internet experience: You consider yourself as a
   - Nonuser
   - Novice user
   - Intermediate user
   - Advanced user
8. What is your comfort level with the Internet?
   - Very comfortable
   - Comfortable
   - Uncomfortable
   - Very uncomfortable

9. Have you taken online courses in the past? If so, how many?

**Search Tasks**
1. Locate the section of the course that discusses life jackets
2. Locate the section of the course that discusses fire extinguishers
3. Locate the section of the course that discusses how to pass another boat

**Usability Questions (These questions were asked after the participants determined that they had found the specific topic that they were asked to find.)**

1. What is the name of the course section where you found the information?

2. Is this course section the best place to put the information? If not, what would be a better section name?

3. It was easy to find the information
   - Strongly Disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

4. The visual design [of the course] is pleasing
   - Strongly Disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

5. The content on the page is an appropriate length
   - Strongly Disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

6. Additional comments regarding the interface
Exit Survey (These questions were asked after the participants had finished finding the information on each of the three online courses.)

1. Which website do you prefer and why?

2. What is your preference in relation to page length?
   - All content is segmented into different pages
   - All content is on one page

3. For online test questions, what is your display preference?
   - One question displayed on a page, then click next
   - All questions displayed on one page with scrolling

4. For online tests, what is your feedback preference?
   - Immediate feedback after each question
   - Feedback at the end of the entire test

5. If you had the ability to retake a test until you passed, and the test questions changed each time, would you
   - Review the content before taking the test
   - Take the test first then review the content
   - Keep taking the test without reviewing the content, until you passed
Appendix B – Usability Testing Instruments

Consent Form

You are about to participate in the evaluation of an online boating course. The purpose of this evaluation is to investigate how learners interact with the interface while performing tasks. Findings from the study will provide guidelines to improve online instruction.

For the study, you will be asked to fill out a demographic questionnaire, perform assigned tasks for an e-learning course, and participate in an exit interview after the usability test. There is no time limit for completing these tasks, but in general, it will require approximately 20 minutes.

Your participation is voluntary and your decision whether or not to participate will not affect any of your current and future relations with boating courses you take or the University of Missouri. Even if you decide to participate, you do not have to answer all the questions. You may discontinue participation at any time.

Any information obtained in connection with this study will remain confidential and will not be disclosed. All the identifying information will be removed after data have been collected.

Should you have any questions, please feel free to contact Dr. Joi Moore, the principal investigator of the study. She can be reached by e-mail at moorejoi@missouri.edu or by phone at (573) 884-2797. For any other information regarding human participation in research, please feel free to contact the UM Campus IRB Office at 573-882-9585.

Demographics Survey

1. What is your age?

2. What is your Gender?

3. What is your highest level of completed education?
   - High School Diploma
   - Bachelors Degree
   - Masters Degree
   - Doctorate Degree
   - Other: Please describe below
   - Comment

4. Internet experience: You consider yourself as a
   - Nonuser
   - Novice user
   - Intermediate user
   - Advanced user
5. Have you taken online courses (Internet courses that do not have any face-to-face component) in the past? If so, how many?

6. Do you have any experience or knowledge about driving a boat? If so, what type of boat?

7. Do you currently have a boating certificate or license?

**Quiz Questions on Hull Types**

1. On which part of a boat is the hull located?
   a. Top
   b. Right
   c. Left
   d. Bottom
   **Correct Answer: D**

2. The basic types of vessel hulls can best be described using what two words?
   a. Moving and non-moving
   b. Displacement and planning
   c. Rough and smooth
   d. Narrow and wide
   **Correct Answer: B**

3. What type of hull would most likely be found on a sailboat?
   a. Displacement
   b. Deep-vee
   c. Multi-hull
   d. Planing
   **Correct Answer: A**

4. What type of hull would most likely be found on a speed boat?
   a. Flat bottom
   b. Round bottom
   c. Deep-vee
   d. Multi-hull
   **Correct Answer: C**

5. A planing hull would be found on which one of the following boats?
   a. Kayak
   b. Personal Watercraft
   c. Catamaran
   d. Sailboat
   **Correct Answer: B**
Satisfaction Survey
Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree
1. The course was easy to use and navigate
2. I was not overwhelmed by the numerous options (e.g., images, animations, buttons, etc.) or complexity of the online course
3. The online course performed the way I expected
4. I found it easy to determine my location in the online course (i.e., the visited sections and the overall organization)
5. All interaction elements, such as buttons or movable objects, worked as expected.
6. The visual design was pleasing
7. The content was easy to understand and was aligned with the purpose of the online course.
8. The content was well-organized
9. I found the technical functioning very good regarding audio, video, animation speed, and content display
10. I am satisfied with my overall experience of completing the task.

Exit Survey
1. Which course do you prefer and why?
2. Which course has the best visual design?
3. Which course do you prefer for content organization?
4. Is it important to be able to control different media elements (e.g., audio, video, and animation)? If so, explain any necessary changes for the course websites?
5. Which do you prefer: Text narration only, Text only, Both at the same time
6. Do you have any additional comments?
Appendix C – Proposed Online and other Electronic Course Delivery and Presentation Standards

Standard 10.1 – Organization of Course Content

Standard 10.1.1 – Content within online or other electronic courses will be presented in a narrative fashion utilizing a consistent style throughout the course in terms of headings, titles, labels and font. “Narrative” is defined as a sequential description of information contained within the National Boating Education Standards that can be written in paragraph form or provided to the student through narration within audio or video elements.

Standard 10.1.2 – A table of contents (or site map for online courses) will be available to show the organization of the course content. In an online course, students will know that they have already viewed the course content upon receiving a cue (i.e. color change, check mark, etc.) that a particular task/section has been completed.

Standard 10.1.3 – Courses must be organized into multiple chapters. “Chapter” is defined as a module, section, unit or any other segmentation or packaging of materials within a course. Online courses must have an assessment at the end of each chapter. “Assessment” is defined as a chapter review, practice quiz, final examination, chapter test or any other form of evaluation of the student’s progress. As noted in Testing Standard 9.2.4 “any examination offered for boater certification in a state must conform to the examination plan adopted by the Boating Law Administrator of that state.”

Standard 10.1.4 - An online or other electronic course will be designed such that any advancement through the course is initiated by the action of the student (for example, by the student clicking on a “next” button or successfully completing an end-of-chapter assessment). There will be no automatic advancement provided.

Standard 10.1.5 – If animations or video clips are used within a course, the student must be able to re-play the instructional segments of the animation or video.

Rationale – An online boating safety course is, essentially, an electronic book that will be read independently by the students without the presence or assistance of an instructor. Therefore, the content must be presented to the students in such a way as to promote comprehension and retention of the material whether the courses are published as a textbook or completed electronically.
Standard 10.2 – Minimum Initial Study Time for an Online Course

Standard 10.2.1 - Online courses will be organized so that the minimum time for the course content to be delivered to and completed by the student is at least three (3) hours. Course content is defined as that material meeting the National Boating Education Standards 1-8, not including any course assessments.

Standard 10.2.2 - Each page of the online course content will have a minimum time that a student is required to remain on that page (“credited time”) which the course provider will set when the online course is presented for review and will retain through the approved period. The sum of the credited times over all content pages will equal or exceed three (3) hours. The student may not progress to the next page until the credited time has expired, however, students may stay on a page longer than the credited time. Additional time required to re-study the materials if a student fails a chapter assessment does not count as part of the credited time.

Standard 10.2.3 – If a student exits or logs off a page before completing its credited time, he/she will be required to complete the remaining time on that page when he/she returns before progressing to the next page.

Standard 10.2.4 – If a student leaves an assessment without completing it, the course will be designed to give the student the option of returning to continue taking the assessment at the point in which he/she stopped or of treating the abandonment as a failing score. The passing score and number of questions (beyond the minimum 50 questions as required in Testing Standard 9.2.4) on all assessments will be established by the Boating Law Administrator of each state.

Rationale – Simply following through the minimum content necessary to meet the National Boating Education Standards 1-8 should take a minimum of three (3) hours. This provides the opportunity for the individual to absorb the information and discourages bypassing material or skipping to the assessment.
Appendix D – Proposed Additions to the NASBLA Testing Standards

Standard 9.3 – Online Testing Requirements

Standard 9.3.1 - Students will proceed through all of the credited time course content pages in each chapter prior to taking each chapter assessment to receive credited time for taking the course.

Standard 9.3.2 – Once a student has successfully completed an assessment for a chapter, the content pages for that chapter will be available for additional review by the student at any time with no time requirements. However, content pages will not be made available to the student via any means while the student is taking any assessment.

Standard 9.3.3 – All assessments will adhere to the NASBLA Terms and Conditions “Testing” requirements.

Standard 9.3.4 – All assessments will be graded automatically and the student shall be provided with his/her score online.

Standard 9.3.5 – If feedback is given after answering each question, no feedback will be given until an answer has been submitted. Once an answer is submitted, it can not be changed by the student.

Standard 9.3.6 – In a course, the Course Provider will not provide links which allow a student to reference the course materials during the final exam.

Standard 9.3.7 – If the state permits, a student may opt to take a challenge exam prior to beginning the course. The challenge exam will be written to the NASBLA test-writing standards. The number of questions, passing score and any applicable fees will be determined by the state of residency for the student and for which the course is valid and approved. A student may only take the challenge exam once and, if he/she fails the challenge exam, then the student must take the full course.

Standard 9.3.8 – For final exams offered online, the exam Questions will be randomly selected from a Pool of Questions such that the resulting exam meets the weights specified in NASBLA Testing Standards 3 or P:3. The number of Questions in the Pool from which the random selection draws will be at least four times the number of questions presented on the exam. Furthermore, the questions in the Exam Pool must be distributed according to the weights specified in NASBLA Standard 9.2.3: Testing Standards 3 and 4. The Exam Pool will consist of at least the following minimums:
### National Boating Education Standards

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Standard 9.3.9 - If a course presents more than one final exam to the same student, the exam presentation algorithm will ensure that no two exams have more than 50 percent of the same questions on the exams. A question will be considered to be the same as another question if it has substantially the same stem and the same set of distractors as the question it is replacing.

Rationale – Unlike a classroom course, the assessments in an online course are the only form of evaluation available. Therefore, it is imperative that the online testing standards be established and regulated. The feedback should be designed to encourage students to review, comprehend, and understand the course content rather than to memorize questions and answers.