

EXAMINING USABILITY, NAVIGATION, AND MULTIMEDIA LEARNING
PRINCIPLES IN AN INTENTIONALLY DESIGNED ASYNCHRONOUS
ONLINE COLLEGE COURSE: A USABILITY STUDY

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This qualitative study examines an asynchronous online course from a private university utilizing a template model for all online courses to provide students with consistent navigation and course structure throughout their degree program. The asynchronous online courses are purposely created using three criteria of quality course design: navigation is intuitive, information is chunked, and instructions are written clearly. A two-part usability test was conducted with three internal and three external participants. The two-part usability test focused on course navigation and examined the signaling, segmenting, and coherence principles applied to course content page layouts. Transcripts from the usability tests and observational field notes were coded through an iterative process in Nvivo. Through emic and etic coding, seven main categories were identified: user experience, cognitive load, multimedia learning principles, page design and layout attributes, course navigational attributes, course attributes and information, and participant navigational behavior. The findings for first-day navigation, general navigational behaviors, and perceptions of design elements used to implement the signaling, segmenting, and coherence principle are discussed. Course design recommendations for creating a positive usability experience and suggestions for future research are provided.

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CHAPTER 1

INTRODUCTION

Growth of Online Learning

Within higher education institutions, distance and online learning currently show signs of continual growth. According to the Distance Education State Almanac report from Seaman & Seaman (2017), enrollment of graduate and undergraduate students taking at least one course for distance education in the U.S. had consistent growth, 17.2%, since 2012, including an increase of 5.6% from 2015-2016. This change signified the most substantial increase in the four years (Seaman et al., 2018; Seaman & Seaman, 2017). Almost half of those enrollments, 47.2%, were students exclusively taking distance education courses (Seaman et al., 2018). Distance education courses can encompass synchronous and asynchronous modalities. The CHLOE 3: Behind the Numbers report is a collaboration project between Quality Matters and ACT | NRCCUA's research division Eduventures Research, which examines data regarding fully online courses and programs versus blended courses and programs. The report is based on an annual survey of chief online officers at U.S. higher education institutions (Legon et al., 2019). Legon et al. (2019) found that enrollments for fully online courses grew more than the enrollments of blended courses (Legon et al., 2019). Since the 2019 report, the world was impacted by COVID 19, which caused all K-12 and higher education institutions to migrate the classrooms to some type of online environment. While COVID 19 forced education to migrate to some type of online or blended course offerings, higher education institutions provided courses online for distance learning students and residential students prior to the pandemic. Regardless of modality, tuition-

paying students are attending higher education institutions for quality education.

Asynchronous online courses have a few unique aspects that can lead to students dropping courses compared to face-to-face or blended courses. According to Orlando and Howard (2021), “Many students drop out of online courses because they feel overwhelmed and sometimes frustrated not only by the amount of information presented to them but also by the way it is presented” (p. 55). Unlike a face-to-face environment, an asynchronous online course has the additional aspect of the user experience based on the course design, which can impact the students’ learning experience. Conducting usability tests of online courses can help identify issues with the course design and help improve the user experience for the students.

This study examines some of the challenges of asynchronous online learning regarding usability. The statement of the problem, purpose of the study, topics of inquiry, and significance of the study are presented. Prior research for several facets of quality course design, visual, and web design are explored. Prior research focusing on cognitive load theory (CLT), cognitive theory of multimedia learning, and principles of multimedia are discussed under the lens of usability and online course design. Based on the prior research and theoretical framework presented in Chapter 2, the methodology, research design, data collection, and data analysis is described in Chapter 3.

Challenges of Asynchronous Online Course Design and Usability

With asynchronous online courses, extra measures and considerations should be taken to deliver a quality online course. While asynchronous online courses can provide educational access to many using technology compared with synchronous face-to-face

courses, there are several challenges (Brigance, 2011). One challenge facing online courses is that students rely on communication within the course to know what the expectations are, obtain the learning material, communicate with classmates and instructors, and understand the parameters so they can successfully execute and deliver their assignments. Asynchronous online courses require different instructional design and communication strategies since learners do not get immediate responses to questions like they do in a synchronous class environment (Baldwin, 2019; Baldwin & Ching, 2019a; Brigance, 2011). According to Şendurur et al. (2018), other challenges for online course design include the quality of the learning materials, usability of the course, whether a suitable amount and type of cognitive load are provided, and the appropriate use of visual design.

Overall, course usability is an important factor that impacts the users' cognitive load, and it can hinder the students' learning experience (Ain et al., 2016; Miller, 2011; Pickens, 2017). According to Pickens (2017), "In order for instructional guidance to be effective, the learner's cognitive load must be managed" (p. 51). To reduce cognitive load by design, a student should be able to go into an online course and easily find the learning materials and instructions for the assignments. If the online course is designed with poor usability, students will dedicate their cognitive load effort to navigating the course instead of engaging with course content (Ain et al., 2016; Pickens, 2017; Yong et al., 2016). According to Orlando and Howard (2021),

Learners can experience cognitive overload if the course information is not organized in a logical way and if the course design is not easy to follow. In such cases, learners will spend a lot of mental energy just trying to figure out how the course is organized and how to find information and may end up feeling overwhelmed and frustrated. (p. 55)

High cognitive load pertaining to usability was also found to be an important factor in terms of negatively impacting adult learners who often work a full-time job and care for a family while taking courses (Kasworm, 2018).

According to Yong et al. (2016), the web-based learning platform's interface design is a fundamental concern because it includes the visual elements and the content presentation. The reason interface design is such a fundamental issue is “Because an interface is the first thing users will look at and interact with when using a web-based learning platform” (Yong et al., 2016, p. 319). Beyond overall usability, the course content's visual design can also impact a students' learning experience. The visual design and aesthetics of the online learning environment are also vital elements, along with usability and pedagogy (Miller, 2011).

Online courses usually consist of webpages within a learning management system. Each page provides information for the students to guide them through the course learning materials and activities (Brito, 2017; Reeder, 2018). Since the student navigates the course in a similar fashion to a website, best practices for web design usability and visual design should be taken into consideration (Brito, 2017; Reeder, 2018).

With learning materials, multimedia learning principles should often be applied to content, consisting of text, images, audio, or video. When examining the best practices and valued principles of aesthetics and visual design, along with web and usability design, there are several similarities between visual aesthetics, web, and usability design practices, as well as several of the multimedia learning principles, which are described in Chapter 2.

Since the 1980s, there has been a plethora of research on the multimedia learning principles (Garner et al., 1989; Harp & Mayer, 1998; Mayer, 2014a, 2014b, 2014c, 2017; Mayer et al., 1995; Moreno & Mayer, 2000; Park et al., 2015; Sung & Mayer, 2012; Yue & Bjork, 2017). Based on Mayer's (2001, 2020) research, multimedia learning principles were identified as ways to help reduce cognitive load for the learners engaging in multimedia instruction. These principles are based on cognitive load theory and cognitive theory of multimedia learning. Other principles of visual, web, and usability design that are similar to multimedia learning tenets, can help create quality online courses by helping reduce cognitive load for the user (Bader & Lowenthal, 2018; Garrett et al., 2016; Grant-Smith et al., 2019).

There are several resources and various criteria, based on research, to help instructors and instructional designers create quality online courses. These include, but are not limited to, the *Quality Matters Rubric* (QM Rubric), *Blackboard Exemplary Course Program* rubric, and the Online Learning Consortium (OLC) *Quality Scorecard* (Baldwin, 2019; Baldwin & Ching, 2019a, 2019b; Byrne, 2018; Fisher & Wright, 2010). Usability, visual design, and multimedia learning principles are attributes of only some of the criteria included in the aforementioned rubrics and resources. While each of these rubrics and resources includes various other criteria, this study focuses on those related to usability, visual design, and multimedia learning principles.

There are many attributes that contribute to a user's experience in an online course. Two broad categories include visual design and usability. Usability is often associated with software or e-commerce websites; however, online learning has additional needs such as incorporating learning outcomes, instructional approaches,

sequencing of the content, and the quality of learning (Notess, 2001; Reid et al., 2016).

While some usability studies focus on online courses, the studies vary in their methods (Bartolotta, Bouelle, & Newmark, 2017; Bartolotta, Newmark, & Bouelle, 2017; Bjork, 2018; Fisher & Wright, 2010; Gregg et al., 2017; Miller-Cochran & Rodrigo, 2006; Reeder, 2018; Reid et al., 2016). There remains a gap in terms of 1) research on the usability of courses that utilize a template model and 2) research regarding specific page layouts of instructional and directional content within an online course. While there has been an abundance of research on the different multimedia learning principles, there is a gap in research regarding utilizing those principles in directional and learning content within asynchronous online courses.

Statement of the Problem

Asynchronous online courses are a growing modality in higher education. One challenge with this modality is the possible negative impact the course design can have on the learners' experience. Asynchronous online courses, which have poor usability design, can hinder the learners' experience by causing extraneous cognitive load. While there are best practices and guidance for creating quality asynchronous online courses, there is a gap in research regarding the learners' perspectives of usability within courses that are purposefully designed to implement best practices. Specifically, there is a gap in research on how learners navigate through asynchronous online courses, which use a template model based on recommendations such as Quality Matters. There is also a gap in research regarding the usability of individual page design within online courses, in which multimedia learning principles are applied. Examining students' perceptions of usability of the overall course navigation and structure, along with

individual page layouts, can provide insight into appropriate course design practices.

Research Context

A private aeronautical university based in the southeast of the U.S. has a campus dedicated to distance learning. Most enrollments are in the online modality of courses, and the primary demographic of degree-seeking students in the online programs is adult learners. The distance learning campus has adopted a template model process to design, develop, and distribute the online course offerings. The template model process is where the faculty course developer collaborates with the instructional designer to create the nine-week course in a master template. The content in that master template is then distributed to all live sections, so the students in each section of each term receive the same instructional materials and assignments to provide a consistent quality experience to the students. All online courses at the university have an identical navigational layout within the learning management system (LMS), Instructure's Canvas, and are structured into weekly modules. Students in different course sections will have a consistent experience taking the different courses throughout their degree program. The course template navigation, structure, and boiler-plate items (e.g., Start Here section containing university and academic resources), which exist in every online course for the campus, are based on the Quality Matters and Blackboard Exemplary Course Program rubrics. While the university currently uses the Canvas LMS, in the past, Blackboard was the LMS. More than ten courses won the Blackboard Exemplary Course Award. The university also subscribes to the QM Rubric, and three courses were QM Certified. The specific QM Rubric criteria that pertain to multimedia learning principles and course navigation are provided in Chapter 2.

The private aeronautical university campus is dedicated to online and distance learning and has received accolades for the quality of its online courses. However, no usability tests have been conducted with students on the courses, nor are there data on the students' perceptions of the course design. The university utilizes end-of-course evaluations completed by the students; however, most survey information is focused on instructor-student interactions and not course design and usability.

Educational Challenge Problem Statement

One of the main challenges in the asynchronous online learning environment is the additional layer of the online course navigation and content design interface, which could cause barriers to the student's learning experience if it is designed poorly regarding usability. While there are several criteria resources for creating quality online courses, there is a gap in research regarding the usability of implementing these criteria within asynchronous online courses. A university with a campus dedicated to distance learning strives to implement the best practices of usability and multimedia learning principles to create quality online courses. However, no usability studies have been conducted at the university to determine how the students navigate those courses. Furthermore, usability studies that examine the students' perception of the page layout's usability for the learning materials within those online courses have not been conducted.

While some research studies examine the usability of general online course navigation, there is a gap in the current research that examines the usability of online courses that purposefully implement best practices of usability and multimedia learning principles in the course design. There is also a gap in research that examines perceptions of usability regarding the design and page layout of directional and

instructional content within an online course. Due to the lack of usability testing at the university and a gap in research, there are no data to show how the students are navigating the online courses. There are also no data to show if these implemented design practices help or hinder the students.

Purpose of the Study

The purpose of this exploratory study was to investigate how online learners navigate asynchronous online courses, examine the online learners' perception of usability regarding course content designed using best practices of multimedia learning principles, and examine the perceptions of online learners regarding the usability and perceived quality of asynchronous online courses. Several multimedia learning principles (coherence, signaling, and segmenting) are implemented within the individual courses when designing and developing the individual activity and assessment pages. This situation provides an opportunity for this study to examine how students perceive the use of these principles regarding course usability and overall quality. The outcomes of this study benefit the field by helping explain the perceived impact of using multimedia learning principles on student asynchronous course experiences, with a goal of allowing others to replicate what worked while avoiding what did not.

The exploratory study used a qualitative approach by conducting a usability study consisting of task scenario and think-aloud protocols. The study used one of the current online courses offered at a private university with a campus dedicated to distance and online learning. In that setting, asynchronous online courses are created using a template model to ensure all courses have the same navigation and organization, include clear instructions, and segment the course content. Data was collected from

participants through online usability tests conducted using the Zoom Web Conferencing Software.

Usability testing is often used to evaluate a product by gathering data from representative users to identify problems and ascertain the user's satisfaction (Usability.gov, n.d.). According to Nielsen (2012b), one of the benefits of the think-aloud protocol is enabling the researcher to hear the participant talk about the misconceptions or misinterpretations of design elements. McCloskey (2014) states, "The most effective way of understanding what works and what doesn't in an interface is to watch people use it" (p. 1). McCloskey also explains how task scenario protocol provides qualitative insight into what is causing the users to have issues, which can help determine how the design can be improved.

The qualitative data that resulted from this interview-based approach provided in-depth perceptions regarding the general usability and quality of online course design. Specific evaluation criteria included the perception of the degree to which the course provides intuitive navigation, clear instructions, and meaningfully segmented content. This study also provides insight into the areas of the asynchronous online courses that need improvement.

Topics of Inquiry

In order to determine the quality and usability of asynchronous online courses currently offered through a private university, this study explored the perceptions and expectations of the adult online learners attending the university. There are three qualitative topics of inquiry that guided the study's data collection, analysis, and reporting.

1. In an intentionally designed asynchronous online course, how, to what extent, and why do learners describe their experience with the learning management system's navigation as intuitive? (Each of the following subtopic questions will help frame the Topic 1 analysis to guide analysis of the qualitative data gathered during think-aloud interviews and reporting.)
 - a. What are the main items learners expect to find on their first day of class in an asynchronous online course?
 - b. How do learners navigate online courses?

2. In an intentionally designed asynchronous online course, how, and to what degree, do learners describe information and directions as being segmented in ways that improve intelligibility and enable them to complete activities successfully?

(Each of the following subtopics are explored as part of explaining the Topic 2 participant experiences as part of the etic coding process to aid in the analytic sensemaking process and provide defining concepts rooted in the multimedia learning explanatory framework.)

 - a. Coherence Principle: What are the perceptions and preferences regarding excluding irrelevant content and information, which help learners regarding usability in asynchronous online courses?
 - b. Signaling Principle: What are the perceptions and preferences of webpage design elements, such as headers, icons, and alert boxes, which help learners regarding usability in asynchronous online courses?
 - c. Segmenting Principle: What are the perceptions and preferences regarding web page design elements, such as content organized in sections, tabs, or expanders, which help learners regarding usability in asynchronous online courses.

3. To what extent, why, and how do participants describe different aspects of the asynchronous course as being usable according to common usability principles?

Significance of the Study

This study expands upon the usability study by Reeder (2018), which examined students' perceptions of course navigation, design, and layout within learning management systems. This study also incorporated a modified version of the usability instrument used by Gregg et al. (2017), which examined user experience within online courses in the Canvas LMS. These two studies examined students' perception of the

overall course navigation and design. However, those two studies examined several different courses, each with a different navigational structure and layout. Since this study examined one course within a campus-wide template model, there were fewer variables regarding overall course navigation and structure. While the online course's general usability was studied, having fewer course navigation and structure variables allowed this study to deeply examine the visual design and layout of directional and learning content pages that implement multimedia learning principles. One of the limitations in the study by Reeder (2018) was that the courses used were not screened through a review system such as the OLC *Quality Scorecard* or QM rubric. However, this study examined learners' perceptions regarding asynchronous online courses that have been designed based on quality standards, such as the QM rubric.

While this study focused on specific courses and page layouts within the course at a particular university, the data from the study provides insight for other institutions designing and developing online courses. The overall goal is to provide students with a quality online education by creating courses that are user-friendly and follow best practices. The intent is for students to invest their cognitive load on the learning materials and activities instead of spending their cognitive load on navigating the course.

The theoretical framework of this study stems from cognitive load theory, cognitive theory of multimedia learning, and multimedia learning principles under the lens of usability. Research pertaining to these theories and principles is presented in the next chapter.

Definitions of Terms

The following terms are helpful for understanding the content of this study. Each definition is based on how the term is intended for this study in particular and uses resources supporting those definitions if needed. Where a term is not commonplace or is only used in the study context, it is described as used under the study's conditions and as it is understood by the researcher and stakeholders.

- *Accordion* – Design element within a webpage layout in which content is organized and segmented in vertical panels that can be expanded or collapsed to hide and reveal content. One limitation with accordions is that the viewer can only view one panel of content at a time. When a user selects one panel to view the content, all other panels within the accordion close automatically. The accordion has limited functionality compared to the expander design element.

- *Blackboard Exemplary Course Program* – An award program in which courses are reviewed and evaluated by a group of peers using the Blackboard Exemplary Course Program rubric (Blackboard, 2021).

- *Blackboard Exemplary Course Program Rubric* – Rubric used in the review and evaluation process for the Blackboard Exemplary Course Program. The rubric consists of four major criteria of best practices, including course design, assessment, interaction and collaboration, and learner support.

- *Boiler plate items* – Content pages that are identical in every asynchronous online course within the distance learning campus. These pages are mainly in the Start Here section of the course and contain university-wide resources (e.g., advising, disability services) and academic resources (e.g., university writing lab, APA resources).

- *Cognitive load theory (CLT)* – Theoretical framework that concentrates on a person’s capability of processing information from their working memory into their long-term memory. There are three categories of cognitive load: intrinsic load, extraneous load, and germane load. The Cognitive load theory of multimedia learning, along with multimedia learning principles, derives from CLT.

- *Cognitive theory of multimedia learning (CTML)* – Theory derived from cognitive load theory that serves as a theoretical foundation for effectively designing multimedia.

- *Distance Education* – Educational modalities that use one or several different technologies to deliver instruction to learners who are physically separated from the instructor. The courses provided in a distance education setting should support routine and substantive interaction between the instructor and students asynchronously or synchronously (Seaman et al., 2018).

- *Expander* – Design element within a webpage layout in which content is organized and segmented in vertical panels that can be expanded or collapsed to hide and reveal content. One of the benefits of the expander is that it allows the user to expand or collapse all of the panels of content or specific panels of content. The expander feature does not have the limitations of the accordion feature.

- *Principles of multimedia learning (also referred to as multimedia learning principles)* – Based on cognitive load theory and cognitive theory of multimedia learning, these principles have been identified through research as ways to design multimedia learning materials in a way that they reduce extraneous processing, manage essential processing, and foster generative processing.

- *Quality Matters (QM) Rubric* – Rubric of criteria and standards set by the Quality Matters organization to guide quality online course design and teaching practices.
- *Tabs* - Design element within a webpage layout in which content is organized and segmented in panels that visually represent tabs of a folder. Instead of the user vertically scrolling through content, the user can select the horizontal menu of the tabbed panels to reveal the segmented content.
- *Task scenario protocol* – Usability test protocol in which the participant is asked to complete tasks that are typical of the given scenario. In this study, tasks will consist of activities typical to an online student, such as finding the syllabus or course activity.
- *Template model* – course design and development process consisting of a course faculty developer collaborating with an instructional designer to create one version of a course that will be distributed in multiple sections and taught by several other faculty members. This means students enrolled in different sections of the course will have the same content and activities regardless of the section in which they are enrolled.
- *Template courses* – courses across degree programs have the same navigation and structure, so there is consistency for the student throughout their online academic career. The courses also contain some boilerplate content, such as the Start Here section, which provides information for university and academic resources. This content is identical and consistent across all degree programs.
- *Think-aloud protocol* – Usability test protocol in which the participant is asked

to verbalize their thoughts out loud as they navigate the interface of the online course and complete tasks typical of an online learner.

- *Usability* – The degree to which an interface is easy or difficult to use.
- *Usability test* – An evaluation method to examine how well one is able to easily navigate and use a product.

Delimitations

The scope of this study was limited to using one course from the online campus. While the course's navigation and structure represent all of the online courses, the page layout examples are limited to pages from a single course. The study included participants that are internal and external students of the university. However, due to the nature of usability tests, this study had a small sample size consisting of six participants. The study did not examine the perspectives of instructors who teach the courses or the instructional designers and faculty developers who create the online courses. The usability test also examined the online course design from an internet browser on a computer and not in a mobile environment.

Summary

This chapter introduced the challenges of the asynchronous online learning environment in regard to the usability of course navigation and page layout. This chapter also introduced the statement of the problem, the purpose, and the significance of the study, along with the topics of inquiry. The outcome of this dissertation is to advance the knowledge of best practices for asynchronous online course design regarding usability and multimedia learning principles by examining learners' navigation practices and perceptions of online course design. The following chapter contains the

literature review, which expands on the research regarding quality online course design in distance learning, cognitive load theory, cognitive theory of multimedia learning, principles of multimedia learning, web design best practices, and usability in asynchronous online courses. The next chapter also expands on the theoretical framework.

CHAPTER 2

LITERATURE REVIEW

Distance Learning Online Course Design

Compared with face-to-face course development, creating a quality asynchronous online course can be more complex due to a number of factors; these include the nature of the asynchronous learning environment, complications regarding usability in the online course, as well as with the organization and visual design of course content. According to Baldwin and Ching (2019a), "To design an effective online course, one must maximize user satisfaction and encourage learning outcomes in a format that is different from traditional education" (p. 157).

Quality Online Course Design

The term quality is subjective in nature. However, if a course is poorly designed because of different qualities selected for inclusion, this situation can lead to learner frustration and anxiety and possibly impede learning (Fisher & Wright, 2010). Within the education industry, there are some research-based evaluation tools that provide guidance for creating quality online courses. Some evaluation tools include, but are not limited to, the Quality Matters Higher Ed rubric (QM Rubric), Online Learning Consortium (OLC) Quality Scorecard, and Blackboard Exemplary Course Program Rubric. In a study by Baldwin et al. (2018), the authors examined several evaluation tools and compared their requirements. The researchers found many commonalities amongst the different evaluation tools. Baldwin et al. (2018) compiled a list of criteria that appeared in six out of six (100%) of the online course evaluation tools. These criteria include:

- Objectives are available.
- Navigation is intuitive.
- Technology is used to promote learner engagement/facilitate learning.
- Student-to-student interaction is supported.
- Communication and activities are used to build community.
- Instructor contact information is stated.
- Expectations regarding quality of communication/participation are provided.
- Assessment rubrics for graded assignments are provided.
- Assessments align with objectives.
- Links to institutional services are provided.
- Course has accommodations for disabilities.
- Course policies are stated for behavior expectations. (p. 52-53)

The study by Baldwin et al. (2018) also lists criteria that appear in five out of six of the online course evaluation tools; these criteria include:

- Learners are able to give feedback on the course for improvement.
- Course activities promote achievement of objectives.
- Instructor response time is stated.
- Collaborative activities support content and active learning.
- Self-assessment options are provided.
- Assessments occur frequently throughout course.
- Instructions are written clearly.
- Guidelines for multimedia are available.
- Guidelines for technology are available. (p. 54)

An additional criterion was found in four out of six of the online course evaluation tools

“Information is chunked” (Baldwin et al., 2018, p. 54).

From these principles, this study focused on aspects of the following criteria: navigation is intuitive, instructions are written clearly, and information is chunked. These three criteria were recurrent in the usability study by Reeder (2018), upon which this study expands. These three criteria are related to the principles of multimedia learning, principles of visual web design, and usability in web design. While many of the criteria identified in the different rubrics are important, these three particular criteria hold importance under the lens of multimedia learning principles and usability. For example, within the Accessibility and Usability general standard of the QM Rubric, the following criteria specifically relate to navigation and multimedia content:

- 8.1 Course navigation facilitates ease of use.
- 8.2 The course design facilitates readability.
- 8.3 The course provides accessible text and images in files, documents, LMS pages, and web pages to meet the needs of diverse learners.
- 8.4 The course provides alternative means of access to multimedia content in formats that meet the needs of diverse learners.
- 8.5 Course multimedia facilitate ease of use. (Standards from the Quality Matters Higher Education Rubric, Sixth Edition, 2020)

The course used in this study was designed and developed utilizing the guidance of the QM Rubric.

The following sections offer an overview of cognitive load theory, cognitive theory of multimedia learning to provide a theoretical background for the principles of multimedia learning. The following sections also explain the different multimedia learning principles created to help reduce cognitive load. The subsequent section examines visual web design practices that align with the concepts of select multimedia

learning principles. The successive section examines usability testing for asynchronous online courses.

Cognitive Load Theory

Cognitive load theory (CLT) is a framework for creating and investigating cognitive processing and instructional design (Paas et al., 2003; Um et al., 2012). According to Sweller et al. (1998), “Cognitive load theory has been designed to provide guidelines intended to assist in the presentation of information in a manner that encourages learner activities that optimize intellectual performance” (p. 251). CLT focuses on how information transfers into our long-term memory by dealing with the constraints and limitations of our working memory (Sweller et al., 2019). Cognitive load theory concentrates on how learning tasks impact the capability of processing new information (Sweller et al., 2019). The theory involves three categories of cognitive load: intrinsic load, extraneous load, and germane load (Paas et al., 2003; Um et al., 2012).

Intrinsic Load

Intrinsic cognitive load relates to the inherent complexity and demands of the topic or learning task that are imposed on working memory, along with the prior knowledge of the learner (Cierniak et al., 2008; Deegan, 2015; de Oliveira Neto et al., 2015; Paas et al., 2003; Sweller et al., 2019). According to Sweller (2020), “Intrinsic cognitive load is determined by the intrinsic properties of the information being processed” (p. 9). When creating instructional material, organizing learning tasks by increasing levels of complexity is one way to manage intrinsic cognitive load (Sweller et al., 2019).

Extraneous Load

Extraneous cognitive load relates to a few aspects: how the learning materials and information are presented to the learner, what the instructional procedures require from the learner, and the distractions that are not related directly to the learning task (Deegan, 2015; Sweller et al., 2019). According to Liu et al. (2014), extraneous load relates to the “working memory resources required to process unnecessary information due to poor instructional design” (p. 329). Ineffective design and instructional material format can cause extraneous load that negatively impacts learning; so, reducing extraneous load and increasing germane load, which is described in the next section, is imperative to the learning process (Cierniak et al., 2008; Ibrahim et al., 2012; Mavilidi & Zhong, 2019; Mayer, 2014a).

Germane Load

Germane cognitive load relates to a learner’s effort to comprehend learning materials that produce changes to long term memory caused by the task and mental construction of schemas, assimilation, and manipulation using concepts from cognitive theory (Deegan, 2015; Paas et al., 2003; Um et al., 2012). Costley and Lange (2017) described germane load as “how well the students understand content delivered to them (Ayres, 2006)” (p. 176). In this particular theoretical model, learners construct schemas through processes such as differentiating, interpreting, inferring, organizing information, classifying, exemplifying, summarizing, explaining, and comparing (Costley & Lange, 2017; de Jong, 2010; Mayer, 2002). However, there remain differences among authors regarding the precise definition and function of germane cognitive load.

For example, Choi et al. (2014) reexamined cognitive load theory to incorporate

the impact of the physical learning environment. In their paper, Choi et al. (2014) provides a newer concept of germane load and redefines it as “germane – working memory resources” (p. 239) to help allocate resources from the working memory to help deal with intrinsic cognitive load. According to Korbach et al. (2016), the proposed changes to the model of cognitive load theory by Choi et al. excluded germane cognitive load “from the working memory equation and considered as germane resources that reflect the amount of working memory capacity dedicated to learning relevant information processing that is intrinsic cognitive load” (p. 60). The newer conception of germane load defines it as resources of the working memory, which are allocated to deal with the intrinsic load; and, it suggests that adding interactive elements from long-term memory or context to working memory would increase the intrinsic load (Choi et al., 2014).

de Jong (2010) spurred debate regarding germane load by stating that intrinsic and extraneous load involve cognitive activities required to be performed and are unavoidable; therefore, they are categorized under cognitive load. However, “germane cognitive load is the space that is left over that the learner can decide how to use, so this can be labeled as cognitive effort” (de Jong, 2010, p. 113). Sweller (2010) stated that germane cognitive load relates to learner characteristics, and the learner has “no control over germane cognitive load” (p. 126). de Jong (2010), along with Debie and van de Leemput (2014), noted that some debate about germane load is due to subjective ways cognitive load is measured, which is primarily through self-report. Sweller (2010) also stated that it is difficult to distinguish the difference between germane and intrinsic load through psychometric procedures. This study focused mainly

on extraneous load regarding online course content, so germane and intrinsic load was not examined as a condition of cognitive load. In the context of cognitive load theory and asynchronous online course design, extraneous load is influenced by the instructional or curriculum designer since they are involved with designing the presentation of information and learning activities that are required from the learner.

According to Plass et al. (2010), various research has replicated different cognitive load effects in various learning environments. Therefore, it is suggested that the cognitive load theory can offer instructional designers some guidelines when designing content for multimedia learning environments that incorporate verbal and pictorial representations of information, along with designing content for web-based learning environments (Plass et al., 2010).

Cognitive load theory could be considered when creating the curriculum for an asynchronous online course to help the learner reduce cognitive overload and transform the new knowledge from working memory to long-term memory. Choi et al.'s (2014) proposed revised cognitive load theory framework includes the physical environment as another distinct cognitive load factor that interrelates with learning-task characteristics and learner characteristics. Including the learners' physical environment when considering cognitive load could be employed when creating asynchronous online courses. Cognitive load theory is also a steppingstone for another theoretical framework, the cognitive theory of multimedia learning.

Cognitive Theory of Multimedia Learning

According to Mayer and Moreno (2003), multimedia learning is defined as learning from materials that consist of both words (text or spoken) and pictures (static or

dynamic); and multimedia instruction is the act of presenting the combination of those words and pictures in a way that fosters learning. Cognitive theory of multimedia learning (CTML) is “The theoretical basis for designing effective multimedia” (Mayer, 2017, p. 405).

Regarding CTML, there are three assumptions in the theoretical framework pertaining to how the mind works cognitively “The dual-channel assumption, the limited capacity assumption, and the active processing assumption” (Mayer & Moreno, 2003, p. 44). The dual-channel refers to the way humans process information in two separate channels, one for verbal and the other for visuals (Mayer & Moreno, 2003). Limited capacity refers to the restricted amount of processing each of the two channels are capable of (Mayer & Moreno, 2003). Active processing refers to learners engaging in the three proper cognitive processes, which include selecting, organizing, and integrating, so meaningful learning can occur (Mayer, 2017).

The first cognitive process, selecting, refers to the learner paying attention to the learning materials that are relevant and mentally bringing that information into working memory (Mayer & Estrella, 2014; Mayer et al., 2008). The second cognitive process, organizing, refers to the learner organizing the information mentally into a coherent and logical cognitive structure (Mayer et al., 2008). The third cognitive process, integrating, refers to the learner connecting the new information and mentally connecting it with their own existing knowledge from their long-term memory (Mayer et al., 2008). Multimedia content, directional information, and learning materials within asynchronous online courses should foster those three cognitive processes in a way that the verbal and visual channels are not overloaded (Mayer, 2017).

Principles of Multimedia Learning

The principles of multimedia learning are based on a triarchic theory that there are three instructional goals for creating multimedia learning materials: reduce extraneous processing, manage essential processing, and foster generative processing (Mayer, 2017). These three goals can be met by adhering to the different principles of multimedia learning. Mayer (2017) defined several principles based on research to create multimedia learning content. These principles include multimedia, modality, redundancy, coherence, segmenting, signaling, spatial contiguity, temporal contiguity, personalization, voice, and pre-training principles (Mayer, 2017). Table 1 identifies and summarizes each of the basic principles of multimedia learning.

Asynchronous online learning curriculum often comprises a combination of text, images, sounds, animations, or videos. Cognitive theory of multimedia learning should be another consideration when creating asynchronous online learning curriculum within learning management systems. This study examined applying the principles of multimedia learning through best practices of web design and usability design in asynchronous online courses within a learning management system. There are several principles of multimedia learning. However, this study concentrated on the coherence, segmenting, and signaling principles since those principles can be applied to most online course content within activities and pages designed in learning management systems. These principles also align with the three criteria of quality online courses that this study focuses on: navigation is intuitive (coherence and signaling), instructions are written clearly (coherence, signaling, and segmenting), and information is chunked (segmenting).

Table 1

Definitions of the Basic Principles of Multimedia Learning Principles

Principle	Definition
Multimedia principle	“People learn better from words and pictures than from words alone” (Mayer, 2014b, p.8).
Modality principle	People learn better when words are presented as spoken audio than when words are presented as text (Mayer, 2017).
Redundancy principle	“People learn better from graphics and narration than from graphics, narration, and on-screen text” (Mayer, 2017, p. 406).
Coherence principle (seductive detail principle)	“People learn better from a multimedia lesson when extraneous material is excluded rather than included” (Mayer, 2014c, p.390).
Segmenting principle	People learn better when a lesson is presented to the learner in smaller manageable segments (Mayer, 2014c).
Signaling principle	People learn better when the learning material is organized, highlighted, or emphasized, so it draws the learner’s attention is drawn to the essential elements (Liu et al., 2013; Mayer, 2014c).
Spatial contiguity principle	People learn better when the words are placed next to, or near, the corresponding graphic (Mayer, 2014c).
Temporal contiguity principle	“People learn better when corresponding spoken text and graphics are presented simultaneously rather than successively” (Mayer, 2014c, p. 392).
Personalization principle	People learn better when the written or audio narrated text uses a conversational style instead of a formal style (Mayer, 2017).
Voice principle	People learn better when audio narration is presented in a human voice instead of a machine-like voice (Mayer, 2014c).
Pre-training principle	People learn better when they are provided with key concepts prior to the lesson (Mayer, 2014a, 2017).

Note. Table adapted from Mayer (2014c)

Coherence Principle

Instructors and instructional designers often try to engage learners by adding interesting information through text, images, audio, or video. However, if the interesting information is not relevant to the learning goals and materials, this irrelevant, extraneous information can impair learning. The coherence principle, which is synonymously referred to as the seductive detail effect, emphasizes that excluding

extraneous material helps the person learn better. Several studies examining the seductive detail effect (coherence principle) have demonstrated that including interesting but irrelevant extraneous materials, such as text, images, and sounds, into lessons can hinder learning. These studies varied by examining the seductive details in text (Garner et al., 1989; Harp & Mayer, 1998), text and images (Mayer et al., 1995; Sung & Mayer, 2012), and audio narration (Moreno & Mayer, 2000; Park et al., 2015; Yue & Bjork, 2017).

Rey (2012) conducted a meta-analysis of studies examining the seductive detail effect. Overall, there was a contrast of results when comparing the number of studies. For example, four of the fourteen studies supported the seductive detail effect, five had mixed results, and five did not support it (Rey, 2012). However, when examining the effect sizes of the studies, a combination of the seventeen comparison experiments, which demonstrated mixed support for the seductive detail effect, included at least one large effect size (Rey, 2012). Only one of the studies that did not support the seductive detail effect contained a large effect size. Rey (2012) states that the “meta-analysis support the existence of a seductive detail effect with regard to retention and transfer performance” (p. 230). Applying the coherence principle when creating asynchronous online courses could help the learners eliminate extraneous information that may impair the learning experience. In addition to the coherence principle, another principle that can be applied to online course design is the segmenting principle.

Segmenting Principle

When creating instructional content, applying the segmenting principle means to chunk the content into smaller, manageable pieces. Miller (1956) described chunks as

“groups of items that go together” (p. 95) while researching the limits of processing information. Mayer’s segmenting principle extends the concept of chunking for multimedia instructional content, which can include a combination of images, text, audio, or video. The segmenting principle also includes the learners having control over the pace of the segmented instruction (Rey et al., 2019).

There have been a variety of studies on the segmenting principle, several relating to instructional animation (Cheon et al., 2014; Mayer & Chandler, 2001), videos (Ibrahim et al., 2012), and presentation slides (Mayer et al., 2018). The study by Cheon et al. (2014) examined the impact of using pause breaks, which contained recall questions throughout an animation on the formation of lightning. The results presented by Cheon et al. (2014) state that pausing and asking the learner to provide a short-answer recall as a way of segmenting the animation content outperformed the other groups on transfer tests with a significance of $p = .019$ and an effect size of $\eta^2 = 3.459$. Mayer and Chandler (2001) also used animation on the formation of lightning to examine the segmenting principle; however, they focused on the user control perspective. The study by Mayer and Chandler (2001) produced statistically significant results ($p < .01$) that learners benefitted on transfer tests when having complete control over viewing animation segments at their own pace and then watching the entire animation again as one continual lesson. Ibrahim et al. (2012) examined an intervention of segmenting, signaling, and weeding content in educational videos about insects. The results of the study by Ibrahim et al. (2012) showed statistical significance on retention ($p = 0.007$) and transfer ($p = < 0.001$) tests for the group that watched a video on insects, which implemented segmenting and signaling principles. The study by Mayer et

al. (2018) examined a geography lesson segmented in a slideshow. The participants who received the segmented presentation, in which each click of a mouse presented more information on the slides, performed statistically significantly ($p = .021$) higher than the participants who had the non-segmented presentation with an effect size of $d = 0.34$ (Mayer et al., 2018).

Mayer and Pilegard (2014) analyzed several studies that conducted experimental tests regarding the segmenting principle, mainly focusing on learner-paced audio narrated presentations. The analysis demonstrated that all ten experiments supported the segmenting principle with “a median effect size of 0.79” (Mayer & Pilegard, 2014, p. 316). Rey et al. (2019) conducted a meta-analysis on studies that examined the segmenting effect, focusing on learner pacing and system pacing. Their analysis shows support for the segmenting principle regarding transfer performance and retention; however, the overall effect sizes were small to medium (Rey et al., 2019).

The mentioned studies focus on individual lessons presented in animations, videos, or presentations, which can be considered continuous media. However, those studies do not examine a larger module lesson with directional text in an asynchronous online course, which consists of various web pages that are not a continuous media piece.

A study conducted by Méndez-Carbajo and Wolla (2019) examined the segmenting principle by comparing the difference between content presented in long form and short form online learning modules. The study compared four areas: completion rates, gains in test scores, changes in the type of learning, and changes in information absorption of learners who completed either the long form of the economics

course or the version that was chunked out into four smaller segments (Méndez-Carbajo & Wolla, 2019). There were positive results for the segmenting treatment in all four of those areas. Completion rates increased with statistical significance and effect sizes ranging from 4%-8%; gains in test scores for pre- and post-test increased for medium-to-high-knowledge learners by 10%, and high-knowledge learners 6% with an effect sizes ranging from 5%-10%; changes in the type of learning showed retained learning increased between 4%-24% with statistical significance, and changes in information absorption demonstrated gains of the test-item level ranging from 1%-9% with statistical significance (Méndez-Carbajo & Wolla, 2019). One thing Méndez-Carbajo and Wolla (2019) noted in their study regarding the value-added learning is that the proportions and patterns of the positive learning amongst the four modules were minimal, and suggest segmenting alone is not enough to increase student learning. However, the segmenting treatment did demonstrate improvements overall in this particular asynchronous online course environment.

While chunking content into manageable segments can benefit asynchronous online learners, additional measures can be taken when designing the segmented content, such as signaling, frequently referred to as cueing.

Signaling Principle

The signaling principle, also referred to as cueing, can be applied in various ways within asynchronous online course content. There are two distinguishable modes of signaling, textual signaling and graphical signaling (Schneider et al., 2018; Van Gog, 2014). Schneider et al. (2018) identified five subcategories within textual signaling: “organizational signals (e.g., headings or summaries), colors (e.g., font colors), text

picture references (e.g., “see the picture”), intonation (e.g., in auditory texts), or a mixture of types (e.g., coloring and text-picture referencing)” (p. 2). Within graphical signaling, Schneider et al. (2018) identified six subcategories:

pointing gestures (e.g., arrows or gestures of pedagogical agents), colors (e.g., parts of a picture), labels (e.g., naming parts of an animation), flashing, spotlights (also called anti-cueing; e.g., greying out parts of an illustration), graphic organizers, or, again, a mixture of two or more types (e.g., pointing gestures and labels). (p. 2)

There are a wide variety of ways to implement the signaling principle, and there are a wide variety of studies ranging from signaling used in text (Dyson & Gregory, 2002; Rey, 2010), signaling for text and images (Scheiter & Eitel, 2015) signaling used for navigation (Sung & Mayer, 2012), signaling in interactive multimedia e-learning lessons (Ozcelik et al., 2010), and signaling used in educational videos or animations (Ibrahim et al., 2012; Moreno, 2007).

Mayer and Fiorella (2014) conducted an analysis of several multimedia learning principles, including the signaling principle. They examined 28 different experiments within 19 studies on various implementations of the signaling principle. Their results show that out of the 28 experiments, 24 of them supported the signaling principle with a median effect size of 0.41 (Mayer & Fiorella, 2014).

Richter et al. (2016) also conducted a meta-analysis on the signaling principle focusing on text-picture relations. The analysis showed 38 out of 45 studies yielded positive effect sizes when implementing a signaling treatment and had a positive impact on comprehension performance compared to non-signaled treatments (Richter et al., 2016). Regarding the overall signaling principle, the effect size of the analysis yielded a small-to-medium, "r-.17" (Richter et al., 2016, p. 32). The study also examined the

strength of the control groups in the studies. Studies that had weak control groups had stronger signaling effect than students with strong control groups “($r = .23$ vs. $r = .13$)” (Richter et al., 2016, p. 32). However, even the studies with stronger control groups still yielded a positive effect suggesting support for the signaling principle (Richter et al., 2016).

In relation to asynchronous online course design, signaling can be used in text and web page design for the content items that provide a lot of information and instructions in text format. The use of headings (to demonstrate organization and importance of sections), bold, italics, and icons are some samples of implementing signaling in text-based learning materials to help provide cues and guide the learners (Dyson & Gregory, 2002; Grant-Smith et al., 2019; Mayer, 2017; Ozcelik et al., 2010; Richardson et al., 2014; Sung & Mayer, 2012;). Many practices of multimedia learning principles are similar to practices of web design principles. Online courses in higher education settings are generally created and hosted in learning management systems (LMS) and provide a website structure for the learners to engage with the course.

Web Design Practices – Applying to Online Course Environments

According to Grant-Smith et al. (2019), the LMS provides an important infrastructure for online learning by delivering the resources and learning content to the learners. The content and resources within the LMS are often presented to the learners as webpages. Pang et al. (2016) describe web design as arranging a group of discrete yet related elements in a 2D space so users can mentally construct and interpret those elements as a whole. According to Brito and Surrency (2020), pages within the learning management systems may "contain a combination of text, images, audio, and video.

They are treated as instructional web pages, and their overall design should adhere to web design and multimedia learning principles" (p. 249). According to Reeder (2018), online courses have "a visual communication component and, similar to a webpage, the design and consistency of that visual communication should be considered" (p. 17).

Lin (2013) compiled a list of standardized definitions for several general design principles. These include, but are not limited to the following:

- Balance – arranging design elements to provide equilibrium
- Dominance – arranging design elements with emphasis to provide visual prominence and hierarchy
- Emphasis – arranging design elements to demonstrate visual significance
- Rhythm – harmoniously arranging design elements in a recurrent manner
- Harmony – arranging elements to create an esthetically pleasing relationship between the elements
- Unity – arranging elements in a homogenous way to demonstrate harmony
- Variety – arranging elements with some diversity to add interest to the design (Lin, 2013)

Several of these principles are echoed in the literature and practices relating to online course design.

In a literature review about website design and user engagement, Garrett et al. (2016) found 20 different website design elements that frequently appeared in the research they reviewed. The top seven elements and their descriptions include: navigation (is the site easy to navigate), importance of graphical representation (does the site use contrasting colors, icons, or multimedia content), organization (is the site organized logically), content utility (does the site provide useful or interesting information), purpose (does the site declare its purpose), simplicity (does the site have a

simple design), and readability (is the site content easy to read, minimal to no spelling or grammar errors, and understand) (Garett et al., 2016). While this study examined the literature on public websites, these design elements are applicable to asynchronous online courses as well.

Grant-Smith et al. (2019) examined visual design in online course environments, specifically courses in an LMS. Grant-Smith et al. (2019) noted similar design elements in the online environment that were important to student engagement, such as clear communication, balanced aesthetics, legibility with the use of consistent typefaces, colors, and visual symbology. They also noted that some elements could have a negative impact on the user experience, such as busy or overcrowded pages and a layout or design that is inconsistent (Grant-Smith et al., 2019).

The concept of visual design practices is reiterated by Pang et al. (2016), “It is important for web designers to be able to guide users by manipulating the low-level visual cues of page components (e.g., color, size, position, and space), to balance between the perceptual quality and business goal of a webpage” (p. 1).

Several of these design elements relate to visual design principles, the criteria of quality online course design, and multimedia learning principles. These commonalities are displayed in Table 2.

Bader and Lowenthal (2018) related the following Bauhaus design philosophy, “less is more and form follows function” (p. 7) to online course design stating, “Online courses, which are built for human interaction, would need to follow this same logic: the visual appearance of the course’s navigational system, the content integration, the emotional tone, and the intuitive layout have a direct impact on the functionality of the

course” (p. 8). The visual web design practices of online course webpages are not only for aesthetic purposes but also for usability.

Table 2

Commonalities between the Elements of User Engagement, Visual Design Elements, Criteria for Quality Online Course Design, and Multimedia Learning Principles

Design Elements of Engagement (Garett et al., 2016)	Visual Design Elements (Grant-Smith et al., 2019)	Quality online course design criteria (Baldwin et al., 2018)	Multimedia Learning Principles (Mayer, 2014c)	Design Principles (Lin, 2013)
Navigation	Avoid inconsistent layout	Navigation is intuitive	<ul style="list-style-type: none"> • Coherence • Signaling 	<ul style="list-style-type: none"> • Emphasis
Graphical representation	<ul style="list-style-type: none"> • Balance aesthetics • Legibility with consistent fonts, colors, and symbology 		<ul style="list-style-type: none"> • Signaling 	<ul style="list-style-type: none"> • Balance • Dominance • Emphasis • Variety
Organization		information is chunked	<ul style="list-style-type: none"> • Segmenting 	<ul style="list-style-type: none"> • Balance • Dominance • Emphasis • Rhythm • Harmony • Unity • Variety
Content utility	Clear communication		<ul style="list-style-type: none"> • Coherence 	<ul style="list-style-type: none"> • Dominance • Emphasis
Purpose		Objectives are available*		
Simplicity	Avoid <ul style="list-style-type: none"> • overcrowded pages • inconsistent layout 		<ul style="list-style-type: none"> • Coherence • Signaling • Segmenting 	<ul style="list-style-type: none"> • Balance • Dominance • Emphasis • Rhythm • Harmony • Unity • Variety
Readability	Clear communication	Instructions are written clearly	<ul style="list-style-type: none"> • Coherence • Signaling • Segmenting 	<ul style="list-style-type: none"> • Balance • Dominance • Emphasis

Note. While this study does not focus on the criteria relating to *objectives are available*, this criterion was the most prevalent in the rubrics to measure quality course design.

Usability in Asynchronous Online Course Environments

Unlike face-to-face courses, learners in online courses have to navigate and interact with the learning management system interface. In addition to consuming learning materials, completing, and submitting assignments, learners have to traverse through the asynchronous online courses to locate the content and activities. If the online course is designed without taking usability into consideration, it could lead to frustration and difficulties for the online learner. Bartolotta, Bourelle, and Newmark (2017) stated that “A course’s usability is evidenced by how easily a student-user can find and access course materials such as assignments, readings, modules, and other resources on the course Web site, such as videos, sound bites, or other media” (p. 287).

According to Nielsen (2012a), “Usability is a quality attribute that assesses how easy user interfaces are to use” (p. 1). Usability testing can help identify different elements of online courses that could lead to student frustration, which can determine areas of improvement in the online course design (Reeder, 2018). “Usability research methods, in particular, provide a simple yet valuable set of tools for evaluating interface design and gathering information about students’ digital composition practices” (Bjork, 2018, p. 6). According to Bjork (2018), Jakob Nielsen's research has shaped the popular usability theories and methodologies used today. Some methodologies recommended from Nielsen's research are the use of think-aloud testing (2012b) and having no more than five users participating in the usability tests (Nielsen, 2000).

Miller-Cochran and Rodrigo (2006) conducted a usability study for an online writing class to identify potential design problems in the course. The researchers

conducted a heuristic evaluation, where the test administrator observed how users work through and complete assigned tasks. In addition, the researchers also used think-aloud protocol during the evaluation so the participants would explain the choices they were making and why as they completed the different tasks.

The study, which consisted of five participants, identified problematic and helpful aspects of the online writing course. Assumptions that the participants would know what to do when first going into an online course were not accurate. While participants could identify the link to the syllabus, it was not clear that the syllabus was something the participants should look for (Miller-Cochran & Rodrigo, 2006). Information repeated in multiple places in the course led to confusion, especially for deadlines related to large projects that had multiple smaller assignments building up to it. When it came to directional text in different activities, participants missed important information that was contained in large blocks of text; however, using bold was suggested to help the participants find the most important within the text (Miller-Cochran & Rodrigo, 2006). These concepts relate to segmenting content into smaller chunks and signaling important text.

A few aspects that were helpful were linked icons on the home page informing participants what to do first and provided step-by-step instructions on what to do to get started for the course (Miller-Cochran & Rodrigo, 2006). A simple course design with a few icons and minimal text on the home page made for clear navigation. However, the sidebar navigation did not include all of the same links as the home page, and the participants were confused by having to keep returning to the home page instead (Miller-Cochran & Rodrigo, 2006). This informed the researchers that the participants

wanted multiple methods to navigate the course. Other themes that came up in the study by Miller-Cochran and Rodrigo (2006) showed that participants would explore the course in no particular order and are able to "structure their own experience in the course in the order that they choose" (p. 100).

While the study by Miller-Cochran and Rodrigo (2006) examined an online writing course, the findings are subject agnostic. The elements identified in the study could be taken into consideration when designing online courses, regardless of the topic.

Fisher and Wright (2010) conducted a usability test for online course design, which consisted of a pretest, task completion with a think-aloud protocol, and exit surveys. The usability test results from fourteen participants revealed three main themes, "course tools, readability, and lack of clarity" (Fisher & Wright, 2010, p. 232). The course tools referred to a tabbed menu that kept collapsing, so items were often hidden. The particular course used in the study had lengthy narratives, and several participants stated the information was difficult to find because of readability, sometimes to the point of preventing the participant from completing a task. Some recommendations from the study include "presenting content with obvious headings and in bulleted or outline format" (Fisher & Wright, 2010, p.233). Fisher and Wright (2010) identified a few items for lack of clarity. One item was the issue of finding due dates, along with locating and submitting assignments. The other item pertained to navigation instructions for completing assignments. However, this seemed to be a poor design specifically for this course. According to Fisher and Wright (2010), participants were asked to find Assignment 1; however, the assignment was not located in the obvious Assignments area but located in the discussion and bottom of the syllabus. It seemed

students were going to where most would expect to find the assignment, but the assignment was not there. The course content used in the study appeared to have some flaws that were identified; these mistakes should be avoided in online course design.

Reid et al. (2016) conducted a usability study of online college courses in the Canvas environment, which focused on the navigation, course layout, and preferences for the online course's look-and-feel. Reid et al. (2016) conducted a survey, which 516 participants completed, and an observation of online learners doing a task-based think-aloud usability session in which five participants completed. The survey participants consisted of a mix of undergraduate and graduate students with a mean age of 35.5 years. The participants for the usability test were chosen to replicate the demographic population of the online undergraduate students, primarily adult learners: "one student between the ages of 20-23; one student aged 24-29; two students between the ages of 30-39; and one student aged 40-49" (Reid et al., 2016, p. 453).

The survey portion of the study by Reid et al. (2016) focused on three areas: course navigation structure, syllabus design, and course landing page. For the course navigation, the participants identified the navigational elements and listed them in order of importance. The survey included screenshots with three to four different versions of the syllabus and course landing page, and the participants answered questions about usage, functionality, and preference for each variation. The participants also provided qualitative feedback regarding their thoughts on the overall course design (Reid et al., 2016).

The survey findings showed that the participants preferred efficiency in the

course design. For example, the most important elements for the course landing page included a course outline, due dates, and timely instructions, and the participants “preference indicated that usefulness and the ability to find information quickly were more important than the attractiveness of the page” (Reid et al., 2016, p. 452). The participants indicated similar elements for the syllabus by preferring a course schedule as a predominant feature in the syllabus. The qualitative feedback also reiterated the theme of efficiency in course design. For the navigation of the course, the participants preferred the menu in this order: Course Home Page, Assignments, Announcements, and then Modules (organizing the course content including all of the discussions quizzes and assignments) (Reid et al., 2016).

In the think-aloud portion of the study, the participants were asked to complete tasks common to online students, such as: locating a reading activity, locating an assignment due date, locating the grades for an assignment, and contacting their group members regarding an assignment (Reid et al., 2016). While the participant and the administer were physically in the same room for the usability session, the participants’ computer mouse-movements, along with audio and video of the usability session, were recorded for data collection and analysis. In addition, the participants filled out a paper form to indicate the difficulty or ease for each of the tasks using a scale of one to five (Reid et al., 2016).

The findings from the think-aloud portion in the study by Reid et al. (2016) showed that the participants were able to complete the tasks with little difficulty within the Canvas LMS, and this included some participants using Canvas for the first time. The findings also show that the participants primarily navigated to the one area of the

course, which organized the course content including the different assignment, quiz, and discussion activities, to complete all of the tasks (Reid et al., 2016). This pattern reemphasized the results of the survey regarding the preference for the course landing page. Recordings of the participants' mouse clicks and audio comments from the sessions provided information on what the participants were thinking while they were completing the tasks in the course. Some general design flaws regarding terminology were also identified in this particular study; however, Reid et al. (2016) did not expand on these details. The study by Reid et al. (2016) shows that the participants prefer efficiency and finding information quickly regarding online course design.

In a similar yet larger study, Gregg et al. (2017) presented their findings when an online campus migrated from the ANGEL LMS to the Canvas LMS. The usability test consisted of nineteen participants and used courses across several different departmental units at the university. The participants consisted of undergraduate and graduate students ranging from the ages of 18-59. The usability test sessions included task scenarios and think-aloud protocols, in which the participants completed a set of given tasks on a task sheet, talked through their thought process while completing the tasks, and then provided additional feedback by answering open-ended questions (Gregg et al., 2017). The usability test sessions were conducted in a face-to-face setting, while the sessions were recorded for data collection and analysis. The following are the overall findings from the usability think-aloud observations in the study by Gregg et al. (2017):

1. Students like the Canvas LMS and find it relatively easy to use.
2. Students orient to their courses differently than educators and designers.
3. Students rely heavily on Modules but have individualized navigation practices.

4. Students can be confused by terminology discrepancies and ambiguities.
5. Students can be confused by multiple interfaces within a course.
6. Students can be confused by inconsistent content organization within a course.
7. Students can be confused by different designs across courses.
8. Students can be confused by some design features inherent to Canvas. (p. 2)

While the usability test did not ask the participants to compare the experiences of the two different LMSs (ANGEL and Canvas), the participants made comparison comments and stated how Canvas was easier than ANGEL. Similar to the study by Reid et al. (2016), in the study by Gregg et al. (2017), the participants' navigation behaviors reflected a preference for efficiency. The participants preferred links to quickly access the assignments, grades, and course content. Repeating the findings from Reid et al. (2016), the participants in the study by Gregg et al. (2017) also emphasized a preference to have the course schedule in the syllabus.

In the study by Gregg et al. (2017), the participants preferred the Modules area as the landing page in the survey portion. In the think-aloud portion of the study, the participants utilized the Modules area profoundly. The Modules area in Canvas can organize the different types of course activities, such as content, assignments, discussions, and quizzes, and the participants discovered this as a preferred method to access the various course content (Gregg et al., 2017). While the participants preferred the Modules area, they also utilized other ways to accomplish the same tasks and demonstrated that their navigation practices differed from course designers and educators. For example, the participants used the Calendar, To-Do area, and the Syllabus area to access course activities. One participant relied on the organization of

the Grades area, including the display of due dates, as a primary way to keep track of assignments and workload (Gregg et al., 2017).

The study by Gregg et al. (2017) also revealed areas where participants experienced confusion in the course design. Terminology in the course, such as the terms lessons and units used to describe the content organization. Directional text referring to dropbox submission instead of assignment or discussion submissions also caused confusion (Gregg et al., 2017). Another aspect of the course design that confused the participants in this particular study, was the use of external content management systems, which have a different interface than the online course in Canvas. Also, the participants' prior online course experience differed from the course in the usability test regarding the LMS used, and the way courses were organized by their past instructors. This led to some confusion, and the participants expressed specific preferences for consistency amongst different courses (Gregg et al., 2017).

The study by Gregg et al. (2017) was conducted at a university with a campus dedicated to distance learning and used the Canvas LMS, which is similar to this study. While the study focused on the usability of asynchronous online courses in Canvas, the study's findings can be applied to any modality of courses that utilize an online component.

Reeder (2018) conducted a usability study to gain insight into students' perceptions of online courses. The study used surveys, think-aloud sessions for three different online learning environments, and follow-up interviews.

There were 148 participants who completed the survey on perceptions of online courses in general. The survey results revealed the most frustrating elements in the

online courses and the most important features of online courses. The most frustrating elements included disorganization of content, too many clicks, inconsistent navigation, confusing menu, too many menu options, and distracting visuals (Reeder, 2018). There were three general areas of the most important features for the participants. These areas include organizational items (easily understandable menu, organized sequence, fewer clicks, and fewer menu buttons), visual elements (embedded media, visual cues, and clear visual layout), and consistency (course to course and course to course consistent menu) (Reeder, 2018). The survey results also revealed that the participants preferred the organization of the course either by chapter or unit list, assignments, readings, activities, module-based by topic, or weekly organized by dates (Reeder, 2018).

The think-aloud session consisted of six participants that completed a list of scenario-based tasks in three different online courses, and each course was in a different online learning environment. From the think-aloud usability test results, nine different categories emerged “(1) frustration; (2) excitement; (3) feeling of being lost; (4) confusion; (5) disgust; (6) positivity; (7) anxiety; (8) understanding; (9) action” (Reeder, 2018, p. 56).

Several areas of frustration, anxiety, and feeling lost and confused were revealed. These include, but are not limited to, the following:

- Being overwhelmed by so many words
- Having to click too many times
- Having to scroll and search for so many things with the feeling of missing important information
- Having to print content because it was difficult to read it on the screen

- Feeling lost and not being able to find content or important assignment information due to poor navigation
- Feeling overwhelmed and unable to organize and manage time because the instructor hid weekly module content (Reeder, 2018)

The participants were excited about the availability of the syllabus or course assignment schedule in some of the online courses (Reeder, 2018). In contrast to the study by Miller-Cochran and Rodrigo (2006), the participants in this study searched immediately for the course syllabus. When the participants became confused or lost in the course, they would refer back to the syllabus and use it as a manual for the course. (Reeder, 2018). Some other positive attributes were being able to find the instructor's contact information easily.

The follow-up reflective interviews were conducted after the think-aloud session and revealed positive and negative feelings, along with poignant points (Reeder, 2018). Some positive items among the three different courses included the following: use of headings to make content clear, good navigation helped the participants, and presenting information in one place for assignments, due dates, expectations, and submission location (Reeder, 2018). Some negative items amongst the three different courses included the following: the course calendar feature did not work properly, the assignment and activity titles were confusing, and too many clicks were needed to find and access items. The course design was so poorly that a student expressed the desire to withdraw from the class because it was so disorganized and frustrating to find the content and expectations of assignment activities (Reeder, 2018).

Reeder's (2018) study provides insightful information on students' perspectives of online courses. The common themes that emerged aligned to the three criteria this study focused on, navigation is intuitive, instructions are written clearly, and information

is chunked. The study by Reeder (2018) also revealed how students could become so frustrated by poor design and usability that it hinders their learning experience, and one participant said they would consider a course withdraw.

Just as a face-to-face student attends classes to learn, so do online students. The online course design needs to be done properly so that the course itself does not become a barrier to the learner. This current study is an expansion of and takes guidance from Reeder's (2018) study. The instrument used in the study by Gregg et al. (2017) serves as the foundation for the usability test conducted in this study. The authors granted permission to use the instrument and modify it to meet the needs of this study.

While the study by Reeder (2018) examined three different courses in three different learning environments and learning management systems, this study examined asynchronous online courses that use a template model. The template model means that the course navigation and general structure are identical amongst all courses. Regardless of which course the learner is enrolled in, the main course navigational menu is the same, and the course is organized into nine weekly modules. The course content varies in the specific activities and assignments, but the courses' general holistic design is the same.

Using the criterion of quality online courses (navigation is intuitive, instructions are written clearly, and information is chunked), along with the three multimedia learning principles (coherence, signaling, and segmenting), usability testing was conducted to gain insights on students' perceptions for online course design and usability. The following chapter explains the methodology for this study.

Theoretical Framework

Online courses can add additional layers of complexity for learners. One goal for designing online courses is to help reduce extraneous learners' cognitive load by improving general navigation, usability, and visual design in the course, so the learner can concentrate on the learning materials and activities instead of learning how to understand the course as a display structure. The theoretical framework is based on Sweller et al.'s (1998) cognitive load theory and Mayer's cognitive theory of multimedia learning, focusing particularly on elements of usability and visual web design principles. According to Miller (2011), implementing "clear and usable interaction with the instructional materials" (p. 315) can reduce learners' extraneous cognitive load, allowing dedication of mental effort and concentration to learning and performance.

Cognitive load theory relates to the cognitive process of transferring information from short-term memory to long-term memory while dealing with limitations of working memory (Sweller et al., 2019). There are three categories of cognitive load, intrinsic, extraneous, and germane. Extraneous load relates to the learner's cognitive requirements based on how the learning materials are presented to the learner (Deegan, 2015). The framework of this study concentrates on the attempt to reduce extraneous cognitive load through the best practices of visual web design, usability, and multimedia learning principles applied in online courses.

Mayer has conducted years of research on multimedia content and cognitive load. The cognitive theory of multimedia learning focuses on designing effective multimedia content to help reduce cognitive load (Mayer, 2017). Throughout his research, Mayer has defined several multimedia learning principles to help provide

guidance when designing multimedia materials. Online courses are in a web environment and often include a combination of images, text, audio, or video, making them multimedia materials. There are a few similarities in the different multimedia learning principles and best practices for visual and web design, which have been demonstrated in this chapter. These similarities include but are not limited to intuitive navigation, segmented and organized content, clear communication without extraneous information, and clean layouts that are not overwhelming and confusing. The goal is to create a course design that allows the learner to focus on the learning materials, synthesize the information, and successfully complete the learning assessments in the course without adding extra barriers of poor design and navigation that would cause an increase in extraneous load.

Summary

This chapter provided a review of the literature on the topics important to this study. This chapter identified gaps in the research and introduced the theoretical framework for this study. Based on the existing literature and the gaps in the literature, the next chapter explains the methodology of this study.

CHAPTER 3

METHODOLOGY

Introduction

The purpose of this exploratory qualitative study was to examine the perceptions of online learners regarding online course design, focusing on the subjective criteria that include intuitive navigation, clearly written instructions, and segmented information. This study examined participant perceptions of the overall course design and function, along with the details of individual webpage design used to display instructional and directional content utilizing the implementation of three multimedia learning principles: coherence, signaling, and segmenting.

Topic of Inquiry

This chapter outlines the proposed methodology to address the following topics of inquiry.

1. In an intentionally designed asynchronous online course, how, to what extent, and why do learners describe their experience with the learning management system's navigation as intuitive? (Each of the following subtopic questions will help frame the Topic 1 analysis to guide analysis of the qualitative data gathered during think-aloud interviews and reporting.)
 - a. What are the main items learners expect to find on their first day of class in an asynchronous online course?
 - b. How do learners navigate online courses?
2. In an intentionally designed asynchronous online course, how, and to what degree, do learners describe information and directions as being segmented in ways that improve intelligibility and enable them to complete activities successfully?

(Each of the following subtopics is explored as part of explaining the Topic 2 participant experiences as part of the etic coding process to aid in the analytic sensemaking process and provides defining concepts rooted in the multimedia learning explanatory framework.)

- c. Coherence Principle: What are the perceptions and preferences regarding excluding irrelevant content and information, which help learners regarding usability in asynchronous online courses?
 - d. Signaling Principle: What are the perceptions and preferences of webpage design elements, such as headers, icons, and alert boxes, which help learners regarding usability in asynchronous online courses?
 - e. Segmenting Principle: What are the perceptions and preferences regarding web page design elements, such as content organized in sections, tabs, or expanders, which help learners regarding usability in asynchronous online courses.
3. To what extent, why, and how do participants describe different aspects of the asynchronous course as being usable according to common usability principles?

Pilot Study

The study described in the following sections consisted of two rounds. The initial round served as a pilot study with a sample size of one, and the second round was the final usability test with a larger sample size of five. The setting, recruitment procedures, and participant descriptions were the same for the pilot study portion and the final usability test portion. The purpose of conducting a pilot study was to refine the instrument (Ravitch & Carl, 2021). The pilot study served to ensure the following:

- The questions and task scenarios for the usability test are clear for the participants to understand.
- The data collected from the usability study align with the research questions.
- The amount of questions are sufficient (not excessive or moderate).

Minor modifications discovered in the pilot study were implemented in the usability study for the rest of the participants. These modifications consisted of consolidating two follow-up questions and minor rewording to ensure clarity of the tasks and questions. According to Ravitch and Carl (2021),

Piloting instruments create data that are used to drive data-based changes to your study. These data may or may not be used as part of the formal data set,

depending on how significantly you change or revise the instruments as a result of piloting them. (p. 90)

Since the changes made from the pilot study to the final usability test were minor and did not impact the participants' performance or data collected, the data from the pilot study were included in the overall data analysis.

Research Design

This study used a qualitative approach by conducting a usability test consisting of think-aloud and task scenario protocols. Usability tests can occur in several different forms (Bjork, 2018). Conducting a usability test requires examining how users interact with a website or software, and how the processes and components of the product impact the user's ability to successfully complete the intended tasks of the product (Mitchell & West, 2017; Warren et al., 2011). Research by Nielsen (2000, 2012a, 2012b, 2012c) shaped how usability testing is done today, including think-aloud protocols and task scenarios (Bjork, 2018).

Nielsen (2012b) defined think-aloud testing as asking the “participants to use the system while continuously thinking out loud — that is, simply verbalizing their thoughts as they move through the user interface” (Defining Thinking Aloud Testing, para 1). Gregg et al. (2018) described think-aloud protocol “observing individuals as they navigate a website while they attempt to complete specific tasks and simultaneously externalize their internal thought processes” (p. 18). There are advantages and disadvantages to conducting think-aloud testing. Some advantages to think-aloud testing include the aspect that only a small sample size is needed, the method can be used for almost any type of technology interface, and the researcher can gather robust data from participants (Nielsen, 2012b). Some disadvantages to think-aloud testing

include putting a user in an unnatural setting and asking them to talk through their process, so users may not say everything going through their mind and could filter what they say, and intervention from the facilitator could impact results (Nielsen, 2012b). Several studies have utilized think-aloud protocols (Bjork, 2018; Fisher & Wright, 2010; Gregg et al., 2017; Miller-Cochran & Rodrigo, 2006; Reeder, 2018; Reid et al., 2016) to learn how to improve websites and online course environments. These studies provided informative results on practices for design and how users interact with content.

Another protocol is task scenario, which has participants complete practical tasks to provide insight into areas that cause trouble for users and improve the design (McCloskey, 2014). Several studies asked participants to conduct tasks that simulate actual activities a user would normally do within that environment. For instance, Miller-Cochran and Rodrigo's (2006) study had participants perform typical online student tasks such as finding the syllabus, assignments, deadlines, take quizzes, and post to discussions. In Reeder's (2018) study, participants were asked to find the information for contacting the instructor, the syllabus, the course schedule, and identify discussion and participation requirements. In the study by Gregg et al. (2017), participants were asked to locate information for different course activities, such as a due date for a quiz, general workload of assignments for the upcoming week, information for discussion participation guidelines, where to find their grades, along with logistical tasks including how to set up email notifications for course announcements and how to contact team members for a project. These three studies used a think-aloud protocol and task scenarios in conjunction with each other to gather more in-depth data on the usability of the course and the participants' perceptions. This current study used the same practices

of think-aloud and task scenario protocols during the usability tests because they provide an opportunity to reveal what the participant is truly thinking about the design, insight into any design misconceptions, and an awareness of what items cause the participants to have trouble (McCloskey, 2014; Nielsen, 2012b). The participants also completed a short online survey, which provided information on their prior experience regarding online courses, along with some demographic information.

Setting

The usability tests were conducted remotely using the web conference tool Zoom for a few reasons. The participants lived in various locations, which were different from my own location. Due to the current global pandemic, remote usability sessions were also in the best interest regarding safety for both myself and participants. Zoom was available for free to me and participants through my university account. Zoom also has the capability to record the users' screen, video from the webcam, and audio of the conversation during the usability test session.

Participants

The study consisted of a total of six participants enrolled in online courses for the pilot study and the final study. Two different groups of participants were recruited for this study. These two groups are identified as internal and external participants.

The internal participants are online students enrolled in an online course at the private university where I work. The internal participants had some prior experience with the overall navigation and structure of the template used to design all of the university's online courses.

The external participants were students enrolled in at least one online course at a

different higher educational institution (university, community college, state college, etc.). Since the external participants were not familiar with the university's online courses' overall course navigation and structure, they provided a perspective of a user brand new to the online course, along with additional insight compared to the internal participants.

Three internal participants were recruited from the private university through announcements posted in several online graduate and undergraduate courses offered in various degree programs. An additional three external participants were recruited through listservs, social media groups, and professional memberships within the field of educational research. Each participant received a \$10 gift card for participating in the usability study. According to Nielsen (2000), it is better to use small groups of no more than five people when conducting usability tests. Nielsen (2012c) stated the main reason for the small sample size is due to return on investment, and “there’s little additional benefit to running more than five people through the same study” (How Many Test Users in a Usability Study?, para 4). If testing users from different groups, three participants from each group would be ideal to guarantee that the diversity of behavior within the group has been examined (Nielsen, 2000).

The aim of this study is to gain perceptions from internal and external participants regarding the usability of the online courses, which are purposely designed to meet the three criteria: navigation is intuitive, instructions are written clearly, and information is chunked.

Demographic Information

There were a total of six participants in the study consisting of three internal

participants and three external participants. The external participants are online students attending other higher educational institutions in Florida, Texas, and North Dakota and do not have experience with the private university’s online courses or template structure.

Figure 1

Demographic Information: Breakdown by Gender amongst Internal and External Participants

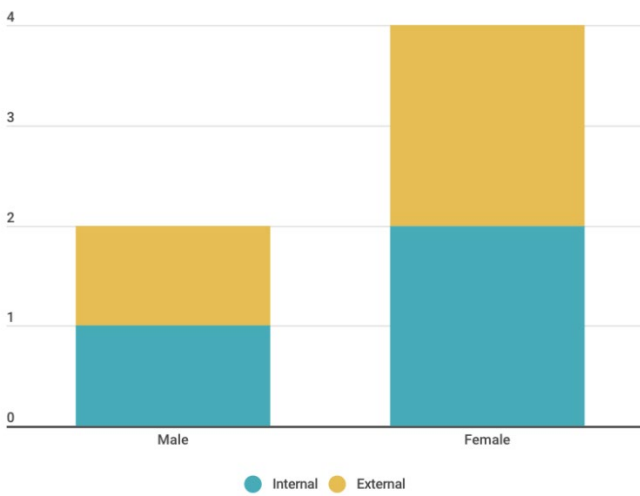
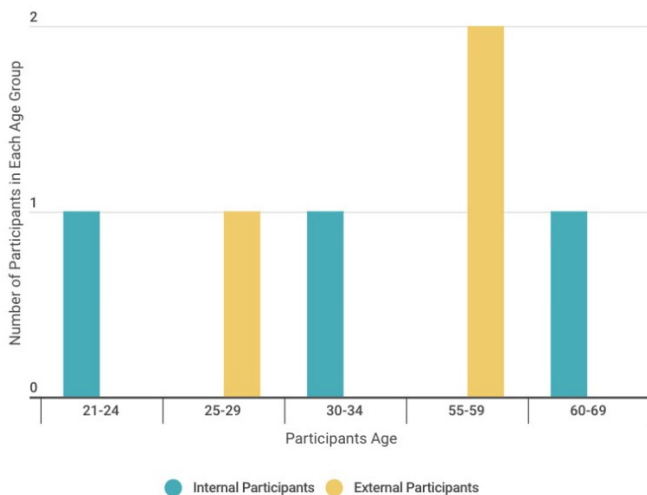


Figure 2

Demographic Information: Breakdown by Age Groups amongst Internal and External Participants



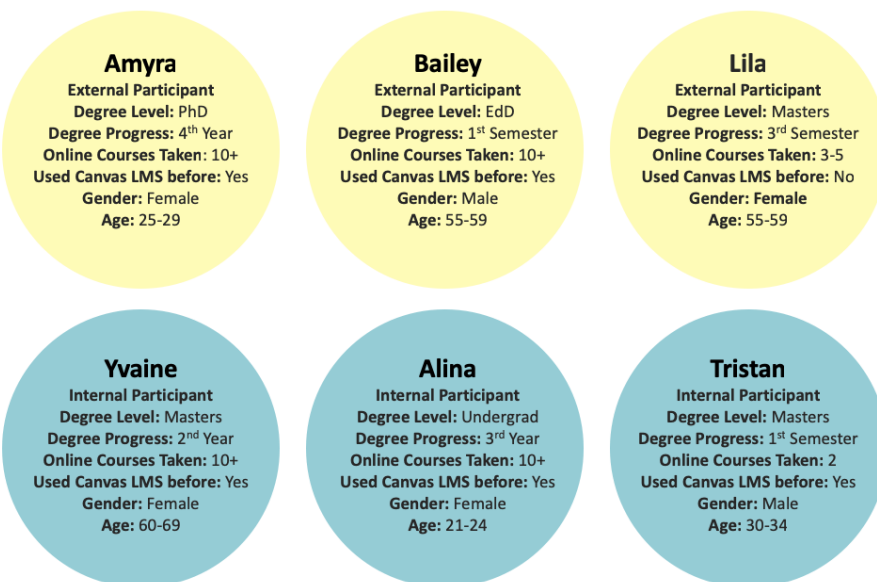
Each group of participants, internal and external, consisted of two females and one male, for a total of four female participants and two male participants (See Figure 1). Internal participants consisted of one participant from the age groups 21-24, 30-34, and 60-69. One of the external participants is in the 25-29 age group, and two of the external participants are in the 55-59 age group (see Figure 2).

Summary of Participants

The participants reflected a variety of online learners, which is representative of the student population taking online courses at the private university. Most of them were adult learners, which is the primary demographic of online students at the private university. The following sections provide a depiction of each participant, demonstrating their relevance for providing data for this usability study. Figure 3 shows a summary overview of the participants. The participants' names have been replaced with pseudonyms to protect their identity.

Figure 3

Summary Overview of the Internal and External Participants



Amyra

Amyra is an external participant between 25-29 years old. She is in her fourth year of a Ph.D. program related to instructional design and learning technologies. She has taken over ten online courses in her academic career and has used Canvas as an online student. During the usability test, Amyra was methodical while navigating the course, examining the content, and thoroughly explained her thoughts.

Bailey

Bailey is an external participant between 55-59 years old. He is in his first semester of an Ed.D. program related to instructional design and learning technologies. He has taken over ten online courses in his academic career and has used Canvas as an online student. During the usability test, Bailey quickly navigated through the course and pages and was straight to the point regarding the think-aloud aspect. Even though Bailey is an external participant and had never taken any of the university's online courses, he found the discussion participation expectations, along with the general course and syllabus information, similar to other online courses he has taken in the past at other universities. Throughout the usability test, Bailey referred to time management and features in the course navigation and design that would help save or take extra time.

Lila

Lila is an external participant between 55-59 years old. She is in her third semester of a Masters' program related to instructional design and learning technologies. She has taken three to five online courses in her academic career; however, she has never used Canvas as an online student. During the usability test,

Lila took her time while thoroughly reading instructions and exploring the course's navigation and content. Lila stated, "I'm a person who tends to read instructions first." Lila expressed being a little overwhelmed at the beginning of the usability test because she had never used Canvas before. However, after completing a few tasks in the usability test, she understood the course structure and began to find things with ease.

Yvaine

Yvaine is an internal participant between 60-69 years old. She is in her second year of a Masters' program at the private university related to aviation business. She has taken over ten online courses in her academic career and has used Canvas as an online student. During the usability test, Yvaine demonstrated that she was comfortable with the course by navigating and reading through the pages with ease and promptness. She explained that she was almost finished with her degree and only had three courses to complete. She was familiar with not just the course navigation and structure but also the expectations for general discussion and assignments of the courses. She also expressed that she is an airline pilot, so she tends to download her readings and other course content in order to work offline when possible.

Alina

Alina is an internal participant and is between 21-24 years old. She is in her third year of an undergraduate program related to communications at the private university. She has taken over ten online courses in her academic career and has used Canvas as an online student. During the usability test, Alina demonstrated that she was familiar with the course navigation, boiler plate template items, and general activity expectations.

Tristan

Tristan is an internal participant and is between 30-34 years old. He is in his first semester of the master's program related to aviation at the private university. He has taken two online courses in his academic career and has used Canvas as an online student. Even though Tristan has only taken two online courses at the university, he demonstrated that he was comfortable and knowledgeable regarding the course navigation, boiler plate template items, and general activity expectations.

Materials

The online courses for the distance learning campus utilize a template model. This means that all courses across the different degree programs have the same navigational menu, along with a standardized module titled "Start Here" that includes university and academic-related resources. The courses also have a weekly module structure for the course content. Many of these consistent features implemented in the course come from recommendations of the QM Rubric.

The courses' overall navigation and format are identical; however, each courses' curriculum content is unique. There is a style guide, which the instructional designers use when creating the online courses for general individual page layout that include standards for best practices in accessibility, web design, and multimedia learning principles. Some items in the style guide that addresses accessibility include, but are not limited to:

- Using alt text for images
- Linking descriptive text instead of spelling out a website url
- Indicating the time duration for videos in the course

- Using proper headings

For web design best practices, the style guide recommends

- Use headings and page layout to demonstrate the hierarchy
- Use float codes to align images and do not use tables for page layout
- Use bold and other font formatting appropriately - not excessively
- Use an appropriate amount of white space - not excessively

The style guide also includes elements from the multimedia learning principles of signaling and segmenting. These include, but are not limited to:

- Utilizing bold, italics, and icons effectively for signaling
- Using headings for sections
- Organizing content into tabs, expanders, or accordions to break down large amounts of content for segmenting

Since the template model is used for the online courses, the usability test allows for a closer look at the individual page layout and presentation of curriculum and directional content, in addition to the usability of the overall course. While the purpose of the usability test is to see if the participants can successfully complete the tasks or not, the think-aloud protocol can provide insightful data as to why the participant was successful or not. Observational field notes from the usability test can also provide insight regarding if the participant is reading, hovering their mouse, scrolling or clicking, along with other computer user behaviors and expressions such as frustrations or ease of use. These data can reveal areas that need improvements, such as design, clarity of instructions, or other factors.

Data Collection

Prior to the usability test session, the participants completed an online

demographic survey (see Appendix A for the entire survey). The demographic information consisted of the following:

- Age
- Gender
- Degree level (undergraduate, graduate, etc.)
- Degree major
- How far along are they in their degree program?
- How many for-credit online courses have they completed?
- Which learning management systems have they used?

This information provided insight into the participants' prior experience with online courses in learning management systems.

Regarding the usability portion, I met with one participant at a time to go through the session. The usability test session lasted around 60 minutes. Miller-Cochran and Rodrigo (2006) included the following tasks in their usability study for online courses:

- Show and explain to the administrator what you would do to get started in the course.
- Start at the homepage right after logging into the course.
- Find the syllabus for the course.
- Find the first module in the course (p. 106)

Miller-Cochran and Rodrigo (2006) also recommended incorporating the following tasks for the participants to complete in the usability test

- Tasks they would need to be able to do in any online course (i.e., find assignment prompts, deadlines, syllabus)
- Tasks they must do repeatedly in this specific course (i.e., take quizzes, post to discussion boards, upload to a course drop box) (p. 102)

While the study by Miller-Cochran and Rodrigo is not a recent study, these tasks of a typical online learner still apply to the current study.

Gregg et al. (2017) also conducted usability studies consisting of think-aloud and task scenario protocols, which specifically focused on navigating courses within the Canvas LMS, similar to this study.

This usability test was one session consisting of think-aloud and task scenario protocol; however, it consisted of two distinct parts. Part 1 of the usability test focused on course navigation. This part was derived from the Penn State University Canvas UX usability test conducted by Reid et al. (2016) and Gregg et al. (2017). The original authors granted me permission to use and customize the existing instrument (see Appendix G). In this portion of the think-aloud usability test, I verbally asked the participants to complete a task that an online student would do, for example, find the syllabus, locate a due date for an assignment, etc. (Gregg et al., 2017; Miller-Cochran & Rodrigo, 2006; Reeder, 2018; Reid et al., 2016). The participant talked through their thought process while trying to navigate the course to complete the task I gave them.

Part 2 of the usability test focused on content page layouts for course assignments and activities. Three types of activities were used, an assignment page, an instructional page describing the full details of a course-long project containing multiple assignments throughout the course, and a readings and resources page. For the assignment and project pages, there were three versions of the page layout design. Each page contained the same text content, with a few exceptions explained later in this section, and an image relating to the page content.

The first version of the page, referred to as No MMLP, had minimal design layout

to the directional content. The page contained spaces between paragraphs, correct spelling, and grammar, but no clearly defined sections or elements of signaling (headings, bold formatting, icons, etc.). The second version of the page, referred to as Some MMLP, had the same content; however, it included headings, appropriate use of bold formatting, and other minimal formatting. The third version, referred to as Full MMLP, had styled themes applied using Design Tools by Cidi Labs, which included colored banners, stylized headings, content organized and segmented, and the use of icons.

The participant did not need to complete the assignments or course project; however, they were asked to identify specific information on the page. The participants were asked to find some items on the various pages, including assignment due dates and various activity requirements. The purpose of having the participants search for this information was not to see if they could answer the questions correctly, but to have the participants use the page and examine the content formatted in the various layouts. I verbally asked the participants to answer questions about the page content and their overall thoughts regarding the page content organization for all three versions. Specific details of the assignment, such as when it was due, the number of pages required, etc., were modified within each of these layouts. When the participants were asked questions about the assignment on all three versions, the participant needed to examine the content within the layout and not memorize the requirements on the other page layouts.

There were also variations of a content page with information about the module's readings and resources. There were a total of five different page layouts for the readings and resources. The first three variations followed the same pattern as the

assignment and course project: No MMLP, Some MMLP, and Full MMLP. However, there were two additional Full MMLP page variations. Each of the three Full MMLP pages used a web page layout feature of expanders, tabs, or accordions, respectively. Expanders, tabs, and accordions are interactive panels of content used to segment large chunks of content. The participants answered questions about the different page layouts regarding the clarity and usability of how the content is organized on the page.

Both parts of the usability test also included some follow-up questions after the task scenarios were completed. The entire instrument, including screenshots of the page layouts and examples of the expanders, tabs, and accordions, is located in Appendix B.

Data Analysis

The usability sessions in Zoom were recorded and saved as videos. Zoom has a feature to automatically generate text transcripts of the audio from the recording. I cleaned the transcript files to remove any instances of the participants' real names and replace the names with a randomly generated pseudonym. I also listened to the recording and corrected any imperfections and inaccuracies from the automatically produced transcript generation process to ensure the text transcripts match the recording.

I also created field notes from the video recordings to indicate any non-verbal cues from the participants, such as frustration and any noticeable patterns of navigation by the users with the screen share captures from the session. The field notes also contain information regarding the participants' attempts to complete the tasks, along with anecdotal notes regarding why they succeeded or failed. For example, the

anecdotal notes included a certain step in the process that confused the participant or information about multiple participants struggling with similar issues.

The field notes and transcripts were imported into NVivo, where I coded and analyzed the data from the sessions. Several iterations of coding were conducted to analyze and organize emerging themes and categories.

First and second cycle coding methods were applied to the data from the think-aloud and task scenario protocol elicitations, along with the observation field notes. According to Saldaña (2016), Initial Coding is “a first cycle, open-ended approach to coding the data with some recommended general guidelines” (p.115). During the first cycle coding process, qualitative data are broken down into distinct parts and examined for similarities and differences (Saldaña, 2016). Utilizing these coding methods helped identify a hierarchy of categories and emerging themes from the usability tests.

Etic and emic coding were utilized for analysis. According to Ravitch and Carl (2021), etic coding is the process of examining the data for something specific based on “prior literature, prior research, or even your own informal theories” (p. 265). Emic coding is an inductive approach in which the coding verbiage aligns very closely with the verbiage in the data, and the meanings and themes emerge from the data (Ravitch & Carl, 2021; Tracy, 2013).

Based on prior literature, topics of inquiry, and the nature of the tasks and questions in the usability test, etic coding was used with predetermined categories. For example, categorizing the user experience into positive and negative categories (Reeder, 2018). Fisher and Wright (2010) found themes relating to readability and clarity regarding specific page layout of directions. Also, specific task steps such as

reading, hovering, scrolling, and clicking can be used to identify usability themes and categories from the observational field notes (Gregg et al., 2017). Based on the topics of inquiry and the predefined tasks in the usability test, I also explored the following overarching themes and categories in the data.

- Intuitive navigation
- Clarity of instructions
- Coherence principle
- Segmenting principle
- Signaling principle
- Navigational methods

Other emic codes, which were not predefined, were created and used as needed during the iterative coding process.

To ensure trustworthiness and credibility, triangulation for the data analysis was conducted with a total of three researchers. Once I identified the categories and subcategories during the coding process, a second and third researcher examined the categories for accuracy and clarity. The three researchers needed to have a consensus on the categories. Any disagreements were discussed to come up with categories in which there was agreement. If there was no consensus with specific categories amongst the three researchers, those categories were removed.

Synopsis of Cases, Categories, and Codes

Cases

Once the transcript documents were imported into NVivo for coding, I created pre-defined cases for each participant, each task from Part 1 of the usability test, each

version of the different page layouts from Part 2 of the usability test, and each of the planned follow-up questions throughout the usability test. I coded the dialog for each participant to their respective cases. Then I went through each of the transcripts and coded the dialog pertaining to each task, page layout, and planned questions to their respective cases. These cases consisted of the following:

- Participants (a case for each participant)
 - 01_Amyra
 - 02_Bailey
 - 03_Lila
 - 04_Yvaine
 - 05_Alina
 - 06_Tristan
- Tasks (a case for each task in Part 1 of the usability test)
 - Task 1 – 1st Day
 - Task 2 – Syllabus
 - Task 3 – Module Topic & Objectives
 - Task 4 – Upcoming Assignment Workload
 - Task 5 – Reading Activity
 - Task 6 – Disc Participation
 - Task 7 – Due Date
 - Task 8 – Course Long Project WCBT
 - Task 9 – Find Grades
- Page Layout (a case for each page layout examined in Part 2 of the usability test)
 - Assignment – V1 – No MMLP

- Assignment – V2 – Some MMLP
- Assignment – V3 – Full MMLP
- Project – V1 – No MMLP
- Project – V2 – Some MMLP
- Project – V3 – Full MMLP
- Resources – V1 – No MMLP
- Resources – V2 – Some MMLP
- Resources – V3a exp. – Full MMLP
- Resources – V3b tab – Full MMLP
- Resources – V3c acrd. – Full MMLP
- Questions (a case for each structured question in Part 1 and Part 2 of the usability test)
 - Intro – Q2 – 1st day
 - PT1 – Follow Up – Q1 – Impressions for Course and Tasks
 - PT1 – Follow Up – Q2 – Home Page
 - PT1 – Follow Up – Q3 – Module Structure
 - PT2 – Follow Up – Q1 – Visual Design of Page
 - PT2 – Follow Up – Q2 – Color and Themes
 - PT2 – Follow Up – Q3 – Headers, Bold, Icon
 - PT2 – Follow Up – Q4 – Expander, Tab, Accordion
 - PT2 – Follow Up – Q5 – Overall Course Design Page Layout

An additional set of cases were created for each of the three criteria for quality course design: information is chunked, instructions are written clearly, and navigation is intuitive. Each of these three cases contained two subcategories indicating if the criteria were met or not. The data were coded to these cases based on the course content. For

example, all of the page layouts that did not segment the content were coded as No – Info Not Chunked. Data from the participant’s dialog were also coded accordingly. For example, the participant expressed that the instructions were or were not clear, or the navigation was or was not intuitive. The following represents the case structure.

- Course design criteria
 - Information is chunked
 - No - info not chunked
 - Yes - info is chunked
- Instructions written clearly
 - No - instructions not clear
 - Yes - instructions are clear
- Navigation is intuitive
 - No - nav not intuitive
 - Yes - nav is intuitive
 - Navigational dead ends

A third sub-category, Navigational Dead Ends, was added to the Navigation is Intuitive case category. Anytime the participant expressed unexpected behavior in the navigation, or they could not find something in particular due to navigational issues, these instances were coded in this sub-category accordingly.

Some demographic attributes were added to each participant case, including internal and external participant status, degree status, degree progress, age group, gender, and prior Canvas experience. Attributes were also added to the other cases pertaining to the usability test components. Some of these attributes were applied where applicable, including alignment to each topic of inquiry, application of multimedia

learning principles (none applied, some applied, or fully applied), types of multimedia learning principles applied (signaling, segmenting, and/or coherence), and designation for expanders, tabs, and accordions.

Figure 4

Crosstab Query in NVivo of User Experience Codes and Sub-Codes and Their Coding Frequencies between Internal and External Participants

Codes	Internal or External Student = Internal (n=3)	Internal or External Student = External (n=3)	Total (n=6)
<input type="radio"/> Negative UE	2	3	5
<input type="radio"/> Confusion	2	3	5
<input type="radio"/> Dislike - existin...ture or attribute	2	2	4
<input type="radio"/> Frustration	1	0	1
<input type="radio"/> Overwhelmed	0	2	2
<input type="radio"/> Positive UE	3	3	6
<input type="radio"/> Consistency	2	1	3
<input type="radio"/> Consistent - Ca...s LMS Attribute	0	1	1
<input type="radio"/> Consistent - Course Design	2	1	3
<input type="radio"/> Consistent - Template Model	2	0	2
<input type="radio"/> Easy to Navigate	2	3	5
<input type="radio"/> Helpful	1	3	4
<input type="radio"/> Intuitive	1	3	4
<input type="radio"/> Like - existing feature or attribute	3	3	6
<input type="radio"/> Time Management	3	3	6
Total (Unique)	3	3	6

The process of adding these particular dialog elements into their respective cases and adding attributes helped organize the content for coding and for running crosstab, matrix coding, and other queries for analysis. For example, Figure 4 shows a crosstab containing the coding frequencies of some of the codes and sub-codes within the User Experience category and how they compare amongst internal participants and external participants.

Categories and Codes

Etic Codes

Several predefined categories and codes were used in the initial etic coding

process. Some of the categories, codes, and sub-codes were based on the literature in Chapter 2, the topics of inquiry, or the nature of the usability test. These categories and codes include:

- User experience
 - Positive user experience
 - Negative user experience
- Participant navigation behavior
- Multimedia learning principles (MMLP)
 - Signaling
 - Bold
 - Color usage
 - Headings
 - Icons
 - Segmenting
 - Bullet or ordered list
 - Chunking
 - Expanders
 - Tabs
 - Accordions
 - Coherence
- Page design and layout attributes
 - Positive page design attributes
 - Negative page design attributes

The user experience and participant navigation behavior categories have been used in prior studies and aligned with the general theme of the topics of inquiry. Specific codes

and sub-codes were created in the emic coding process.

Categories were created for each of the three multimedia learning principles, in which this study focused regarding page layout. These categories, codes, and sub-codes align with the second topic of inquiry. Sub-codes were created for the common design practices, elements, and attributes related to each of the multimedia learning principles. For example, based on the literature in Chapter 2, using headings, bold, and graphical cues are common ways to apply the signaling principle. These design elements were also used in the page layout variations, so sub-codes were created for each of these design elements within their respective principle. As participants referred to these design elements, the transcripts were coded accordingly.

The categories of the page layouts were predefined based on the nature of the instrument for the usability study and to capture data that addressed the second topic of inquiry. Positive and negative codes were predefined, but the other sub-codes were created through the emic coding process.

The usability test examined navigation and different page layouts with a variation of multimedia learning principles applied. While some categories and codes applied mainly to the navigation portion and other categories and codes applied mainly to page layout and multimedia learning principles, several of these categories and codes did overlap throughout the usability test dialog.

Emic Codes

Other categories, codes, and sub-codes emerged throughout the iterative emic coding process. Cognitive load, course attributes, and course navigation attributes emerged as overarching thematic categories. Several codes and sub-codes were

created for all of the overarching categories during the emic iterative coding process.

1. Cognitive load: While this study did not measure cognitive load using psychometrics, the theme of cognitive load relative to their interactions with the content emerged as users identified specific examples in the course design, navigation, and page layouts that made their experience easier or more difficult. The two principal codes under the cognitive load category were potentially causes extraneous cognitive load and potentially reduces extraneous cognitive load. These titles are for internal coding terminology. The content associated with these two codes does not prove if the navigation or design caused or reduced cognitive load for the participant. However, in many of these examples the participants described, which are organized in these respective codes, coincide with the recommended practices of course design and multimedia learning principles, which have been attributed to either help reduce or contribute to extraneous cognitive load according to the prior research described in Chapter 2. For example, Bailey stated the following about the Project page layout with signaling, segmenting, and coherence principle applied: "I like it. This is almost chunking. I've got a chunk here, a chunk here, a chunk there. it's easier for me to process." Bailey's observation of using design elements to chunk content aligns with the segmenting principle helping to reduce cognitive load.

2. Course attributes: The course attributes category, codes, and sub-codes emerged as the participants referred to the organization of the course and different content areas or attributes of the course as items they were looking for, not in a navigational context, but as a way to find information or complete tasks. Some examples include discussions, syllabus, schedules, grading information, instructor

information, instructor communication and feedback, due dates, assignment verbiage, etc. For example, Amyra stated that at the beginning of the course, she would: “look at the instructor bio to kind of see who is this professor, what kind of expectations, or what's their contact information.” She was not looking for a specific navigational element but instead for that particular course attribute and information. This category, along with the many codes and sub-codes, helped identify what course attributes were important, useful, or not useful to the different participants.

3. Course navigation attributes: The course navigation attributes category, codes, and sub-codes emerged as the participants referred to the different specific navigational elements in the course such as the course main menu, Canvas main menu, modules area, along with the navigation items on the home page such as the Start Here button, module links, etc.

Several codes and sub-codes within these categories also emerged. Some of these categories and codes include time management, home page navigation, along with many other sub-codes. For a complete list of categories, codes, sub-codes, and definitions, please view the codebook in Appendix I.

Summary

This chapter described the different aspects of the methodology for this study. The methodology explained the logistics of the research design, a summary of participants, data collection, and data analysis. The etic and emic coding process was presented, along with a synopsis of the cases, categories, codes, and the code book. The following chapter presents the research findings of this study.

CHAPTER 4

RESEARCH FINDINGS AND ANALYSIS

Introduction

This chapter discusses the findings from the usability tests data, which consist of transcripts from the recorded sessions and field notes of my observations. Throughout this chapter, direct quotes from the participants are used. Within the quotes of the participant responses, anything in brackets and italics indicates my observed action of the participant. Thematic categories and codes were identified from the data in the transcripts and embedded field notes through an iterative coding process. The following sections provide an overview of the thematic categories and patterns. Results and interpretation of the data analysis for both parts of the usability test, which focus on course navigation and page design layout, are also presented.

Examining Patterns and Relationships of Cases, Categories and Codes

The iterative etic and emic coding process identified seven main categories: user experience, cognitive load, multimedia learning principles, page design and layout attributes, course navigational attributes, course attributes and information, and participant navigational behavior. Within these categories, codes and sub-codes were identified. In order to examine emerging themes and relationships amongst cases and categories, several crosstabs and matrix coding queries were created in NVivo. Some of these queries examined the coding frequencies of the categories for cognitive load (potentially reduces and potentially causes), user experience (positive and negative), and page design layout (positive and negative) amongst all of the individual tasks in Part 1 of the usability tests as presented in the following image.

Figure 5

Crosstab Query in NVivo of the Coding Frequencies for Positive and Negative Codes in Each of the Cases Representing Completed Tasks in Part 1 of the Usability Test

Cases	Potentially Causes Extraneous Cognitive Load	Potentially Reduces Extraneous Cognitive Load	Negative Design Layout	Positive Design Layout	Negative UE	Positive UE	Total
Task 1 - 1st Day	7	0	1	0	9	3	20
Task 2 - Syllabus	0	1	0	0	0	1	2
Task 3 - Module Topic & Objectives	0	2	0	0	0	1	3
Task 4 - Upcoming Assignment Workload	0	5	0	0	0	4	9
Task 5 - Reading Activity	0	0	0	0	0	0	0
Task 6 - Disc Participation	0	8	0	3	2	4	17
Task 7 - Due Date	0	1	0	1	0	1	3
Task 8 - Course Long Project WCBT	0	2	0	1	0	3	6
Task 9 - Find Grades	0	0	0	0	0	0	0
Total	7	19	1	5	11	17	60

While the numbers represent how often these categories and codes appear in the individual cases, the trends demonstrate that the participants had a positive experience while completing the tasks. While there were some negative experiences, most of those occurred in the very first task, where three of the participants were experiencing the course for the first time and had to learn their way around the course. In the first task, participants were not directed to find anything specific; they just demonstrated what they look for on their first day.

Another crosstab query examined those same coding frequencies amongst the individual page layouts from Part 2 of the usability test, as shown in Figure 6. The coding frequency from this query shows that the pages designated as No MMLP (minimal or no multimedia learning principles applied) tended to have more negative codes and codes relating to potentially causing extraneous load. Whereas the pages designated as Full MMLP (several multimedia learning principles and colored themes applied to the page) tended to have more positive codes and codes relating to

potentially reducing extraneous cognitive load, except for the page that used accordions (this is explained later in the Results section of this chapter).

Figure 6

Crosstab Query in NVivo of Select Coding Frequencies amongst the Cases for Each Page Layout the Participants Examined in the Second Part of the Usability Test

Cases	Potentially Causes Extraneous Cognitive Load	Potentially Reduces Extraneous Cognitive Load	Negative Design Layout	Negative PDL Attributes or Features	Positive Design Layout	Positive PDL Attributes or Features	Negative UE	Positive UE	Total
Assignment - V1 - No MMLP	8	0	15	7	0	0	0	0	30
Assignment - V2 - Some MMLP	3	4	4	0	3	0	1	2	17
Assignment - V3 - Full MMLP	3	6	4	1	14	3	6	3	40
Project - V1 - No MMLP	8	0	13	5	3	0	4	0	33
Project - V2 - Some MMLP	4	4	5	3	10	2	5	4	37
Project - V3 - Full MMLP	1	4	8	2	14	2	2	4	37
Resources - V1 - No MMLP	4	1	13	9	2	0	2	0	31
Resources - V2 - Some MMLP	3	5	4	2	13	4	2	3	36
Resources - V3a exp. - Full MMLP	0	7	4	0	14	8	4	13	50
Resources - V3b tab - Full MMLP	5	5	8	4	16	8	4	7	57
Resources - V3c acrd. - Full MMLP	8	0	12	9	6	4	3	1	43
Total	47	36	90	42	95	31	33	37	411

Results

The usability test consisted of two parts. The first part of the usability test focused on navigation and addressed the questions posed in the first and third topics of inquiry.

The second part of the usability test focused on the page layout with multimedia learning principles applied and addressed the second topic of inquiry.

1. In an intentionally designed asynchronous online course, how, to what extent, and why do learners describe their experience with the learning management system's navigation as intuitive? (Each of the following subtopic questions will help frame the Topic 1 analysis to guide analysis of the qualitative data gathered during think-aloud interviews and reporting.)
 - a. What are the main items learners expect to find on their first day of class in an asynchronous online course?
 - b. How do learners navigate online courses?
2. In an intentionally designed asynchronous online course, how and to what degree do learners describe information and directions as being segmented

in ways that improve intelligibility and enable them to complete activities successfully? (Each of the following subtopics will be explored as part of explaining the Topic 2 participant experiences as part of the etic coding process to aid in the analytic sensemaking process and will provide defining concepts rooted in the multimedia learning explanatory framework.)

- a. Coherence Principle: What are the perceptions and preferences regarding excluding irrelevant content and information which help learners regarding usability in asynchronous online courses?
 - b. Signaling Principle: What are the perceptions and preferences of webpage design elements, such as headers, icons, and alert boxes, which help learners regarding usability in asynchronous online courses?
 - c. Segmenting Principle: What are the perceptions and preferences regarding web page design elements, such as content organized in sections, tabs, or expanders, which help learners regarding usability in asynchronous online courses.
3. To what extent, why, and how do participants describe different aspects of the asynchronous course as being usable according to common usability principles?

What Learners Expect to Find on the First Day of Class

One of the subtopic questions in the first topic of inquiry asks what the main items learners expect to find on their first day of class in an asynchronous online course. At the beginning of the usability test, the participants demonstrated several similarities regarding what they were looking for and what they typically do on the first day of class. Locating the syllabus was the priority for five of the six participants. Most of the participants wanted to get a general idea of the assignments and projects they would have to complete during the course. Tristan explained that,

[I would] probably look at the syllabus first. I might, like know how like how the course is broken down. Because some do like the online forum-type discussion. Some do essay like two- or three-hundred-word essay posts. Some do like a paper. So, It's, kind of want to know, like how, what I'm doing for my grade.

Similar to Tristan, several of the participants wanted to know this information to

help them with their time management for the course. For instance, while looking through the syllabus, Yvaine stated, “I kind of go through the description and the syllabus to see is there anything like a final research paper that's going to be really daunting, that I'm going to have to worry about.” When she got to the grading information in the syllabus, Yvaine expressed, “I decided to take the course. Whatever I gotta do to get through it, I'm going to do it. It helps kind of evaluate time management.” Yvaine knows she is expected to complete the activities. However, she wants to be able to organize her time so she can do so successfully. Amyra also wanted to know about the assignments and stated, “I would just go straight to the course syllabus. And I would also note and see the due date of the assignment. So those are the two things that kind of stick out in my mind.” While most participants looked for the type of assignments, expected workload, and schedule information for time management in the syllabus, some participants looked through the modules area or the Canvas To-Do List feature. Participant utterances demonstrated that efficiency, from the navigation of the course to the overall experience of the course, is important to them so they can manage their time and successfully complete the course activities. Efficiency is a similar theme in the study by Reid et al. (2016).

Another item the participants looked for was the instructor bio and contact information. Both internal and external participants expressed wanting to find information about their instructor. The internal participants also demonstrated their knowledge of the requirement for students to email their instructor confirming that they had read the syllabus. Besides this requirement, Tristan stated he wanted to read his instructor's bio to see: “If they put about their background, or you know, any common

goals if they work for the airlines, a private charter, or something.” Tristan expressed that he works in the airline industry and wanted to see if he had anything in common with the instructor. Similar to Tristan, Alina also wanted to know more about the instructor. Alina stated she wanted to look at the instructor bio information item in the course for a particular purpose stating, “So I can be familiar with who I’m going to email.” The participants explained that they wanted to know their professors and connect with them. To that end, some participants expressed that having more information about the instructor helps them understand the class expectations and possibly how strict they would grade.

There are a few other areas of interest the participants expressed regarding what they looked for at the beginning of class. More than half of the participants wanted to know the reading activities for the first week of class or any videos they needed to watch and how long they were. Tristan wanted to know what textbook or required materials he needed to purchase for the course. Alina wanted to know about the module overview and objectives and stated that she wrote them down as a habit she learned in high school. Some participants sought the course introductions discussion area to see who their classmates were, especially if the class had a group project. Once the participants expressed what information they wanted about their online course, they demonstrated their navigational practices to find that information.

General Navigation and Course Design and Structure

The second subtopic question under the first topic of inquiry examined how learners navigate online courses. This section explains how the participants navigated the course on their typical first day of class, including finding the syllabus and navigating

the home page. This section also discusses how the participants navigated to find different content and activities in the course, including: 1.) grades, 2.) due dates, 3.) assignment workload, 4.) information about a course-long project, and 5.) discussion participation information.

First Day Navigation

Participants navigated to the syllabus or modules area, using the main course menu, to get an overview of the course structure, schedule, and general assignments. Based on the tasks and questions relating to the first-day navigation, most participants navigated the course easily. However, other participants noted some challenges with the Home page.

Several participants went to the Start Here module content, which is located in the Modules area of the course since there is a Start Here button on the Home Page. The internal participants were already familiar with the content of this section since it was identical in all of the online courses they had taken. However, Bailey, an external participant who had never seen the Start Here content of this course, said he was still familiar with the concept and structure: “That’s the stuff that you know Start Here, the first-day check-in with things like that.” Bailey took other courses that had similar content sections and followed the same navigational practices. Since the design of this course has elements consistent with other courses Bailey has taken, he demonstrated a level of comfort and ease that aligns with practices for reducing extraneous cognitive load.

Alina, who is an internal university participant, stated while navigating through the content in the Start Here section: “It’s usually the same in all the courses, but I like to

look anyway.” The consistency of the content in the Start Here section was viewed as providing an easy user experience for most participants. However, there were some challenges and confusion.

For example, Lila is an external participant who had not used Canvas before the session. When Lila began the usability test and examined the Home page, she stated:

I would read from top to bottom, first of all. I’m not going to click Start Here [button] until I’ve read these things down here. Instead of just clicking Start Here, I’m going to read these things. [*selects the Module 1 link on the Home page, which opens up the Module 1 Overview and Objectives page*].

For Lila, the layout of the home page caused confusion, and she was not clear which action she should complete first.

Lila continued to read through the Module 1 Overview and Objectives content thoroughly. After reading the page, she selected the Next button, which opened up the next content page or activity in the Module 1 area. After doing this a few times, she admitted she was lost and found her way back to the Home page. Back on the Home page, she stated:

Because now I’m feeling like I should have clicked here [*circles cursor over the Start Here button*] before I started reading this stuff. Because this [Start Here button], when you hover says Important Information, it doesn’t say Start Here. [The ‘link title’ that pops up upon ‘mouse over’ on the Start Here button says, “Important Information.” The participant does not know this, but that is the name of the page that the Start Here button goes to, and this causes confusion]

Lila identified the design elements that caused the confusion and why she made the navigational choices based on her interpretation. This particular navigational dead-end also shows how one confusing design element can lead to further confusion and frustration for the user, which is associated with causes of extraneous cognitive load.

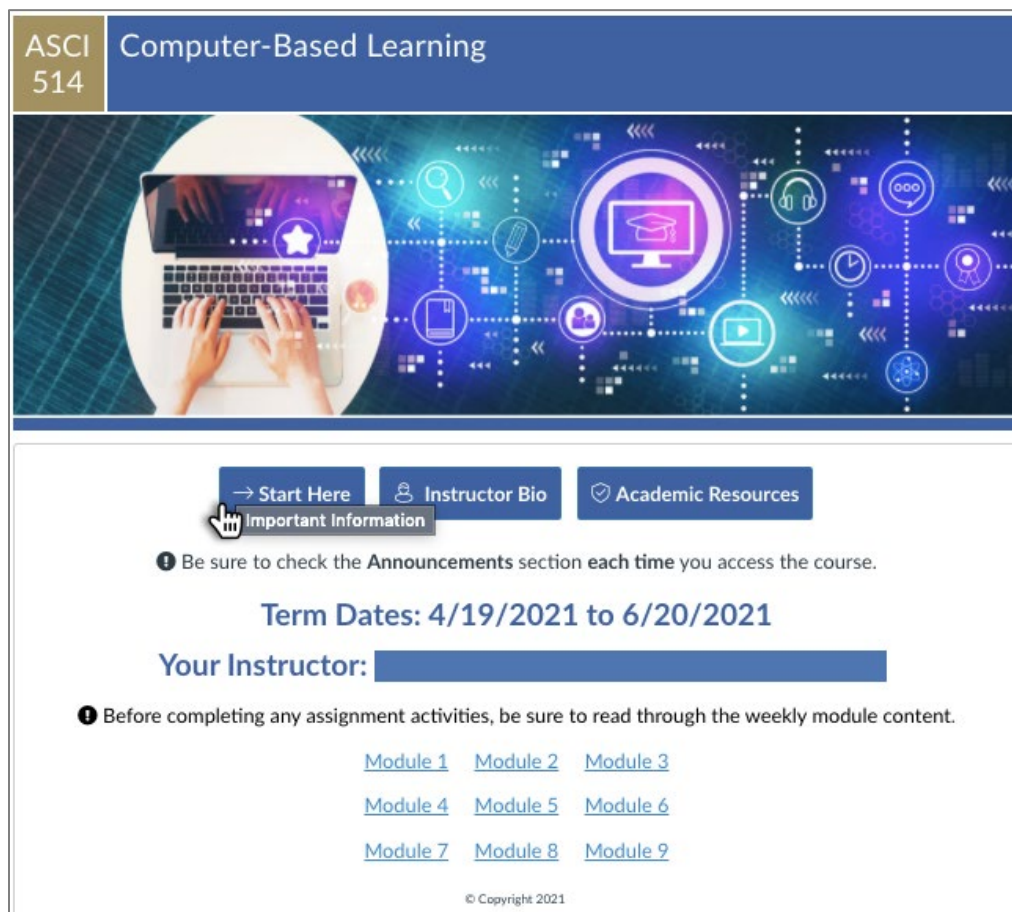
So, I clicked it twice now. [*Selects Start Here and the “Important Information”*]

page] Okay, so Start Here truly meant start here, whereas I thought Start Here was going to start the course.

While Lila noted she should have selected the Start Here button first, the pop-up link title that appears when the participant hovers their cursor over the button (see Figure 7) caused confusion since the verbiage was different.

Figure 7

Screenshot of the Home Page Demonstrates the Important Information Title Popping Up when the Cursor Hovers over the Start Here Button



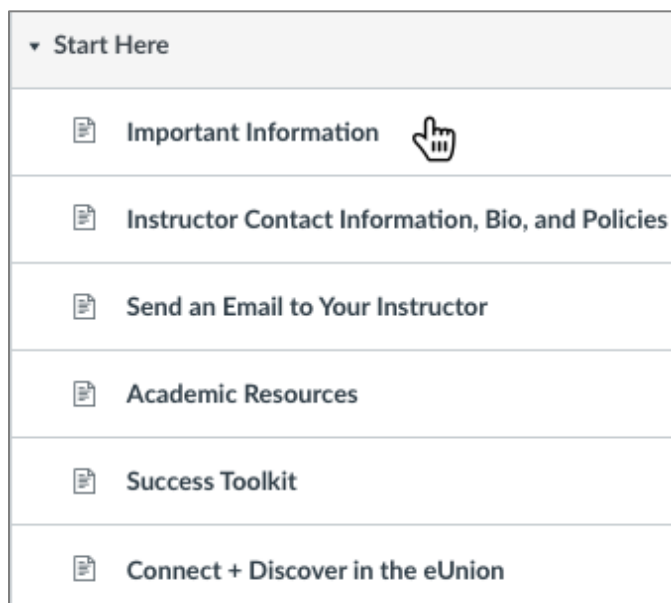
The links to the nine individual modules near the bottom of the Home page also caused confusion regarding where one should start. For example, Amyra encountered similar confusion as well. While Amyra did select the Start Here button, later in the usability test, she stated:

There was too many things going on [circles cursor around main content on Home page] in the sense of like I hit the Start Here [hovers the cursor over Start Here button], but then you also have the modules [moves cursor near individual links to the nine modules] ...

Amyra explained that too many items on the Home page caused confusion. However, she also continues describing the confusion of the Start Here button going to the Important Information Page, which is the first page of the Start Here module section, as shown in the following figure.

Figure 8

The Start Here Module in the Modules Area of the Course, the Cursor is next to the Important Information Page, which is where the Start Here Button Links



Amyra suggests it would be clearer if the Start Here button link went to the Start Here module in the Modules area instead, by stating:

The Start Here link, I think that was the most confusing link in the course just because you click on it [*Selects Start Here button and the Important Information page opens*] and it has the course syllabus and all these other things. [...] That seems a little redundant because I had click the Start Here button, and maybe if the homepage Start Here links me directly to this portion, it would be less confusing [*circling cursor over the Start Here module items in the Modules area of the course*].

Even though Amyra expressed confusion while navigating the course, she did not report being overwhelmed and could find her way and navigate through the course. Since Amyra had used Canvas before and Lila had not, this difference may explain the two different user experiences, which should be investigated in future research. However, the instructions' wording, the inclusion of multiple links, and the order in which each appears on the Home page were attributed by some participants as creating a confusing experience and did not meet the criteria for presenting clear instructions.

While the Start Here button caused some confusion for two external participants, all participants demonstrated that the overall course navigation was less confusing. Participants demonstrated that they were able to find most of the information and activity items in the rest of the tasks with ease.

Another note about the Home page and images regarding the course navigation. Amyra commented about the banner image on the course home page, stating:

I like the computer image only because it signaled me to the title of the course, which is not something that's always visible. [...] But the picture itself broke the page in a way that when I would scroll down, I couldn't immediately see the start here links. So, I think that if I was not inclined to scroll down, I would have missed that entire section and have been nothing to compel me to come back to it.

Even if the computer image added meaning to the page, the size and placement of the image are important in the page layout, allowing the user to find and focus on crucial information. This participant feedback aligns with recommended practices for the coherency principle and hierarchy of visual design.

Common Navigation Practices

During the first part of the usability test, the participants completed tasks such as finding the syllabus, reading activities, the module topic and module objectives,

discussion participation requirements, and grades. When navigating the course to complete these tasks, the participants favored two navigational paths the course main menu and the Modules area.

1. *Course main menu*: The main navigational strategy participants demonstrated was utilizing the course's main navigational menu, especially the Modules link. The Modules link in the main menu goes to the Modules area of the course, where the participant can view all of the module activities and select the specific module activity they need. The individual module links on the Home page go to the Overview and Objectives page for each of the specific modules, which forces the participants to select the Next or Previous buttons to navigate through the module content, instead of being able to select the specific module activity they want like they can in the Modules area.

Figure 9

Crosstab Query in NVivo of Select Coding Frequencies for Course Navigation Attributes amongst the Cases for Each Task the Participants Completed in the First Part of the Usability Test

Codes	Task 1 - 1st Day	Task 2 - Syllabus	Task 3 - Module Topic & Objectives	Task 4 - Upcoming Assignment Workload	Task 5 - Reading Activity	Task 6 - Disc Participation	Task 7 - Due Date	Task 8 - Course Long Project WCBT	Task 9 - Find Grades	Total
○ Home Page Navigation	11	2	2	0	1	0	1	0	0	17
○ Academic Resources Btn	1	1	0	0	0	0	0	0	0	2
○ Instructor Bio Btn	2	2	0	0	0	0	0	0	0	4
○ Module Links HMPG	4	0	1	0	0	0	0	0	0	5
○ Start Here Btn	5	1	0	0	0	0	0	0	0	6
○ Main Menu - Canvas	1	1	2	0	0	0	5	0	0	9
○ Main Menu - Course	12	4	9	6	5	6	5	7	7	61
○ Discussions Link - Menu	1	0	0	0	0	0	0	0	0	1
○ Grades link - menu	1	0	0	3	0	0	2	0	6	12
○ Modules Link - Menu	5	0	8	4	5	6	3	6	1	38
○ Modules area	8	0	8	5	6	5	4	9	1	46
○ Next and Previous Button	8	2	5	0	0	0	1	0	1	17
Total	59	13	35	18	17	17	21	22	16	218

In a crosstab analysis (see Figure 9) comparing the course navigation attribute coding

frequencies amongst the cases for all the tasks, the coding trends show the participants referred to or used the main menu, especially the Modules link for most of the tasks. The crosstab also shows that the participants preferred to use the main menu links more than the navigational links on the Home page.

2. *Modules area*: Several participants explained that the modules area of the course was an easy way to find things in the course and repeatedly utilized the Modules link in the course main navigational menu. Yvaine repeatedly stated how much she liked the Modules link in the course main navigational menu, especially in comparison to the nine links to the individual modules on the home page:

Whereas if you use this module link [*points cursor to "Module 1" link on home page*], you've got to go next, next, next, next. So, I don't like these module links, or that's not how I use it. I like to use this [*points cursor to "Modules" link in main course navigation menu*] because I can go directly into the specific thing I want to do.

Yvaine verbally expressed how much she likes the Modules area and demonstrated this through her navigation practices. Quickly finding information and activities organized and segmented into weekly modules reinforced the practice of chunking content to create a positive usability experience. Participants were also asked to find the upcoming workload of assignments for the week, information about a course-long project, and discussion participation requirements. Again, the participants repeatedly used the Modules link in the course's main navigational menu, but they also used other ways to navigate and find information. For example, to determine what upcoming assignments were scheduled for the week and a specific due date of an assignment, some participants went to the Grades area of the course, the Schedule section of the syllabus, or the Canvas To-Do List feature on the Home page.

3. *Discussion guidelines*: When participants were asked to find the participation requirements for a specific discussion activity, the participants navigated to the discussion via the Modules area. However, most users also selected the Discussion Guidelines link in the discussion activity. That link took the participants to the Discussion Guidelines page, which explained the detailed information and requirements for the discussion activities in the course. The participants, internal and external, demonstrated that this link was intuitive to providing the information.

Another feature a few participants looked for to provide the participation requirement information was the discussion rubric. The discussion rubric location in Canvas is not as obvious as an assignment rubric. To view a rubric in a discussion activity in Canvas, the user must select a dropdown menu from a button that is not clearly marked. Instructions regarding how to access the rubric in a discussion are provided to the users on the Discussion Guidelines page and in the first graded discussion activity that uses a rubric in the course. Amyra, who is an external participant, looked for the rubric and could not find it. However, she explained that she was looking for a rubric but that the information in the Discussion Guidelines page provided most of the information she was seeking. Yvaine, an internal participant, also used the rubric to locate discussion participation requirements. Yvaine stated:

I go to discussion, and normally there's a rubric. Well, every single discussion requirement does have the Discussion Guidelines as a link [*selects the link and is currently viewing the Discussion Guidelines page*]. And it gives you what your participation requirements are. And there's the rubric which, I'm not really big into, I'm an elderly student, and I'm not really big into rubrics. And, most of the discussion items, most of the discussion rubrics are pretty similar that I have found. I maybe looked at it once or twice.

While Yvaine stated she has no preference for using rubrics to locate assignment

information, she knew that they contain information about assignment requirements and demonstrated through navigation and conversation that she could locate that information with ease. Yvaine demonstrated efficiency in her navigation and ability to find information, reinforcing the purpose of consistent course design and structure throughout the different courses to provide a positive user experience.

Throughout the usability test, participants noted positive and negative user experiences. However, there were more positive than negative trends in the overall experience for the participants (see Figure 10). While the Home page includes essential information and quick links, the general layout, some of the instructional verbiage, and the confusion of the Start Here button were the main items that participants noted provided for a negative user experience. The Modules link in the main menu and the Modules area proved to be the preferred method for navigating the course. The participants expressed and had a positive user experience when using these methods to search for information and activities in the course.

Figure 10

Coding Matrix of the Common Course Navigational Elements Used in the Usability Test Compared to the Positive and Negative User Experiences

	A : Home Page Navigation	A1 : Module Links HMPG	A2 : Start Here Btn	B : Main Menu - Course	B1 : Grades link - menu	B2 : Modules Link - Menu	C : Modules area	D : Next and Previous Button
Negative UE	9	8	2	3	0	0	1	4
Confusion	6	5	2	1	0	0	0	3
Dislike - existing feature or attribute	3	3	0	2	0	0	1	1
Overwhelmed	2	2	0	0	0	0	0	1
Positive UE	3	3	0	12	2	5	9	1
Consistency	0	0	0	2	0	2	3	0
Consistent - Course Design	0	0	0	0	0	0	2	0
Consistent - Template Model	0	0	0	2	0	2	2	0
Easy to Navigate	0	0	0	2	0	2	2	0
Helpful	0	0	0	1	1	0	1	0
Intuitive	0	0	0	1	1	0	0	0
Like - existing feature or attribute	3	3	0	8	0	3	6	1

The first part of the usability test addressed what learners are looking for on their first day of an asynchronous online course and how the learners navigate an online course. As the participants' demonstrated their navigational practices and explained their thought processes, they provided information about the usability of the course navigation, course structure, and the benefits of consistency.

Usability in Course Navigation, Course Structure, and Consistency

The third topic of inquiry examines what aspects of the asynchronous online courses the participants described as usable and how the participants would describe the course elements designed following common usability principles. Participants experienced a course purposely designed to meet three of the criteria for quality course design: navigation is intuitive, instructions are written clearly, and information is chunked. The first part of the usability test focused on the criteria of navigation is intuitive. However, there are a few items that address the other two criteria.

The other aspect of the course design and structure that should be considered is the template model. The main navigational menu, the module structure, and the Start Here module, along with its contents, are identical across all of the online courses offered by the private university. While there were external and internal participants in the study, all stated that the main navigational menu and the module structure were intuitive. The participant who had never used Canvas before demonstrated that they were comfortable using the Modules area as the primary way to find activities and information after completing the first few tasks. The internal participants who have taken classes created from this template model demonstrated they were familiar with where to look for activities and specific information for those activities. Using a consistent course

navigational menu and the weekly module structure in the usability test was a success. The participants expressed a positive user experience; and, they were also able to demonstrate that the navigation was intuitive in the course by finding what they needed in the course with ease.

Also, all users expressed and could demonstrate their preference to utilize the Modules area of the course for navigation during the test. Several participants expressed they used the Modules area because it was easy to visually identify what they needed to do each week since the information was organized into weekly module segments. While the criterion information is chunked often refers to the text on a page, segmenting course activities into organized chunks, like weekly modules, was successful and preferred in this usability test. This criterion also aligns with the segmenting principle to help reduce cognitive load.

Since the template model promotes consistency amongst courses, not only did the participants demonstrate navigating with ease, but they also knew general assignment expectations. For example, discussion activities have a general expectation to post an initial post early in the module week and post two replies by the end of the module week. One of the external participants knew this expectation regarding discussion participation. The internal participants knew about the Discussion Guidelines page. These participants demonstrated that using the link to the Discussion Guidelines page was intuitive since they are used to seeing that page and link in all of their courses. The page information provides clear instructions about the discussion participation expectations, and the participants demonstrated they were able to easily find the requested information.

Using consistent course design, course navigation, and course structure rendered a positive experience in this usability test. Chunking information and providing clear instructions also gave the participants a positive user experience. The participants' ability to navigate the course and find information in the course with ease due to these design choices align with the practices of reducing cognitive load from a usability aspect.

While the first part of the usability test focused on the criteria of intuitive navigation, the second part of the usability test focused on the other two criteria for creating quality online courses: information is chunked, and instructions are written clearly. The first part of the usability test focused on the first and third topics of inquiry, the second part of the usability test focused on the second topic of inquiry by examining multimedia learning principles applied to page design layout for course content and instructions.

Page Design Layout: Multimedia Learning Principles

To address the second topic of inquiry, the second part of the usability test examined page layouts with various degrees of multimedia learning principles applied. Figure 11 shows the coding matrix query comparing the coding frequencies of multimedia learning principles to the positive and negative page design layout, along with the positive and negative user experience codes.

When examining the coding matrix, the frequencies showed that the content in the signaling and segmenting principles had more positive coding references than negative coding references. Bolded and heading references were coded more frequently, but bullet lists, chunking, the use of icons, and alert boxes were also

referenced throughout the usability test.

Figure 11

Coding Matrix of the Designation and Description Summaries Used for the Different Page Layouts and the Various Multimedia Learning Principle Design Elements Applications

	A : Coherence Principle	B : Decorative Heading Icons	C : Images	D : Segmenting Principle	E : Bullet or Ordered list	F : Chunking	G : Signaling Principle	H : Alert Box	I : Bold	J : Color Usage	K : Headings	L : Icons
Negative Design Layout	11	2	9	18	14	4	25	4	16	2	8	2
Dislike - Existing PDL Attribute	10	1	9	9	6	4	12	3	5	1	5	2
Dislike - Missing PDL Attribute	0	0	0	7	4	2	14	0	11	0	5	0
Negative PDL Attributes or Features	3	2	1	12	9	2	7	1	3	1	2	1
Busy	0	0	0	2	1	1	2	0	1	0	1	0
Hard to Find Attributes	0	0	0	3	2	0	1	0	0	0	0	0
Mistaken for Link	2	2	0	0	0	0	2	1	0	1	0	1
Wordiness - A lot of content on page	0	0	0	8	7	1	3	0	3	0	1	0
Positive Design Layout	4	1	3	39	15	25	83	7	31	10	45	11
Like - Existing PDL Attribute	3	1	2	36	13	24	73	6	26	8	42	9
Like - Missing PDL Attribute	1	0	1	0	0	0	1	0	1	0	0	0
Positive PDL Attributes or Features	1	1	0	6	3	3	17	2	6	2	10	2
Ability to open or collapse content	0	0	0	1	0	1	1	0	0	0	1	0
Catches Eye or Attention	0	0	0	2	1	1	3	0	2	0	3	0
Easy to Find Information PDL	1	1	0	1	1	0	11	2	4	1	5	2
Negative UE	13	6	7	2	1	1	13	6	1	6	1	7
Confusion	10	6	4	2	1	1	12	6	1	5	1	7
Dislike - existing feature or attribute	3	0	3	0	0	0	2	1	0	2	0	0
Frustration	0	0	0	0	0	0	0	0	0	0	0	0
Overwhelmed	0	0	0	2	1	1	1	0	0	1	0	0
Positive UE	2	1	1	15	4	12	38	5	9	6	23	4
Consistency	0	0	0	0	0	0	2	1	1	0	0	1
Consistent - Course Design	0	0	0	0	0	0	2	1	1	0	0	1
Easy to Navigate	0	0	0	2	0	2	6	1	0	1	6	0
Helpful	0	0	0	1	0	1	4	2	1	2	3	1
Intuitive	1	1	0	1	1	0	3	0	2	1	1	0
Like - existing feature or attribute	1	0	1	14	3	12	27	3	5	4	17	2

Table 3

Designation and Description Summaries Used for the Different Page Layouts and Various Multimedia Learning Principle Design Elements Applications

Designation	Description
No MMLP	Page layout had minimal design elements, and no multimedia learning principles were applied (e.g., no headings, bold formatting, or clearly defined sections of content).
Some MMLP	Page layout had a few design elements, and some multimedia learning principles were applied (e.g., some bold text and headings to help define sections of content).
Full MMLP	Page layout had several design elements, styled themes, colored banners, stylized headings, clearly defined sections, bold text, alert boxes, and icons.

Each content page was designated as No MMLP, Some MMLP, or Full MMLP based on the design elements and implementation of multimedia learning principles. Please see Table 3 for a summary of these designations and descriptions, which were defined and described in Chapter 3.

This study focused on the signaling, segmenting, and coherence principles since these three principles are the most applicable to webpage layout and design. The following sections examine the three specific multimedia learning principles and the variations of implementation amongst these different page layouts

Signaling

The signaling principle means that people learn better when the learning material is organized, highlighted, or emphasized, so it draws the learner's attention to the essential elements (Liu et al., 2013; Mayer, 2014c). In this study, bold text, headings, icons, and alert boxes were used as the design elements to implement the signaling principle in some of the page layouts.

The participants examined three pages with layouts containing minimal or no multimedia learning principles applied (designated as No MMLP). These three pages did not have any headings, bold text, icons, alert boxes, or additional color theme design elements. The participants expressed that design elements like adding headings and bolding important information would be helpful and improve the usability of these pages. For example, when examining some of the pages designated as No MMLP, which had no multimedia learning principles applied, Amyra explained, "To me, I kind of get lost in the wordiness of it. That you know, there's like four paragraphs, and it would be really helpful if they just use bold labeling and maybe you know a few bullet points."

This observation by Amyra aligns with similar findings in prior research from Chapter 2 regarding wordiness and readability. The participant's suggestions of adding bold label headings and bullet lists align with design elements recommended for implementing the signaling principle. Lila similarly stated:

Maybe this heading [*used cursor to highlight text, "Course-Specific Resources," which is not formatted as a heading*], could have been bold or something. [...] Same here, this looks like a heading to me, but it doesn't stand out [*used cursor to highlight text "ADDIE and Needs Analysis Tutorials," which is not formatted as a heading*].

Lila was able to identify words and phrases that should have been formatted as headings to help signal the beginning of a new section of content on the page to help break up the content.

Alina identified similar items, which were not formatted as bold or headings on the page, and made suggestions that they could be formatted to stand out. Alina stated:

Yeah, I think that some of this stuff should be bolder like this [*referring to non-formatted text that says W/CBT Module - Course Project Overview*] can be bolder and underlined just because [...] I think if this is bold, and this is bold, [*moving cursor to the Course Project Overview verbiage*], and it was spaced out a little bit more, than yeah I would, I think that will be better.

Along with the other participants' observations, Alina's suggestions reinforce a need to have pages utilizing design elements to help organize the content and emphasize sections and essential information. These design elements, which were not present on the pages but identified as elements the participants recommend using, align with the suggested practices for the signaling and segmenting principle.

When the participants examined pages that did implement multimedia learning principles, designated as Some MMLP and Full MMLP, they expressed that the design elements, such as section headings and bold text were helpful regarding usability and

finding information on the page. For example, when Lila examined the second version of the resources page (Some MMLP), she stated, “I think this page is an improvement on the last one, just with the headings being a larger font and a little bolder. It's easier to find that section.” For Lila, the use of headings to signal the segmented sections was beneficial compared to the page with no design elements for signaling or segmenting. Baily had a similar experience when examining the second version of the assignments page (i.e., Some MMLP) and stated, “It’s getting better. I like bolding and moving things around, so it draws my eyes to it. Again, it puts it in logical blocks or more logical blocks.” Bolding, headings, and segmenting design elements were positive improvements regarding usability, especially when comparing the page's design that did not use any of these features.

When examining the second version of the Project page (Some MMLP), Yvaine and Tristan both expressed preferences for the bold text. Yvaine exclaimed, “Bold is good! Bold is excellent! I like bold!” Similarly, Tristan also had positive comments about the use of bold and stated, “I saw you highlighted, bolded kind of more important notes, which I like [...] I, like the bolded text, kind of draws, draws it out to the reader.” Based on the participants’ statements and ability to efficiently locate information on the pages, the benefits of using headers and bold for signaling and organizing the content into sections for segmenting align with the purpose of implementing these multimedia learning principles.

Near the conclusion of the usability test, the participants answered follow-up questions. One of these questions asked the participants how they felt about the included headers, bold text, and icons in the page layouts. Lila stated, “So the headers

and bold texts are key to me. That's visually much easier to find information that way.” Lila expressed that these design elements used for signaling were visually helpful regarding usability. Bailey had a similar statement and expressed, “I like headers text, something that can draw your eye to that particular item.” Bailey and Lila both expressed their preference for these design elements used for signaling. Yvaine also added the case for not overusing these elements by stating:

In general, I like when the purpose of the page to provide resources and tutorials is in some format bolded, bigger fonts stands out. And then under each subsection, it's also a larger font and then whatever is really important, due dates, some specific limiting feature that the instructor wants to highlight, bold. Of course, if you do too much bolding, then I'll be ignoring the bolding. But bold what's important. I like the bolding.

The participants prefer the use of headings and bolding important text, so the information stands out and is easy to find. Yvaine also recognized that these elements need to be used appropriately, and overusing these elements would defeat the purpose of implementing the signaling principle.

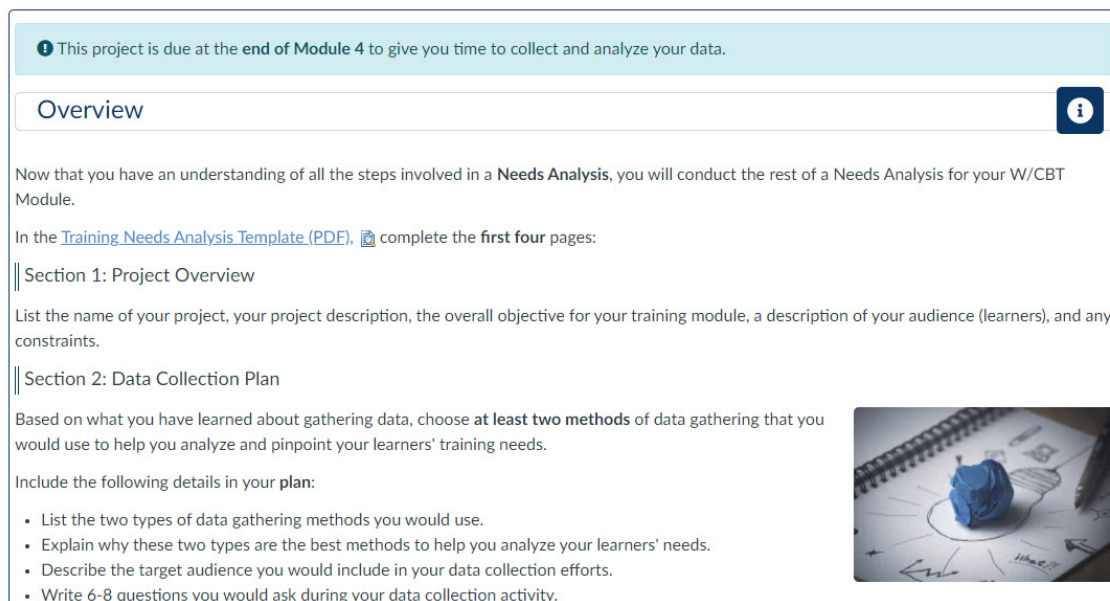
Regarding usability, the participants explained the benefits of using headings to identify the sections of content and bolding important information. These perceived benefits and positive perceptions coincide with the purpose of the signaling principle and design elements. According to prior research examined in Chapter 2, this approach could reduce student cognitive load to make the page more usable.

When it came to using icons, there was a variety of reactions and perceptions. In the third version of the Assignment and Project pages, which were designated as Full MMLP, icons were used in different ways. On both of these pages, the headings included icons. These icons were blue or had a blue background, and depending on the theme of the page, either preceded the text on the left side of the page or were justified

on the right side of the page (see Figure 12 and Figure 13.). On the Assignment page, an information icon was used in an alert box (see Figure 12). This icon is the same font size and color as the paragraph text.

Figure 12


Excerpt from the Assignment Page Version 3, Full MMLP, in which the Headings have an Icon Aligned to the Right after the Text and an Icon Preceding an Important Statement in the Alert Box near the Top of the Page



This project is due at the end of Module 4 to give you time to collect and analyze your data.

Overview

Now that you have an understanding of all the steps involved in a Needs Analysis, you will conduct the rest of a Needs Analysis for your W/CBT Module.

In the [Training Needs Analysis Template \(PDF\)](#),  complete the first four pages:

Section 1: Project Overview


List the name of your project, your project description, the overall objective for your training module, a description of your audience (learners), and any constraints.

Section 2: Data Collection Plan

Based on what you have learned about gathering data, choose at least two methods of data gathering that you would use to help you analyze and pinpoint your learners' training needs.

Include the following details in your plan:

- List the two types of data gathering methods you would use.
- Explain why these two types are the best methods to help you analyze your learners' needs.
- Describe the target audience you would include in your data collection efforts.
- Write 6-8 questions you would ask during your data collection activity.



On the Project page (see Figure 13), an information icon was used at the beginning of a paragraph with important information; and, one of the pages used an icon in an alert box. The participants gave positive feedback for the icon that preceded the paragraph of important text. Bailey stated, “The use of icons really draws your attention to what you need to know.” In this instance, the icon is used appropriately and fulfilled the purpose of drawing the participant’s attention to signal the important information about the assignment.

I then asked the participants to identify what they felt was the most important information on the page. Several participants referred to the paragraph preceded by the

information icon. In this instance, the participants expressed a positive experience regarding usability when the icons were used to signal important information. These positive participant perceptions align with the purpose of the signaling principle and design elements on the page. According to the research examined in Chapter 2, these practices could reduce cognitive load from a usability perspective.

Figure 13


Excerpt from the Project Page Version 3, Full MMLP, in which the Headings have an Icon Preceding the Text and an Icon Preceding an Important Paragraph

Overview

For your course project, you will create a 30-minute Web/Computer Based Training (W/CBT) Module in Canvas.

The purpose of this training module is to solve a problem or performance issue, also known as a performance gap. Specifically, a performance gap is the difference between what people should be doing and what they are actually doing. The problem could come from your workplace, school, or any other organization – or it could be fictitious. Aviation-related topics are encouraged. Sample problem statements in an aviation context could be: Our airline has a higher rate of damage to baggage than our competitors or our baggage handlers have higher rates of injuries this year than in the last five years.

Excluded topics include those that address how to use any type of software product or app to increase productivity (e.g., Only 50% of our managers know how to use Microsoft Excel®).

 Limit the scope of your problem to something that can be solved in a 30-minute instructional activity. Don't try to do an entire college course or solve a large, complex problem. It's better to choose just one aspect of a problem.

Assignment Timeline

The seven W/CBT assignments are cumulative and will help you develop your W/CBT Module in a step-by-step way. Below is a breakdown of the



However, in other instances, the use of the other icons caused confusion.

Several participants tried to select the information icon in the Overview heading and the teal alert box because they thought the icon was a link. When asked why they thought it was a clickable link, Lila stated:

Because a lot of things I'm used to seeing on web pages, or in other courses, or things that I've created [...] That that "i" is kind of a universal for more information [referring to the information icon], so I thought it was clickable.

In Lila's explanation, the choice of icon used in the design, which was the information icon, caused confusion. The information icon is commonly used in web design as a link

to indicate additional information. In this instance, the information icon was used to symbolize the general information provided in the overview section. Amyra had a similar experience and thought that the icon was a clickable link. Amyra stated:

I thought that it might have been something clickable. Just because the blue. I know it wasn't underlined, but then had this kind of symbol here [*hovers the cursor over decorative checkmark icon on the right side of heading text*], so it made it look like maybe a menu option or maybe something you would expand or redirect. [...] the icon. So, there was one page where you had put it in blue it was like Assignment Timeline that was in blue, and then there was a little square icon here. Because of that icon, I was compelled to click on it because I wasn't sure if that was a link or if that was a menu option.

For Amyra, the way the icon was formatted with a blue square background resembled a clickable design element of a link instead of a signaling element to draw attention to the section and provide a visual representation of the section content.

While some of the icons used in the headings caused some confusion, the icons in the alert box served a clearer purpose; that is, even though Lila expected the icon in the heading to be a link, she did not have that same expectation for the icon in the alert box. Illustrating this point, Lila noted her reasoning:

The icons you know that "I" wasn't clickable on that one layout, so that confused me. But now I'm seeing another one here that's [*pointing cursor to the 'information' icon in the alert box at the top of the page.*] I don't know. I'm not expecting that one to be clickable. I guess because it's smaller, maybe.

While icons can be used to signal important information, the participants' experience suggests it is important to pay attention to how the icons are being used to signal the information and avoid confusion.

The participants had different perspectives with the alert boxes as well. In the third version of the assignment page (Full MMLP), a teal alert box is displayed at the top of the page, indicating the due date information. However, some of the participants

overlooked the alert box at the top of the page. Amyra explained that she overlooked it, stating:

It's the color because it kind of seems like it's just part of the website [referring to the teal alert box blending with the blue theme of the page]. The other thing is that because it was in blue. In my mind, if it was like an announcement, it would have registered as a warning or something if it was like red, something that totally contrasted the color scheme of the page. Then, my eyes would have been like, 'oh what, what is this.'

However, later in the usability test, the resources page layout versions 3A, 3B, and 3C had a yellow alert box at the top of the page. The yellow alert box on the page with a blue theme stood out to Amyra, and she noted the difference when stating:

Okay, this is the resource file folder, this is the ADDIE file folder, and so, then I see the yellow message [circles cursor around alert box] [...] Yeah, it actually stood out because it was yellow it kind of caught my attention.

Other participants found the teal alert box on the assignment page. Tristan stated, "So, this it catches my eye right away [*highlighting the alert box, which states the project is due at the end of Module 4.*]" When asked to identify what they felt was the important information on the page, Alina identified the content in the alert box, and Yvaine identified the due date information in the alert box.

Regarding the use of icons and alert boxes as design elements, the choice of color created some negative user experiences. For the icons, the use of color confused the participants to mistake the icon for a link. The teal alert box blended in with the blue theme of the page and did not stand out for some as it was intentionally designed.

The use of color also created positive user experiences. The participants complemented the color themes, colors of the headings, and the yellow alert box.

Amyra explained how the color helped her regarding navigation and finding information. She noted that the color blue used in the page theme helped the yellow

alert box stand out for her, stating

I really liked the labeling and the color features because those [features] were actually helping me navigate through things and just kind of break down the information. [...] I also I really appreciated that the blue, it was within theme, so that it made things like the yellow boxes also stand out. So, the contrast also kind of gave me a guidance to say, 'hey, this is something different, this is not a menu option, you know, look at this.'

Amyra further expressed how the use of colored themes helped segment the content and stated:

I think, for me, the color is really a guiding marker. [...] but the yellow box did help versus the blue box. Because it just felt like it was part of the imagery. One of the things that I liked about the second half of the testing, where I was going through the pages and looking at the layout, was that it used color to kind of break sections out. To me, that really stood out.

While the use of color was not a primary design element used for signaling, the use of color in conjunction with the signaling design elements was helpful, and Amyra's statements reinforce how this practice helped her to navigate those particular page layouts. Yvaine had similar preferences and stated, "I like color. I like blue, but I like banner colors, right. I mean, of course, these are the hot links have to be blue. I mean, you could go overboard, but blue banners are great." While Yvaine expressed positive comments regarding the use of color, she also added a comment about not overusing color. Similar to her comments about not overusing bold for signaling, she reiterated that the overuse of color could be a negative design choice. Lila had a similar perspective as well and stated: "I like the nice solid blue. I wouldn't want to see a ton of color in here, but the blue indicates *[circling cursor over the accordion panel headings/links]* to me oh there's a section here. It's a break." Yvaine and Lila both like the use of color, as long as there is not too much color. Some participants liked the use of color but did not feel that a lack of using color created a negative experience. Bailey

stated: “I like color. [...] If it wasn't there, I wouldn't go ‘there's no color.’ But when I do see it, I go, ‘ah great you have some color.’ Makes it easier to track for me.” Bailey expressed that the use of color is helpful from a signaling perspective. Alina had similar comments and stated, “I prefer pages with colorful themes, or at least like some words highlighted or bold.” Overall, the participants’ expressed positive perceptions for the pages using color in conjunction with design elements to signal important content, which aligns with the signaling principle. When using color in design, cultural meaning, color blindness, and color contrast for accessibility and readability should be taken into consideration, and these aspects of using color should be examined in future research.

The use of icons and alert boxes as design elements for signaling can work if used methodically and appropriately. However, when they are not used appropriately, they can lead to confusion and has been attributed to causing extraneous cognitive load, according to the research discussed in Chapter 2

The trends of the usability test support the approach of methodical and appropriate implementation of signaling design principles to create a positive user experience and make it easier for the user to find information on the page. These findings align with prior research by Fisher and Wright (2010) and Miller-Cochran and Rodrigo (2006), which is discussed in Chapter 2, and recommended design practices that can help reduce extraneous cognitive load. In addition to examining design elements to implement the signaling principle, this study also examined using design elements implementing the segmenting principle.

Segmenting

The segmenting principle means people learn better when a lesson is presented

to the learner in smaller manageable segments (Mayer, 2014c). In this study, the content was organized into smaller segments with different design practices. Ordered or unordered lists were used to organize groups of links and project or assignment requirements. Sections of content are organized into chunks with the assistance of headers to provide white space. While the headings are used as a signaling design element, headings are also used for accessibility. Headings are used to help to identify the context of the content within the segmented section. In addition to segmenting content into sections and using headings, three pages utilized the three different interactive web design attributes of expanders, tabs, and accordions (screenshots with examples of these three features are located in Appendix B).

The participants repeatedly expressed their preference to have content segmented. When examining the pages in which no segmenting principles were applied to the content, participants expressed that the pages were busy and suggested that the content needed to be segmented.

When examining the first version of the assignment page, designated as No MMLP, Yvaine stated:

It takes me. It would take me half hour to figure out what I'm doing from this page. [...] Well, I think it needs some section, section headings, and dividers. [...] And I think there's just too much information on this page.

Her reaction coincides with prior studies by Fisher and Wright (2010), Miller-Cochran and Rodrigo (2006), and Reeder (2018), where participants become overwhelmed by too much content on the page. Alina and Bailey had similar comments as they examined the first version of the project page, designated as No MMLP. Alina explained this sense of being overwhelmed from the text as follows:

Because I personally, if I was to look at this, I would look at it for a couple seconds and then go to something else, because to me, this is just paragraphs [circling cursor over the paragraphs of text on page]. My eyes aren't going to really focus very hard on this unless it was something I really, really need to do. I'm not really going to focus on this very much [circling cursor over third and fourth paragraphs].

While Alina's comments emphasized how she would not focus on the content, Bailey suggested adding white space as a possible solution by stating:

There's a lot of text on this thing that I don't know that you need all right together could use some of the white space a little differently. It's kind of hard to read, frankly. I wear glasses, but golly yeah, there's just a lot there. It's a very busy slide with a just a lot of information.

While Alina's and Bailey's comments were specific to the project page and its use of white space in the layout, Amyra had similar comments regarding the overall pages designated as No MMLP as she stated:

I've noticed that in the first part, when we had big paragraphs, and they were in black lettering, I had the tendency of just kind of skipping over it because it just felt overwhelmed. I remember some of the usability pages, they all had the same font sizes, and to me, my eyes were like, 'whoa, Okay, I want to skip everything.'

The participants' comments and reactions reinforced the need for segmenting content because participants lose focus and interest when there is too much text on the page. These comments and reactions are very similar to prior research by Fisher and Wright (2010), Miller-Cochran and Rodrigo (2006), and Reeder (2018), where participants felt that too much text and wordiness on the page caused challenges regarding readability, which can lead to extraneous cognitive overload.

One design element used to help segment the content was lists (ordered lists with numbers and unordered lists with bullets). As the participants navigated and examined the page layouts, they identified items organized in lists as essential items on the page. A few participants exclaimed that they liked the use of lists to segment and

organize the content. Amyra stated:

I really liked the bullet points. [...] The links and little things that are neat are [*circling cursor over bullet list items*]. [...] Some of my courses is not organized like this. So, it's a little bit irritating for me to go and look, so if I was to see this, [...] I will be able to know exactly what I was going to find.

In addition to Amyra preferring the use of bullet lists, Yvain and Tristan also had positive remarks about the use of bullet lists. Yvaine stated that when finding specific information on the page, she was able to find it easily “Because they're all bullets, and the bullets is great.” Tristan expressed similar positive comments about the use of bullets by stating: “And it looks like it breaks down its kind of nice. [*Pointing cursor to bullet lists on the page*].” When there was appropriate content that could be organized in an ordered or unordered list, the participants’ positive feedback supported the suggested design element as a way to segment the content. In addition to using lists, another method for implementing the segmenting principle was to create clear sections of content on the page and identify these sections with headers.

Headings were used as a design element for signaling, but they also serve as a design element for segmenting. The use of headings not only helps to provide white space, but they also help organize the page by providing context to the content within the different sections. For the page layouts designated as Some MMLP and Full MMLP, the participants demonstrated the ability to find information on these pages with ease compared to the pages designated as No MMLP based on their navigational behaviors and page examination, along with positive comments.

When comparing the different versions of the pages, Yvaine stated: “Versions two and three [designated as Some MMLP and Full MMLP] are nicer in layout because they break out what each section is, what information it's giving you.” The sections on

the page made the content clearer for Yvain. Alina had similar comments when examining the third version of the assignments page (designated as Full MMLP) by stating, “I like how it is organized by the sections. I like the way that’s organized [...] I basically like that everything seems to be organized in little sections.” These comments and reactions from the participants reinforce the segmenting principle regarding making pages more organized and usable. While the participants expressed positive perceptions and the preference for the use of headings and white space to help organize the content into smaller chunks, other design elements for segmenting content were also examined.

Expanders, Tabs, and Accordions

The other design elements used to segment and organize content on the page consisted of the interactive web features in the form of expanders, tabs, and accordions. These elements are defined in the Definitions section, and screenshots of these different elements are provided in Appendix B. However, to recap here, expanders are container panels in which the user has the ability to expand or collapse all of the content within the expander panels. Tabs visually resemble file folder tabs in which the user selects the specific tab to view the content within the tab panel. The accordion is visually identical to the expander; however, the user can only view one accordion panel at a time. Each time the user selects an accordion panel, that specific panel opens, and the other panels close.

All participants expressed a positive preference for using the expander feature based on the feedback and conversations during the usability test. The tabs and accordions had a mix of positive and negative, but overall, tabs were preferred over

accordions. A crosstab query examined coding frequencies amongst the three different page layouts containing either expanders, tabs, or accordions (see Figure 14).

Figure 14

Crosstab Query in NVivo of Select Coding Frequencies amongst the Cases for Each Page Layout Containing Expanders, Tabs, or Accordions

Codes	Resources - V3a exp. - Full MMLP	Resources - V3b tab - Full MMLP	Resources - V3c acrd. - Full MMLP	Total
<input type="radio"/> Potentially Causes Extraneous Cognitive Load	0	5	8	13
<input type="radio"/> Potentially Reduces Extraneous Cognitive Load	7	5	0	12
<input type="radio"/> Negative Design Layout	4	8	12	24
<input type="radio"/> Dislike - Existing PDL Attribute	3	4	8	15
<input type="radio"/> Negative PDL Attributes or Features	0	4	9	13
<input type="radio"/> Content Hidden	0	2	6	8
<input type="radio"/> Hard to Find Attributes	0	0	3	3
<input type="radio"/> Wordiness - A lot of content on page	0	2	1	3
<input type="radio"/> Positive Design Layout	14	16	6	36
<input type="radio"/> Like - Existing PDL Attribute	14	10	2	26
<input type="radio"/> Positive PDL Attributes or Features	8	8	4	20
<input type="radio"/> Ability to open or collapse content	3	1	3	7
<input type="radio"/> Clean - Clear - Neat	2	1	0	3
<input type="radio"/> Easy to Find Information PDL	2	3	0	5
<input type="radio"/> Organized	3	0	0	3
<input type="radio"/> Visually Appealing	0	2	1	3
<input type="radio"/> Negative UE	4	4	3	11
<input type="radio"/> Confusion	3	0	0	3
<input type="radio"/> Dislike - existing feature or attribute	2	4	2	8
<input type="radio"/> Frustration	0	0	2	2
<input type="radio"/> Personal Preference	0	3	0	3
<input type="radio"/> Positive UE	13	7	1	21
<input type="radio"/> Easy to Navigate	1	5	0	6
<input type="radio"/> Helpful	2	0	0	2
<input type="radio"/> Intuitive	1	0	0	1
<input type="radio"/> Like - existing feature or attribute	12	3	1	16
Total	98	97	72	267

The coding frequency from this query shows that the page using expanders tended to have more positive codes and codes relating to potentially reducing extraneous load. In comparison, the page using accordions tended to have more negative codes and codes relating to potentially causing extraneous load.

1. *Expanders*: All six participants expressed positive comments for the page

using expanders. The comments coded as negative were other details of the page that were not related to the expander feature. The participants expressed that they liked the expanders because they segmented the content, but it also gave the user the control to expand and collapse the content. The user could choose how much or how little of the content they wanted to view.

Alina and Tristan liked the way the expanders segmented the content to make the page clear and organized. According to Tristan, "I Like the expanding things it kind of makes that page look a bit neater, more organized." In addition to the expanders organizing the content, Alina felt the interaction feature of being able to expand and collapse the different panels was fun as she exclaimed: "Oh, I like the way it's organized too. Because, in a way, it's kind of like a little suitcase and everything, just like packed up nice neat [...] I like the expander. It's kind of fun." In addition to the visual organization, Amyra also expressed that she liked the heading labels of each expander panel and the functionality of the expanders, stating:

What I really liked about the expander thing is that the labeling in the expander, if it's accurate, it makes it easy because I don't have to think about it. I just say 'oh there's html' click, and then I assume that everything there is to know about this is going to be listed there [*hovers the cursor over Canvas & HTML Basics section/panel heading/link*].

Amyra demonstrated through her navigational practices and commented that the design and functionality of the expander made it easy to find information. Bailey also reemphasized how the design and functionality of the expanders can save him time by stating:

I like the expander because I'm not wasting time running my eyes over that [expands and collapses the ADDIE & Needs Analysis expander panel content] when I know I need that [*hovers the cursor over Canvas & HTML Basics heading and expander panel*]. [...] Now I like this it is much easier to find.

In addition to Amyra's and Bailey's comments and experience, Lila had similar praises regarding the clarity of the expander's visual design, along with the functionality of the Expand All and Collapse All buttons. Lila expressed her appreciation for this page design:

I like this layout a lot. [scrolling down through the page and back to the top] The headings are clear. If I, you know, if I didn't want to read all this course-specific stuff, I could collapse and just jump right to the one I needed [selects Collapse All button and all of the expander panels collapse so just the three headings/links of each expander are displaying].

Lila continues providing positive comments as she selects the Collapse All button causing all of the expander panels to collapse, so just the three headings/links of each expander are displaying, and she states:

I like the fact that you can collapse them and just find the main heading that you need [selects Collapse button to close all expander panels then circles cursor over the three heading/links]. But if that isn't specific enough, you can expand them individually [selects the Course Specific Resources heading/link to open that particular expander panel] or expand them all [selects the Expand All button to expand all of the expander panels of content], so I find it very easy to navigate.

In addition to Lila's comments on how easy it is to expand and collapse all of the content, Yvaine also added that having these segmented panels and the ability to open and close them helps her absorb the material and not feel so overwhelmed by stating:

I like it. It sequences you're absorbing the requirements of the project. Well, it keeps you from being overwhelmed. [Referring to content organized in expander] [...] I do like the expansion and contraction stuff because it force it when you take action to expand [reopens Canvas & HTML Basics expander panel], it forces your mind to say 'that's what I'm going to, that's what I'm going to look at now.' And it and when they're closed up, and all I'm looking at is this one, I don't get distracted.

The participants mostly had positive perceptions and feedback regarding the use of expanders as a means of better organizing page content into segmented chunks, which also coincide with the segmenting principle. Using such expanders to segment

large amounts of content could help reduce cognitive load during LMS page use, aligning with prior research by Méndez-Carbajo and Wolla (2019) and Rey et al. (2019). After examining the expanders, the participants viewed the next page layout, which used tabs as an interactive web feature to segment content.

2. *Tabs*: Five participants gave positive feedback about the use of tabs to organize the content into different sections when navigating the page. Two participants preferred tabs over the use of expanders because the content in the tabs fit on their screen, so the participants did not have to scroll through the page. For example, Lila stated why she valued tabs when explaining:

You know I liked the expander too. But this is even better in that everything's kind of right in front of you [*selects Course-Specific Resources tab heading/link*]. So, when I want to read about the resources, it's all right on my screen [*circling cursor over the content in the Course Specific Resources tab panel*].

In addition to being able to easily view the content on the screen, Lila also explained that the navigation for the tabs was intuitive by saying:

And then I realized my choices are right up at the top [*glides cursor to the three-tab headings/links and hovers over each, then selects each of them revealing the content for each tab panel*]. And again, to right in front of me, no scrolling needed. [*points cursor to content in the tabbed panel*]

Not having to scroll was also a described benefit for Bailey, who stated:

I like this even better. I gotta tell you because I'm not scrolling [*selecting the different tab headings/links*]. It's one click, and there it is. Super easy. [...] No, I like it very, very easy to see. I'm not wasting a lot of time reading stuff I don't need. [...] Now, this is really simple. [...] this is easy. [...] Headers, tabs, things that that you can put in little chunks that I can open and close are much better than putting it all on one page.

Lila's and Bailey's positive reactions and comments, along with their navigational practices, demonstrated that using tabs to segment content aligns with the segmenting principle and made for a positive usability experience.

Other participants provided general positive comments about the use of tabs, even if they preferred the expanders instead. For instance, Amyra stated, “The ease of it, the clicking and everything popping up, I think it was pretty easy [*selects the different tab menu links*].” The ease of use expressed by Amyra was also emphasized by Tristan, stating:

This is where everything is located at the top, so the user can kind of see. [*Circles cursor over tab heading/links*.] I don't know. I didn't mind the last page. I don't mind like look at everything at once.[...] It was about the same as the dropdown menus [referring to expanders]. [...] I like in different chunks. [...] Like I said, I like the tabs at the top of your catches your if you are looking for a broader topic.

While Tristan liked the ease of use and the content organized in chunks, Alina did as well but preferred the fun of clicking the expander panels as she stated: “I like it [tabs], but I still like the other thing [referring to the expander] a little bit better [...] it's just it's a personal thing. I just think it's fun to click.” For these participants, the use of tabs to organize content provided no overwhelming, negative experiences; further, through their navigational behavior and comments, the users demonstrated that the tabs were easy to navigate and clearly organized the content. The positive remarks and navigational experience align with the purpose of the segmenting principle.

However, one participant did not like tabs and preferred the use of expanders. The main reason for the adverse reaction to tabs was due to not being able to see all of the content at once, which the expander provides for the user. Yvaine explained, “[I] don't like tabs. [...] because you lose it [referring to the content]. Tabs hides things. Subtly they subtly hide things.” When Yvaine compared the functionality of expanders versus tabs, she stated:

You know, because I can have it all. And I can just put them all out right. I like the

expansion, because if I want everything in one page, so I can scroll up and down, that's my preference.

Yvaine is an internal participant and noted that she had seen tabs used in other classes at the university. Even though she repeatedly stated she did not like tabs, she also added: "It looks pretty. [...] What we're used to navigating by tab, so it's not a difficult navigational feature. It's just what is visually preferred, I think." Using tabs as a design element to chunk and organize content does align with the segmenting principle. However, compared to the expanders, the tabs element does not provide an option for the user to view all of the content. Some of the participants like the tabs feature better than expanders because they prefer less scrolling. However, another participant dislikes tabs because they cannot see all of the content, and they expressed that it is not as user-friendly and adds barriers regarding viewing all of the content. Other participants who did not have negative feedback for the tabs page still preferred the ability to see all of the content like the expander allows them to do. After examining the tabs, the participants viewed the next page layout, which used accordions as an interactive web feature to segment content.

3. *Accordions*: While the accordions visually appear almost identical to expanders, there was an overwhelming consensus with all participants that the accordions were the least preferred way to segment content on a page. Even the participants who did not have many negative perceptions of the accordions did not like that the accordions would only show one panel at a time. When the participants would try to open another panel, the panel they were currently viewing automatically closed. All of the participants expressed through their navigational behavior and conversation that they preferred expanders. The participants preferred the expanders over the

accordions to choose which content panels they could see and the ability to expand or collapse all. When Amyra examined and tried to navigate the page with accordions, she stated:

The one thing that, especially for information that was really detailed and that may not have been so obvious from the title was that, if I click this [*Selects the Course Specific Resources heading/link to open panel*], then the other goes away [*hovers cursor over the other two collapsed accordion panels – ADDIE... and Canvas... sections*]. So, then it, it puts a lot of strain on me, because then I have to remember and double-check like Okay, what did I read or what am I looking for again. It was really distracting.

Based on Amyra's navigational practices and comments, she struggled when the content was automatically hidden. Amyra continued with further comments stating:

There was too much information under one. So, it would be easier for me to remember if I click, let's say like this Canvas if it only had like one or two things in it. Then I would be more inclined to remember, like, okay, was definitely not there. But because there was a lot of information under it, I think that if I didn't ask you 'hey, what was it again,' it would have taken me a lot longer because I would have been clicking them multiple times.

The purpose of the accordion is to break down content into smaller segments, but if the accordion panels have more than a few lines of information, that seems to cause issues. The amount of content in the accordion panels is segmented exactly the same as the expanders and tabs. However, Amyra expressed that the hiding of the content in the accordions and the amount of content caused usability issues.

In addition to Amyra's comments, Yvaine had similar concerns and a strong dislike for the accordions as she exclaimed:

I have to open up everything. Oh, my God! this is worse than tabs! Stuff gets hidden. I can't see everything else. You cannot see everything at once with one scroll! [...] yeah, I don't like the layout because they overlap what's a call they overlapping and requires too much action. It's worse than tabs! I couldn't even find the information!

Yvaine did not like the tabs because she could not see all of the content at once, but as

she continued examining the page and using the accordions, she felt they added even more of a burden to her process with the opening and closing of the panels to reveal and hide the content, stating:

[...] As I said, because I like the expansion-contraction [referring to expanders] because you can get it all out there and just keep scrolling and scrolling. And sometimes, when you do this accordion thing. Because you can just quickly scroll up and down and see if a certain word is going to trigger, trigger a thought process. They'll say, oh, let me look up there. Well, I have to open this up, and now I've lost it. I mean, in that split second, I've lost whatever thought process I had. And now I don't know what I'm looking for in here. That's because you've hid you hidden it from me. You prevented me from opening it all up if that's what I want.

While Amyra and Yvain identified how the accordions disrupted their thought process and caused a negative user experience, some of the participants saw a few positive features, but they still had negative comments and preferred the expanders over accordions. As Tristan stated:

I like the compactibility of it. But as far as like seeing all the information, I don't like it. So, it's probably least of my favorite. [...] I can say accordion font looks nice, but I'd kind of like to see it all expanded at once. So, if I'm like, okay well, 'what is this' and I have to go back up here, and I just have to jump around a little.

Lila had similar concerns and a mix of positive and negative comments, stating:

I guess I don't like the accordion as well because it closes the others [*circles cursor over the three closed accordion panels*]. No big deal, it would just be a matter of getting used to it. [...] I think it's fairly easy to find the information you need. It would be nice to have these stayed open if you wanted them to, each section.

While the basic design and navigation of the accordions were easy, the forced hiding of content caused issues for the participants. While the accordions organize content into smaller segments, the functionality of the accordions is counter-intuitive regarding usability and trying to reduce cognitive load. Another item to note from observations is

that while Tristan tried to search for information on the page, he used the browser's find feature (Control + F on a PC), and the browser could only search through the panel of content displayed on the page. The find feature could not search through the other hidden accordion panels, which could cause additional usability issues and possible accessibility issues.

In addition, Bailey did not notice the difference between expanders and accordions at first. Even though he did not demonstrate any challenges navigating either of the pages, he did state:

I don't know that I have a real super big preference either way. [...] I like stuff to open up and stay open. [...] It's easier for me to go back and forth. Yeah, if I have both open, I can kind of go, oh, you know wasn't there, and I'm not wasting time while it opens and closes.

Alina did not initially say anything about not being able to open all of the panels in the accordion, but when I asked a follow-up question, she stated, "I actually noticed a difference, and I prefer it to where I can open one thing and open other at the same time." While the accordions organize content into segments, the participants demonstrated difficulty navigating and finding information on the page. Several participants were vocal about their dislike of the accordions, especially since they could not view the rest of the content on the page. A few participants made statements that coincide with examples of causing extraneous cognitive load.

There are several ways to segment content into manageable chunks of information for the user. When it comes to page layout, using headings for white space and context provided a positive experience. Participants demonstrated a positive user experience and provided positive feedback for the use of bullet and numbered lists.

Table 4

Positive and Negative Aspects for the Expanders, Tabs, and Accordion Design Elements Used to Segment Content

	Positive	Negative
Expanders	<ul style="list-style-type: none"> Organizes content into segments Users said expanders are easy to Navigate Provides users the ability to expand and collapse all of the content – gives users control over how much or how little they view. 	<ul style="list-style-type: none"> User has to scroll to see content when all expander panels are open.
Tabs	<ul style="list-style-type: none"> Organizes content into segments Users said tabs are easy to Navigate Depending on the amount of content, tabs fit on one screen and minimize scrolling. Even though users can only see one panel of content at a time, it only took one click to view another panel of content. 	<ul style="list-style-type: none"> Users can only see one panel of content at a time.
Accordions	<ul style="list-style-type: none"> Organizes content into segments Users said the navigation was easy from a functionality perspective. 	<ul style="list-style-type: none"> Users can only see one panel of content at a time. They do not have control over how much content displays at one time. Opening one panel of content forcibly closes the initial panel of content. This distracted and frustrated the users. Users became frustrated and forgot which panels they had already viewed when the panels forcibly closed and opened.

When it comes to using expanders, tabs, or accordions, expanders had the most positive user experience and feedback. The participants had some positive and negative experiences and feedback using tabs but felt they could be beneficial if used appropriately. However, the participants all had some criticism or demonstrated some difficulty and negative user experience finding information on pages that used accordions. A list of the positive and negative aspects of using expanders, tabs, and

accordions is presented in Table 4 to provide a comparative overview of these three different design elements. While each design element has positive and negative attributes, participants preferred expanders because they were viewed as providing superior usability.

Throughout the usability test, the participants demonstrated through their navigation behavior, expressed user experience, and the conversations that they did not like busy pages or pages with too much text content. This result is similar to prior usability studies by Fisher and Wright (2010), Miller-Cochran and Rodrigo (2006), and Reeder (2018) regarding readability and usability. The participants preferred and demonstrated positive experiences when the content was organized into smaller segments, especially with the use of headers and expanders for the page layout. These design elements align with the recommended practices for implementing the segmenting principle, which have been associated with helping reduce cognitive load. While the signaling and segmenting principles were the most prominent principles applied to the page layouts, the study also examined the Coherence principle.

Coherence

The coherence principle means “people learn better from a multimedia lesson when extraneous material is excluded rather than included” (Mayer, 2014c, p.390). For this study, each of the page layouts consisted of text directions or content and an image. The images were related to the content on the page; however, they were not vital to the page content. For example, the page layouts for the course project instructions had an image of a chalkboard drawing of different training concepts. The page layouts for the assignment had an image of a notebook with a lightbulb drawn on it

and a piece of blue paper crumpled on top of the lightbulb. The page layouts for readings and resources had an image of an open laptop leaning against a stack of books.

During the usability test, several participants commented that the image in the project pages did not make sense and distracted them while searching for information on the page. Some of them thought maybe it was because the image was small or because they did not know the content as well and could not connect the image to the text. For example, Amyra stated:

I noticed that when I was in the course, and there was an image to the side, I didn't really pay attention to it. I didn't really look at it. It didn't really give me any insight to what was there. I think if there is a lot of images, for the sake of imagery, it kind of takes away.

Amyra did not see any contribution from the image or relation to the content, and Lila had similar contents stating:

I don't know what this picture is for unless I read the paragraph, I think. [...] I never knew what those images were for on the other pages. But I'm also not reading. Perhaps if I had read it, it would have I would have realized what it was for. I think it was just a space-filler.

While the image did not add anything positive to Amyra's or Lila's experience, the image was distracting for Yvaine and Tristan. Yvaine stated:

I have no idea what this is for [*circles cursor over the image on the page – the image looks like a chalk drawing of training concepts and icons*] this doesn't help me; I'm not quite sure whether, um, so I'm not sure why it's there. Okay, so that there's plenty of information on this page, as I said, I have no idea, this is not helping me [*pointing to the image on the page*].

Tristan expressed that it could be the small size of the image that made it distracting.

Tristan also provided possible suggestions and stated:

Maybe it's pictures too small. I can't really read it. [*circling cursor over image*] Maybe if it was bigger or related to the course. [...] I don't know what it is. That a

flower? [*chuckles and zooms in the browser window to make it larger*] Maybe was bigger? I guess related to the [course]. Maybe you could have like a table or something like a flow-charting business. [...] have a table right there right. Maybe something else to draw the reader in.

However, the participants did not say anything about the images on the other page layouts. Since the assignment page layouts were the first set of pages the participants looked at, they may not have felt the need to comment again on the other pages. Since it was described as small, maybe the training concepts in the image were not clear enough. This example of adding an image, which is extraneous information, to provide interest to the content violates the coherence principle. These findings align with the study by Mayer et al. (1995) and the study by Sung and Mayer (2012).

In the results relating to signaling, the icons used in the heading format caused negative user experience and feedback. While the icons are intended to draw the users' attention and provide additional context, these heading icons could violate the coherence principle if they are not used appropriately. The most common navigational and user experience issue with the icons appeared to be the use of the information icon. However, it is still something to consider that icons should serve a purpose to inform the user and not as extraneous decorative content. The crosstab queries and frequency counts explain why items coded under the Coherence Principle trended with more negative codes. These codes referred to the coherence principle being violated instead of implemented.

Summary of Results for Multimedia Learning Principles

As the participants examined the variety of page design layouts, they provided feedback and demonstrated that the pages that implemented the signaling, segmenting, and coherence principles were easier regarding usability. These design practices align

with two quality course criteria: instructions are written clearly, and information is chunked. The results of the second part of the usability align with these design recommendations and the concept that better usability practices can help lead to reducing extraneous cognitive load and provide a better user experience within an asynchronous online environment.

Time Management

Throughout both parts of the usability tests, several participants referred to aspects of time management. For example, the participants wanted to know the course schedule and types of assignments on their first day so they could plan their time accordingly. The participants also expressed the benefits of the to-do list feature in Canvas to keep them on track for completing their assignments. Several participants mentioned that they would download files for required readings and copy assignments and discussion prompts into a document so they could work offline. Tristan and Yvaine elaborated that they do this since they do not always have internet access due to required airline travel for their jobs.

Several participants also mentioned time management while examining the content of the page layouts. Bailey liked that the resources page provided verbiage for items that were informative resources instead of required readings so he could spend his time focusing on what he needed to do and not waste time on resources that were not required. In addition, participants expressed how the segmented content in expanders helped them find information quickly and did not waste their time.

The conversations with the participants and their comments as they navigated the course and pages reinforce the desire for efficient course design, which aligns with

the study by Reid et al. (2016). The participants provided specific course features such as the schedule, Canvas to-do list, and the grades area as helping them with their time management. The participants also indicated how the content organization and distinction of what is required versus what is supplemental is also beneficial regarding time management.

Summary

This chapter presented the research findings for the navigation and page design layout of a purposely designed asynchronous online course. The results show that appropriately and methodically implementing recommended design practices of using intuitive navigation, segmenting content, and providing clear instructions by including design elements associated with the signaling, segmenting, and coherence principle provided a positive user experience. These design practices include providing consistent navigation, bolding important words or key phrases, using headings, segmenting course content into weekly modules, and chunking page content into organized sections. The results also show that not using these recommended design practices provided a negative user experience regarding usability. For instance, participants were overwhelmed when there was too much information on the page that was not segmented; however, using accordions to segment content also caused frustration. Participants were also distracted by the use of non-essential images. Inconsistent link titles cause a confusing navigational experience. Table 5 provides an overview of the evidence and findings that address the three topics of inquiry. In the next chapter, the practical applications, limitations, and suggestions for future research are discussed.

Table 5

Matrix Aligning Topics of Inquiry, Evidence, and Findings

Topic of Inquiry (Abbreviated)	Evidence	Findings
<p>TOI 1 - How do learners describe their navigational experience in an intentionally designed asynchronous online course w/in an LMS? What are learners looking for and expecting to find on their first day of class? And how do they navigate the course?</p>	<ul style="list-style-type: none"> • Participants' navigation behavior • Navigated to and looked through the syllabus. • Utilized the course main menu to navigate. • Utilized the Modules area to navigate. • Utilized Canvas To-Do list feature to quickly see due dates. • Participants' comments • Expressed preference for course main menu over Home page navigation. • Expressed preference to use Modules area to easily see the course structure and find activity items. • Expressed desire to organize their time management. • Expressed desire to have ability to work offline. 	<ul style="list-style-type: none"> • Modules Area • Main Menu • Syllabus • Schedules/ To-Do Lists
<p>TOI 2 – What are the learners' perceptions and preferences of the page layout regarding usability when the coherence, signaling, and segmenting practices are applied?</p>	<ul style="list-style-type: none"> • Participants' navigation behavior • Demonstrated ease of finding information when design elements were used methodically for the three principles. • Demonstrated difficulty when design elements were not used or were not used methodically, • Participants' comments • Expressed frustration or being overwhelmed when examining pages when design elements were not used or were not used methodically, • Expressed preference for pages when design elements were used methodically for the three principles and how those design elements helped regarding usability. • Identified important information on the page as the items that used signaling design elements. 	<ul style="list-style-type: none"> • Preferred pages with design elements for signaling, segmenting, & coherence principles when used methodically.

(table continues)

Topic of Inquiry (Abbreviated)	Evidence	Findings
TOI 3 - How do participants describe different aspects of the asynchronous course as being usable according to common usability principles?	<ul style="list-style-type: none"> • Participants' navigation behavior • Demonstrated ease of finding activities and information in the Modules area, which segments activities for each week. • Demonstrated navigational confidence (especially internal participants) with consistent main menu and modules area, which are used in the template model. • Demonstrated ability to easily find and understand instructional information when design elements used methodically, • Participants' comments • Expressed ease of navigation for the course main menu and modules area. • Expressed preference and desire for information to be segmented (modules area and content on page). • Expressed preference for methodically used design elements and how they helped clarify instructions and ability to easily find information for activities. 	<ul style="list-style-type: none"> • Utilizing the three criteria of quality online course design: Intuitive navigation, chunked/segmented content, and clear instructions provide a positive user experience.

CHAPTER 5

DISCUSSION

Discussion of Results

The purpose of this study was to examine if utilizing recommended design practices to create a quality online course within a template model helped learners regarding usability. The results and interpretations from the results presented in Chapter 4 demonstrate the positive and negative design course design elements. In addition, the positive and negative user experiences relating to navigation and page design layout are discussed in the following sections.

Connecting Findings to Theoretical Framework

The theoretical framework for this study is based on cognitive load theory, cognitive theory of multimedia learning, and multimedia learning principles, in particular the elements that focus on usability and visual web design. One reason for designing asynchronous online courses with usability in mind is to help reduce extraneous cognitive load. Through recommended practices based on research, there are many ways to do this. This study focused on the recommended practices of using a template for course navigation and structure to create intuitive navigation, segmenting the course structure into weekly modules, and applying the signaling, segmenting, and coherence principle to create clear instructions. While this study did not measure extraneous cognitive load, the results presented in Chapter 4 align with the recommended practices to help reduce extraneous cognitive load.

Recommendations for Practice

Using the results of this study as a basis for identifying improvements, the

following sections provide recommendations to support a better usability experience.

These enhancements should help learners find information more efficiently through the navigation and page design layout of course content.

Template Model – Consistent Navigation and Course Structure

The first recommendation is to utilize a template model in asynchronous online courses within an entire program or campus for consistency. Based on this study, the consistent course main menu and having a course structure in which the content is organized into weekly modules would be the crucial design elements to focus on when creating the template for all other courses to follow. Having a consistent navigational menu reduces usability barriers and creates an efficient experience so the learners can focus on the course content and complete course activities. The external participants demonstrated that the navigational menu and the modules area provided an organized, efficient, and positive user experience. The internal participants demonstrated that the consistency of the main menu and modules area amongst several courses created a positive and easy user experience aligning with recommended design practices to reduce extraneous cognitive load from a usability perspective.

The second recommendation is to streamline the Home page, prioritize important content and utilizing visual hierarchy, and ensure the link descriptions and destinations are consistent to avoid confusion. The Home page should have important information; however, the following design elements should be taken into consideration.

- The selection and value of the content displayed on the home page (e.g., the instructor's name, course name, important links, directions to guide the learners where to go first, etc.).
- The visual hierarchy of the content on the home page, especially when using

banner images; they should not intrude on the important information and content of the page.

- The number of links presented on the home page, especially if the course has links in a main navigational menu.
- When including links on the home page, ensure the link text, link title, and link destination are consistent.

The Home page is the first page the learners see, and for first-time users, providing clear instructions in a simplified design can help guide them through the course and provide the essential information, so they have a positive user experience and reduce extraneous cognitive load. Successful navigation of course content is a necessary aspect of the asynchronous online course experience. However, presenting the content and instructions is another aspect that can help or hinder the learner regarding usability.

Implementing Multimedia Learning Principles through Visual Design

There are several recommendations for utilizing design elements methodically. These approaches allow successful implementation of the signaling, segmenting, and coherence principle when designing course content pages. With these recommendations, several suggestions from this study need to be considered when using different design elements for each of these principles.

Signaling

The third recommendation is to utilize design elements such as headings, bold text, and icons to apply the signaling principle to page layouts; however, these design elements should be used methodically and with purpose. These design elements aligned with the categories identified by Garrett et al. (2016) and Schneider et al. (2018) and provided a positive user experience in this study. The following are suggested

practices for using bold and icons to implement the signaling principle are supported by the participants' navigation behavior and comments described in Chapter 4.

- Use bold for important keywords or short phrases to draw the learners' attention. Some examples from this study include important dates, time requirements for an assignment, etc.
- Do not use bold excessively. If too much text is bold, it does not stand out to the user, and therefore it no longer serves the purpose of signaling.
- Using an appropriate icon to precede an important statement of a few sentences draws the user's attention and can be used instead of bolding multiple sentences.
- Consider the context, symbolism, size, color, and other formatting when using icons to ensure they signal the user and do not detract from the purpose of the icon.
- Consider the amount of color used, the purpose for how it is being used, and which color is being used especially for complying with Web Content Accessibility Guidelines (WCAG).
- When using design elements for signaling, especially alert boxes, using colors that stand out from the page instead of colors that blend in with the page can help draw the user's attention.

In addition to bold text and icons, headings are another design element to signal users.

Headings used to signal sections of content were very helpful to the participants to help digest the information on the page and find specific information easily. Most text editors have the capability to use heading levels for visual design and to meet accessibility standards. Headings with a larger font size than the content, or bold formatting, help visually signal organized sections of content on the page. Using these design elements to implement signaling in the course content and learning materials helped guide the learners by providing cues, which is consistent with prior research by Dyson and Gregory (2002), Grant-Smith et al. (2019), Mayer (2017), Ozcelik et al. (2010), Richardson et al. (2014), and Sung and Mayer (2012).

Using appropriately titled headings to signal different sections is recommended when a considerable amount of text is on a content page. In addition to using headings as a visual signal, they are also an element for segmenting content.

Segmenting

Similar to the studies by Fisher and Wright (2010), Miller-Cochran and Rodrigo (2006), and Reeder (2018), the participants in this study did not like pages with large amounts of text. Several participants admitted they would glance over the information because it was too much on the page. Chunking content into smaller sections is recommended for content with a large amount of text, aligning with the segmenting principle. This recommendation is consistent with the study by Fisher and Wright (2010).

Using headings should be applied with appropriate titles that introduce the sections of content accordingly. Expanders, tabs, and accordions are additional ways to chunk content into interactive segments; however, this study shows that the way the content is segmented can positively or negatively affect usability. These findings have a similar theme from a study by Méndez-Carbajo and Wolla (2019), which noted that chunking content demonstrated some general improvements, the segmenting treatment alone was not enough. While Méndez-Carbajo and Wolla (2019) measured learning, the concept that only segmenting content is not always helpful and other design elements should be considered. When looking at recommendations for using expanders, tabs, and accordions, there is more to consider than the feature of segmenting content. As presented earlier in Table 4 , each design element has positive and negative attributes. Expanders provided users with control over how much content and which content they

viewed. The positive point for tabs in the context of this study was that the users did not have to scroll to view all of the content; however, the users could only view one tabbed panel of content at a time and did not have the option to view all of the content.

Accordions also prevented the users from having the ability to view all of the content, and the added animation to force the panels opened and closed distracted the users.

Based on these functionality features, the participants preferred the expanders because they were viewed as providing superior usability.

The fourth recommendation is to use headings for a simple way to segment content, use expanders if that design feature is available, use tabs to help users avoid scrolling, and avoid using accordions. Expanders are recommended since they provide the user with control on how to view the content. Expanders can be used to chunk content and provide users with control over the way they pace and view the segmented content aligns with the findings of the segmenting principle by Rey et al. (2019). Tabs can be used with considerations of the purpose of the content and the amount of content. Use tabs if it helps prevent the user from scrolling on the page to view all of the content; but, if the user needs to scroll to view the content within the tab, using an expander is the recommended alternative. These design elements provided positive user experiences and aligned with the concepts of the signaling principle. The use of accordions should be avoided since they provided a frustrating and negative user experience and did not serve the purpose of the signaling principle to reduce cognitive load by segmenting content into smaller chunks. In addition to the signaling and segmenting principles, this study also provides recommendations for implementing the coherence principle.

Coherence

The fifth recommendation is to exclude extraneous text and images in course content and activity instructions. In the different versions of the Project page, the image of training concepts distracted the participants. Some participants suggested it was because the image was small, and hard to tell what the image portrayed. When using images in page design layout, the purpose of the image should be taken into consideration. Also, the size of the image should be considered to ensure the image is clear, so it does not confuse the users; but, the image should not be too large and encroach on other important content. These design recommendations for navigation and page layout can help provide a positive user experience regarding usability. Some of these benefits can also help learners with their time management for completing activities and assignments in their course.

Time Management and Usability

The sixth and final recommendation is to take the learners' time and time management into consideration. Throughout the usability test, participants demonstrated and expressed that they wanted to find things quickly and easily in the course for usability and efficiency. The preference to have an efficient experience is similar to the studies by Gregg et al. (2017) and Reid et al. (2016). The participants wanted to know what activities and assignments they needed to do each week to manage their time throughout the course. Also, when looking at the page layouts, several participants disliked reading a lot of unnecessary text or going through an extensive list of links. The participants expressed their preference for having concise instructions, segmenting the content, and clearly identifying which resources and

readings are required versus recommended or supplemental to help save them time. Also, several participants expressed that they like to download and save the content to view offline because of their work and travel schedules, and they are not always connected to the Internet to access the course content online. While the learner is responsible for their own time management, a skill of self-regulated learning (Zimmerman, 2002), asynchronous online courses can incorporate design elements and features to help nurture this skill. Providing a user-friendly schedule of assignments with due dates, methodically identifying required and supplemental resources, and allowing learners to download content to work offline are simple practices to incorporate in the course design that can help the learner foster time management and succeed in the course.

The recommendations from this study can act as guidance for creating future asynchronous online courses with usability in mind. These recommendations cover navigation areas, applying multimedia learning principles to content page design, utilizing a template model, and designing for an efficient experience that allows learners to manage their time better. These recommendations are based on the findings that address the three topics of inquiry (see Table 6).

While these recommendations can be applied in various asynchronous online course settings, several limitations have been identified and are presented in the following section.

Table 6

Matrix Aligning Topics of Inquiry, Findings, and Recommendations

Topic of Inquiry (Abbreviated)	Findings	Recommendations
<p>TOI 1 - How do learners describe their navigational experience in an intentionally designed asynchronous online course w/in an LMS? What are learners looking for and expecting to find on their first day of class? And how do they navigate the course?</p>	<ul style="list-style-type: none"> • Modules Area • Main Menu • Syllabus • Schedules/To-Do Lists 	<p>1) Utilize template model for consistency and efficient navigation. 2) Streamline the Home page by prioritizing important content, consistent link descriptions, and destinations to avoid confusion. 6) Utilize schedules/to-do lists, clearly identify required vs. supplemental readings, and provide users the ability to work offline to help with time management.</p>
<p>TOI 2 – What are the learners’ perceptions and preferences of the page layout regarding usability when the coherence, signaling, and segmenting practices are applied?</p>	<p>Preferred pages with design elements for signaling, segmenting, & coherence principles when used methodically</p>	<p>3) Utilize signaling design elements (headings, bold text, and icons) methodically and with purpose. 4) Use headings or expanders to segment content; use tabs to avoid scrolling; and avoid using accordions. 5) Exclude extraneous text and images in course content and activity instructions.</p>
<p>TOI 3 - How do participants describe different aspects of the asynchronous course as being usable according to common usability principles?</p>	<p>Utilizing the three criteria of quality online course design: Intuitive navigation, chunked/segmented content, and clear instructions provides a positive user experience.</p>	<p>1) Utilize template model for consistency and efficient navigation. 3) Utilize signaling design elements (headings, bold text, and icons) methodically and with purpose. 4) Use headings or expanders to segment content; use tabs to avoid scrolling; and avoid using accordions.</p>

Limitations

This study examined the usability of a purposely designed asynchronous online course from a navigational and content page layout perspective. The course design and structure used in this study is part of a template model and represents the navigation and course structure for all of the asynchronous online courses offered at the university. The gathered data and reported findings are beneficial to the university or similar organizations and institutions offering asynchronous online courses, but there are some limitations. The data results, analysis, and recommendations can apply to asynchronous online courses in various learning management systems and higher educational institutions; however, these will not apply to all scenarios, programs, and institutions.

While the six participants consisted of internal students and external students for different perspectives and fit the criteria recommended for the sample size of usability testing, a larger sample size would add additional data and insight. The usability test examined one course currently offered at the university; however, the course was in a sandbox environment. The participants were only in the course for the duration of the usability test, so they had a limited time to become familiar with the course navigation, structure, and content. While the usability test aims to replicate an authentic experience, the nature of the usability tests is not identical to an asynchronous course experience. The usability test lasted for about an hour and is structured by suggested typical tasks; however, analyzing usability in an active asynchronous course would provide a more authentic experience and further insight into usability practices and issues.

Regarding page design layout and applying multimedia learning principles, only three types of activities were examined, an assignment, course project, and readings

and resources. Three to five versions of these pages were examined; however, testing additional content types and variations for implementing these principles would provide further insight. While the framework for this study is based on cognitive load theory and design practices recommended to reduce cognitive load, this study did not measure participants' cognitive load. Additionally, my field notes documenting non-verbal cues and screen-captured navigation trends could be subjective in translation.

Another limitation with usability testing is the limited amount of time available, so I can only examine a certain number of items and ask a certain number of questions. Due to the limited time, the instrument and study do not address every aspect of the course or page design layout. However, this situation creates more questions to be addressed in recommended future studies.

Recommendations for Future Research

This study supports the three criteria for creating quality online courses based on usability: navigation is intuitive, instructions are clear, and information is chunked. This study also supports that the methodical use of design elements to implement multimedia learning principles can also lead to a positive usability experience. While these findings are based on the cognitive load theoretical framework, this study did not examine or assess cognitive load. Future research should determine if these practices reduce cognitive load from an end-user perspective.

While this study examined one asynchronous online course in the context of a template model, future studies could examine multiple courses from a program or campus to compare the data between courses. Other suggestions would be to examine a wider variety of course content pages and page design layouts utilizing the signaling,

segmenting, and coherence principle. Future studies could also examine course videos and expand the research to include other multimedia learning principles. In addition, future studies could examine the usability and navigational habits of other course activities, along with LMS features such as group projects, the group collaboration area, projects that require students to use external tools, and other features and course elements. Future studies could also examine if different page layouts have a different impact when applied to different types of content. Other aspects for further studies would be to examine these design practices regarding accessibility and Universal Design for Learning (UDL).

For this study, having the internal and external candidates' perspectives provided valuable insight into the benefits and gaps in the course design and structure. However, the setting was a one-hour usability test and not an active nine-week class. It is recommended that future usability tests take place during an active class section to emulate a more realistic environment. Additionally, future studies could incorporate courses from different colleges, universities, or higher educational institutions that utilize a template model and compare the commonalities and differences between templates from a usability perspective. Finally, future studies could look at the usability of blended courses and other modalities offered in higher education, professional development, and K-12.

Conclusion

The intent of this study was to investigate the usability of navigation and page design layout of an asynchronous online college course within a template model, which is purposefully designed to implement recommended design elements and practices

based on quality course design criteria and multimedia learning principles. This study examined how students navigate, what they expect to find on their first day of class, and what they think about page design layout for course content regarding implementing multimedia learning principles. Based on the findings, courses designed using the following criteria can create a positive user experience regarding usability:

- Intuitive navigation, especially with the use of a template model
- Information is chunked in the course structure and content presentation
- Instructions are written clearly and enhanced by methodically using the signaling, segmenting, and coherence principle

Several recommendations for creating a positive usability experience in asynchronous online courses have been identified based on the usability test:

1. Utilize a template model in asynchronous online courses within an entire program or campus for consistency and intuitive navigation.
2. Streamline the Home page, prioritize important content, and ensure the link descriptions and destinations are consistent to avoid confusion.
3. Utilize design elements such as headings, bold text, and icons to apply the signaling principle to page layouts; however, these design elements should be used methodically and with purpose.
4. Use headings for a simple way to segment content; use expanders if that design feature is available; use tabs to help users avoid scrolling; and avoid using accordions.
5. Exclude extraneous text and images in course content and activity instructions.
6. Consider the learners' time and time management by utilizing schedules or to-do lists with clear due dates for course activities, clearly identifying required and supplemental readings and resources, and providing users the ability to work offline.

These recommendations based on the findings align with the concepts and principles to help reduce cognitive load; however, future research should be conducted to measure

cognitive load from a usability perspective. Learners taking asynchronous online courses should have minimal barriers so they can focus on learning the course content and submit their assignments to successfully complete their course. Providing intuitive navigation and utilizing the signaling, segmenting, and coherence principle methodically to design asynchronous online courses can help reduce barriers regarding usability.

APPENDIX A
DEMOGRAPHIC SURVEY INSTRUMENT

1. Please view/download the Research Consent Form (DOCX). [Attached in survey question]

By selecting "I Agree" I certify that I am at least 18 years or older (and considered a legal adult), a United States citizen, current undergraduate or graduate online student attending a public or private higher education institution (college or university), and understand the information on this form. I also voluntarily agree to participate in the usability study and grant permission for audio, video, and screen recording during the usability test session. I am also agreeing to both the Embry-Riddle Aeronautical University consent form *and* the University of North Texas Consent form.

- I Agree
- I Do NOT Agree

2. Age

- 18-20
- 21-24
- 25-29
- 30-34
- 35-39
- 40-44
- 45-49
- 50-54
- 55-59
- 60-69
- 70-79
- 80
- Choose not to answer

3. Gender

- Female
- Male
- Transgender
- Do not identify as female, male, or transgender
- Choose not to answer

4. What is the current level of degree you are seeking?
 - a. Associates Degree
 - b. Undergraduate 4-year degree
 - c. Master's Degree
 - d. Combined bachelor's and master's (4+1) degree
 - e. PhD Degree

5. Are you a student of Embry-Riddle Aeronautical University?
 - a. Yes
 - b. No
[If YES go to Question 6 – if NO go to *Question 8*]

6. At which ERAU campus are you enrolled to take classes?
 - a. Worldwide Online (100% asynchronous online courses)
 - b. Worldwide Other modalities (not 100% asynchronous online courses)
 - c. Daytona Campus
 - d. Prescott Campus

7. As an ERAU student, have you taken, or do you plan on taking the course ASCI 514 – Computer-Based Instruction?
 - a. Yes
 - b. No

8. What is your major? (e.g., Biology, Learning Technologies, Aviation Maintenance, Computer Science, undecided, etc.)
[Fill in the blank]
 -

9. What higher education institution are you currently enrolled? (Optional)
 - [Fill in the blank]

10. How far along are you in your current degree program? This is my...
 - a. first semester (Just started)
 - b. second semester
 - c. third semester of my first year
 - d. second year

- e. third year
- f. fourth year
- g. fifth year (or longer)

11. How many academic (for-credit) online courses have you completed in your entire academic career?

- a. None
- b. 1
- c. 2
- d. 3-5
- e. 5-10
- f. More than 10

12. Which learning management systems (e.g., Canvas, Blackboard, etc.) have you used in the past or are currently using? (Check all that apply).

- a. Canvas
- b. Blackboard
- c. Desire2Learn
- d. Moodle
- e. Not Sure
- f. Others: please list

13. Please provide your name, email, and time zone (for scheduling purposes). The researcher will contact you using the email address you provide to schedule the usability test.

If you have any questions, please feel free to contact me: XXXX@XXXX.edu or XXXXX@XXXX.edu (Please put 'Usability Study' in the subject line).

[Fill in the blank]

APPENDIX B
USABILITY TEST SCRIPT AND INSTRUMENT

::Before recording::

For this study, I will need to record you. Do I have your permission to record?

::Begin Recording::

Thank you for taking the time today to participate in this study. As a researcher, I would like to learn more about how you interact with online courses. The data collected from this study will help inform best practices for online course creation, teaching, and learning.

You have submitted a signed research consent form agreeing to participate in this interview. However, I would like to confirm that you meet the requirements for the study, agree to participate, and are willing to be recorded for the study.

Could you please verify that you are at least 18 years or older, a United States citizen, current undergraduate or graduate online student attending a public or private higher education institution (college or university)? Please say "I am."

Can you also please verify your consent to participate in the study and grant permission for the researcher? Please say "I agree."

Can you also please verify your consent to allow me to record the audio, video, and screen recording during this usability session? Please say "I agree."

Thank you.

Today, you will be asked to look at a course titled ASCI 514 – Computer-Based Instruction. Please note, you are navigating this course for this usability study, but you will not receive academic credit for this course. It does not matter if you are unfamiliar with the subject matter of this course. You will only be asked to perform nine (9) course-related tasks within this course. *There are no right or wrong answers to these tasks.* I simply want you to try to perform each task and while doing so, explain what you are doing out loud. In addition to the tasks, you will also be asked some factual and opinion questions.

First, I will ask you two questions regarding your experience with online courses. Then we will proceed to the usability test. The usability test consists of two parts. The first part pertains to general navigation of the course, and the second part pertains to the visual layout of the activity directions. After the usability test portion, I will ask some follow up questions. At that time, you can provide any additional comments if you would like to.

Questions

Question 1

Are you currently using the Canvas learning management system (LMS) in your course work at the university?

Question 2

When you enter your online course for the first day of class, what are you looking for as you try to determine what you need to do for the class?

[*Please note:* This course is in a Sandbox environment, so some features of the normal online courses are not reflected in this sample online course.]

Usability Part 1 – Navigation Task Scenarios:

We will begin the first part of the usability test, which asks you to work through the course as you naturally would as an online student. Please explain what you are doing, and why, as you perform the tasks. *Reminder: there are no right or wrong answers.*

I'm asking that you explain what you are doing as you navigate your way through the course to try to complete the task. Please explain why you are making choices, any instances where you do not know what to do, and how that makes you feel.

Please express your positive and negative impressions, thoughts, frustrations, etc. as you go through this process.

Task 1

Imagine that it is the first day of class. After logging into the course, beginning with the homepage, what do you do to get started in the course? Explore the course and talk through your thought process. Please describe what you are doing, and why, as you work through the task of determining what to do.

Task 2

Imagine that it is the first day of class, you need to review the syllabus. Please show and explain how you would locate the syllabus in this class.

Task 3

Imagine that it is the first day of class, you want to know what the module topic and module objectives are for the first week of class. Please show and explain how you would locate the module topic and module objectives in this class.

Task 4

At the next step of your class experience, you would like to get an idea regarding what assignments and work you must do in the upcoming week in the course. Please find that information in this course. As you do so, explain where would you look in the class to find your upcoming workload and assignments?

Task 5

Imagine that your instructor sent an email reminding you to complete the *Module 3 Readings*. Please find that reading activity and explain what you are doing and why.

Task 6

Imagine that you have a question regarding the participation requirements in the *5.3 Discussion: Social Media in Online Learning*. Please show and explain how you would locate the participation requirements for the discussion activity.

Task 7

For the next task, pretend that you just remembered that you have the *7.3 Activity: Asynchronous Drill and Practice* this week and need to check the submission due date. Please locate that date and explain what you are doing and why you think this is the right approach.

Task 8

The overarching course project in this class is the *WCBT Module*, which consists of several assignment due throughout the course. Where would you expect to find the detailed information about this project and associated assignments? Please demonstrate how you would find the information for this multiple activity project. *Follow up* - Please explain whether, and why, you prefer having these assignment items to be grouped together in one module or spread across the module weeks where they are due.

Task 9

In the next stage of your course work, pretend that you want to see if your assignment *4.2 Canvas Activity: Design a Content Page* was graded. Look for that information and explain where you are looking, why, and any thoughts you have about the experience as you do it to successful check if it has been graded.

Additional Follow-Up Opinion Questions

I am going to ask you a few follow-up opinion questions pertaining to your experience completing class tasks as you navigate through the course. Then we will proceed to the second part of the usability test.

Question 1

Tell me about any thoughts or impressions you have regarding this course and the tasks you just performed.

Follow-up questions:

- What was easy about locating what you needed in the class?
- What was difficult with finding what you were looking for in the class?
- Do you have any suggestions for improving this class so that it is easier to find what you are looking for?

Question 2

Tell me about what you feel should be on the home page in an online course and why.

Question 3

Do you have any thoughts or opinions regarding the structure of the modules area of this course? Explain how you think the modules of a class should be organized so they can be best understood and used by students.

[**Take 5-minute break if participant needs one**]

This concludes the first part of the usability test. If you would like to take a short 5-minute break let me know. I will keep the recording going, so please continue to share your screen. However, you may mute your mic and turn off your video during the break, then turn them back on once you return.

[end of 5-minute break – if needed]

We are still recording, please make sure your mic and video are on and that you are still sharing your screen.

Usability Part 2 – Page Layout Visual Design:

We will begin the second part of the usability test where I am asking you to look at how the pages are visually laid out. Please remember to explain what you are looking at, and why, as you examine the pages. Provide any thoughts you may have regarding the way the information is presented. Again, there are no right or wrong answers.

At this point, you will experience three different versions of activity information and/or directions. For each page, you will be asked a few short questions.

Select the *Usability Test: Page Layout Samples* page. You will notice there are several links on this page. These will take you to the different versions of the pages you will examine.

[Screenshots of page layouts provided at end of the instrument, for example, of what participants will see in the usability test.]

When asked, please select the specific link as instructed. Once the page opens, I will ask you questions. Please remember to explain your thought process for each decision you make and action you take.

1st Set – Project Instructions:

Task 1

Under the “*Project*” section – please select the link that says “*Version 1*”

1. How many assignment activities are related to this overall project? Please explain the process used to look for this information.
2. After looking at the instructions for this project, what do you feel are the three most important items of information on this page?
3. Please explain your overall thoughts regarding how easy it was to find information on this page. What could be changed or improved to make it more usable? Do you think it should be organized differently in terms of page layout and content organization to make it more usable? If so, how?

At the bottom of the page, select the *Next* button.

Task 2

“*Version 2*”

1. *Locate the information on the page regarding when the assignment is due for the 3.3 W/CBT Module Assignment 5: Flowcharting.* Please talk through the process you used to locate this information.
2. After looking at the instructions for this project, please explain what you feel are the three most important items of information on this page and why?
3. Please explain your overall thoughts regarding how easy it was to find information on this page. What could be changed or improved to make it more usable? Do you think it should be organized differently in terms of page layout and content organization to make it more usable? If so, how?

At the bottom of the page, select the *Next* button.

Task 3

“*Version 3*”

1. According to the directions, when is the *Needs Analysis* activity due? Please explain how you found this information as you look for it.
2. According to the directions, how long does the *training module* need to be? Please talk through your process as you locate this information.
3. After looking at the instructions for this project, please explain what you feel are the three most important items of information on this page and why?
4. Please explain your overall thoughts regarding how easy it was to find information on this page. What could be changed or improved to make it more usable? Do you think it should be organized differently in terms of page layout and content organization to make it more usable? If so, how?

At the bottom of the page, select the *Return to Usability Test: Page Layout Sample* link

2nd Set – Assignment Instructions:

Task 1

Under the “*Assignment*” section – please select the link that says “*Version 1*”

1. *Locate the information on the page regarding when the assignment is due.* Please explain what you are doing and why as you look for this information.
2. After looking at the instructions for this assignment, please explain what you feel are the three most important items of information on this page and why?
3. Please explain your overall thoughts regarding how easy it was to find information on this page. What could be changed or improved to make it more usable? Do you think it should be organized differently in terms of page layout and content organization to make it more usable? If so, how?

At the bottom of the page, select the *Next* button.

Task 2

“*Version 2*”

1. According to the directions, how many *data gathering methods* should be used? As you look for it, please explain how you locate this information.
2. After looking at the instructions for this assignment, please explain what you feel are the three most important items of information on this page and why?
3. Please explain your overall thoughts regarding how easy it was to find information on this page. What could be changed or improved to make it more usable? Do you think it should be organized differently in terms of page layout and content organization to make it more usable? If so, how?

At the bottom of the page, select the *Next* button.

Task 3

“*Version 3*”

1. *Locate the information on the page regarding when the assignment is due.* Please explain how you are searching to locate this information.
2. After looking at the instructions for this assignment, please explain what you feel are the three most important items of information on this page and why?
3. Please explain your overall thoughts regarding how easy it was to find information on this page. What could be changed or improved to make it more usable? Do you think it should be organized differently in terms of page layout and content organization to make it more usable? If so, how?

At the bottom of the page, select the *Return to Usability Test: Page Layout Sample* link

3rd Set – Resources:

Task 1

Under the “*Resources*” section – please select the link that says “*Version 1*”

1. Please locate the *links for resources about HTML*. As you look for this information, please explain your thought process.
2. Please explain your overall thoughts regarding how easy it was to find information on this page. What could be changed or improved to make it more

usable? Do you think it should be organized differently in terms of page layout and content organization to make it more usable? If so, how?

At the bottom of the page, select the *Next* button.

Task 2

“Version 2”

1. Next, please locate links for resources about *Needs Analysis*. As you look for this information, explain your thought process.
2. Please explain your overall thoughts regarding how easy it was to find information on this page. What could be changed or improved to make it more usable? Do you think it should be organized differently in terms of page layout and content organization to make it more usable? If so, how?

At the bottom of the page, select the *Next* button.

Task 3

Please note the next three pages will be similar; however, they utilize features such as expanders, tabs, and accordions for content layout. Expanders, tabs, and accordions have unique features, as you will see as you examine the different pages. Some questions will be specific to these different features. In this page, the content is organized using *expanders*.

“Version 3a”

1. Please locate the *link for resources about HTML Formatting* and talk through the process as you look for this information.
2. What are your thoughts about the page layout and the content of this page organized in an expander?
3. Please explain your overall thoughts regarding how easy it was to find information on this page. What are your thoughts about navigating for content organized in an expander? What could be changed or improved to make it more usable?

At the bottom of the page, select the *Next* button. In this page, the content is organized using *tabs*.

Task 4

“Version 3b”

1. Please locate the *link for resources about Instructional Design Needs Analysis* and talk through the process as you look for this information.
2. What are your thoughts on the page layout and the content of this page organized in tabs?
3. Please explain your overall thoughts regarding how easy it was to find information on this page. What are your thoughts about navigating for content organized in tabs? What could be changed or improved to make it more usable?

At the bottom of the page, select the *Next* button. In this page, the content is organized using *accordions*.

Task 5

“Version 3c”

1. Please locate the *link for resources about Identifying the target audience* and talk through the process as you look for this information.
2. What are your thoughts on the page layout and the content of this page organized in an accordion?
3. Please explain your overall thoughts regarding how easy it was to find information on this page. What are your thoughts about navigating for content organized in accordion?

At the bottom of the page, select the *Return to Usability Test: Page Layout Sample* link

Additional Follow-Up Questions

I'm going to ask you a few follow up opinion questions pertaining to the pages we just looked at, regarding page layout.

Question 1

Please explain how you feel about the visual design of the course content pages.

Question 2

Please tell me how you feel about the use of colorful themes on content pages compared with pages with no colorful themes.

Question 3

Please tell me how you felt about the included headers, bold text, and use of icons in the page layouts.

Question 4

When comparing the three pages that used expanders, tabs, and accordions, please tell me which of those features you felt were the most user friendly and why?

Question 5

Do you have any comments, questions, or suggestions about the course design?

This concludes the Usability test. Thank you again so much for your time. Please feel free to contact me if you have any questions regarding the research study.

:End Recording:

Acknowledgment: Usability test and script adapted with permission from Gregg, A., Reid, R., Aldemir, T., Garbrick, A., Frederick, M., & Gray, J. of Penn State University. Original Source: [PSU Canvas UX - Companion Site: Supporting Documents to Conduct Your Own UX Testing](#)

Sources

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Screenshots from Usability Test – Part 2

Figure B.1

Project Instructions Version 1

W/CBT Module - Course Project Overview:

For your course project, you will create a 20-minute Web/Computer Based Training (W/CBT) Module in Canvas. The purpose of this training module is to solve a problem or performance issue, also known as a performance gap. Specifically, a performance gap is the difference between what people should be doing and what they are actually doing. The problem could come from your workplace, school, or any other organization – or it could be fictitious. Aviation-related topics are encouraged. Sample problem statements in an aviation context could be: Our airline has a higher rate of damage to baggage than our competitors or our baggage handlers have higher rates of injuries this year than in the last five years.

Excluded topics include those that address how to use any type of software product or app to increase productivity (e.g., Only 50% of our managers know how to use Microsoft Excel®).

Limit the scope of your problem to something that can be solved in a 20-minute instructional activity. Don't try to do an entire college course or solve a large, complex problem. It's better to choose just one aspect of a problem.

The seven W/CBT assignments are cumulative and will help you develop your W/CBT Module in a step-by-step way. Below is a breakdown of the assignments that you will complete on the way to creating your W/CBT Module. Become familiar with these assignments so you are prepared for them. You will need to decide on a training need during this module.

Below is the list of deliverables for the Web/Computer Based Training Module:

- [1.6 W/CBT Module Assignment 1: Identify a Performance Gap](#)
- [1.7 W/CBT Module Assignment 2: Project Sponsor Interview](#)
- [2.3 W/CBT Module Assignment 3: Needs Analysis](#)
- [3.2 - W/CBT Module Assignment 4: Writing Objectives](#)
- [3.3 W/CBT Module Assignment 5: Flowcharting](#)
- [6.2 W/CBT Module Assignment 6: Storyboard](#)
- [8.3 W/CBT Module Assignment 7: W/CBT Due](#)

Return to [Usability Test: Page Layout Samples](#).



Note. Page layout of project instructions with very minimal multimedia learning principles applied.

Figure B.2

Project Instructions Version 2

W/CBT Module - Course Project Overview:

Overview

For your course project, you will create a **45-minute** Web/Computer Based Training (W/CBT) Module in Canvas. The purpose of this training module is to solve a problem or performance issue, also known as a performance gap. Specifically, a performance gap is the difference between what people should be doing and what they are actually doing. The problem could come from your workplace, school, or any other organization – or it could be fictitious. Aviation-related topics are encouraged. Sample problem statements in an aviation context could be: Our airline has a higher rate of damage to baggage than our competitors or our baggage handlers have higher rates of injuries this year than in the last five years.

Excluded topics include those that address how to use any type of software product or app to increase productivity (e.g., Only 50% of our managers know how to use Microsoft Excel®).

Limit the scope of your problem to something that can be solved in a 45-minute instructional activity. Don't try to do an entire college course or solve a large, complex problem. It's better to choose just one aspect of a problem.



Assignment Timeline

The **seven W/CBT assignments are cumulative** and will help you develop your W/CBT Module in a step-by-step way. Below is a breakdown of the assignments that you will complete on the way to creating your W/CBT Module. Become familiar with these assignments so you are prepared for them. You will need to decide on a training need during this module.

Below is the list of deliverables for the Web/Computer Based Training Module:

- [1.6 W/CBT Module Assignment 1: Identify a Performance Gap](#)
- [1.7 W/CBT Module Assignment 2: Project Sponsor Interview](#)
- [2.3 W/CBT Module Assignment 3: Needs Analysis](#)
- [3.2 - W/CBT Module Assignment 4: Writing Objectives](#)
- [3.3 W/CBT Module Assignment 5: Flowcharting](#)
- [6.2 W/CBT Module Assignment 6: Storyboard](#)
- [8.3 W/CBT Module Assignment 7: W/CBT Due](#)

Return to [Usability Test: Page Layout Samples](#).

Note. Page layout of project instructions with some multimedia learning principles applied with use of headings and bold font.

Figure B.3

Project Instructions Version 3

W/CBT Module

Course Project Overview

i Overview

For your course project, you will create a **30-minute** Web/Computer Based Training (**W/CBT**) Module in Canvas.

The purpose of this training module is to solve a problem or performance issue, also known as a performance gap. Specifically, a performance gap is the difference between what people should be doing and what they are actually doing. The problem could come from your workplace, school, or any other organization – or it could be fictitious. Aviation-related topics are encouraged. Sample problem statements in an aviation context could be: Our airline has a higher rate of damage to baggage than our competitors or our baggage handlers have higher rates of injuries this year than in the last five years.



Excluded topics include those that address how to use any type of software product or app to increase productivity (e.g., Only 50% of our managers know how to use Microsoft Excel®).

i Limit the scope of your problem to something that can be solved in a 30-minute instructional activity. Don't try to do an entire college course or solve a large, complex problem. It's better to choose just one aspect of a problem.

📅 Assignment Timeline

The **seven W/CBT assignments are cumulative** and will help you develop your W/CBT Module in a step-by-step way. Below is a breakdown of the assignments that you will complete on the way to creating your W/CBT Module. Become familiar with these assignments so you are prepared for them. You will need to decide on a training need during this module.

Below is the list of deliverables for the Web/Computer Based Training Module. All deliverables are due by the **last day** of the module week indicated for each activity.

- Module 2 [Identify a Performance Gap](#)
[Project Sponsor Interview](#)
- Module 3 [Needs Analysis](#)
- Module 4 [Writing Objectives](#)
[Flowcharting](#)
- Module 5 [Storyboard](#)
- Module 9 [W/CBT Module Due](#)

Return to [Usability Test: Page Layout Samples](#).

Note. Page layout of project instructions with more multimedia learning principles applied with use of headings, bold font, and icons.

Figure B.4

Assignment Instructions Version 1

2.3 - Needs Analysis W/CBT Module Assignment 3

Now that you have an understanding of all the steps involved in a Needs Analysis, you will conduct the rest of a Needs Analysis for your W/CBT Module.

This project is due at the end of Module 3 to give you time to collect and analyze your data.

In the [Training Needs Analysis Template \(PDF\)](#),  complete the first four pages:

Section 1: Project Overview - List the name of your project, your project description, the overall objective for your training module, a description of your audience (learners), and any constraints.

Section 2: Data Collection Plan - Based on what you have learned about gathering data, choose at least two methods of data gathering that you would use to help you analyze and pinpoint your learners' training needs. Include the following details in your plan:

- List the two types of data gathering methods you would use.
- Explain why these two types are the best methods to help you analyze your learners' needs.
- Describe the target audience you would include in your data collection efforts.
- Write 6-8 questions you would ask during your data collection activity.
- In addition to the questions that you would ask, describe any strategies you would also employ to encourage employees to participate and to ensure that your data collection method was as accurate as possible.

Section 3: Data Analysis - Based on what you have learned about analyzing data and the questions you asked in your Data Collection Plan, report on your real or fictional results. Ideally, if your project is real and you have time to collect some data, you would post your real results. Include the following details in your analysis:

- Use a histogram, Pareto chart, scatterplot, or another type of chart or table to analyze and display your results.
- Answer these questions: Did your data reveal a correlation between the performance gap and a particular action, behavior, or group? How do the results of your 5 Whys analysis compare to your data collection results?

Section 4: Recommendations - Based on your analysis, report your recommendations for designing this training. Consider the following questions in making recommendations:

- Did your analysis reveal that you need to focus on one segment of your audience or one aspect of your intended training over others?
- Did your analysis reveal that other actions (beyond your training) should also be implemented?
- Did your analysis reveal that a particular type of training or format would work best to solve your problem (for instance, a module with a lot of visuals or one with a checklist that people can use)?

These samples may help you with your project:

- [Training Needs Analysis Sample \(PDF\)](#) 
- [Data Collection Sources \(PDF\)](#) 
- [Data Analysis Reference Sheet \(PDF\)](#) 

Save your assignment using a naming convention that includes your first and last name and the activity number (or description). Do not add punctuation or special characters.

Return to [Usability Test: Page Layout Samples](#).



Note. Page layout of assignment instructions with very minimal multimedia learning principles applied.

Figure B.5

Assignment Instructions Version 2

2.3 - Needs Analysis W/CBT Module Assignment 3

Now that you have an understanding of all the steps involved in a **Needs Analysis**, you will conduct the rest of a Needs Analysis for your W/CBT Module.

This project is due at the **end of Module 5** to give you time to collect and analyze your data.

In the [Training Needs Analysis Template \(PDF\)](#),  complete the first four pages:

Section 1: Project Overview - List the name of your project, your project description, the overall objective for your training module, a description of your audience (learners), and any constraints.

Section 2: Data Collection Plan - Based on what you have learned about gathering data, choose at least two methods of data gathering that you would use to help you analyze and pinpoint your learners' training needs. **Include the following details in your plan:**

- List the two types of data gathering methods you would use.
- Explain why these two types are the best methods to help you analyze your learners' needs.
- Describe the target audience you would include in your data collection efforts.
- Write 6-8 questions you would ask during your data collection activity.
- In addition to the questions that you would ask, describe any strategies you would also employ to encourage employees to participate and to ensure that your data collection method was as accurate as possible.

Section 3: Data Analysis - Based on what you have learned about analyzing data and the questions you asked in your Data Collection Plan, report on your real or fictional results. Ideally, if your project is real and you have time to collect some data, you would post your real results. **Include the following details in your analysis:**

- Use a histogram, Pareto chart, scatterplot, or another type of chart or table to analyze and display your results.
- Answer these questions: Did your data reveal a correlation between the performance gap and a particular action, behavior, or group? How do the results of your 5 Whys analysis compare to your data collection results?

Section 4: Recommendations - Based on your analysis, report your recommendations for designing this training. **Consider the following questions in making recommendations:**

- Did your analysis reveal that you need to focus on one segment of your audience or one aspect of your intended training over others?
- Did your analysis reveal that other actions (beyond your training) should also be implemented?
- Did your analysis reveal that a particular type of training or format would work best to solve your problem (for instance, a module with a lot of visuals or one with a checklist that people can use)?

These samples may help you with your project:

- [Training Needs Analysis Sample \(PDF\)](#) 
- [Data Collection Sources \(PDF\)](#) 
- [Data Analysis Reference Sheet \(PDF\)](#) 

Save your assignment using a naming convention that includes your first and last name and the activity number (or description). Do not add punctuation or special characters.

Return to [Usability Test: Page Layout Samples](#).



Note. Page layout of assignment instructions with some multimedia learning principles applied.

Figure B.6

Assignment Instructions Version 3

Needs Analysis


2.3

W/CBT Module Assignment 3

i This project is due at the **end of Module 4** to give you time to collect and analyze your data.

Overview **i**

Now that you have an understanding of all the steps involved in a **Needs Analysis**, you will conduct the rest of a Needs Analysis for your W/CBT Module.

In the [Training Needs Analysis Template \(PDF\)](#),  complete the **first four** pages:

Section 1: Project Overview


List the name of your project, your project description, the overall objective for your training module, a description of your audience (learners), and any constraints.

Section 2: Data Collection Plan

Based on what you have learned about gathering data, choose **at least two methods** of data gathering that you would use to help you analyze and pinpoint your learners' training needs.

Include the following details in your **plan**:

- List the two types of data gathering methods you would use.
- Explain why these two types are the best methods to help you analyze your learners' needs.
- Describe the target audience you would include in your data collection efforts.
- Write 6-8 questions you would ask during your data collection activity.
- In addition to the questions that you would ask, describe any strategies you would also employ to encourage employees to participate and to ensure that your data collection method was as accurate as possible.



Section 3: Data Analysis

Based on what you have learned about analyzing data and the questions you asked in your Data Collection Plan, report on your real or fictional results. Ideally, if your project is real and you have time to collect some data, you would post your real results.

Include the following details in your **analysis**:

- Use a histogram, Pareto chart, scatterplot, or another type of chart or table to analyze and display your results.
- Answer these questions: Did your data reveal a correlation between the performance gap and a particular action, behavior, or group? How do the results of your 5 Whys analysis compare to your data collection results?




Section 4: Recommendations

Based on your analysis, report your recommendations for designing this training.

Consider the **following questions** in making recommendations:

- Did your analysis reveal that you need to focus on one segment of your audience or one aspect of your intended training over others?
- Did your analysis reveal that other actions (beyond your training) should also be implemented?
- Did your analysis reveal that a particular type of training or format would work best to solve your problem (for instance, a module with a lot of visuals or one with a checklist that people can use)?

These samples may help you with your project:

- [Training Needs Analysis Sample \(PDF\)](#) 
- [Data Collection Sources \(PDF\)](#) 
- [Data Analysis Reference Sheet \(PDF\)](#) 

Assignment Submission **✓**

Save your assignment using a naming convention that includes your first and last name and the activity number (or description). Do not add punctuation or special characters.

Return to [Usability Test: Page Layout Samples](#).

Note. Page layout of project instructions with more multimedia learning principles applied with use of headings, bold font, and icons.

Figure B.7

Resources and Tutorials Version 1

Layout 3: V1 - no mm

The following are resources and tutorials that will help you throughout the course. Please review these as needed.

Course Specific Resources

- [Instructional Design.org](#) ^e
- [Nielsen Norman Group, Usability 101: Introduction to Usability](#) ^e
- [Online Learning, A Journal of the Online Learning Consortium](#) ^e
- [Bloom's Taxonomy/Donald Clark](#) ^e
- [University of Queensland, Australia](#) ^e
- [Conditions of Learning \(Robert Gagne\)/Instructional Design.org](#) ^e
- [HTML Essential Training/LinkedIn Learning](#) ^e
- [W3Schools](#) ^e
- [HTML Goodies](#) ^e
- [eLearning Guru](#) ^e
- [Multimedia Resource for Learning and Online Teaching](#) ^e
- [SCORM, Shareable Content Object Reference Model Initiative/Cover Pages](#) ^e
- [Sookmyung Women's University, Applying Learning Theory to CBT and Web-Based Instruction/Patsula](#) ^e



Note: Since the WWW is always changing, some of these links may have broken (i.e. removed or significantly modified) since listed above. This list is not meant to be the definitive set of useful locations. If a link returns an error message, instead of the web page you expected, it may be that the web site is very busy right now and you can try reaching it again later. However, if you continue to be unsuccessful in reaching the desired webpage, it may have been updated and the address changed. Strategies for finding missing pages include:

- First, go to the web site address (URL), you were trying to reach, located near the top of the browser. Ensure that the information is entered accurately (no missing or additional characters, no missing or additional spaces).
- Second, if data is entered accurately and still no success, then go to the web site address (URL) and delete the last portion of the address up to the first slash mark. Try going to that location instead. If that returns an error message, delete more of the address as before. The goal is to get to a root page at the web site that will allow you to find the new link to the information you want. In addition, you may find lots of new and useful information at that site you were not even aware existed.
- Finally, if the steps above are unsuccessful, then use one of the many search engines available on the web to look for the exact title of the desired web page. If unsuccessful again, the information is probably no longer available.

ADDIE and Needs Analysis Tutorials

Some of the multimedia resources in this course include video tutorials from LinkedIn Learning. You can log in two ways. If you select the link to a resource, you will be prompted to enter your ERAU email and password. Or you may log in via the [ERAU homepage](#) ^e under the **Tools** section.

Watch the following videos (the first three in this playlist):

- [Instructional Design Essentials: Models of ID](#) ^e
 - Helping learners learn (01:05)
 - What is instructional design?! (03:09)
 - Getting to know ADDIE (03:39)

Watch the following videos (the first seven in this playlist):

- [Instructional Design Essentials: Needs Analysis Part I](#) ^e
 - Welcome (01:06)
 - What to know before watching this course (00:37)
 - Understanding the importance of needs analysis (03:57)
 - Communicating with project sponsors (04:07)
 - Setting project objectives (05:10)
 - Identifying the target audience (03:46)
 - Establishing project constraints (04:25)

Canvas Formatting and HTML Basics Tutorials

Explore the Rich Content Editor in the following Canvas tutorial and video to learn how to add links, videos, tables, and images, as well as format your content within your training module.

- [What is the Rich Content Editor?](#) ^e
- [Rich Content Editor](#) ^e (03:43)

Read and interact with the following tutorials on w3schools.com, a well-respected web design training site. Although you will be using the Rich Content Editor for formatting most of your content in your module, knowing some basic HTML can help you make your content look even better. Be sure to select the "Try it Yourself" sections and experiment with the HTML to see how it changes.

- [HTML Introduction](#) ^e
- [HTML Basic Examples](#) ^e
- [HTML Elements](#) ^e
- [HTML Attributes](#) ^e
- [HTML Headings](#) ^e
- [HTML Paragraphs](#) ^e
- [HTML Formatting](#) ^e
- [HTML Links](#) ^e
- [HTML Images](#) ^e - Be sure to pay attention to the "Image Floating" section. This will explain the code needed to make images wrap around text within the content.

Return to [Usability Test: Page Layout Samples](#).

Note. Page layout of Resources and Tutorials page with very minimal multimedia learning principles applied.

Figure B.8

Resources and Tutorials Version 2

Resources and Tutorials

The following are resources and tutorials that will help you throughout the course. Please review these as needed.



Course Specific Resources

- [Instructional Design.org](#)
- [Nielsen Norman Group, Usability 101: Introduction to Usability](#)
- [Online Learning, A Journal of the Online Learning Consortium](#)
- [Bloom's Taxonomy/Donald Clark](#)
- [University of Queensland, Australia](#)
- [Conditions of Learning \(Robert Gagne\)/Instructional Design.org](#)
- [HTML Essential Training/LinkedIn Learning](#)
- [W3Schools](#)
- [HTML Goodies](#)
- [eLearning Guru](#)
- [Multimedia Resource for Learning and Online Teaching](#)
- [SCORM, Shareable Content Object Reference Model Initiative/Cover Pages](#)
- [Sookmyung Women's University, Applying Learning Theory to CBT and Web-Based Instruction/Patsula](#)

Note: Since the WWW is always changing, some of these links may have broken (i.e. removed or significantly modified) since listed above. This list is not meant to be the definitive set of useful locations. If a link returns an error message, instead of the web page you expected, it may be that the web site is very busy right now and you can try reaching it again later. However, if you continue to be unsuccessful in reaching the desired webpage, it may have been updated and the address changed. Strategies for finding missing pages include:

- First, go to the web site address (URL) you were trying to reach, located near the top of the browser. Ensure that the information is entered accurately (no missing or additional characters, no missing or additional spaces).
- Second, if data is entered accurately and still no success, then go to the web site address (URL) and delete the last portion of the address up to the first slash mark. Try going to that location instead. If that returns an error message, delete more of the address as before. The goal is to get to a root page at the web site that will allow you to find the new link to the information you want. In addition, you may find lots of new and useful information at that site you were not even aware existed.
- Finally, if the steps above are unsuccessful, then use one of the many search engines available on the web to look for the exact title of the desired web page. If unsuccessful again, the information is probably no longer available.

ADDIE and Needs Analysis Tutorials

Some of the multimedia resources in this course include video tutorials from LinkedIn Learning. You can log in two ways. If you select the link to a resource, you will be prompted to enter your ERAU email and password. Or you may log in via the [ERAU homepage](#) under the **Tools** section.

Watch the following videos (the first three in this playlist):

- [Instructional Design Essentials: Models of ID](#)
 - Helping learners learn (01:05)
 - What is instructional design? (03:09)
 - Getting to know ADDIE (03:39)

Watch the following videos (the first seven in this playlist):

- [Instructional Design Essentials: Needs Analysis Part I](#)
 - Welcome (01:06)
 - What to know before watching this course (00:37)
 - Understanding the importance of needs analysis (03:57)
 - Communicating with project sponsors (04:07)
 - Setting project objectives (05:10)
 - Identifying the target audience (03:46)
 - Establishing project constraints (04:25)

Canvas Formatting and HTML Basics Tutorials

Explore the Rich Content Editor in the following Canvas tutorial and video to learn how to add links, videos, tables, and images, as well as format your content within your training module.

- [What is the Rich Content Editor?](#)
- [Rich Content Editor](#) (03:43)

Read and interact with the following tutorials on w3schools.com, a well-respected web design training site. Although you will be using the Rich Content Editor for formatting most of your content in your module, knowing some basic HTML can help you make your content look even better. Be sure to select the "Try it Yourself" sections and experiment with the HTML to see how it changes.

- [HTML Introduction](#)
- [HTML Basic Examples](#)
- [HTML Elements](#)
- [HTML Attributes](#)
- [HTML Headings](#)
- [HTML Paragraphs](#)
- [HTML Formatting](#)
- [HTML Links](#)
- [HTML Images](#) - Be sure to pay attention to the "Image Floating" section. This will explain the code needed to make images wrap around text within the content.

Return to [Usability Test: Page Layout Samples](#).

Note. Page layout of Resources and Tutorials page with some multimedia learning principles applied.

Figure B.9

Resources and Tutorials Version 3a


Resources and Tutorials

i Please read through all sections before proceeding to the next page, and refer back whenever necessary.

The following are resources and tutorials that will help you throughout the course. Please review these as needed.

Course Specific Resources ADDIE & Needs Analysis Canvas & HTML Basics

- [Instructional Design.org](#) ↗
- [Nielsen Norman Group. Usability 101: Introduction to Usability](#) ↗
- [Online Learning. A Journal of the Online Learning Consortium](#) ↗
- [Bloom's Taxonomy/Donald Clark](#) ↗
- [University of Queensland. Australia](#) ↗
- [Conditions of Learning \(Robert Gagne\)/Instructional Design.org](#) ↗
- [HTML Essential Training/LinkedIn Learning](#) ↗
- [W3Schools](#) ↗
- [HTML Goodies](#) ↗
- [eLearning Guru](#) ↗
- [Multimedia Resource for Learning and Online Teaching](#) ↗
- [SCORM, Shareable Content Object Reference Model Initiative/Cover Pages](#) ↗
- [Sookmyung Women's University. Applying Learning Theory to CBT and Web-Based Instruction/Patsula](#) ↗



Note: Since the WWW is always changing, some of these links may have broken (i.e. removed or significantly modified) since listed above. This list is not meant to be the definitive set of useful locations. If a link returns an error message, instead of the web page you expected, it may be that the web site is very busy right now and you can try reaching it again later. However, if you continue to be unsuccessful in reaching the desired webpage, it may have been updated and the address changed. Strategies for finding missing pages include:

- First, go to the web site address (URL), you were trying to reach, located near the top of the browser. Ensure that the information is entered accurately (no missing or additional characters, no missing or additional spaces).
- Second, if data is entered accurately and still no success, then go to the web site address (URL) and delete the last portion of the address up to the first slash mark. Try going to that location instead. If that returns an error message, delete more of the address as before. The goal is to get to a root page at the web site that will allow you to find the new link to the information you want. In addition, you may find lots of new and useful information at that site you were not even aware existed.
- Finally, if the steps above are unsuccessful, then use one of the many search engines available on the web to look for the exact title of the desired web page. If unsuccessful again, the information is probably no longer available.

👉 Please proceed to the **ADDIE & Needs Analysis** section.

Return to [Usability Test: Page Layout Samples](#).

Note. Page layout of Resources and Tutorials page with more multimedia learning principles applied. Content is organized and segmented using tabs. There are three tabbed sections: Course Specific Information, ADDIE & Needs Analysis, and Canvas & HTML Basics. This page shows the Course Specific Resources tab selected.

Figure B.10

Resources and Tutorials Version 3b

The screenshot shows a web page titled "Resources and Tutorials" with a dark blue header. Below the header is a yellow-bordered box containing an information icon and the text: "Please read through all sections before proceeding to the next page, and refer back whenever necessary." Below this is a paragraph: "The following are resources and tutorials that will help you throughout the course. Please review these as needed." A tabbed interface follows, with three tabs: "Course Specific Resources", "ADDIE & Needs Analysis", and "Canvas & HTML Basics". The "ADDIE & Needs Analysis" tab is selected and highlighted in dark blue. The content under this tab includes: "Some of the multimedia resources in this course include video tutorials from LinkedIn Learning. You can log in two ways. If you select the link to a resource, you will be prompted to enter your ERAU email and password. Or you may log in via the [ERAU homepage](#) under the **Tools** section." It then lists two video playlists. The first playlist is titled "Watch the following videos (the first three in this playlist):" and contains three items: "Instructional Design Essentials: Models of ID" (with sub-items: "Helping learners learn (01:05)", "What is instructional design?! (03:09)", "Getting to know ADDIE (03:39)"), and "Instructional Design Essentials: Needs Analysis Part I" (with sub-items: "Welcome (01:06)", "What to know before watching this course (00:37)", "Understanding the importance of needs analysis (03:57)", "Communicating with project sponsors (04:07)", "Setting project objectives (05:10)", "Identifying the target audience (03:46)", "Establishing project constraints (04:25)"). The second playlist is titled "Watch the following videos (the first seven in this playlist):" and contains the same seven items as the first playlist. At the bottom of the tabbed content, there is a hand icon and the text: "Please proceed to the Canvas & HTML Basics section."

Return to [Usability Test: Page Layout Samples](#).

Note. Page layout of Resources and Tutorials page with more multimedia learning principles applied. Content is organized and segmented using tabs. There are three tabbed sections: Course Specific Information, ADDIE & Needs Analysis, and Canvas & HTML Basics. This page shows the ADDIE & Needs Analysis tab selected.

Figure B.11

Resources and Tutorials Version 3b

The screenshot shows a web page titled "Resources and Tutorials" with a dark blue header. Below the header is a yellow-bordered box containing an information icon and the text: "Please read through all sections before proceeding to the next page, and refer back whenever necessary." Below this is a paragraph: "The following are resources and tutorials that will help you throughout the course. Please review these as needed." Underneath is a tabbed interface with three tabs: "Course Specific Resources", "ADDIE & Needs Analysis", and "Canvas & HTML Basics". The "Canvas & HTML Basics" tab is selected and highlighted in white, with a mouse cursor pointing at it. The content of the selected tab includes a paragraph about the Rich Content Editor, a bulleted list of links: "What is the Rich Content Editor?", "Rich Content Editor (03:43)", "HTML Introduction", "HTML Basic Examples", "HTML Elements", "HTML Attributes", "HTML Headings", "HTML Paragraphs", "HTML Formatting", "HTML Links", and "HTML Images" (with a note about "Image Floating").

Return to [Usability Test: Page Layout Samples](#).

Note. Page layout of Resources and Tutorials page with more multimedia learning principles applied. Content is organized and segmented using tabs. There are three tabbed sections: Course Specific Information, ADDIE & Needs Analysis, and Canvas & HTML Basics. This page shows the Canvas & HTML Basics tab selected.

Figure B.12

Resources and Tutorials Version 4a

Resources and Tutorials

Please read through all sections before proceeding to the next page, and refer back whenever necessary.

The following are resources and tutorials that will help you throughout the course. Please review these as needed.

Expand All Collapse All

Course Specific Resources

- [Instructional Design.org](#)
- [Nielsen Norman Group, Usability 101: Introduction to Usability](#)
- [Online Learning, A Journal of the Online Learning Consortium](#)
- [Bloom's Taxonomy/Donald Clark](#)
- [University of Queensland, Australia](#)
- [Conditions of Learning \(Robert Gagne\)/Instructional Design.org](#)
- [HTML Essential Training/LinkedIn Learning](#)
- [W3Schools](#)
- [HTML Goodies](#)
- [eLearning Guru](#)
- [Multimedia Resource for Learning and Online Teaching](#)
- [SCORM, Shareable Content Object Reference Model Initiative/Cover Pages](#)
- [Sookmyung Women's University, Applying Learning Theory to CBT and Web-Based Instruction/Patsula](#)

Note: Since the WWW is always changing, some of these links may have broken (i.e. removed or significantly modified) since listed above. This list is not meant to be the definitive set of useful locations. If a link returns an error message, instead of the web page you expected, it may be that the web site is very busy right now and you can try reaching it again later. However, if you continue to be unsuccessful in reaching the desired webpage, it may have been updated and the address changed. Strategies for finding missing pages include:

- First, go to the web site address (URL), you were trying to reach, located near the top of the browser. Ensure that the information is entered accurately (no missing or additional characters, no missing or additional spaces).
- Second, if data is entered accurately and still no success, then go to the web site address (URL) and delete the last portion of the address up to the first slash mark. Try going to that location instead. If that returns an error message, delete more of the address as before. The goal is to get to a root page at the web site that will allow you to find the new link to the information you want. In addition, you may find lots of new and useful information at that site you were not even aware existed.
- Finally, if the steps above are unsuccessful, then use one of the many search engines available on the web to look for the exact title of the desired web page. If unsuccessful again, the information is probably no longer available.

Please proceed to the ADDIE & Needs Analysis section.

ADDIE & Needs Analysis

Canvas & HTML Basics



Return to [Usability Test: Page Layout Samples](#).

Note. Page layout of Resources and Tutorials page with more multimedia learning principles applied. Content is organized and segmented using expanders with the same three sections as Figure B9. The user may expand or collapse all of the expander panels. This page shows the Course Specific Resources panel selected.

Figure B.13

Resources and Tutorials Version 4b

Resources and Tutorials

Please read through all sections before proceeding to the next page, and refer back whenever necessary.

The following are resources and tutorials that will help you throughout the course. Please review these as needed.

Expand All Collapse All

Course Specific Resources

- [Instructional Design.org](#)
- [Nielsen Norman Group, Usability 101: Introduction to Usability](#)
- [Online Learning, A Journal of the Online Learning Consortium](#)
- [Bloom's Taxonomy/Donald Clark](#)
- [University of Queensland, Australia](#)
- [Conditions of Learning \(Robert Gagne\)/Instructional Design.org](#)
- [HTML Essential Training/LinkedIn Learning](#)
- [W3Schools](#)
- [HTML Goodies](#)
- [eLearning Guru](#)
- [Multimedia Resource for Learning and Online Teaching](#)
- [SCORM, Shareable Content Object Reference Model Initiative/Cover Pages](#)
- [Sookmyung Women's University, Applying Learning Theory to CBT and Web-Based Instruction/Patsula](#)

Note: Since the WWW is always changing, some of these links may have broken (i.e. removed or significantly modified) since listed above. This list is not meant to be the definitive set of useful locations. If a link returns an error message, instead of the web page you expected, it may be that the web site is very busy right now and you can try reaching it again later. However, if you continue to be unsuccessful in reaching the desired webpage, it may have been updated and the address changed. Strategies for finding missing pages include:

- First, go to the web site address (URL), you were trying to reach, located near the top of the browser. Ensure that the information is entered accurately (no missing or additional characters, no missing or additional spaces).
- Second, if data is entered accurately and still no success, then go to the web site address (URL) and delete the last portion of the address up to the first slash mark. Try going to that location instead. If that returns an error message, delete more of the address as before. The goal is to get to a root page at the web site that will allow you to find the new link to the information you want. In addition, you may find lots of new and useful information at that site you were not even aware existed.
- Finally, if the steps above are unsuccessful, then use one of the many search engines available on the web to look for the exact title of the desired web page. If unsuccessful again, the information is probably no longer available.

Please proceed to the ADDIE & Needs Analysis section.

ADDIE & Needs Analysis

Some of the multimedia resources in this course include video tutorials from LinkedIn Learning. You can log in two ways. If you select the link to a resource, you will be prompted to enter your ERAU email and password. Or you may log in via the [ERAU homepage](#) under the Tools section.

Watch the following videos (the first three in this playlist):

- [Instructional Design Essentials: Models of ID](#)
 - [Helping learners learn \(01:05\)](#)
 - [What is instructional design? \(03:09\)](#)
 - [Getting to know ADDIE \(03:39\)](#)

Watch the following videos (the first seven in this playlist):

- [Instructional Design Essentials: Needs Analysis Part 1](#)
 - [Welcome \(01:56\)](#)
 - [What to know before watching this course \(00:37\)](#)
 - [Understanding the importance of needs analysis \(03:57\)](#)
 - [Communicating with project sponsors \(04:07\)](#)
 - [Setting project objectives \(05:10\)](#)
 - [Identifying the target audience \(03:46\)](#)
 - [Establishing project constraints \(04:25\)](#)

Please proceed to the Canvas & HTML Basics section.

Canvas & HTML Basics

Explore the Rich Content Editor in the following Canvas tutorial and video to learn how to add links, videos, tables, and images, as well as format your content within your training module.

- [What is the Rich Content Editor?](#)
- [Rich Content Editor](#) (03:43)

Read and interact with the following tutorials on w3schools.com, a well-respected web design training site. Although you will be using the Rich Content Editor for formatting most of your content in your module, knowing some basic HTML can help you make your content look even better. Be sure to select the "Try it Yourself" sections and experiment with the HTML to see how it changes.

- [HTML Introduction](#)
- [HTML Basic Examples](#)
- [HTML Elements](#)
- [HTML Attributes](#)
- [HTML Headings](#)
- [HTML Paragraphs](#)
- [HTML Formatting](#)
- [HTML Links](#)
- [HTML Images](#) - Be sure to pay attention to the "Image Floating" section. This will explain the code needed to make images wrap around text within the content.

Return to [Usability Test: Page Layout Samples](#).

Note. Page layout of Resources and Tutorials page with more multimedia learning principles applied. Content is organized and segmented using expanders with the same three sections as Figure B9. This page shows the content when Expand All is selected.

Figure B.14

Resources and Tutorials Version 4c

The screenshot displays a web page titled "Resources and Tutorials". At the top is a dark blue header with the title in white. Below the header is a yellow-bordered box containing an information icon and the text: "Please read through all sections before proceeding to the next page, and refer back whenever necessary." Underneath this box is a paragraph: "The following are resources and tutorials that will help you throughout the course. Please review these as needed." Below the paragraph are two buttons: "Expand All" (with a downward arrow) and "Collapse All" (with an upward arrow). A mouse cursor is pointing at the "Collapse All" button. Below the buttons are three dark blue expandable sections, each with a right-pointing chevron and white text: "Course Specific Resources", "ADDIE & Needs Analysis", and "Canvas & HTML Basics".

Return to [Usability Test: Page Layout Samples](#).

Note. Page layout of Resources and Tutorials page with more multimedia learning principles applied. Content is organized and segmented using expanders with the same three sections as Figure B9. This page shows the content when Collapse All is selected.

Figure B.15

Resources and Tutorials Version 4d

The screenshot shows a web page titled "Resources and Tutorials" with a dark blue header. Below the header is a yellow box with an information icon and the text: "Please read through all sections before proceeding to the next page, and refer back whenever necessary." Below this is a paragraph: "The following are resources and tutorials that will help you throughout the course. Please review these as needed." There are two buttons: "Expand All" and "Collapse All". The page has three main expandable sections, each with a dark blue header and a white body. The first section is "Course Specific Resources", which is expanded. The second section is "ADDIE & Needs Analysis", which is also expanded and has a mouse cursor over it. The third section is "Canvas & HTML Basics", which is expanded and has a mouse cursor over it. At the bottom of the page, there is a link: "Return to Usability Test: Page Layout Samples."

Resources and Tutorials

Please read through all sections before proceeding to the next page, and refer back whenever necessary.

The following are resources and tutorials that will help you throughout the course. Please review these as needed.

Expand All Collapse All

Course Specific Resources

ADDIE & Needs Analysis

Some of the multimedia resources in this course include video tutorials from LinkedIn Learning. You can log in two ways. If you select the link to a resource, you will be prompted to enter your ERAU email and password. Or you may log in via the [ERAU homepage](#) under the **Tools** section.

Watch the following videos (the first three in this playlist):

- [Instructional Design Essentials: Models of ID](#)
 - Helping learners learn (01:05)
 - What is instructional design?! (03:09)
 - Getting to know ADDIE (03:39)

Watch the following videos (the first seven in this playlist):

- [Instructional Design Essentials: Needs Analysis Part I](#)
 - Welcome (01:06)
 - What to know before watching this course (00:37)
 - Understanding the importance of needs analysis (03:57)
 - Communicating with project sponsors (04:07)
 - Setting project objectives (05:10)
 - Identifying the target audience (03:46)
 - Establishing project constraints (04:25)

Please proceed to the **Canvas & HTML Basics** section.

Canvas & HTML Basics

Explore the Rich Content Editor in the following Canvas tutorial and video to learn how to add links, videos, tables, and images, as well as format your content within your training module.

- [What is the Rich Content Editor?](#)
- [Rich Content Editor](#) (03:43)

Read and interact with the following tutorials on w3schools.com, a well-respected web design training site. Although you will be using the Rich Content Editor for formatting most of your content in your module, knowing some basic HTML can help you make your content look even better. Be sure to select the "Try it Yourself" sections and experiment with the HTML to see how it changes.

- [HTML Introduction](#)
- [HTML Basic Examples](#)
- [HTML Elements](#)
- [HTML Attributes](#)
- [HTML Headings](#)
- [HTML Paragraphs](#)
- [HTML Formatting](#)
- [HTML Links](#)
- [HTML Images](#) - Be sure to pay attention to the "Image Floating" section. This will explain the code needed to make images wrap around text within the content.

Return to [Usability Test: Page Layout Samples](#).

Note. Page layout of Resources and Tutorials page with more multimedia learning principles applied. Content is organized and segmented using expanders with the same three sections as Figure B9. The user may expand or collapse all of the expander panels. This page shows the ADDIE & Needs Analysis, and Canvas & HTML Basics panels selected.

Figure B.16














Resources and Tutorials Version 5a


Resources and Tutorials

i Please read through all sections before proceeding to the next page, and refer back whenever necessary.

The following are resources and tutorials that will help you throughout the course. Please review these as needed.


▾ Course Specific Resources

- [Instructional Design.org](#) 
- [Nielsen Norman Group, Usability 101: Introduction to Usability](#) 
- [Online Learning, A Journal of the Online Learning Consortium](#) 
- [Bloom's Taxonomy/Donald Clark](#) 
- [University of Queensland, Australia](#) 
- [Conditions of Learning \(Robert Gagne\)/Instructional Design.org](#) 
- [HTML Essential Training/LinkedIn Learning](#) 
- [W3Schools](#) 
- [HTML Goodies](#) 
- [eLearning Guru](#) 
- [Multimedia Resource for Learning and Online Teaching](#) 
- [SCORM, Shareable Content Object Reference Model Initiative/Cover Pages](#) 
- [Sookmyung Women's University, Applying Learning Theory to CBT and Web-Based Instruction/Patsula](#) 



Note: Since the WWW is always changing, some of these links may have broken (i.e. removed or significantly modified) since listed above. This list is not meant to be the definitive set of useful locations. If a link returns an error message, instead of the web page you expected, it may be that the web site is very busy right now and you can try reaching it again later. However, if you continue to be unsuccessful in reaching the desired webpage, it may have been updated and the address changed. Strategies for finding missing pages include:

- First, go to the web site address (URL), you were trying to reach, located near the top of the browser. Ensure that the information is entered accurately (no missing or additional characters, no missing or additional spaces).
- Second, if data is entered accurately and still no success, then go to the web site address (URL) and delete the last portion of the address up to the first slash mark. Try going to that location instead. If that returns an error message, delete more of the address as before. The goal is to get to a root page at the web site that will allow you to find the new link to the information you want. In addition, you may find lots of new and useful information at that site you were not even aware existed.
- Finally, if the steps above are unsuccessful, then use one of the many search engines available on the web to look for the exact title of the desired web page. If unsuccessful again, the information is probably no longer available.

 Please proceed to the **ADDIE & Needs Analysis** section.

▸ ADDIE & Needs Analysis

▸ Canvas & HTML Basics


Return to [Usability Test: Page Layout Samples](#).

Note. Page layout of Resources and Tutorials page with more multimedia learning principles applied. Content is organized and segmented using accordions with the same three sections as Figure B9. Accordions and expanders look identical, but accordions have limitations compared to expanders. The user may only view one of the accordion panels at a time. This page shows the Course Specific Resources panel selected.

Figure B.17


Resources and Tutorials Version 5b

Resources and Tutorials

 Please read through all sections before proceeding to the next page, and refer back whenever necessary.

The following are resources and tutorials that will help you throughout the course. Please review these as needed.

▸ Course Specific Resources

▾ ADDIE & Needs Analysis 


Some of the multimedia resources in this course include video tutorials from LinkedIn Learning. You can log in two ways. If you select the link to a resource, you will be prompted to enter your ERAU email and password. Or you may log in via the [ERAU homepage](#) under the **Tools** section.

Watch the following videos (the first three in this playlist):

- [Instructional Design Essentials: Models of ID](#)
 - Helping learners learn (01:05)
 - What is instructional design?! (03:09)
 - Getting to know ADDIE (03:39)

Watch the following videos (the first seven in this playlist):

- [Instructional Design Essentials: Needs Analysis Part I](#)
 - Welcome (01:06)
 - What to know before watching this course (00:37)
 - Understanding the importance of needs analysis (03:57)
 - Communicating with project sponsors (04:07)
 - Setting project objectives (05:10)
 - Identifying the target audience (03:46)
 - Establishing project constraints (04:25)

 Please proceed to the **Canvas & HTML Basics** section.

▸ Canvas & HTML Basics

Return to [Usability Test: Page Layout Samples](#).

Note. Page layout of Resources and Tutorials page with more multimedia learning principles applied. Content is organized and segmented using accordions with the same three sections as Figure B9. Accordions and expanders look identical, but accordions have limitations compared to expanders. The user may only view one of the accordion panels at a time. This page shows the ADDIE & Needs Analysis panel selected.

Figure B.18

Resources and Tutorials Version 5c

Return to [Usability Test: Page Layout Samples](#).

Note. Page layout of Resources and Tutorials page with more multimedia learning principles applied. Content is organized and segmented using accordions with the same three sections as Figure B9. Accordions and expanders look identical, but accordions have limitations compared to expanders. The user may only view one of the accordion panels at a time. This page shows the Canvas & HTML Basics panel selected.

APPENDIX C
RECRUITMENT FLYER

UNIVERSITY OF NORTH TEXAS

The UNT Department of Learning Technologies Is Conducting a Research Study on

Qualitative Exploratory Usability Study

Examining usability, navigation, and multimedia learning principles in an intentionally designed asynchronous online college course – a usability study

Participants Needed:

You are invited to participate in a research study usability test that will be conducted by xxxxxxx, Sr.

Instructional Designer at xxxxxxx University and PhD candidate at the University of North Texas (UNT).

The usability test will take place online using Zoom. Audio and video recording (including web cam and screenshare) will be used for data collection purposes only.

If you are at least 18 years or older, a United States citizen, current undergraduate or graduate online student attending a public or private higher education institution (college or university), you may qualify to participate in a research study examining the usability of online courses utilizing multimedia learning principles. *For XXXX students – if you have taken or plan on taking ASCI 514 – Computer-Based Instruction, you are *not* eligible for this study.

Eligible subjects will participate in a usability study of an online course. The purpose of the qualitative study is to investigate how students navigate asynchronous online courses, the usability of asynchronous online course, and the usability of specific activity pages, which utilize any of the three multimedia learning principles: coherence, signaling, and segmenting.

There is no compensation for this study. While the usability study will include content from a real online course, you do not need to have knowledge in the subject matter. Also, no course credit or extra credit will be given for this usability study. Participating in this study will have no impact on any other courses you may be taking.

If you are interested in participating in this study, please fill out this short [demographic survey](#). The survey includes a place for you to provide contact information in order to coordinate the usability study. The consent form for the demographic survey is the first item in the survey. The Principal Investigator will include the usability study consent form in the email for scheduling the usability study.

Please note – if this recruitment information is in your course, please do *not* contact your instructor about this research. If you have questions, please contact the Principal Investigator using the following information.

Principal Investigator: xxxxxx

For more information, please contact xxxxx@xxxxx or xxxxx@xxxxx (Please put 'Usability Study' in the subject line)

APPENDIX D
EMAIL CORESPONDANCE TO PARTICIPANTS

Dear [Participant Name]

Thank you for expressing your interest to participate in this usability study.

I am a doctoral candidate in the Department of Learning Technologies at the University of North Texas in Denton, TX and a Sr. Instructional Designer at XXXXXXXXX. I am conducting this research study to explore how college students interact with online courses, along with the usability of course navigation and page layout design, by conducting a usability study.

I would like to coordinate a date and time that is convenient for you so we can conduct the usability test.

Please indicate your availability in the poll.

[Insert Poll/Time slots here]

Once you have indicated your availability, I will email you a calendar appointment with the link to the Zoom meeting room.

Once we are in Zoom, I will provide you with a link and access to the course sandbox area for the usability test. A reminder, you do not need to worry about the subject matter of the course content. This study is looking at the course navigation and page layout.

A general overview of the usability study:

The usability test consists of two parts with a short break if needed. In the first part, I will ask you to complete a few tasks that are typical of an online student. While completing these tasks, I will ask you to talk through your thought process. I will also ask you a few questions regarding the tasks as well in relation to usability. In the second portion, I will ask you to examine some activity pages, each with a different page layout design. For each of the different versions of the activities, I will ask you to find different information on the pages. I will have some follow up questions at the end as well.

Please sign the attached consent form and email it back to me prior to the usability test. You may sign the consent form digitally, or you may print, sign, and scan/take high quality photo of the signed consent form.

I appreciate your time and willingness to participate in this study.

I'll be in touch with the calendar appointment. Please feel free to contact me via email if you have any additional questions or concerns.

Sincerely,
XXXXXX

Hey [Participant]

We will meet at [##:## am/pm – time zone] on [Day] [month] [date]. (e.g., 11:00 am pacific time on Monday, March 15th).

Here is the link and password to the Zoom meeting.

Link [XXXXXX]

Password [XXXXX]

Please be sure you have access to a computer with internet connection, a webcam, and a mic/headset.

I will provide you with the link to access the course at the beginning of our meeting.

If you have any issues accessing the Zoom meeting, please email me right away. If you need to cancel or reschedule, please let me know as soon as possible.

Reminder, if you have not done so already, please email me your signed consent form.

Thanks for your time.

XXXXXX

APPENDIX E
CONSENT FORM DEMOGRAPHIC SURVEY

INFORMED CONSENT FORM

Qualitative Exploratory Usability Study: Examining usability, navigation, and multimedia learning principles in an intentionally designed asynchronous online college course – a usability study

Purpose of this Research: The purpose of this study is to learn more about how you interact with online courses, along with the usability of course navigation and page layout design, by conducting a usability study. The data collected from this study will help inform best practices for online course creation, teaching, and learning. We are asking you to complete a short demographic survey that will also ask you to provide your email address if you are interested in participating in a usability test session. There will be a separate consent form for the usability study, which will be emailed to you if you are interested. The initial demographic survey will take 5-10 minutes.

Eligibility: To be in this study, you must be at least 18 years or older, a United States citizen, current undergraduate or graduate online student attending a public or private higher education institution (college or university). You must also have access to a computer with an internet connection.

Risks or discomforts: Risks of participating in this study are no more than what is experienced in daily life.

Benefits: While there are no benefits to you as a participant, your participation in this research may help provide guidance for best practices of quality design for online courses.

Confidentiality of records: Your individual information will be protected in all data resulting from this study. While the members of the research team will have access to your personal information, publication of the data will not include any identifying information. Random pseudonyms will be used in place of your name when analyzing the data and in the research publication and/or presentation. All data will be destroyed one year after research publication. Information collected as part of this research may be used or distributed for future research studies without additional consent from you.

Compensation: There is no compensation for this study.

Contact: If you have any questions or would like additional information about this study, please contact Monica Surrency xxxxxxx@xxxx.edu or xxxxx@xxxx.edu. For any concerns or questions as a participant in this research, contact the Institutional Review Board (IRB) at 386-226-xxxx or via email teri.gabriel@xxxx.edu.

Voluntary Participation: Your participation in this study is completely voluntary. You may discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. Should you wish to discontinue the research at any time, no information collected will be used.

CONSENT. By selecting "I AGREE" in the Demographic Survey question and submitting the demographic survey, I certify that I am at least 18 years or older, a United States citizen, current undergraduate or graduate online student attending a public or private higher education institution (college or university). I further verify that I understand the information on this form, that the researcher has answered any and all questions I have about this study, and I voluntarily agree to participate in the study.

() AGREE () DISAGREE

APPENDIX F
CONSENT FORM USABILITY TEST

INFORMED CONSENT FORM

Qualitative Exploratory Usability Study: Examining usability, navigation, and multimedia learning principles in an intentionally designed asynchronous online college course – a usability study

Purpose of this Research: The purpose of this study is to learn more about how you interact with online courses, along with the usability of course navigation and page layout design, by conducting a usability study. The data collected from this study will help inform best practices for online course creation, teaching, and learning. We are asking you to take a usability test consisting of two parts, which will comprise of task scenarios in conjunction with think-aloud protocols. The focus of the study is strictly on the navigation of the course (part 1) and visual design of page layouts utilizing any of the three multimedia principles: coherence, signaling, and segmenting (part 2). The curriculum or subject matter aspect of the course will not be examined in the study. The usability study will take 45-60 minutes or less.

Eligibility: To be in this study, you must be at least 18 years or older, a United States citizen, current undergraduate or graduate online student attending a public or private higher education institution (college or university). You must also have access to a computer with an internet connection, a webcam, and a mic/headset to participate in this study.

Risks or discomforts: Risks of participating in this study are no more than what is experienced in daily life. There may be some frustration while navigating; however, please note there are no right or wrong answers. Even though content from a real course is being used in the study, this study is independent from your academic career and will have no impact on your other courses or degree program. You will not receive academic credit for going through the course in the usability study.

Benefits: While there are no benefits to you as a participant, your participation in this research may help provide guidance for best practices of quality design for online courses.

Confidentiality of records: Your individual information will be protected in all data resulting from this study. While the members of the research team will have access to your personal information, publication of the data will not include any identifying information. Random pseudonyms will be used in place of your name when analyzing the data and in the research publication and/or presentation.

The recordings will be kept with others related to the study in the researcher's private Embry-Riddle Aeronautical University (ERAU) Zoom cloud account (password protected and requires dual authentication). Since recordings are automatically deleted after 180 days in Zoom, backups of the audio and video recordings will be stored in the researcher's private ERAU OneDrive cloud account (password protected and requires dual authentication) and the researcher's private University of North Texas OneDrive cloud account (password protected). All data will be stored in password protected cloud storage (ERAU Zoom account, ERAU OneDrive account, and backups in UNT OneDrive account). Transcripts cleaned of all personal identifying data will be stored on the researcher's password protected laptop in a password protected folder so the researcher can conduct coding and analysis in the NVivo software. All data will be destroyed one year after research publication. Information collected as part of this research may be used or distributed for future research studies without additional consent from you.

Compensation: There is no compensation for this study.

Contact: If you have any questions or would like additional information about this study, please contact Monica Surrency xxxxxxx@xxxx.edu or xxxxx@xxxx.edu. For any concerns or questions as a participant in this research, contact the Institutional Review Board (IRB) at 386-226-xxxx or via email teri.gabriel@xxxx.edu.

Voluntary Participation: Your participation in this study is completely voluntary. You may discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. Should you wish to discontinue the research at any time, no information collected will be used.

CONSENT. By signing and submitting this form to the researcher, I certify that I am at least 18 years or older, a United States citizen, current undergraduate or graduate online student attending a public or private higher education institution (college or university). I further verify that I understand the information on this form, that the researcher has answered any and all questions I have about this study, and I voluntarily agree to participate in the study.

AUDIO/VIDEO/PHOTOGRAPHY:

- I agree** to be audio recorded and video recorded during the research study.
 - I agree** that the audio recording and video recording can be used in publications or presentations.
 - I do not agree** that the audio recording and video recording can be used in publications or presentations.
- I do not agree** to be audio recorded and video recorded during the research study.

Video and audio recording are required for this study. You may opt out at any time and the data will be secured.

Signature of Participant _____ Date: _____

Printed Name of Participant _____

APPENDIX G
PERMISSIONS

From: Reid, Ronda <rjj102@psu.edu>
Sent: Tuesday, October 26, 2021 1:35 PM
To: Surrency, Monica
Subject: RE: [EXT] RE: Permission to utilize usability testing instrument for dissertation

Hi, Monica—

Good to hear from you and congratulations on coming to the end of your dissertation.

I checked with my colleagues, and we are fine with you using the information in your dissertation as described below.

All the best,
Ronda

From: Surrency, Monica
Sent: Monday, October 25, 2021 6:00 PM
To: Reid, Ronda <rjj102@psu.edu>
Subject: Re: [EXT] RE: Permission to utilize usability testing instrument for dissertation

Hello Prof. Reid,

I hope all is well.

I wanted to follow up with you regarding my dissertation and the usability instrument you and your team allowed me to utilize for my study. I would like to include the adapted and modified instrument in the Appendix section of my dissertation. The dissertation will be publicly available for free and unlimited download by all users once it is published through the University of North Texas at the end of the fall 2021 semester.

Please let me know if I can include the instrument in my dissertation appendix and if you want a specific attribution in addition to the Acknowledgement and Resources listed at the end of the document.

I appreciate your time and consideration.

Please let me know if you have any questions.

Sincerely,
Monica Surrency

From: Brito, Felix <debritoj@erau.edu>
Sent: Friday, September 24, 2021 8:43 AM
To: Surrency, Monica J
Subject: [EXT] Re: Verifying permission to use screenshots in dissertation

Good morning, Monica,

I hereby grant you permission to use the screenshots you need for your dissertation.

Please let me know if you need additional assistance from me.

Felix

Felix Brito, Ph.D.
Executive Director of Instructional Design and Development
Instructional Design and Development
Worldwide Campus
1 Aerospace Boulevard
Daytona Beach, FL 32114
386.226.6962
felix.brito@erau.edu
Embry-Riddle Aeronautical University
Florida | Arizona | Worldwide

From: "Surrency, Monica J"
Date: Thursday, September 23, 2021 at 8:14 PM
To: "Brito, Felix" <debritoj@erau.edu>
Subject: Verifying permission to use screenshots in dissertation

Hey Felix,

I'm wrapping up my dissertation. I'd like to verify that I have permission to use some screenshots from the course used in my usability study. The course developer Dr. Mark Miller gave me permission to use the course for my study. These are some of the sample screenshots I need for the dissertation.

Image of the home page

Image of the Start Here module in the Modules area

I also have different versions of the project page, assignment page, and readings and resources page with various levels of multimedia learning principles applied. These screenshots will be in the Appendix section. I would like to put screenshots of all the different page layouts. The content is from the course; however, I modified the layouts for the purpose of this study. The purpose of the screenshots in the dissertation is to demonstrate the various layouts used in the study, not the content itself.

Let me know if you have any questions or need any further information.

Thank you for your time.
Monica

From: Miller, Mark D. <millmark@erau.edu>
Sent: Thursday, September 24, 2020 3:31 PM
To: Surrency, Monica J
Subject: Re: Permission to use ASCI 514 for dissertation usability test

Monica, **I would be honored if you used the ASCI 514 for your dissertation.** Let me know if you have any questions about the course. It was my first course development using backward design and no textbook. The big breakthrough was implementation of a project developing a Canvas module instead of letting the students use whatever LMS they wanted to. That original course before the redevelopment was all over the place and had way too many textbooks.

Aloha, Mark
DR. MARK MILLER, ED.D
PROGRAM COORDINATOR, MASTER OF SCIENCE AERONAUTIC
Graduate Department, Worldwide College of Aeronautics
1382c Kamahele St.
KAILUA, HI 96734
808.352.7742
millmark@erau.edu
EMBRY-RIDDLE AERONAUTICAL UNIVERSITY
Florida | Arizona | Worldwide

From: "Watret, John Robert" <watretj@erau.edu>
Date: Wednesday, October 14, 2020 at 1:23 PM
To: "Brito, Felix" <debritoj@erau.edu>
Cc: "Surrency, Monica J"
Subject: Re: Permission to include outside students in dissertation study of our online courses

Approved.

//john

John R. Watret, Ph.D., FRAeS.

Chancellor

Worldwide Campus

Worldwide Campus

1 Aerospace Boulevard

Daytona Beach, FL 32114

386.226.6970

john.watret@erau.edu

Embry-Riddle Aeronautical University

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From: "Surrency, Monica J"
Date: Tuesday, September 29, 2020 at 11:02 AM
To: "Brito, Felix" <debritoj@erau.edu>
Subject: Permission to include outside students in dissertation study of our online courses

Greetings, Dr. Watret,

I am a Sr. Instructional Designer in the IDD team at Worldwide.

Currently, I am in the dissertation stage in my Ph.D. program at the University of North Texas. For my research, I will be conducting a two-part think-aloud usability test of our online courses. I will be focusing strictly on the navigation of the course (part 1) and visual design of page layouts utilizing multimedia principles (part 2). I will not be examining the curriculum or subject matter of the course.

I will be seeking 3-5 ERAU WW students to participate in the study. However, a current student could have some bias or prior knowledge for navigating our courses. I am asking permission to recruit 3-5 college students outside of ERAU for my research. Having external participants will provide critical qualitative data with their outside perspective regarding navigation and usability.

If I am permitted to have outside participants, I would recruit them through AECT, LinkedIn, Educause ListServe, the FSU Instructional Systems private Facebook Group, and the UNT Learning Technologies private Facebook group.

Please let me know if including students from outside of ERAU for the study would be permissible.

I appreciate your time and consideration.

APPENDIX H
IRB APPROVAL

Embry-Riddle Aeronautical University
Application for IRB Approval
EXEMPT Determination Form

Principal Investigator: Monica Surrency

Other Investigators: Dr. Scott Warren, Dr. Demetria Ennis-Cole, Dr. Wellesley (Rob) Foshay - dissertation committee at University of North Texas (UNT)

Role: Staff/Admin **Campus:** Worldwide **College:** Arts & Sciences

Project Title: Examining usability, navigation, and multimedia learning principles in an intentionally designed asynchronous online college course – a usability study

Review Board Use Only

Initial Reviewer: Teri Gabriel **Date:** 12/11/2020 **Approval #:** 21-059

Determination: Exempt

Beth Blickensderfer **Elizabeth L.**
IRB Chair Signature: Blickensderfer, Ph.D. Digitally signed by Elizabeth L. Blickensderfer, Ph.D.
Date: 2020.12.15 17:01:07 -0500'

Brief Description:

The purpose of this study is to learn more about how you interact with online courses, along with the usability of course navigation and page layout design, by conducting a usability study. The data collected from this study will help inform best practices for online course creation, teaching, and learning.

The study will also include a short online survey in Google Forms to gather demographic information about the participant. One question prompts the participants for their name and email address so the researcher can contact them and coordinate the usability test session.

This research falls under the **EXEMPT** category as per 45 CFR 46.104:

(2) Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met: (Applies to Subpart B [Pregnant Women, Human Fetuses and Neonates] and does not apply for Subpart C [Prisoners] except for research aimed at involving a broader subject population that only incidentally includes prisoners.)

From: Gabriel, Teri [REDACTED]
Sent: Tuesday, February 9, 2021 7:44 AM
To: [REDACTED]
Cc: [REDACTED]
Subject: [EXT] IRB 21-059 IRB Reliance Agreement-UNT - ERAU

Dear [REDACTED]

Attached please find the signed Reliance Agreement between Embry-Riddle Aeronautical University (ERAU) and University of North Texas (UNT) for project titled, ***Examining usability, navigation, and multimedia learning principles in an intentionally designed asynchronous online college course – a usability study*** under the direction of Principal Investigator at ERAU, Monica Surrency.

By signing this agreement UNT agrees that ERAU will be the 'IRB of Record' for the above project and will rely on ERAU's IRB for review and continuing oversight for this project until its completion. ERAU provided IRB review and approved this project on December 15, 2020. The approval document is attached for your records.

Respectfully yours,

Teri Gabriel, MPA, CRA, CFHSP
IRB Director
Legal Department



Embry-Riddle Aeronautical University
Florida | Arizona | Worldwide

Institutional Review Board Reliance Agreement

This Institutional Review Board Reliance Agreement (“Agreement”) is entered into and effective as of February 4, 2021 (“Effective Date”) by and between EMBRY-RIDDLE AERONAUTICAL UNIVERSITY (“Embry-Riddle”), a non-profit organization located at 1 Aerospace Boulevard, Daytona Beach, Florida 32114 – FWA #00018875 and UNIVERSITY OF NORTH TEXAS (UNT), Research and Innovation, Hurley Administration Building, 1155 Union Circle #310979, Denton, Texas 76203 – FWA #00007479.

WHEREAS, Federal regulations found at §45 CFR 46.114, allow for Institutional Review Board reliance agreements between institutions when the institutions are engaged in cooperative research projects (study), in order to avoid duplication of effort; and

WHEREAS, Embry-Riddle, through its employee, Monica Surrency (“Principal Investigator”), is conducting a human research study IRB # 21-059 entitled “Examining usability, navigation, and multimedia learning principles in an intentionally designed asynchronous online college course – a usability study” in cooperation with UNT and

WHEREAS, Embry-Riddle has a qualified Institutional Review Board (“IRB”) that will review the study; and

WHEREAS, UNT wishes to rely on the review of Embry-Riddle’s IRB for the study and ERAU is receptive to UNT relying on its IRB’s review;

NOW, THEREFORE, Embry-Riddle and UNT, as parties, create this agreement in accordance with the terms and conditions herein.

1. Scope and Limitation

- a. UNT may rely on Embry-Riddle in accordance with the terms of this Agreement for IRB review and continuing oversight of the study for the entire duration of the project, until it has been closed by Embry-Riddle’s IRB.
- b. The parties acknowledge that each party is responsible for the development and operation of its own human subjects protection program. Each party reserves the right and retains the ultimate responsibility to determine what research is appropriate to be conducted at its own facilities. Neither party will assume responsibility for any other aspect of the other party’s human subjects protection programs or human subjects research operations. Each party will remain responsible for ensuring its own compliance with applicable Federal, State, and local laws regarding human subjects research.
- c. [External institution] will retain responsibility of the protection of human subjects at its location, including:
 - i. Safeguarding the rights and welfare of human subjects;
 - ii. Educating the members of its research community in order to establish and maintain a culture of compliance with Federal, State and local laws regarding human subjects research.

- iii. Implementing appropriate oversight mechanisms to ensure compliance with the determinations of the Embry-Riddle IRB.

2. Compliance with Law.

- a. During the term of this Agreement, each party will maintain an approved Federalwide Assurance (FWA) of compliance with the Office for Human Research Protections (OHRP), and upon request, provide a copy of its FWA to the other party, and abide by the terms and conditions of their respective FWA and this Agreement. In the event a party's FWA is amended in a manner that affects this reliance agreement, such party will notify the other party and promptly supply a copy of the amended FWA to the other party. For research covered by this agreement, each party agrees to comply with requests for information in its possession that is necessary for oversight by the other IRB.
- b. Embry-Riddle shall perform all of the functions required under applicable, Federal, State, and local laws and regulations, whether foreign or domestic, for reviewing and approving human subject research in connection with the study, including without limitation, §45 CFR 46. Embry-Riddle's review and approval shall also be conducted in accordance with all relevant institutional policies regarding human subjects research. The investigators of [External institution] will abide by all conditions and determinations made by Embry-Riddle in connection with its review and approval of the study.
 - i. UNT will not conduct the study if it has not been reviewed and approved by Embry-Riddle's IRB.
 - ii. UNT will obtain review and approval from Embry-Riddle's IRB prior to the implementation of any amendments to the study.
 - iii. UNT will not conduct the study if it is suspended or terminated by Embry-Riddle's IRB.
- c. Both parties shall ensure adherence to this agreement and shall ensure that its employees, investigators, and agents adhere to the applicable Federal, State and local laws, regulations and policies regarding the conduct of human subjects research, including but not limited to, §45 CFR 46 and other applicable governmental regulations and guidance.

3. Liability. Each party, Embry-Riddle and [External institution] shall only be responsible, to the extent permitted by law, for actions or claims arising from or caused by willful, reckless, or negligent acts or omissions of its respective officers, employees, and agents thereof.

4. Reporting and Notification

- a. Each party shall immediately notify the other, at the contact listed below, in writing, of any serious or continuing non-compliance issues involving the study.
- b. Each party shall immediately notify the other, in writing (within not more than five [5] working days), if and when an oversight agency or organization initiates any action regarding such noncompliance.
- c. Embry-Riddle shall immediately report, in writing to UNT any determinations made by the Embry-Riddle IRB of suspension or termination of IRB approval involving the study.
- d. Each party shall immediately notify the other, at the contact listed below, any information which it may acquire about the study that may be relevant to a determination of non-compliance, unanticipated problems involving risks to subjects or others (including adverse events), or suspension or termination of the research by Embry-Riddle's IRB.

5. Termination. Either party may terminate this Agreement (1) immediately upon written notice to the other party in the event of a break of this Agreement by the non-terminating party or (2) with or without cause upon thirty [30] calendar days' prior written notice of termination to the other party.
6. Confidentiality/HIPAA
 - a. Individual information: The parties agree to maintain strict confidentiality of all information received or obtained in connection with the performance of this Agreement (whether or not such information involves the research project) which relates to or identifies a particular research subject or any other specific individual, including but not limited to, the name, address, treatment, or condition, financial status, or any other personal information which is deemed to be confidential or private in accordance with applicable local, State, or Federal law whether foreign or domestic (including, without limitation, the Health Insurance Portability and Accountability act of 1996 and any regulations and official guidance thereunder) and standards of professional ethics. The parties will notify their respective employees, contractors, agents, and representatives of this confidentiality requirement and require them to maintain the confidentiality of such information. UNT shall not send to Embry-Riddle any documents containing identifiable human subject information unless requested by Embry-Riddle for audit purposes.
 - b. Embry-Riddle shall promptly (within no more than forty-eight [48] hours) notify UNT of any unauthorized use, loss or disclosure of individually identifiable human subject information or violations of information security laws, regulations, or policies whether foreign or domestic.
7. Documentation. UNT shall maintain all documents reviewed by them in connection with the study, including any communication with investigators, and make those documents available to Embry-Riddle upon written request. When informed consent is required, the investigators will maintain in his/her files signed consent forms associated with the study in accordance with Embry-Riddle's Records Retention Policy. Upon written request, Embry-Riddle shall make available to UNT all IRB minutes concerning the study. If any governmental or regulatory authority notifies UNT that it will inspect Embry-Riddle's records, facilities or procedures, or otherwise take action related to the study UNT shall promptly notify Embry-Riddle and provide Embry-Riddle with copies of any reports issued by the investigating authority, including any response by UNT.
8. Assignment and Binding Effect. Neither party shall assign, subcontract, or transfer any of its rights or obligations under this Agreement to a third party without prior written consent of the other party. If any assignment, subcontract, or transfer of rights does occur in accordance with the Agreement, this Agreement shall be binding upon and inure to the benefit of the parties hereto and their respective authorized successors or assigns.
9. Independent Contractor. Each party shall be considered to be an independent party and shall not be construed to be an agent or representative of the other party, and therefore, shall have no ability to bind the other party or have any liability for the acts or omissions of the other party. In addition, neither party, nor any of its employees, agents, or subcontractors, shall be deemed to be employees or agents of the other party. Therefore, neither party nor any of its employees, agents or subcontractors, shall be entitled to compensation, workers' compensation, or employee benefits of the other party by virtue of this Agreement.

10. Amendment, Modification and Waiver. This Agreement shall not be altered or otherwise amended except pursuant to an agreement, in writing, signed by each of the parties. A waiver, by either party, of a breach of any provision of this Agreement must be in writing and shall not operate or be construed as a waiver of any subsequent breach. The failure of a party, in any instance, to insist upon the strict performance of the terms of this Agreement shall not be construed to be a waiver or relinquishment of any of the terms of this Agreement, whether at the time of the party's failure to insist upon strict performance or at any time in the future, and such term or terms shall continue in full force and effect unless amended or waived in writing in accordance with this Agreement.

11. Survival. The provisions of this Agreement relating to confidentiality and documentation of records shall survive the termination of this Agreement.

12. Notice.


To ERAU
Teri Gabriel, MPA, CRA, CFHSP
IRB Director
Legal Department




To: UNT
Jamie Peno
Director
Research Integrity and Compliance



Approved by:


Embry-Riddle Aeronautical University
Charlie Sevastos
Vice President and General Counsel
IRB Institutional Official

2/8/21
Date


Michael Rondelli (Feb 4, 2021 10:20 CST)
University of North Texas
Michael Rondelli
Associate Vice President, Research Commercial Agreements
IRB Institutional Official

Feb 4, 2021
Date

UNT - Embry-Riddle Reliance Agreement

Final Audit Report

2021-02-04

Created:	2021-02-04
By:	Janis [REDACTED]
Status:	Signed
Transaction ID:	CBJCHBCAABAAbw7MD1FWnoxRchlyWVvkeei-kH2NAIN

"UNT - Embry-Riddle Reliance Agreement" History

-  Document created by Janis [REDACTED]
2021-02-04 - 10:21:07 PM GMT - IP address: 47.185.154.56
-  Document emailed to Michael [REDACTED] for signature
2021-02-04 - 10:21:50 PM GMT
-  Email viewed by Michael [REDACTED]
2021-02-04 - 10:29:37 PM GMT - IP address: 104.47.46.254
-  Document e-signed by Michael [REDACTED]
Signature Date: 2021-02-04 - 10:29:47 PM GMT - Time Source: server - IP address: 47.184.127.135
-  Agreement completed.
2021-02-04 - 10:29:47 PM GMT

APPENDIX I
CODEBOOK

Codebook with names and descriptions of the categories (row highlighted in yellow), codes (row highlighted in grey), and sub-codes, along with the number of references coded for each in NVivo.

Name	Description	#Ref
Cognitive Load	Usability and MMLP principles are supposed to help reduce extraneous cognitive load. This is the top-level category of attributes that relate to cognitive load. This study does not 'test' or 'measure' cognitive load. However, course organization, course design, instructions, page layout, and page design align to practices that can either potentially help reduce or potentially cause extraneous cognitive load (ECL) based on the research discussed in Chapter 2.	351
Potentially Causes Extraneous Cognitive Load	Based on research discussed in Chapter 2, if a student is overwhelmed, or a page layout is busy, something causes confusion, etc. These characteristics could potentially cause extraneous cognitive load. The participant refers to a course attribute, design feature, page layout, verbiage, navigation element, etc., and expresses these types of characteristics, then that is coded here. Does not mean ECL occurred, but the potential is there.	135
Cause ECL - Course Design and Organization	Course Design & Organization coded as possibly causing extraneous cognitive load. Attributes such as course structure (e.g. the general design and type of content on the home page, module structure, etc.)	10
Cause ECL - MMLP	Multimedia learning principles applied or missing and coded as possibly causing extraneous cognitive load.	45
Cause ECL - Navigation	Navigation elements (Canvas, course, or page navigation) or difficulty of navigation coded as possibly causing extraneous cognitive load. Attributes such as the module links on the homepage, using the next & previous buttons, lack of the expand all feature in tabs or accordions.	16
Potentially Reduces Extraneous Cognitive Load	Participant describes something that relates to attributes that are often associated with practices to reduce extraneous cognitive load. This can relate to the overall course organization, navigation, page layout or design elements, or directions. Examples could include 'drew my eye or attention,' 'easy to find,' 'organized,' etc. Does not mean ECL was reduced, but the potential is there.	167
Reduce ECL - Course Design and Organization	Course Design & Organization coded as possibly reducing extraneous cognitive load. Attributes such as course structure (e.g. modules area) consistency (e.g. discussion activity expectations), etc.	17
Reduce ECL - MMLP	Multimedia learning principles applied and coded as possibly reducing extraneous cognitive load	50
Reduce ECL - Navigation	Navigation elements (Canvas, course, or page navigation) or ease of navigation coded as possibly reducing extraneous cognitive load. Attributes such as the Course Main Menu or ease of finding an item in the context of navigating (e.g. finding an activity or the ease of navigation for tabs, expanders, or accordions).	12
Suggestion to Reduce Extraneous Cognitive Load	Suggestions participants made that they felt would make the page, design, navigation, course organization better, easier to use, or made clearer. These suggestions, if implemented, would follow recommended practices based on research to help reduce ECL	49

(table continues)

Name	Description	#Ref
Suggest ECL - Course Design and Organization	Participants suggest improvements to general course design or course organization. These improvements could help reduce extraneous cognitive load.	3
Suggest ECL - MMLP	Participants suggest improvements to implement design elements that follow design practices of Multimedia Learning Principles. These improvements could help reduce extraneous cognitive load.	18
Suggest ECL - Navigation	Participants suggest improvements to navigation (course or page). These improvements could help reduce extraneous cognitive load.	3
Course Attributes and Info	Common course attributes, Items, information, or general areas of the course that the participant is looking for, refers to, or uses. These are not navigation elements (those are in the "Course Navigation Attributes" codes). Students may refer to or navigate to the "Grading Information" so that is here. But if they use the "Grades" link to access that info, that will be coded in the 'navigation attributes' section.	390
Announcements	Area of the course where instructors can post announcements to the students regarding important information for the course, specific assignment reminders, general resources, and bulletins, etc. All of the instructor's announcements are consolidated in this one area.	5
Assignments	Participant refers to, uses, navigates to, or examines a course assignment or assignment information	29
Number in assignment link	Several participants expressed their preference that the naming convention of the assignments includes the activity number (e.g. 2.1 - assignment xxxx). These conversations are coded here.	6
Course Long Project	Participant refers to, uses, navigates to, examines the course long project - which consists of several assignments throughout the course. The official title of this project is the W/CBT Module.	19
Course Organization	Participant refers to course organization or expresses they want to know how the course is organized.	9
Course Summary or Breakdown	Participant refers to course summary or course breakdown.	5
Discussions	Participant refers to, uses, navigates to, examines course discussion or discussion information	26
Due Dates	Participant refers to, uses, navigates to, examines course assignment or assignment information	40
Grading Information	Participant refers to, uses, navigates to, examines, or looks for grades, grades area, or grading information	25
Home Page Attributes	Common course attributes, Items, information, or general areas of the home page that the participant is looking for, refers to, or uses. These are not navigation elements (those are in the "Course Navigation Attributes"- "Home Page Navigation" codes). Students may refer to the "Academic Resources" so that is here. But if they use the "Academic Resources" link to access that info, that will be coded in the 'navigation attributes' section.	9
Important Files	Refers to documents, PDFs, presentations that participants felt were important.	13
Instructor Communication or Feedback	Participant refers to the instructor's communication with the class. Or the participant is referring to the instructor providing feedback to the students.	9

(table continues)

Name	Description	#Ref
Instructor Information	Participant refers to the instructor bio information in the course or general information about their instructor.	11
Module Attributes	Participant refers to, uses, or looks for module items such as topic, organization, module number, module title, module activities in general. There are sub-codes for some of the module areas or attributes: Course Specific Information module & content; Objectives or Outcomes which are present in all weekly modules; and the Start Here module and content.	72
Course Specific Information	Participant refers to, uses, or looks for content in the Course Specific Information module.	4
Objectives or Outcomes	Participant refers to, uses, looks for, or navigates to Module Objectives or Course Learning Outcomes	14
Start Here Content	Participant refers to, uses, or looks for content in the Start Here module.	8
Readings Resources Videos	Participant refers to, uses, or looks for readings, resources, and/or videos.	32
Videos	Participant mentions specific details about videos.	17
Required Materials to buy	Participant refers to, uses, or looks for required materials (e.g. textbook from the bookstore)	4
Rubric	Participant refers to, uses, looks for, or examines rubric	5
Schedule	Participant refers to, uses, looks for, or navigates to schedule	12
Syllabus	Anything pertaining to the participant referring to, navigating to, using, or viewing the syllabus.	46
Terminology or Verbiage	Participant refers to the terminology or verbiage used. In some instances, the terms or verbiage specifically caused confusion or helped clarify.	4
To-Do List Canvas Feature	Participant refers to, uses, or looks for To-Do list feature in Canvas	6
Verbiage for Assignment File Naming Convention	Participant specifically referred to the boilerplate verbiage used in the course assignments that explain how students should name their files before submitting their assignments.	9
Course Navigation Attributes	Common areas, links, or buttons in the course participant uses to navigate.	220
Home Page Navigation	Participant navigates to the Home page or uses the Home page to navigate	55
Academic Resources Btn	Participant uses or refers to the Academic Resources button on the home page.	2
Instructor Bio Btn	Participant uses or refers to Instructor Bio button on home page	5
Module Links HMPG	Participant refers to or uses the Individual Module Links on the home page.	17

(table continues)

Name	Description	#Ref
Start Here Btn	Participant uses or, refers to Start Here button on the home page	11
Main Menu - Canvas	Participant used the main Canvas Menu (just to the left of the course main navigational menu)	5
Main Menu - Course	Users used the Main navigational menu in the online course	88
Discussions Link - Menu	Participant specifically selects the Discussions link in the main course navigational menu.	1
Grades link - menu	Participant uses or refers to Grades link in the Main course navigation menu. This does not always mean it is related to grading information - this is just navigational.	14
Modules Link - Menu	Participant specifically selects the Modules link in the main course navigational menu.	41
Modules area	Participant navigates to or through the modules area in various ways with the exception of the links on the home page (different code for that - Module Links HMPG)	52
Next and Previous Button	Participant uses the "Next" or "Previous" Canvas button (intended to navigate through module content pages or activities)	19
Multimedia Learning Principles	Multimedia Learning Principles and some of their design elements	294
Coherence Principle	Referring to the coherence principle in which extraneous content should be excluded. (e.g. misc. images or extra information)	16
Decorative Heading Icons	In some of the pages, the headings have decorative icons - coded here when participants referred to this specific feature. This feature could be considered extraneous information that does not relate to the content - breaking the coherence principle.	5
Images	Participants refer to image on the page. The image was extraneous content and breaks the coherence principle.	11
Segmenting Principle	Referring to practices used to organize content into smaller chunks. This could be headings on a page, expanders, tabs, or accordions, modules of content, etc.	86
Bullet or Ordered list	Participant refers to bullet or ordered list. These lists are generally used to organized or chunk content - following the segmenting principle.	48
Chunking	Participant refers to segmenting, chunking, or categorizing, content - following the segmenting principle.	35
Signaling Principle	Refers to attributes of Signaling principle such as Bold, Icons, or other formatting that 'signals' the user.	192
Alert Box	Some of the page layouts have an 'alert box' with an 'important' or 'informative' message. References to this feature are coded here. Alert boxes use a colored border, icon, and bold text to stand out and draw attention - following the segmenting principle.	19
Bold	Participant refers to bolded content - following the signaling principle.	62
Color Usage	Participant refers to the use of color for a particular attribute, design layout, page design, etc.	17

(table continues)

Name	Description	#Ref
Headings	Participant refers to headings. Headings are generally used to organized or chunk content - following the segmenting principle.	71
Icons	Participant refers to icons used to precede headings or important text - following the signaling principle.	20
Page Design and Layout Attributes	Attributes of design and layout of the page for course activity or instructions.	473
Design Elements General	General Design elements that are mentioned outside of the positive or negative attributes or the MMLP attributes.	47
Description or Summary	Instructions, assignment, component, or attribute description or summary.	8
Links	Participant refers to links in general or specific links on the page.	21
Page Length and Need for Scrolling	Participants refer to the length of the page content, the need for scrolling, or not needing to scroll.	6
Timeline	In some of the page layout versions, there is a timeline of when the different assignments relating to the course-long project are due.	10
White Space	Participants refer to white space in page design or layout.	2
Design Layout Indifferent	Participant is indifferent about the layout or layout attributes	2
Expanders Tabs Accordions	Participant refers to, looks for, or uses the Expander, Tab, or Accordion feature. Expanders, tabs, and accordions are ways to chunk content into different panels on a page. There is a sub-code for each of these.	107
Accordion	Participant refers to, looks for, or uses the Accordion feature.	32
Expanders	Participant refers to, looks for, or uses the Expander feature.	42
Tabs	Participant refers to, looks for, or uses the Tabs feature.	33
Important Items of Information on Page	When examining the different versions of the page layouts, the participants were asked to express what they felt were the three most important items of information on that page. These responses are coded here.	35
Negative Design Layout	The page design or layout attribute provides a negative experience. There is another 'Negative UE' code that refers to general user experience. This code only pertains to Page Design Layout.	126
Dislike - Existing PDL Attribute	User dislikes existing attribute or feature on the page (wordiness, bold, images, headers, etc.).	51
Dislike - Missing PDL Attribute	Dislikes because the particular page design or layout attribute or feature is missing. (e.g. there is no bold formatting, but the participant expresses that bold should be used or would be helpful.)	24
Negative PDL Attributes or Features	Specific page design, layout attributes, or features participants dislike or consider negative. Sub-codes created for the common specific items that kept coming up as negative page design attributes.	51

(table continues)

Name	Description	#Ref
Busy	Participant refers to design attribute or page layout as 'busy' or something similar.	9
Content Hidden	Participant refers to not being able to view all of the content on the page. Especially with Tabs or Accordions since their design only allows user to view one panel of content at a time, so the rest of the content is hidden.	6
Hard to Find Attributes	Participant expresses that something is hard to find or something did not stand out so it was more difficult to find or notice.	8
Mistaken for Link	Participant thought a specific item was a clickable link even though it was not. (e.g. decorative headers with an 'information' icon).	2
Redundant Text or Attributes	Participants felt the attribute, layout, text, or verbiage was redundant or repetitive.	6
Wordiness - A lot of content on page	Wordy, a lot of text, a lot to read, a lot of content on the page.	20
Positive Design Layout	The page design attribute provides a positive experience. There is another 'Positive UE' code or category that refers to general user experience. This code only pertains to Page Design Layout.	156
Like - Existing PDL Attribute	User likes existing attribute or feature (wordiness, bold, images, headers, etc.)	102
Like - Missing PDL Attribute	Likes because the particular page design or layout attribute or feature is missing.	3
Positive PDL Attributes or Features	Common page design, layout attributes, or features participants like or consider positive. This is specific to Page Design & Layout. Sub-codes were created for the common specific items that kept coming up as positive page design attributes.	51
Ability to open or collapse content	Pertains to Expanders - participants made several positive references to the ability of being able to expand or open or collapse all of the panels to view or hide content on the page.	12
Catches Eye or Attention	Participant comments or refers to attribute or feature catching their eye or drawing their attention.	4
Clean - Clear - Neat	Participant refers to page, design, or attribute as being clean, clear, neat, straightforward, etc.	3
Easy to Find Information PDL	Participant states that information is easy to find or their actions demonstrate that the information they were looking for was easy to find. (They found it very quickly)	21
Organized	Participant refers to how something is organized, grouped, or sectioned on the page.	4
Visually Appealing	Participant refers to the page design or attributes being visually appealing or commenting on the overall look or the page.	7
Participant Navigation Behavior	Attributes to describe participant navigation behavior attributes. (e.g. skimming, concentrating, etc.)	137

(table continues)

Name	Description	#Ref
Concentrating or Thoroughly Reading	Participant is concentrating, focusing, and/or thoroughly reading the content, page, or course area.	7
Navigate Expander Tab Accordion	Participant navigational behavior specific to using Expanders, Tabs, and Accordions.	45
Expand Collapse All Button	Participant uses or refers to using the Expand or Collapse all button. Specific feature to the expanders. There is an “Expand All” and “Collapse All” button that allows the user to expand or collapse all of the content panels within the expander.	8
Selects ETA Panel Menu Headings	Participant uses or refers to using the Heading Links to open or close the panels in the tabs, expanders, or accordions.	37
Reviewing	Participant is reviewing the content or items on the page - not thoroughly reading, but not quickly skimming either. Somewhere in-between	19
Scrolling	Scrolling behaviors of the participants. Sub-codes were created for the common scrolling behaviors observed and noted.	43
Casual Scrolling	Most common scrolling. General pace where the user is going slow enough to get the general idea of the content, but not slow where the participant is reading word for word or line by line.	28
Quickly Scrolling	Participant scrolling fast so the content on the page is not observable. For example, the user knows something is at the bottom of the page or document so the user scrolls fast to get to the bottom quickly.	2
Scrolling Up and Down	Participant is scrolling up and down the page somewhat quickly looking for content on the page or document.	11
Slowly Scrolling	Participant slowly scrolls the page or document to read and take in the content presented to them.	2
Skimming	Participant quickly skims through the content or items on the page or screen.	7
Would Not Read Item or Instructions	Participant mentions they would not read the item, instructions, or documents.	7
Would Read Item or Instructions	Participant mentions they would read the item, instructions, or documents.	9
User Experience	Relates to overall user experience and feelings of the content, design, organization, and some navigation experiences. Not HOW the participant navigates, but their navigation experience (e.g. frustrating, easy, etc.) FYI - Navigation Behavior codes cover how participant navigates.	272
Did not notice or see item	Participant is looking for something that is on the page, document, or navigation element, but the participant did not notice or see that particular item. Examples are they scrolled down too quickly and the item was at the beginning of the page.	10

(table continues)

Name	Description	#Ref
Negative UE	Attributes the participant expresses that relate to a negative user experience (e.g. expressing frustration) and identifying attributes that caused these negative user experiences.	59
Confusion	User demonstrates some confusion.	33
Dislike - existing feature or attribute	User dislikes existing attribute or feature and that contributes to the negative user experience. (navigation, page layout, wording, etc.)	18
Frustration	User is demonstrating frustration	1
Overwhelmed	User is demonstrating being overwhelmed.	7
Personal Preference	Participant personally prefers one feature over the other. May not be a positive or negative attribute, Just a personal preference.	2
Positive UE	Attributes the participant expresses that relate to a positive user experience (e.g. expressing something that is helpful, intuitive, consistent) and identifying attributes that caused these negative user experiences.	109
Consistency	Participant identifies consistency within course design or organization, page design, or activity types. Some of these are Canvas LMS elements, and some are due to the template model.	22
Consistent - Canvas LMS Attribute	Participant refers to a Canvas LMS feature or attribute that is consistent in all courses.	1
Consistent - Course Design	Consistent features that the Instructional Designers or Course Developer designs in the course. Not boilerplate items, but things we try to design consistently within a course and sometimes between courses. (e.g. requirements for discussions are usually posted early and reply to two peers).	6
Consistent - Template Model	Participant refers to an item that is consistent due to the template model so all courses have those attributes. (e.g. Start Here boilerplate content, syllabus, some standard verbiage, etc. that the university uses in all of our courses.)	5
Easy to Navigate	Participant refers to or describes attribute as easy to navigate.	11
Helpful	Participant refers to or describes attribute as helpful.	10
Intuitive	Participant refers to or describes an attribute as intuitive, easy to understand or use, self-explanatory, etc.	10
Like - existing feature or attribute	User likes existing attribute or feature (navigation, page layout, wording, etc.) and that contributes to the positive user experience.	56
Suggestions	Suggestions from the participants on how to make an attribute better for a better user experience.	19
Time Management	Participants concerned with time management of the overall course and activities they need to complete. They also comment on time-saving attributes in the course - this could be a Canvas attribute like the To-Do list feature, or the way instructional content is presented, etc.	57

(table continues)

Name	Description	#Ref
Feature Saves Participant Time	Participant expresses that the particular feature or attributes can save the participant time.	7
Participant thinking of time management	Participant is thinking about their time management for the overall course or specific course items.	17
Work Offline	Participant mentions working offline. Downloading stuff to view offline. Copying activity from Canvas to Word to work offline.	16

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