The Design and Development of Guidelines for Interactive Course Organizers

Wejdan Ahmed Almunive

Dissertation Submitted to The Faculty of the Virginia Polytechnic Institute and State University

In Partial Fulfillment of the Requirements for The Degree Of

Doctor of Philosophy

In

Curriculum and Instruction

Barbara B. Lockee (Chair)

Kenneth Potter

Mark Bond

Alicia Johnson

March 25, 2020

Blacksburg, Virginia

Keywords: interactive course organizers, course syllabi, design and development research, instructional message design, visual literacy, interactivity
The Design and Development of Guidelines for Interactive Course Organizers

Wejdan Ahmed Almunive

Abstract

An Interactive Course Organizer (ICO) is an artifact that contains text and visual representation of a traditional course syllabus, it integrates visual elements, such as timelines, drawings, charts, graphs, maps, or pictures to show the sequencing and organization of major course topics while offering the user an actively controlled progression of the amount of course information covered. The goal of this research was to develop a theoretically- and empirically-grounded guidelines to design and develop of ICOs. It is anticipated that these guidelines can assist course developers and instructional designers in designing ICOs. This study employed a design and developmental research methodology with four phases: analysis, design, development and validation. Findings from literature review investigations in course syllabi, instructional message design, visual literacy, and interactivity theories and research as well as expert review informed the building of the guidelines.
Interactive Course Organizer (ICO) is a tool that acts as a course syllabus. It combines both text and visual representation of a traditional course syllabus, and integrates visual elements, such as timelines, drawings, charts, graphs, maps, or pictures to help learners visually see the interrelationships between different parts of the course and how they all fit together. Its purpose is to provide visuals to assist learners in seeing the course and how it is organized “big picture”. And by adding the interactivity feature, learners will navigate, access, and view the course content. It is a course framework to help students understand what it is they will be learning in the course. This research aimed to develop a theoretically- and empirically- grounded guidelines to design and develop of ICOs. It is anticipated that these guidelines can assist course developers and instructional designers in designing ICOs. This study employed a design and developmental research methodology with four phases: analysis, design, development and validation. Findings from literature review investigations in course syllabi, instructional message design, visual literacy, and interactivity theories and research as well as expert review informed the building of the guidelines.
Dedication

To my family, thanks for all of your support, love, and encouragement, which has helped me to succeed and never give up.
Acknowledgements

I would like to thank those who supported me as I worked toward my PhD degree throughout my five years at Virginia Tech. I could not have completed my PhD degree without the help and support of these people.

First, I would like to express my sincere thanks to my advisor, Dr. Barbara Lockee, for her continuous understanding, support, and guidance. I was very fortunate to be one of her advisees. I also would like to thank my committee members, Dr. Ken R. Potter, Dr. Aaron Bond, and Dr. Alicia Johnson, for their thoughtful and insightful comments and guidance.

I would like to thank the expert reviewers for this study, Dr. Rune Pettersson, Dr. MJ Bishop, Dr. Susan G. Magliaro, and Dr. Jung Lee. Their feedback provided meaning and relevance to my study.

Finally, my family and friends deserve great thanks for their endless love, understanding, and support.

Thanks to all of you!
Table of Contents

Dedication ....................................................................................................................... IV
Acknowledgements ......................................................................................................... V
Table of Contents .......................................................................................................... VI
List of Figures .................................................................................................................. X
List of Tables ................................................................................................................... XI

Chapter 1: Introduction .................................................................................................. 1
  Background for the Study .............................................................................................. 1
  Need for the Study ........................................................................................................ 3
  Research Problem ....................................................................................................... 4
  Purpose of the Study .................................................................................................. 5

Chapter 2: Literature Review ........................................................................................ 8
  Introduction .................................................................................................................... 8
  ICOs - Definition, Purpose, and Components .............................................................. 9
    ICO Definition ........................................................................................................... 9
    ICO Purpose ............................................................................................................. 9
      Course syllabus ....................................................................................................... 9
      Visual organizers .................................................................................................... 10
      Interactivity and learner control ........................................................................... 10
    ICO Components ..................................................................................................... 11
      Text components ................................................................................................... 11
      Visual components ............................................................................................... 12
  Learning Theories Related to the Use of ICO .............................................................. 15
Theories related to the use of text and visuals ................................................................. 16
  Information processing theory .......................................................................................... 16
  Dual coding theory .......................................................................................................... 17
  Cognitive load theory ...................................................................................................... 18
Theories related to the use of visual organizers ................................................................. 21
  Meaningful learning theory ............................................................................................ 21
Theories related to the use of interactivity and learner control ........................................ 25
  Cognitive theory of Multimedia learning ........................................................................ 25
Evidence-Based Studies to Support the Use of ICO ......................................................... 26
  The use of course syllabus ............................................................................................. 26
  The use of visual organization ...................................................................................... 27
  The use of interactivity and learner control ................................................................. 29
Discussion ........................................................................................................................ 30

Chapter 3: Research Methodology ................................................................................... 33

Introduction ....................................................................................................................... 33
  Purpose of the Study ...................................................................................................... 33
  Research Questions ...................................................................................................... 34
  Research Design: .......................................................................................................... 34
  Study Procedure ........................................................................................................... 36
    Phase One - Analysis Phase ....................................................................................... 37
    Phase Two - Design Phase ......................................................................................... 38
    Phase Three – Development Phase ........................................................................... 39
    Phase Four – Validation Phase .................................................................................. 40
Characteristics of Expert Reviewers ............................................................................... 40
Instrumentation ................................................................................................................ 40
Data sources .........................................................................................................................41

Data Analysis ..................................................................................................................................42

Chapter 4: The Design and Development of the Guidelines ..........................................................43

Introduction .................................................................................................................................43

Study Procedure ..........................................................................................................................43

Analysis Phase ............................................................................................................................43

  Graphics for learning Model .......................................................................................................51

  Design Phase .............................................................................................................................56

  Development Phase ..................................................................................................................60

  Validation Phase .......................................................................................................................72

Chapter 5: Expert Reviews Feedback ..........................................................................................73

Introduction ....................................................................................................................................73

  Overall Expert Perspectives ........................................................................................................75

Expert Reviews Recommendations ...............................................................................................75

  The Application of ICOs .............................................................................................................76

  Overall Design of the Guidelines ................................................................................................80

  Analysis Phase ............................................................................................................................81

  Design Phase .............................................................................................................................82

  Development Phase ..................................................................................................................83

  The Application of the Guidelines ..............................................................................................85

Summary ..........................................................................................................................................86

Chapter 6: Discussion ....................................................................................................................89

Introduction ......................................................................................................................................89

VIII
List of Figures

Figure 1: An example of concept map. ................................................................. 22

Figure 2: An example of graphic organizer. ......................................................... 23

Figure 3: Screenshot of the template. ................................................................. 59

Figure 4: Screenshot of the ICO embedded in an LMS................................. 59
List of Tables

Table 1: Graphic Types to Use for Varied Goals................................................................. 12
Table 2: Common Methods Employed in Design and Development Research.................. 35
Table 3: Summary of Research Design Process .................................................................... 37
Table 4: Higher Education Institutional Websites Analyzed for Syllabus Requirements........ 47
Table 5: A Framework for A Course Syllabus ..................................................................... 48
Table 6: Following the Visual Model to Plan ICOs ................................................................. 53
Table 7: A List of Different Data Visualization Websites....................................................... 57
Table 8: Guidelines to Analyze the Context for ICO ............................................................. 61
Table 9: Guidelines for Designing ICOs .............................................................................. 64
Table 10: Guidelines to Develop Interactive Visuals for ICOs ........................................... 68
Chapter 1: Introduction

Background for the Study

In an online course, there are a number of processes and guidelines learners will need to follow throughout the course. The organization and structure of the course plays an essential and significant role in guiding the students through the course materials. An Interactive Course Organizer (ICO) is an artifact that contains text and visual representation of a traditional course syllabus, it integrates visual elements, such as timelines, drawings, charts, graphs, maps, or pictures to show the sequencing and organization of major course topics while offering the user an actively controlled progression of the amount of course information covered. In other words, ICOs are interactive in the sense that students have control over what information and interactive features they can view and use to acquire more detailed information. The purpose of an ICO is to provide visuals to assist learners in seeing the course and how it is organized “big picture,” instead of just showing learners a linear format as presented in a text-only syllabus, and to clearly articulate the connections between course content.

An ICO enables learners to visually see the interrelationships between different parts of the course and how they all fit together. It describes the course topics, learning objectives, course materials, assignment, schedule, learners support services, assignments, tests, etc. ICO provides learners with prior knowledge and helps them organize their thoughts and ideas to prepare for a course. It offers learners an educationally rich portal to course materials that forms the basis of an online or face-to-face course exploration. By adding the interactivity feature, learners will navigate, access, and view the course content. It is a course framework to help students understand what it is they will be learning in the course.
Commonly, course syllabi can be loaded with certain subject terminology that is either vague or insignificant to learners in the beginning of a class (Nilson, 2007). For learners, looking at the course content and placing the pieces together will help them understand the interrelationship between course content and the nature of the subject. Learners' first encounter with the discipline and course may be confusing or overwhelming. Therefore, the syllabus is an outline that describe students’ roles and responsibilities that both professors and students share in the class (Grunert, 1997). An ICO is a visual form of a syllabus which provides learners with an overview of the course and offers them interactive content, enabling them to take part in its information expansion.

The structure of ICOs is very similar to that of concept maps (Novak & Gowin, 1984), advance organizers (Ausubel, 1968), and graphic organizers (Hawk, 1986) which are generally used by instructors to help students organize information presented or read (DiCecco & Gleason, 2002; Kim, et al. 2004). An ICO is a tool that is presented prior to the course to be learned, and then branched out to show how main ideas can be broken down into specific topics. It helps students recognize the course they are beginning to learn is not totally new and provides visual explanations to show course concepts. Hyerle (1996) emphasized that visual tools can be used to encourage learners to connect and organize information and detect interrelationships between them. ICOs are designed to illustrate how the course content is incorporated together, which is usually unclear to some learners particularly those entering a new discipline.

When it comes to using text and visuals, theories of learning — specifically those that build on cognitive sciences and knowledge acquisition — expand our knowledge of how to develop instructional materials that improve learning and performance. Information processing theory examines the roles of memory structures of the human brain: sensory, short-term, and
long-term memory; how they perform; and how information is processed through these systems and then stored in the brain (Driscoll, 2004). This theory offers a perspective of memory structures that have an essential impact on both dual coding theory and cognitive load theory in learning. According to these theories, ICO can help in holding and maintaining students’ attention, minimizing cognitive load, and supporting information retention. Thus, ICOs are promising learning tools that can be adapted to an online learning setting to enhance students’ reception, retention, and retrieval of information (Driscoll, 2004; Paivio, 1986; Sweller et al., 1998).

In online courses, interactivity is reached by allowing the learner to make decisions using digital devices specific actions that control the progression of the course (Clark & Mayer, 2016). In an ICO, the feature of interactivity is implemented by navigational features, such as timelines, drawings, charts, graphs, maps, or pictures and links that allow learners to select a topic and its details. Clark and Mayer (2016) stated that “We also know that learners prefer learner control, and in many e-learning environments, they can easily drop out if not satisfied” (p. 322). In an ICO, the learner will have the opportunity to control and view course topics, such as: instructor and course information, learning objectives, assignments, tests, schedule, school policies, as well as different support services offered to the learner. From an instructor’s perspective this creation (ICO) can be used for an extended period of time as long as it serves its purpose.

Need for the Study

The growth of online learning has revolutionized education and provided easy access to learning for multitudes of learners. The increase of online education enrollment is continually rising in the higher education programs. A report by Allen and colleagues (2018) tracking online education in the United States showed that “distance education enrollments increased for the
fourteenth straight year, growing faster than they have for the past several years” (p. 3). In the fall of 2016, more than one in four students were taking a minimum of one online course, which is a total of 6.3 million students (Allen et al., 2018). According to Allen and colleagues (2018), 31.6% of students enrolled in online courses with 14.9% in online courses only, and 16.7% in both online and face-to-face courses.

Course Management Systems (CMS) or Learning Management Systems (LMS) are key components of online and face-to-face courses. They can be described as web-based systems, typically password-protected, where electronic materials (documents, files, web links) can be distributed, and where learners can participate in online lectures and discussions. With Internet access and a login, those systems can be accessed from anywhere at any time. LMS and CMS are commonly used in educational environments to deliver course information, as well as to facilitate fulfillment of coursework (McAvinia, 2016). According to Dahlstrom and colleagues (2014), currently, almost all educational institutions use learning management systems.

Research Problem

With this continuously growing use of LMS, research has shown that in some cases LMS are not used to fulfill their full potential; the purpose of the systems over the years has changed and they now act primarily as content management systems (Dias & Diniz, 2014). Azmi and Singh (2015) stressed that nowadays, LMS are mainly being used as a document distribution system for course materials. The challenge that exists with online learning is not in rebuilding the learning process but rather designing new approaches by utilizing the new tools available to us (Ehlers, 2009). This raises the question of how the design of another layer to the system can make the learning experience more fulfilling. There is a need to improve the use of LMS to adapt to the current innovation and improvement in presenting course materials. One of the many ways
to expand the utilization of LMS is to present the students with a solid basic structure of the course as well as to guide and direct them through the course materials, so they can see how each of the topics are related to each other. Also, it increases the interaction between the students and the course materials in the system itself.

Furthermore, Oblinger and Hawkins (2006) stressed that “Online instruction is more than a series of readings posted to a website; it requires deliberate instructional design that hinges on linking learning objectives to specific learning activities and measurable outcomes” (p.15). It is essential that instructors provide a framework for teaching an online course — the course syllabus can be considered this framework. For learners, the course syllabus provides them with clear directions and expectations for the coursework (McKeachie, 1978; 1999). Yet, according to Eberly and colleagues (2001), “Despite the importance of a syllabus, the structures and formats of written syllabi tend to be handed down from one generation to the next, rarely considered as part of curriculum redesign” (p. 56). Likewise, Merrill (2020) stressed: “a first-class syllabus can help promote effective, efficient and engaging learning, but traditional syllabi too often fail to attain this purpose”. Thus, designing an inclusive syllabus can offer a sound framework for the course, as well as guidance for learners, and there are steps that can be followed in crafting an efficient course syllabus. This is where new inventive learning approaches with a focus on an interactive, visually pleasant course syllabus can be explored.

**Purpose of the Study**

With the increased number of software programs and websites dedicated to easy visual design, it is necessary to explore new ways to achieve the simplicity and efficiency of visually pleasing and professional syllabi. An effective ICO (i.e., a course syllabus) can, however, be developed through design choices and the reduction of elements that distract from the message—
skills that are not inherent for many instructors. Developing an ICO easily can be overwhelming for instructors, hence there is a need for theoretically grounded guidelines to create ICOs that can be utilized by instructors that fit their design level. Moreover, it will give learners a view of the course's "big picture" and serve as a road map that defines the content and context of learning in online courses.

The purpose of this design and development study is to develop theoretical guidelines that can help educators in creating ICOs. The aim of the guidelines is to assist in designing ICOs, considering their capability to help students visualize the course “big picture,” and to clearly articulate the connections between course content, as well as serve as road maps that define the content and context of learning in courses. The guidelines are designed and developed with a theoretically grounded foundation from several cognitive information processing theories. Furthermore, the guidelines will assist in crafting ICO content, integrating both text and visuals while they support each other, and minimizing cognitive load.

With the utilization of the design and development research method, the guidelines produced an approach that can be generalized and that aims to improve the syllabus design process (Richey & Klein, 2007). The guideline were validated by experts in the field, and their recommendations were used to revise the guidelines. The guidelines can add to the literature on syllabus design, instructional message design and visual literacy. As such, this set of theoretical guidelines can assist in developing not only ICOs but also other visual instructional materials.

Design and development research applies various methods to link practice, research, and theory to solve an educational problem (Richey, Klein and Nelson, 2004). Consequently, the proposed developmental research study applied design principles from instructional message design and visual literacy to ICOs. An evaluation rubric was provided to expert reviewers to collect their
feedback. Built on the findings and recommendations from the expert reviewers, the guidelines were revised based on those findings and recommendations. This set of theoretical guidelines can assist in developing not only ICOs, but also other visual materials.
Chapter 2: Literature Review

**Introduction**

This research study aims to design, develop, and validate a set of guidelines to create Interactive Course Organizers (ICOs). With the growing number of software programs and websites that are used to build professional and simply designed visuals, such as infographics, presentations, and print templates, it is essential to explore new ways to reach the simplicity and efficiency of a visually pleasing and professional syllabus. When developing an efficient ICO (i.e., a course syllabus), many skills are required, such as the amount of text that needs to be included, how text and visuals come together, how they are integrated, design choices, and the removal of elements that distract from the message. Most of these skills are not inherent for many instructors and creating ICOs can easily be overwhelming for them; hence, there is a need for theoretically grounded guidelines to create ICOs that can be used by instructors that match their design levels. Besides, from the students’ point of view, ICOs are their first exposure to the course, and they serve as road maps that outline the content and context of learning in courses. Assuming the potential of ICOs for learning, the following questions will be answered:

- What comprises an overview of ICOs, including their definition, identifying their purpose, and the components built into them?
- How — according to several learning theories — can ICOs help in supporting cognitive functions in learning?
- What evidence-based studies exist to support this type of visual presentation?
ICOs - Definition, Purpose, and Components

ICO Definition

An ICO is an artifact that contains text and visual representation of a traditional course syllabus. It integrates visual elements, such as timelines, drawings, charts, graphs, maps, or pictures to show the organization of major course topics while offering the users an actively controlled progression of the amount of course information covered. In other words, ICOs are interactive in the sense that students have control over what information they can view and what interactive features they can use to acquire more detailed information.

ICO Purpose

The purpose of an ICO is to provide visuals to assist learners in seeing the course “big picture,” and how it is organized, instead of just showing learners a linear format as presented in a text-only syllabus, and to articulate the connections between course content. An ICO adds more features to a traditional syllabus, making it more visually organized and interactive. It is built on the fundamental principle of a traditional course syllabus, visual organization of advance organizers, graphic organizers, and concept maps, as well as the interactivity and learner control over the amount of viewed information.

Course syllabus

Parks & Harris (2002) stressed that a course syllabus can serve as a contract between faculty members and learners, permanent record, as well as a learning tool. Syllabi are contracts that offer and detail course rules and policies (Habanek, 2005). On the other hand, syllabi are learning tools to prepare for the coursework, monitoring learners’ progress, and explanations for how the course fits with real-life experiences (Parks & Harris, 2002). More than half of the students refer to the course syllabus at least once a week during a course period (Smith &
Thus, a syllabus plays an important role in attracting learners’ attention toward the course. The purpose of developing a course syllabus is to provide the context and a summary of the course, as well as to describe the expectations instructors have for their students. According to Littlefield (1999), a well-designed syllabus also sets the course agenda, acts as a planning tool for faculty, and serves as a contract between the faculty members and learners.

**Visual organizers**

Thinking can take various forms and visual organizers can support different ways of thinking about a subject (Clarke, 1990). Visual organizers have been used by educators to clarify the objectives and the thought processes to create meaningful learning (Clarke, 1990; Jones, Pierce, & Hunter, 1989). In the literature, visual organizers have been referred to by several terms, including; advance organizers (Ausubel, 1968), concept maps (Novak & Gowin, 1984), and graphic organizers (Hawk, 1986). An advance organizer is a method that links previous and existing information using new information to support the learning and retention of that new material (Ausubel, 1968). A concept map is another form of graphic organizer that connects relationships among concepts using labeled nodes (Novak & Gowin, 1984). Similar to that, graphic organizers intended to work as advance organizers, to activate learners’ prior knowledge and illustrating its relationship with new (Hawk, 1986). While they have various names and different purposes, their main goal is to provide learners with a ‘visual map’ to assist them in organizing complex knowledge by linking new and unfamiliar information to their own prior knowledge to create meaningful, useful, and accessible learning.

**Interactivity and learner control**

Interactive learning environments give learners the opportunity to control the presentation of information and its content (Scheiter & Gerjets, 2007). In the literature on computer-based
instruction, the two terms interactivity and learner control are used interchangeably. According to Scheiter and Gerjets (2007), the term interactivity is often used in the literature to describe the flexibility of single representations (e.g., animation), and learner control is based on the learner’s ability to modify several presentations of the information and have several techniques to interact with them (i.e., sequencing, content selection). Even though these terms have different connotative meaning, interactivity by definition involves how much control learners have over the display of information. Consistent with Merrill (1975), learners should be given control over the sequence of instructional material, so they can discover how to learn as they make instructional decisions, which can give learners the ability to acquire strategies for learning in different situations.

**ICO Components**

**Text components**

Several studies have addressed the components of a syllabus. There are four primary roles for the course syllabus: (1) to provide the learner with a course map, (2) to form a contract between the learner and the faculty member, (3) a communication tool connecting the learner with the faculty member, and (3) to distribute the faculty members’ plan for the course (Matejka & Kurke, 1994). As stated by Davis (1993), to achieve these purposes, he suggests incorporating the following components into the course syllabus: (a) course information, for example year and semester, course number, course time and date; (b) the name of the course instructor and his/her contact information, such as phone number, email, office hours and location; and (c) the course prerequisites from the university catalog. Moreover, Davis (1993) proposes 11 elements that should be incorporated in the course syllabus they are as follow: (1) rationale for the sequence of topics, (2) format for class presentations and activities, (3) materials students need for the class,
(4) all student assignments and requirements, (5) how work will be graded and its weight, (6) student responsibilities and the reason(s) for course policies, (7) how students with special needs may arrange to receive appropriate accommodations, (8) the course calendar, including specific opportunities for student feedback and other important dates, (9) time commitments that successful students are likely to make, (10) additional sources students can use to supplement required sources, and (11) a section where students introduce themselves for other students in the class.

Visual components

When it comes to visual components built into an ICO, visuals can be pictures, illustrations, graphs, and icons in the ICO design. Using accurate visuals to represent the instructional message is essential to many aspects of learning. Table 1 provides different graphic types to use for varied instructional goals (Table 1 - for better clarity, a picture, for example, is added).

Table 1: Graphic Types to Use for Varied Goals

<table>
<thead>
<tr>
<th>Instructional Purpose</th>
<th>Graphic Types</th>
<th>Example</th>
</tr>
</thead>
</table>
| Describe specific objects | • Photograph 3-D graphic  
• Illustration  
• Clip art (particularly in diagrams and as game elements) (Malamed, 2015; Meirelles, 2013; Black et al., 2017). | ![Visual Example] |
<table>
<thead>
<tr>
<th>Activity</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tell a story or provide a scenario</td>
<td>• Sequence of photographs Sequence of illustrations&lt;br&gt;• Timeline (Malamed, 2015; Meirelles, 2013; Black et al., 2017).</td>
</tr>
<tr>
<td>Persuade an audience</td>
<td>• Sequence of photos or illustrations to tell a story&lt;br&gt;• Photographs that evoke emotions&lt;br&gt;• Visualization of statistics and data (Malamed, 2015; Meirelles, 2013; Black et al., 2017).</td>
</tr>
<tr>
<td>Explain unfamiliar or complex concepts and theories</td>
<td>• Visual metaphor&lt;br&gt;• Diagram showing connections (Malamed, 2015; Meirelles, 2013; Black et al., 2017).</td>
</tr>
<tr>
<td>Demonstrate a procedure</td>
<td>• Show the steps in a sequence of photos or illustrations&lt;br&gt;• Flow chart&lt;br&gt;• Series of screen captures for software simulation (Malamed, 2015; Meirelles, 2013; Black et al., 2017).</td>
</tr>
</tbody>
</table>
Explain a process
• Diagram the stages or operations of the process
• Icons or simple illustrations to represent each component (Malamed, 2015; Meirelles, 2013; Black et al., 2017).

Point out something specific
• Arrow or pointed shape
• Highlight
• Outline of a circle (Malamed, 2015; Meirelles, 2013; Black et al., 2017).

Depict components of a system
• Illustrate object with labels Diagram of the structure (Malamed, 2015; Meirelles, 2013; Black et al., 2017).

Make comparisons
• Bar graph Pictograph
• Line graph with multiple lines
• A Table when specific values are important (Malamed, 2015; Meirelles, 2013; Black et al., 2017).

Demonstrate trends in data
• Line graph
• Scatter plot (Malamed, 2015; Meirelles, 2013; Black et al., 2017).
Organization of information

- Various chart types (hierarchical, radial, etc.) Concept map (Malamed, 2015; Meirelles, 2013; Black et al., 2017).

Demonstrate motion without animation

- Show object moving along a path
- Illustrations with motion lines
- Illustrations with arrows or dashed lines depicting movement (Malamed, 2015; Meirelles, 2013; Black et al., 2017).

History or changes over time

- Timeline (these don’t have to be arrows) Sequence of photos or illustrations (Malamed, 2015; Meirelles, 2013; Black et al., 2017).

Learning Theories Related to the Use of ICO

In the literature of education research, a social science field, empirical studies have been conducted to investigate several approaches on how to transfer knowledge and the impact of these approaches on learners. Theories of learning — specifically those founded on the study of knowledge acquisition and cognitive sciences — contribute several methods in designing and developing instructional materials that support successful learning and performance. Theories of learning that are important when considering ICOs are: (1) theories related to the use of text and
Theories related to the use of text and visuals

Information processing theory offers an examination of the memory structures which add to our knowledge of the implication of both cognitive load theory and dual coding theory. This section will present how each of these theories assumed that using text and visuals can help in holding and maintaining students’ attention, minimize cognitive load, and support information retention (Pettersson, 2002; Driscoll, 2004; Paivio, 1986; Sweller et al., 1998).

Information processing theory

According to this theory, the human brain has three memory structures: short-term, working, and long-term memory (Pettersson, 2002). When exposed to new information, it is processed through these systems and then stored in the brain (Driscoll, 2004). Short-term memory, also known as sensory memory, is linked with each of our five senses; it stores information for up to one second until it is transferred to the working memory (Pettersson, 2002). Vision is considered our most powerful sense (Avgerinou & Ericson, 1997); thus, visuals are great tools for learning tasks that involve memorizing (Pettersson, 2002). According to Ware (2013), the visual sensory memory or the iconic memory (vision) is the snapshot that the brain holds for a brief period of time after looking at an object. Usually, it can be stored for less than a second, except if it is examined and connected to something that is previously stored in the brain. Visuals have the ability to continually draw from nonvisual information stored in the long-term memory (Ware, 2013).

After processing the information in the sensory memory, it is delivered to the working memory. Only limited information can be held in the working memory due to the activation of
the concepts from the long term memory to comprehend the incoming information (Driscoll, 2004). The working memory then calls upon long term memory to understand its meaning. Lastly, the information is retained in the long-term memory after the experience, and can be saved for a long period of time. When processing new information, humans can draw upon this previous information (Lankow, Ritchie, & Crooks, 2012). Long term memory receives information, recalls certain features of the information, and then retrieves the information as needed (Driscoll, 2004). In the long term memory, information is divided into two processing systems: episodic and semantic memory. The episodic memory is where images and scenes we have experienced can be recalled, as well as the thoughts related to those experiences. The semantic memory gives us the ability to recall information that is not connected to a specific context or experience, and it could be considered the storage of common knowledge (Pettersson, 2002). It should be noted that knowledge in memory is stored as mental schemas, which are developed based on information provided by life experiences. Mental schema provides slots of packets of new knowledge to be placed in the memory (Driscoll, 2004).

Learning focuses on the interaction between short-term and long-term memory components. It occurs through the transformation of relevant information from the short-term to the long-term memory, then the retrieval of that information during a task performance. The primary concern of instructional designers is the function of the working memory. Despite the delivery medium, relevant information should gain learners’ attention, be held in working memory, and ideally be in a form that is readily incorporated into long-term memory.

**Dual coding theory**

This theory enhances the general information processing theory. Paivio (1986) recognized two different cognitive subsystems: one that processes nonverbal information, for
example pictures, and one that processes verbal and auditory languages. According to Paivio (1983), a memory of a picture is superior to a memory of a word; it is called the “picture superiority effect.” Paivio’s dual coding theory of the picture superiority effect assumes that pictures are encoded through two routers, the image subsystem and the verbal subsystem to support memory. The theory describes how people learn concepts more easily by viewing pictures than by reading text alone. For more explanation, if a learner is presented with a picture of a dog and the word “dog,” he or she can store the stimulus to the concept “dog.” To retrieve the stimulus, the learner can recall the word or the picture separately, or together simultaneously. When recalling the word, the picture of the dog is saved and can be retrieved at a later time. Processing information in two different systems can increase the chance of recalling that information. According to dual coding theory, text and pictures are assumed to be processed separately by the image and verbal subsystems, and their combination is likely to facilitate the recall of information (Paivio, 1986).

**Cognitive load theory**

This theory recognizes the memory structures of the information processing theory, however, its main focus is the working memory limitations. Cognitive load is the amount of mental effort required from the human cognitive system to performing a certain task (Sweller, 1988). As stated by Sweller and colleagues (1998), cognitive load is divided to three categories: intrinsic, extraneous, and germane load. When comes to controlling the cognitive load, intrinsic cognitive load can be controlled through the educational content type and the learner knowledge of the content, extraneous and germane cognitive load are controlled by the layout and organization of the educational material. For more explanation, the intrinsic cognitive load (ICL) is associated with the content of material not the instructional design of this material, and it hard
to reduce compared other types of cognitive load (Madrid et al., 2009). ICL can be controlled by the materials interactivity, and it is influenced very slightly by instructional design alone (Brusilovsky, 2004; Lo et al., 2004).

Extraneous cognitive load (ECL) is influenced by elements such as instructional strategies and instructional message design of the materials (Sweller et al., 1998). When creating instructional materials, ECL can be reduced by integrating and relating both textual and visual elements to avoid unnecessary cognitive processes (Cierniak et al., 2009). When talking about ECL, it is important to mention the cognitive theory of multimedia learning (Mayer, 2005) that identifies several cognitive processes learners face when constructing mental representation of their learning experiences. The theory provides several principles for reducing cognitive processes related to ECL. According, to this theory, engaging in three cognitive processes: selection of related text for verbal processing, selection of related visual for visual processing, and then unifying both text and visuals into a clear verbal model and visual model, combining related components of the verbal and visual models can increase active learning (Mayer, 1997). One of the six principles of multimedia learning theory is relevant for the use of text and visuals. The principle called "spatial contiguity principle", which states that “people learn more deeply from a multimedia message when corresponding words and pictures are presented near rather than far from each other on the page or screen” (Mayer, 2005, p. 183).

Lastly, germane cognitive load (GCL) which is beneficial to learning and can be produced by an appropriate instructional design of the educational material (Cierniak et al., 2009). As claimed by several studies on CLT (Cierniak et al., 2009; Madrid et al., 2009; Sweller et al., 1998), GCL have a positive and beneficial effect on learning, while both ICL and ECL have a negative impact on learning. GCL is circuitously influenced by manipulating ECL and is
directly linked to schema formation (Sweller et al., 1998). The perception of GCL is that by using appropriate instructional design strategies learners can be motivated to process information and construct schemas to be store in the long-term memory (Kolfschoten et al., 2010). To promoting GCL, strategies such as chunking and sequencing the content, presenting relations between the content, and creating a rich multimedia learning experience can help learners understand new information (Fallahkhair, Pemberton, & Griffiths, 2005; Liu, Liao, & Pratt, 2009). Here, it is important to reference metacognition strategies which occurs when learners participate in a high order of thinking that includes active control over the cognitive processes involved in learning.

Metacognition: Metacognition is related to the planning, monitoring, evaluating and restoring performance (Kirsh, 2005). It deals with learners’ awareness about their own thinking and knowledge of how to acquire information, how to interpret a complex text, and how to use this knowledge to support memory (Driscoll, 2004). Metacognitive skills depend on the learner, the materials to be learned, and the strategy used to learn these materials. Therefore, the organization and arrangement of the learning materials should offer the learner specific directions and guidance to learn the task on hand. When talking about metacognition, it is important to reference the idea of affordance which was first introduced by J.J. Gibson (Gibson, 1966,1979). According to Gibson, the artifacts in our environment hold functional attributes (referred to as affordances), people can understand, comprehend, and perceive those affordances. When a learner is interacting with instructional materials that present several types of cue structures, such as visual cues, the affordances for the use of the materials are revealed.
Theories related to the use of visual organizers

Meaningful learning theory

As has been explained at the beginning of this chapter, visual organizers have been mentioned in the literature by various names. Some of these include advance organizer (Ausubel, 1968) which is a visual presentation in the form of a narrative or outline to use before the instruction to bridge between what learners know and the instruction on hand. They are used as a strategy to link and connect old information with new information to support the learning and recalling of the new information (Ausubel, 1968). Numerous criticisms have been raised in inconsistency of Ausubel's definition of advance organizer and how it considered to be unclear and ambiguous (Hartley & Davis, 1976). The definition provided by Ausubel for advance organizer is logical rather than operational. It explains abstractly what advance organizer is but does not specify how it is to be developed (Clarke & Bean, 1982).

Another name used to describe visual organizers in the literature is the concept map (Novak & Gowin, 1984). A concept map is another form of graphic organizer that connects relationships among concepts using labeled nodes (Novak & Gowin, 1984). What put concept maps apart from other visual organizer techniques, is their very specific rules. According to Novak (1998), to increase the operationalization of advance organizers, there are two principles to extend the effectiveness of advance organizers. The first principle is that in a concept map information is categorized and identified beginning with the general ideas at the top then secondary ideas are below. The second principle is that the ideas are connected with arrows and the arrows are labeled to explain the type of the relationship.
Figure 1. shows concept map structure.

Lastly, graphic organizers, which were first designed to function as advance organizers, prepare students for learning by activating prior knowledge and illustrating its relationship with new concepts (Hawk, 1986). Graphic organizers are used to organize ideas and concepts visually present the relationships between them independent of the textual information (Darch et al., 1986). The addition of visuals is what differentiates this technique from other visual organizers.
Figure 2. shows an example of graphic organizer.

Figure 2: An example of graphic organizer.

The theory of meaningful learning is related to the visual organizer described above (Ausubel, 1968; Mayer, 1979). The main idea in this theory is the distinction between rote and meaningful learning. Aligning with constructive learning, meaningful learning is consistent with the view of learning as knowledge construction in which students seek to make sense of their experiences. Students engage in active cognitive processing, like paying attention to new information, mentally organizing the new information into a clear representation, and mentally adding new information with existing knowledge (Mayer, 1999). On the other hand, rote learning is consistent with the view of learning as knowledge acquisition in which students seek to add new information to their memories (Mayer, 1999).
Meaningful learning emphasizes the importance of determining students’ prior knowledge in order to build upon their understanding (Ausubel, 1968). According to this theory, learning process happens when new concepts are connected to existing ones in conceptual structure of learner (Kowata et al., 2010). Therefore, new concepts are learned essentially when connected to the learner’s conceptual structure in a more logical way. Ausubel stressed that when the learner is presented with the details of a lesson in a way that the details are incorporated into one another in a relational way, the students were expected to learn more (Ausubel, 1962, 1963). Novak (1998) added that meaningful learning occurs when the following three conditions are present:

1. Prior knowledge: learners are required to identify some information that connects to the information on hand; their prior knowledge have to suit the new presented knowledge.
2. Meaningful material: information to be learned is appropriate to the learners, contains interesting topics, and appropriately organized.
3. The learner must choose to learn meaningfully: learners decide to interact with the new information and connect it to an existing knowledge they learned from a different experience.

Novak (1998), also emphasized the process of meaningful learning, and how new information can be linked to existing concepts in the cognitive structure. Meaningful learning results when the learner chooses to relate new information to ideas the learner already knows (Novak, 1998, p. 19). Thus, students who know more to begin with learn more at the end of a course; this is due to having a stronger start that made them better able to make sense of the things they were taught. Visual organizers are used to support more meaningful learning and assist in encoding and retention of new material by making abstract concepts more concrete and connecting new information with learners’ prior knowledge (Ausubel, 1968; Mayer, 1979)
Theories related to the use of interactivity and learner control

Cognitive theory of Multimedia learning

As has been mentioned at the beginning of this chapter, the terms interactivity and learner control are used interchangeably in the literature on computer-based instruction. The phrase interactivity is most often used to describe the flexibility of any illustration (e.g., animation), and learner control is centered on the learner’s capability to modify some representations and have multiple interactions with these representations (i.e., sequencing, selection of content) (Scheiter & Gerjets, 2007). Thus, interactivity by definition indicates that the learners have control over the presentation of information. One of the most prominent theories in the field and the one related to interactivity and learner control is Richard Mayer's theory of multimedia learning. According to Mayer (2004), “Multimedia learning involves learning from words and pictures and includes learning from textbooks that contain text and illustrations, computer-based lessons that contain animation and narration, and face-to-face slide presentations that contain graphics and spoken words.”

Mayer's theory of multimedia learning (Mayer, 2009) has provided a range of principles, one of which is learner-centered approach, which would also connect to the learner control principle. This principle is all about allowing learners to have control over the information presented to them and independently chosen information. Moreno and Mayer (2007) proposed three aspects of interactivity, which are: pacing (controlling speed of information presentation), manipulating (controlling aspects of information presentation), and navigating (selecting information sources). According to Scheiter (2014), “Giving learners control over their instruction by allowing them to pace, sequence, and select information aids learning if learners possess high levels of prior knowledge and if they receive additional instructional support to
orient themselves in the learning environment and to self-regulate their learning” (p. 487). The Learner Control Principle can be extremely effective with students as it allows them to be more selective over what they need to learn and their particular preferred focus. Learners “can adapt the instruction to their goals, needs, and preferences, thereby creating individualized instruction” (Scheiter, 2014, p. 495).

**Evidence-Based Studies to Support the Use of ICO**

After explaining how ICOs can support cognitive functions according to several learning theories, it is important to understand what kind of research has been conducted to support this type of presentation.

**The use of course syllabus**

Course syllabi play central role in guiding the learning process in higher education institutions; thus, they play a significant role in improving the quality of institutions’ education. Course syllabus can offer details of what will be covered in the course, what students are/would be expected to do, and how learning outcomes are/will be measured and are often examined as part of accreditation reviews by professional organizations (Parkes & Harris, 2002). According to Hess and Whittington (2003), “It is important and fundamental that educators provide a framework for the course they will be teaching. Most often that framework is provided to the students through a course syllabus.” From the learners’ point of view, course syllabus offers security when comes to the direction of the course and what is and expected from to succeed in that course (McKeachie, 1978, 1999).

Course syllabus main purpose is to offer the context and summary of a course and explain learners’ expectations to complete the course. As stated by Habanek (2005), course syllabi are contracts between the instructor and the learners, they include course topics, learning
objectives, grading policies, and institute policies. Additionally, they are learning tools to prepare learners for course assignments, monitor learners’ growth, and explain how the course fits with real life experiences. Course syllabi serve three main purposes: as a contract between the instructor and the student that outlines the expectations of both regarding course requirements including assignments, as a permanent record of what was taught, and as a learning tool (Parkes & Harris, 2002). Smith and Razzouk (1993) stated that students tend to view course syllabi on a weekly basis, which implies the important role they play in attracting learners’ attention toward the course.

Looking at course syllabi from the instructors’ side, they assist in developing and organizing their vision for the course (Appleby, 1999). Course syllabi are documents that guide the learning process and an important part of the course building and evaluation. They can function as a planning tool for faculty members to organizes students’ work during the course, and can help in the planning and achievement of the course goals. To sum up, course syllabi are shown to benefit the essential role of the instructors’ courses, which is supporting and promoting interactive, effective, and purposeful learning (Hess & Whittington, 2013).

**The use of visual organization**

All advance organizers (Ausubel, 1968), concept maps (Novak & Gowin, 1984), and graphic organizers (Hawk, 1986) are deeply rooted in the meaningful learning theory. The obvious purpose of these visual organizers is to connect high order information and low order information and show the relationship between the two to the learners (Armbruster & Anderson, 1981). Compared to text-only format, the benefit of this visual format is that it visually presents the high-level organizational structure of information, pinpointing the main concepts and identifying their interrelationships (Meyer, 1975, 1977, 1980). Moreover, these visual organizers
intend to facilitate learning and recalling of new material to support meaningful learning by transferring abstract concepts to concrete concepts and connecting new information with old existing information (Ausubel, 1968; Mayer, 1979).

Evidently the most commonly examined learning measure in the literature of visual organizers is information comprehension. The majority of those studies reported that visual organizers, specifically graphic organizers, are used to improve comprehension. Furthermore, various meta-analyses studies sustained these comprehension improvements (Ciullo, 2013; Dexter & Hughes, 2011; Dexter, Park, & Hughes, 2011; Moore & Readence, 1984). In these studies, researchers detected a minor, however, consistent effects on knowledge comprehension. Moreover, the findings also show a gain in vocabulary knowledge. For example, Moore and Readence’s (1984) meta-analysis proposes that gains in vocabulary knowledge after the use of graphic organizer could be greater than gains in comprehension. Likewise, a meta-analysis by Dexter and Hughes (2011) and Dexter and colleagues’ (2011) reported a moderate to high effect in vocabulary knowledge after the use of graphic organizers.

A new area of research is the presentation of information in visual organizer using of digital technology-based approaches. They can be used by both learners and instructors. Digital-based graphic organizers allow learners to design and control visual representations of information and provide different ways to display that information (Cañas & Novak, 2010). When learners use graphic organizers to build more abstract comparisons, evaluations, and conclusions, it allows them to play an active role in their learning. On the other hand, graphic organizers allow instructors to present and clarify relationships between content and sub-content and show how it is related to other content areas. A meta-analysis by Ciullo’s (2013) examined the use of digital-based graphic organizers by students with learning disabilities, the study found
a high effect in social studies measures and moderate effects in reading, writing, and information comprehension.

Lastly, after exploring visual organizers’ literature and research that used them in a similar fashion as ICO will be used. Robinson and Schraw (1994) stated that visual organizers can facilitate learners’ understanding of conceptual "big picture" patterns than linear presentations. When starting a new course, a student may have low to no prior knowledge of the course content. Lambiotte and Dansereau (1992) suggested that by introducing visual organizers learners with low prior knowledge of the content can benefit more than those with high prior knowledge. Moreover, Mayer (1979) assumed that the specific macrostructure signaled by a map might guide the knowledge construction of less knowledgeable learners. Additionally, as stated by Shaw and colleagues (2012), “An overview effect suggests that GOs (Graphic organizers) are most beneficial when they can activate learners' prior knowledge or schema before text is presented.”

The use of interactivity and learner control

Learner control is the level to which learners are given control over several instructional features during a lesson (Reeves, 1993). For more explanation, a course with a high degree of learner control may allow learners to select what content in the lesson they want to view. Merrill (1975) recommended given the learner control over the sequence of instructional material. Through learner control, learners can be freed to explore how to learn new content by make instructional choices and experience, the results of those choices offer them the ability to develop strategies for learning in different conditions. Additional, Merrill (1983) Component Display Theory and Reigeluth and Stein (1983) Elaboration Theory suggested that learner control can positively influence the effectiveness and efficiency of learning.
Interactive features, such as learner control over the pace and content may influence the learner’s motivation. Several motivation design models such as ARCS (Keller, 1983) and MUSIC (Jones, 2009) suggested using learner control to motivate learners. Keller (1979) has established that when students are given some control over aspects of their learning, they are more likely to have positive feelings towards the content. Moreover, Jones (2009) stressed that “instructors should design their courses to empower students. Empowerment refers to the amount of perceived control that students have over their learning.” (Jones, 2009). In an experiment conducted by Chen and Catrambone (2014), they found that learners were more motivated and engaged in the learning process when using interactivity, which can also help them produce meaningful learning.

As stated by Patterson (2000) learner control supports a deeper processing of the information presented, due to its ability to influence learners to examine the information then choose what information can assist them in achieve their learning goals. Additionally, the multiple ways learners can access the information provide them with the opportunity to identify the relationships between different information and incorporate them with their prior knowledge (Scheiter & Gerjets, 2007). According to Jonassen and Grabinger (1990), learner control is expected to increase learners’ engagement with the information and aid them in building their own understanding of it instead of being passive receivers of the information.

**Discussion**

This literature review defined ICO as objects that include both text and visual representation of a traditional course syllabus. They combine visual elements, such as timelines, drawings, charts, graphs, maps, or pictures and links to show the outline and organization of main course topics while presenting the learners with an active control over the amount of course
information covered. ICO give learners control over what information they can view and the ability to acquire more detailed information as needed. Following that, many learning theories connected to ICO were explored: (1) theories related to the use of text and visuals, (2) theories related to the use of visual organizers, and (3) theories related to the use of interactivity and learner control. Lastly, evidence-based studies were presented to support this type of presentation.

After reviewing the literature, the development of a learning tool, such as ICO, can guide the learners through any course. ICO serve as a map to navigate any online or face-to-face course and ease the process of familiarization with a new course. From the learners’ point of view, it is their first glance at the course and/or instructor and, often, it is the learners’ first encounter with the discipline. An ICO function as a course syllabus and learners may spend a great deal of time going back and forth to this artifact during the semester on a weekly basis. Looking at an ICO at the beginning can give them the chance to see how the content is related to each other and can open their eyes to the ending gain of the course. To add, ICO is the first impression learners have of the instructor and course content, and it can help in setting the tone of the course. In ICOs, the visual organization of information display features can assist learners in make wise decisions about the use of their time in a course.

From the instructors’ point of view, considering ICO as a course guide to present course material in clear and rich way is the first steps in creating a creative classroom learning environment. Furthermore, as presented in the literature in the use of text and visuals and visual organizers, the proper use of headers, visuals, and layout strategies can enhance syllabi and make them more attractive and user-friendly. With the additions of interactivity and learner control, learners can realize that they are actively participating in the learning process instead of being
passive recipients of information (Littlefield, 1999a). ICO can present the learners with an active relationship with the material, which may increase their engagement and motivation in the learning process (Khalifa & Lam, 2002). ICO can explain course expectations clearly and pleasantly to encourage and motivate learners with the anticipation of positive learners’ outcomes.
Chapter 3: Research Methodology

**Introduction**

This design and development study aims to create a set of theoretically grounded guidelines which can assist in crafting ICO. These guidelines were created using a design and development research approach. To design, develop, and validate this set of theoretically grounded guidelines, a series of steps was followed. These steps are: (1) Analysis phase, conducting a literature review to identify the component of ICO and a specific theoretical foundation for developing the guidelines; (2) Design phase, building the first draft of the ICO (3) Development phase, developing the guidelines and a rubric to evaluate them; and (4) Validation phase, reporting the guidelines validation procedure, revise the guidelines based on expert reviewers’ feedback, and report the results.

**Purpose of the Study**

The purpose of this design and development study is to develop theoretical guidelines that can help educators in creating ICO. The aim of the guidelines is to assist in designing ICO, considering their capability to provide visual to help students see the “big picture” of how a course is organized, clearly articulate the connections between course content, and serve as road maps that define the content and context of learning in a courses. The guidelines are designed and developed with a theoretically grounded foundation from several cognitive information processing theories. Furthermore, the guidelines assist in crafting ICO content, integrating both text and visuals while they support each other, and minimizing cognitive load.
Research Questions

1. What are the components of an effective Interactive Course Organizer?

2. What considerations should be made to design Interactive Course Organizers?

3. How can Interactive Course Organizer guidelines be designed to ensure practical application?

Research Design:

This is a design and developmental research, which is a research that is directly attached to instructional development. According to Richey and Klein (2007), design and developmental research is:

The systematic study of design, development, and evaluation processes with the aim of establishing an empirical basis for the creation of instructional and non-instructional products and tools and new or enhanced models that govern their development. (p. 1)

As explained by Richey and Klein (2007) design and development research can be classified into two categories product and tool research (formerly referred to as Type I research) and model research (formerly referred to as Type II research). There are different research methods that can be used for each type of design and development research if it is a product and tool research or model research. Richey and Klein (2007) provided a more details and descriptions in the common methods employed in design and development research shown in the table below (Table 2).
Table 2: Common Methods Employed in Design and Development Research

<table>
<thead>
<tr>
<th>Type of Research</th>
<th>Project Emphasis</th>
<th>Research Methods Employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product &amp; Tool Research</td>
<td>Comprehensive Design &amp; Development Projects</td>
<td>Case Study, Content Analysis, Evaluation, Field Observation, In-Depth Interview</td>
</tr>
<tr>
<td>Product &amp; Tool Research</td>
<td>Phases of Design &amp; Development</td>
<td>Case Study, Content Analysis, Expert Review, Field Observation, In-Depth Interview, Survey</td>
</tr>
<tr>
<td>Product &amp; Tool Research</td>
<td>Tool Development &amp; Use</td>
<td>Evaluation, Expert Review, In-Depth Interview, Survey</td>
</tr>
<tr>
<td>Model Research</td>
<td>Model Development</td>
<td>Case Study, Delphi, In-Depth Interview, Literature Review, Survey, Think-Aloud Methods</td>
</tr>
<tr>
<td>Model Research</td>
<td>Model Validation</td>
<td>Experimental, Expert Review, In-Depth Interview</td>
</tr>
<tr>
<td>Model Research</td>
<td>Model Use</td>
<td>Case Study, Content Analysis, Field Observation, In-Depth Interview, Survey, Think-Aloud Methods</td>
</tr>
</tbody>
</table>

Source: Richey and Klein (2007, p.40)

This design and developmental research is categorized as model research (Type II), which is research emphasis in the development, validation, and use of design and development models (Richey & Klein, 2007). According to Richey and Klein, model studies focus on models and processes themselves, rather than their demonstration. Model research may address the validity or effectiveness of an existing or newly constructed development model, process, or technique. (p. 11)
Model research according to Richey, Klein, and Nelson (2004) is, “one of the most frequently addressed issues in this approach is providing evidence of the validity of a particular technique or model” (p. 1113). When comes to implementing the validity method Richey and Klein (2007) suggested the experimental method, expert review method, and in-depth interview method. This research employed the expert reviews method for the module validation. As stated by Richey, Klein, and Nelson (2004), the expert reviews feedback’ is utilized to reiterate, finalize, and confirm the set of guidelines.

With the utilization of the design and development research method, the guidelines can produce a generalizable approach that aims to improve the syllabus design process (Richey & Klein, 2007). The guidelines were validated by experts in the field, and their recommendations were used to revise the guidelines. The guidelines can add to the literature on syllabus design, instructional message design and visual literacy. As such, this set of theoretical guidelines can assist in developing not only interactive course organizers, but also other visual instructional materials. Design and development research is pragmatic in nature and is an applied method that is used to create a link between practice, research, and theory while solving practical problems (Richey & Klein, 2007). Consequently, the proposed developmental research study applied design principles from instructional message design and visual literacy to create Interactive Course Organizers (ICOs). An evaluation rubric was provided to expert reviewers to collect their feedback. Built on the findings and recommendations from the expert reviewers, the guidelines were revised based on those findings and recommendations.

**Study Procedure**

This design and development study went through four phases; each phase have its own unique effect on the ending product. The four phases are: (1) Analysis phase, (2) Design phase,
(3) Development phase, and (4) Validation phase. For a more accurate explanation, the center of each step is different and these are outlined in (Table 3).

Table 3: Summary of Research Design Process

<table>
<thead>
<tr>
<th>Design phase</th>
<th>Questions</th>
<th>Data Collection and Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis phase</td>
<td>1. What are the components of an effective Interactive Course Organizer?</td>
<td>1. Review of the literature to determine the components of an effective course syllabus.</td>
</tr>
<tr>
<td></td>
<td>2. What theoretical principle will best suit the guidelines to design and develop Interactive Course Organizer?</td>
<td>2. Review of the literature to locate the appropriate theoretically principle to develop the guidelines for Interactive Course Organizer</td>
</tr>
<tr>
<td>Design phase</td>
<td>3. How should Interactive Course Organizer look like in the finished form?</td>
<td>3. Build a the first version of Interactive Course Organizer</td>
</tr>
<tr>
<td>Development phase</td>
<td>4. What steps should be followed to design and develop the guidelines to design and develop Interactive Course Organizer?</td>
<td>4. Development of the guideline</td>
</tr>
<tr>
<td>Validation phase</td>
<td>5. How are the guidelines assist in designing and developing of Interactive Course Organizer?</td>
<td>5. Expert reviews' feedback to determine the content validity</td>
</tr>
<tr>
<td></td>
<td>6. Are the guidelines effective?</td>
<td>6. Expert reviews' feedback to determine the practicality and effectiveness of the guidelines</td>
</tr>
</tbody>
</table>

**Phase One - Analysis Phase**

In the first phase (analysis phase), different areas of the literature were explored to identify the components of an effective course syllabus, which is the content of ICO. These areas
covered the course syllabus literature to identify the main component of ICO, so they function as course guide, visual organizer literature to justify the visual organization, and the best way to incorporate interactivity and learner control was explored too. Also, another literature review was conducted to locate the specific theoretical foundation for developing the guidelines. Then, a set of evidences to justify the proposed theoretical foundation was provided. For more explanation, the analysis phase is all about conducting a thorough analysis of the available literature to identify the highly developed and theoretically rooted principles in the literature of designing and developing visual instructional materials. Many areas of instructional message design and visual literacy was explored to identify the best principles to be used in building these guidelines. Since ICOs are new and inventive tools that have not been developed yet, in this case Richey and Klein (2007) suggested, “The researcher must still identify literature that is relevant to the foundational theory of the project, even though the link may be indirect”. After the components of ICO are identified and the set of principles are located there is a need to justify the use of these components and principles, which was done by supporting them with empirical studies to ensure they are appropriate to use, and how the can be aligned with the purposed used of the new learning tool in this study.

**Phase Two - Design Phase**

In the second phase (design phase), the actual ICO was built since it has been mentioned in the analysis phase ICO is a new learning tool that has not been developed yet. To develop an actual ICO a sample of effective course syllabus was identified and was converted into an ICO. To ease the process of the conversion, the identified principles are used in each step of the production. First, the content of the course syllabus was broken down into a different component, and the importance of each component are categorized and classified. Second, looking at each
category to determine the best way to visually present the categorized component. Then, utilizing the located principles to develop the ICO.

After the ICO was developed it was uploaded to Canvas, which is a course management system to see how it will be function and operationalize. The design phase is utilized to describe the process of embedding the components and the theoretical principles to ICO. This includes application of theoretical knowledge to the development of the ICO. The aim of the design phase was to identify factors which would contribute in a successful implementation of the ICO. As been stressed by Nunamaker and colleagues (1990), it is essential for researchers to include any environmental factors that may affect the tool meeting its objectives.

**Phase Three – Development Phase**

In the third phase (development phase), the process of developing the guidelines begins and the theoretical foundation was applied to the set of guidelines and a description of the guidelines are completed. As stated by Richey and Seels (1994), “Development is the process of translating the design specifications into physical form” (p. 35). In this phase, starting the selection of any existing resources, adapting, editing, and then adjusting these resources to fit the set of guidelines to aid the guidelines’ development and creation process. In some cases, the need for designing new resources may occur depending on what best suits the purpose of these guidelines. After developing a description of the guidelines’ completed form, a prototype of the guidelines was ready to be validated. To ensure that the guidelines are appropriately validated, an evaluation rubric was developed too, to confirm which theoretical principle each guideline followed and aligned with it. Following this step was sending the guidelines to the expert reviewers with the sample of ICO developed in phase two and a rubric for their feedback, suggestions, and comments so it can be utilized in validating the guidelines.
Phase Four – Validation Phase

In the last and final phase (validation phase), the data gathered from the expert reviewers were reported, incorporated, and included to revise the guidelines based on their feedback. This phase evaluates the effectiveness and efficiency of the guidelines. The phase of revision and evaluation involves looking at the feedbacks, suggestions, and recommendations from the expert reviewers. From this set of data collection, improvements to the final guidelines’ form were made, and the final version of the guidelines to design and develop ICOs are presented in the study.

Characteristics of Expert Reviewers

To provide appropriate and effective feedback, the expert reviewers who reviewed and validated the guidelines for ICOs need to have specific characteristics. First, they were identified based on their expertise in instructional message design, visual literacy, effective development of visual instructional materials (online or printed), and syllabus design. Second, they have a solid knowledge base in learning theories related to the use of text and visuals. After the expert reviewers were identified, obtaining the approval from the Institutional Review Board (IRB) was the next step. The expert reviewers were asked to participate in the study via an email that explained and clarified the study’s purpose and how their participation will be beneficial to the validation of these guidelines.

Instrumentation

A website was created that includes an expert reviewers package with different materials to go over before validating the guidelines. The website contains five pages; (1) information about the study, (2) example of an Interactive Course Organizer (ICO), (3) guidelines to design and develop ICOs, (4) consent form, (5) an evaluation rubric to provide their feedback. The
evaluation rubric was developed electronically using Google Form, the first page of the rubric is the consent form. Then the rubric was organized into 6 sections and they are as follows: sections 1 asked about the application of ICOs, with questions that address their use by the target users and if they achieved their goals with effectiveness, efficiency and satisfaction. Sections 2 includes questions concerning the overall design and organization of the guidelines and questions about the simplicity as well as stability of the guidelines. Sections 3 to 5 contain question for each phase in the design and development process; the analysis, design, and development phase of the ICOs. In the last section, section 6 covers the application of the guidelines with questions about their implement by educators, the intended user audience. Each section includes a paragraph explaining and clarify the purpose and rational for the section. To get appropriate and effective feedback, quantitative and qualitative data was gathered. Each section had a five-point agree-disagree scale (strongly agree to strongly disagree) for the quantitative data collection, and an open-ended question asking for comments and suggestions for the quantitative data collection.

**Data sources**

The literature was the main source of data to develop this set of guidelines. The study involved an examination of literature in different areas to determine the components of an effective course syllabus and instructional message design and visual literacy to locate what principles exist for designing ICOs. Therefore, three important areas were considered when designing these guidelines: course syllabus literature to identify the main component of ICOs, so they function as course guide, visual organizer literature to justify the visual organization, and the best way to incorporate interactivity and learner control will be explored.

The second source of data to develop this set of guidelines is the expert reviewers’ feedback, suggestions, and recommendations. As mentioned in the instrumentations section, both
quantitative and qualitative data were gathered. Therefore, the feedback and recommendations from expert reviewers were analyzed and incorporated in the final guidelines form.

**Data Analysis**

After the quantitative and qualitative data collection from the expert reviewers, centered on the guidelines created and a rubric, the collected data were carefully analyzed to determine the effectiveness and validity of the guidelines designed for Interactive Course Organizers (ICOs), the feedback, suggestions, and recommendations from the expert reviewers were considered and included in the final version of the guidelines.
Chapter 4: The Design and Development of the Guidelines

Introduction

This chapter describes the design and development process that lead to building the guidelines for creating an Interactive Course Organizers ICO. As mentioned in the previous chapter, this design and developmental research is categorized as model research (Type II). This study followed four phases, and each phase had a result that contributes to the final product. The four phases are the (1) analysis phase, (2) design phase, (3) development phase, and (4) validation phase. In the analysis phase, a literature review was conducted to identify the standard components of a course syllabus, and utilized and transform these into the components of an ICO. To aid this transformation, another literature investigation was completed to locate specific theoretical principles to design and develop the guidelines that can assist in building an ICO. In the second phase (design phase), the results gathered and collected from the analysis phase was used to create the first version of the ICO. The development phase covers a description of the completed guidelines form and a rubric developed to verify how each of the theoretical principles aligned with the guideline. Finally, the validation phase includes the feedback from expert reviewers to determine the content validity and practicality, and the effectiveness of the guidelines. The following chapter focuses on the procedures and the methods used to design and develop this site of guidelines.

Study Procedure

Analysis Phase

During this phase of the study, an analysis of literature review was conducted and data was collected to determine the components of a practical course syllabus, as well as identify the theoretical principle used to design and develop the ICO guidelines. After a thorough
investigation into the literature, it was determined that the Quality Matters (QM) rubric is a well-suited framework to utilize when developing a course syllabus. It is essential to explore additional sources of literature to determine the components of a practical course syllabus. As for the theoretical principle model used to design and develop these guidelines, the guidelines provided in the Graphics for Learning by Ruth Colvin Clark and Chopeta Lyons provide profound theoretical foundation for designing and developing these guidelines.

**Components of an effective course syllabus.** With the growth of online learning, it is necessary to ensure the quality of online courses and programs. The Quality Matters (QM) program (see https://www.qualitymatters.org) provides various standards to ensure the quality of online courses and programs, QM emphasizes in the improvement and assurance of the quality of online learning (Quality Matters, 2018a), with the consideration of the educational level, such as K–12, higher education, or professional education level. QM offers foundational standards and a collaborative peer review method to ensure the quality of online courses (Varonis, 2014). It provides standard to assist in designing, implementing, and improving online learning (Guidelines, 2009). The QM program is reinforced by practical research and best practices (Quality Matters, 2018a).

One of the analytical instruments the QM program offers is the QM rubric. This rubric was developed to validate any completely online or blended courses to improve the quality of online programs and meet the standards designed to guide learner success (Quality Matters, 2018b). The QM rubric is structured and built on best practices in consideration of efficient online learning and offers a set of 8 general principles detailed by 44 specific principles that can be used to support and align the quality of any online course and its structure (Quality Matters, 2018). Both QM and the QM rubric undergo enhancement procedures to maintain their
effectiveness, and these procedures are current, practical, and applicable for different academic levels and disciplines (Shattuck, Zimmerman, & Adair, 2014). Thus, the QM rubric can be effectively utilized as a blueprint or framework an instructor can follow when mapping a course syllabus or when evaluating an existing course syllabus. Additionally, it can be used as the foundation layer of a course syllabus.

With the consideration of other resources in the literature in the syllabus components, Hess and Whittington (2003), in Developing an Effective Courses Syllabus, examined the literature regarding the course syllabus from the National Council for Accreditation of Teacher Evaluation. Their article emphasizes the standard components of an effective syllabus and offers examples of what information should be incorporated in each section. They intended for the article to be a guide for professors across all disciplines for developing course syllabi. Likewise, Albrecht (2009), a faculty member and administrator with 28 years of teaching experience, provided insights on course syllabus components. Albrecht highlighted the importance of the elements and the organization of the course syllabus, and she explained the contents of each syllabus component. Albrecht also assisted instructors in organizing course syllabi and offered a set of examples for each section of the course syllabus. Both Hess and Whittington (2003) and Albrecht (2009) provided examples of course syllabi to demonstrate their structure and gave some insights into how all of the components fit together in an actual syllabus.

Barros (2014) created an outline to the describe each curricular unit in higher education programs. He reexamined and built upon earlier work and used the curricular unit requirement provided by the Portuguese Agency for the Accreditation and Assessment of Higher Education Programmes as a foundation for his work (Barros, 2014). Even though the Barros (2014) template offers 25 recommendations for a better and improved course syllabus, he stressed that
curricular unit description is not necessary for a syllabus—it is essential information learners need to know about the course. Although some of the recommendations provided by Barros (2014) are not usually included in a course syllabus, these recommendations can aid in developing course syllabi for different higher education programs. Furthermore, Johnson (2006) provided an outline for the course syllabus structure and content and proposed a course syllabus content checklist to assist faculty members and administrators in developing and evaluating course syllabi.

Davis (1993), explained in depth the different teaching strategies applicable to many higher education programs. Davis (1993) discussed several planning issues that new and experienced faculty members might face when designing or revising a course. She presented a section on the course syllabus and addressed basic brainstorming ideas to create course syllabi, a detailed list of their components, and strategies on how to utilize them. Similarly, Wolfe (2004) adopted the Davis (1993) list of course syllabus components and supplemented them with more detailed information. Furthermore, in O’Brien, Millis, & Cohen’s (2008), a whole section is dedicated to the syllabi component, and it offers various examples for a learning-centered syllabus. The authors proposed 17 elements for a course syllabus, with a collection of examples for different disciplines and learning environments, from a traditional classroom setting to the online classroom.

Correspondingly, for this study, an exploration of various websites for higher education institutes was completed to identify the common components usually found in a course syllabus. It was determined that many higher education institutes equip and supply their websites with the necessary resources for course syllabi design. Some offer templates and checklists that can be easily followed and provide additional resources aimed at assisting faculty members in the
process of creating course syllabi. After the exploration was finalized, Table 4 was developed to provide a list of the various higher education institutes examined, including a link to each institute’s website, which offers course syllabi materials.

Table 4: Higher Education Institutional Websites Analyzed for Syllabus Requirements

<table>
<thead>
<tr>
<th>Higher Education Institute</th>
<th>Link to The Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stanford University</td>
<td><a href="https://teachingcommons.stanford.edu/resources/course-preparation-resources/creating-syllabus">https://teachingcommons.stanford.edu/resources/course-preparation-resources/creating-syllabus</a></td>
</tr>
<tr>
<td>Yale University</td>
<td><a href="https://poorvucenter.yale.edu/SyllabusDesign">https://poorvucenter.yale.edu/SyllabusDesign</a></td>
</tr>
<tr>
<td>Cornell University</td>
<td><a href="https://teaching.cornell.edu/teaching-resources/designing-your-course/writing-syllabus">https://teaching.cornell.edu/teaching-resources/designing-your-course/writing-syllabus</a></td>
</tr>
<tr>
<td>North Carolina State University</td>
<td><a href="https://policies.ncsu.edu/regulation/reg-02-20-07/">https://policies.ncsu.edu/regulation/reg-02-20-07/</a></td>
</tr>
<tr>
<td>Florida State University</td>
<td><a href="https://distance.fsu.edu/docs/instruction_at_fsu/Chptr3.pdf">https://distance.fsu.edu/docs/instruction_at_fsu/Chptr3.pdf</a></td>
</tr>
<tr>
<td>University of Washington</td>
<td><a href="http://www.washington.edu/teaching/teaching-resources/preparing-to-teach/designing-your-course-and-syllabus/">http://www.washington.edu/teaching/teaching-resources/preparing-to-teach/designing-your-course-and-syllabus/</a></td>
</tr>
<tr>
<td>The University of Arizona</td>
<td><a href="https://policy.arizona.edu/faculty-affairs-and-academics/course-syllabus-policy-undergraduate-template">https://policy.arizona.edu/faculty-affairs-and-academics/course-syllabus-policy-undergraduate-template</a></td>
</tr>
<tr>
<td>Brigham Young University</td>
<td><a href="https://ctl.byu.edu/sites/default/files/designing-a-course-syllabus_0.pdf">https://ctl.byu.edu/sites/default/files/designing-a-course-syllabus_0.pdf</a></td>
</tr>
<tr>
<td>Syracuse University</td>
<td><a href="http://facultycenter.ischool.syr.edu/teaching_tech_resources/syllabi/">http://facultycenter.ischool.syr.edu/teaching_tech_resources/syllabi/</a></td>
</tr>
<tr>
<td>University of Missouri–St. Louis</td>
<td><a href="https://www.umsl.edu/services/ctl/faculty/facultyorientation/s/elements.html">https://www.umsl.edu/services/ctl/faculty/facultyorientation/s/elements.html</a></td>
</tr>
<tr>
<td>California State University</td>
<td><a href="https://www.csusb.edu/trc/teaching-tips/course-syllabi">https://www.csusb.edu/trc/teaching-tips/course-syllabi</a></td>
</tr>
<tr>
<td>New Mexico State University</td>
<td><a href="https://provost.nmsu.edu/syllabus-resources/">https://provost.nmsu.edu/syllabus-resources/</a></td>
</tr>
<tr>
<td>Northern Illinois University</td>
<td><a href="https://www.niu.edu/facdev/resources/quicktips/transcripts/syllabus.shtml">https://www.niu.edu/facdev/resources/quicktips/transcripts/syllabus.shtml</a></td>
</tr>
<tr>
<td>University of Nebraska Omaha</td>
<td><a href="https://www.unomaha.edu/faculty-support/teaching-excellence/syllabus-best-practices.php">https://www.unomaha.edu/faculty-support/teaching-excellence/syllabus-best-practices.php</a></td>
</tr>
</tbody>
</table>
Following the QM higher education standards rubric, with proper alignment with the literature in the course syllabus components, and examining a various templates and checklists from higher education institutions to develop a framework for a course syllabus (Table 5) that ensures syllabus components are directly linked and aligned to the course outcomes.

Table 5: A Framework for A Course Syllabus

<table>
<thead>
<tr>
<th>Course Syllabus Sections</th>
<th>Specific Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor and course information</td>
<td>A list including, but not limited to the following:</td>
</tr>
<tr>
<td></td>
<td>• The course number, title, credits, prerequisites (previous courses, competencies, etc.), semester, time, and location of the course</td>
</tr>
<tr>
<td></td>
<td>• Instructor’s name, title, and contact information (phone number, email, office address, office hours, and online attendance if needed), and teaching assistant contact information if applicable to the course;</td>
</tr>
<tr>
<td></td>
<td>• Any relevant course web pages and emails (Albrecht, 2009; Barros, 2014; Davis, 1993; Hess &amp; Whittington, 2003; Johnson, 2006; O’Brien et al., 2008; QM 1.7 &amp; 1.8; Soonpaa, 2018; Wolfe, 2004).</td>
</tr>
</tbody>
</table>
Course overview

- Provide the learners with an introductory statement representing the general learning outcomes of the course (it is typically not measurable), describe the course overall to give learners a clear picture of the course nature. The course description provided in the university catalog
- Identify any expected prerequisite or prior knowledge in the discipline and/or any required proficiencies;
- Ask the learners to introduce themselves to the class, for fully online courses provide the learners with a section to introduce themselves (e.g., discussion board, or they can complete their profile in the LMS used for the courses; Albrecht, 2009; Barros, 2014; Davis, 1993; Hess & Whittington, 2003; Johnson, 2006; O’Brien et al., 2008; QM 1.1, 1.2, 1.4, 1.7, 1.9; Wolfe, 2004).

Course goals and objectives

- Explain what the learners will know and comprehend after taking the course. Three to five objectives can be provided to show the competencies learners will gain by completing the course.
- Consider the goals and objectives that are suited to the course level and describe the measurable outcomes.
- Clearly state the goals and objectives written from the learner’s perspective
- Each module or unit-level learning goals and objectives explain measurable outcomes and are appropriate to the course-level;
- The relationship between learning goals and objectives are aligned with the learning activities (Albrecht, 2009; Barros, 2014; Davis, 1993; Hess & Whittington, 2003; Johnson, 2006; O’Brien et al., 2008; QM 2.1, 2.2, 2.3, 2.4, & 2.5; Soonpaa, 2018; Wolfe, 2004).

Course instructional materials

- A list of instructional materials, books, chapters, articles, and media materials (e.g., audios and videos). These materials have to contribute to the achievement of the learning goals and objectives
- Explain how these materials cover each topic presented in the course and make sure the materials are representing a current theory and practice in the discipline
- Provide complete book citations, as well as the book title, author, edition, and publication
- Details on how to locate and obtain the materials, whether there are multiple bookstores that carry it, whether the materials can be found online, and how to buy them at a reduced cost;
• Provide a description of how to acquire any permissions to use the materials, such as library reserves, journal subscriptions, and accounts for online materials (Albrecht, 2009; Barros, 2014; Davis, 1993; Hess & Whittington, 2003; Johnson, 2006; O’Brien et al., 2008; QM 4.1, 4.2, 4.3, 4.4, & 4.5; Soonpaa, 2018; Wolfe, 2004).

Course outline (schedule)
• Provide the instructional methods that will be used in each course topic (e.g., lecture, reading, discussion) with a description of the tasks and activities (e.g., tests, assignments, research projects)
• Clearly state the instructional method, course activities, and course assignments in the course schedule, with the class date and the topic that will be covered each day and when each activity and assignment is planned;
• Each activity should support the learning objectives of the course and provide opportunities for interactivity to promote active learning (Albrecht, 2009; Barros, 2014; Davis, 1993; Hess & Whittington, 2003; Johnson, 2006; O’Brien et al., 2008; QM 5.1, 5.2, 5.3, & 5.4; Soonpaa, 2018; Wolfe, 2004).

Assignments and evaluation
Provide a description of what the learners will be graded on, and how, by listing the following:
• The number of assignments, tests, and activities will be used and the points for each, as well as the total number of points possible in the course;
• A brief description of the specific criterion the instructor will use to evaluate each assignment;
• Assignments due date and the possible points earned for each of them;
• Policies on attendance and late or missing assignments;
• Penalties in grades, including their rationale;
• Requirements that are expected, even if not graded (Albrecht, 2009; Barros, 2014; Davis, 1993; Hess & Whittington, 2003; Johnson, 2006; O’Brien et al., 2008; QM 3.1, 3.2, 3.3, & 3.4; Soonpaa, 2018; Wolfe, 2004).

Learner support
Provide a detailed description or link to the services available for learners that can help them succeed in the course, with a description of how to obtain these services. Services, such as access to the campus internet, the library, technical support, academic support, and student services accessibility policies (Albrecht, 2009; Barros, 2014; Davis, 1993; Johnson, 2006; O’Brien et al., 2008; QM 7.1, 7.2, 7.3, & 7.4; Soonpaa, 2018; Wolfe, 2004).
Institutional policy statements

Include the following statements and institutional policies which learners are required to follow. An example of the standards will be the following:

- Diversity statement: Explain how a range of social representation is welcome, including race, class, gender, religion, accessibility, and socioeconomic status.
- Technology statement: Clearly state the computer skills and digital information literacy skills expected of the learner, outline the technology requirements and resources needed for the course, and provide information on how to obtain the technologies (e.g., software and hardware). Explain the communication expectations for online discussions, email, and other interactions.
- Academic misconduct statement: Provide the learners with a clear description of academic conduct and guidelines for maintaining academic integrity in the course and an explanation of the implications and consequences learners will face in the case of cheating, plagiarism, or any other areas of academic misconduct.
- Accommodation of students with disabilities: Clearly describe the accommodation policies to the learners and state how learners who meet the Americans with Disabilities Act requirements can request appropriate accommodations or assistance (Albrecht, 2009; Barros, 2014; Davis, 1993; Hess & Whittington, 2003; Johnson, 2006; O’Brien et al., 2008; QM 1.3, 1.4, 1.5, 1.6, 7.1, 7.2, 7.3, & 7.4; Soonpaa, 2018; Wolfe, 2004).

*Most of these statements can be found on the university website.

**Other universities may have other specific standards.

Accessibility and usability of the syllabus

- For electronic syllabus and course content, make sure they are readable and easy to navigate.
- All documents, text, visuals, internet links, and LMS pages are set to rich diverse learners.
- With multimedia materials, make sure they are easy to use and provide an alternative means to access these materials (MQ 8.1, 8.2, 8.3, & 8.4).

Graphics for Learning Model

The first edition of Clark & Lyons (2010) book provides a set of theoretically grounded guidelines to aid in developing instructional materials and learning aids, with an emphasis on the
selection and design of effective visuals to support the instructional content (Hofmann, 2005). The second edition of the book followed the same principles by adding additional methods and used more current research in designing effective visuals for printed and online instructional content (Clark & Lyons, 2010). According to Clark and Lyons (2010), what sets this book apart from others in the field is how it presents “evidence-based, theoretically grounded, practically relevant, clearly presented, and current guidelines” (p. xvi). The guidelines in this book are constructed from two essential resources, research evidence in using visuals and a systematic design process. The guidelines in the book utilize research in visuals and how they best support learning processes to aid in making significant decisions about them. A visual design process is then used to help develop the visual with a systematic approach (Clark & Lyons, 2010).

Clark and Lyons (2010) provided a visual design model for planning graphics systematically. The model was utilized to design and develop ICOs efficiently. The model assisted in ensuring the ICOs are designed and developed to support instructional needs. The model contains five phases: defining the goals, determining the context, designing the visual approach, identifying the communication function needed to match content types, and applying the principles of psychological instructional events. As stated by Clark and Lyons (2010), “when designing the treatment, along with assessing audience, delivery, and production issues, designers need to also consider the goal, the instructional strategy, and multimedia principles” (p. 34). Following this systematic approach, Table 6 below shows how the phases of the visual model have been utilized to plan ICOs and ensure they best aid their instructional needs.
Table 6: Following the Visual Model to Plan ICOs

<table>
<thead>
<tr>
<th>Model Phases</th>
<th>Applied to ICOs Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define the goal</td>
<td>Interactive access to course activities and requirements to allow learners to visualize the “big picture” of the course, identify the connections among the course components, and support learner planning for the semester. (To inform and motivate)</td>
</tr>
<tr>
<td>Determine the context</td>
<td>Learners profile: Each ICO will have its unique target learners, depending on the course. In general, identify the learners’ age, academic background, primary language, access to technology, and proficiency with technology. Learning environment: Because the primary goal of the ICO is to serve as a course syllabus, the LMS will be the learning environment in which this tool will be adopted. It is essential to consider the learners’ interactions with the tool. In the ICO case, learners can determine the time spent looking over the visual display, even the time spent interacting with the materials is included in them. Delivery platform: There will be a need to test the LMS capability to host the ICO and learn what functions can be used to increase the effectiveness of the ICO (a trial test needs to be completed before the development of the ICOs). The website or software (tools) utilized to develop the ICO, because it will be a plugin to display and run the visuals, and the interactivity features need to be tested for display resolution and connectivity and the speed of displaying the content (visuals and text). Pragmatic issues: The technical knowledge related to the LMS, the website, or software used to develop the ICOs and accessibility issues, such as navigation, hyperlinks, multimedia, and resolution.</td>
</tr>
<tr>
<td>Design the visual approach</td>
<td>Display framework or graphical user interface (GUI): The ICO’s overall look and feel, in terms of layout, colors, and font. If it is necessary to use an institution color, font, or logo, some institutions may have a set of guidelines or standards related to branding. It is beneficial to review them before starting the development process. If the ICOs are developed</td>
</tr>
</tbody>
</table>
from scratch, the creator should develop a set of guidelines for the layout, color scheme, and font.

Graphics and visuals:

- Identify the “have-to-have” graphics (Clark & Lyons, 2010). The ICOs intended to transfer the text in the course syllabus to interactive visualizations. Keeping this in mind, each “have-to-have” section of the syllabus will have one or more graphics.
- Decide what carries the storyline. In ICOs, the graphics will tell the storyline, and the text is subordinate and will be integrated into the graphics.
- Decide the size and orientation. The ICOs will be presented on one page at the beginning of the course and may need vertical scrolling. The sizes of the graphics have to be consistent.
- Style and real estate (how it is all going to fit together), considering the cognitive principles of directing attention and minimizing cognitive load.

Identifying the communication function needed to match content types

As established, each component in the course syllabus will be transformed into an interactive visual, starting by identifying the communication function for each element of the course syllabus then organizing the layout plan of the identified visuals.

Identifying the communication function of each component:

- Following the course syllabus component:
  - Instructor and course information (facts): the information listed in this component is specific, and representational graphics can be used to support the textual information.
  - Course overview (principles): information in this component is mainly principle and the objectives of the course, so use relational and interpretive graphics to show the course expectations.
  - Course goals and objectives (principles): for the course goals, it is principles with measurable and clear expectations the learners need to meet to pass the course. Explanatory visuals can be utilized to show the expectations more visually.
  - Course instructional materials (facts): the materials that learners need to obtain before starting the class can be visually represented in this component.
  - Course outline or course schedule (process): in this component, information is provided to show what learners can expect to work on at a particular point in time during the course. Interpretive visuals in a timeline can be used to show what needs to be covered each week.
  - Assignments and evaluation (procedures): information shows
learners what and how they will be evaluated and graded on each assignment, test, and so on. Using a visual representation of each assignment, the learner will be graded, and it will give them an idea of what they are supposed to do in the class and how it is going to affect their overall grade.

Learner support (facts): the information in this component is provided to list the other services available for the learners. Having a visual representation of each service will help them look at the other resources available to them and may aid them in completing the class.

Institutional policy statements (principles): information in the component is principles, but the institutional policies learner is expected to comply. Utilizing representational graphics will support the learners in associating visuals with each statement or policy.

Layout plan of the visuals

Having the content of the ICO organized, following the course syllabus components, will make the organization of the ICO layout plan easier. The ICO will have the same order and structure of a course syllabus in terms of the organization, and the content will be minimized in text and supported with interactive visuals.

Using a visualization website creates a (comprehensive) sample of the ICO to show the estimated finished ICO in regard to the medium used, form, size, and the arrangement of the element (often no textual or visual content); however, it has to show the exact way the elements will be incorporated together. In this stage, it is more about the text font, colors, and the placement of the visuals and the layout. The emphasis here is on the final look of the product, not the textual content and the information. The ICO sample can start with identifying the primary sections, which are the components of the course syllabus, then the textual and visual content of each major section, and, finally, adding an interactivity feature and any other unique feature to the text and visual.

Apply principles of psychological instructional events

The two main principles of psychological stress in an ICO are the attention and cognitive load principles and the principles of the motivational visual. Thus, the following guidelines provided by Clark and Lyons (2010) will be considered when designing and developing an ICO:

- Use signals to focus the attention of the learners.
- Utilize color and contrast to focus the attention of the learners.
- Employ color to improve job performance.
• Place the text close to the visual it describes (contiguity principle).
• Avoid distracting visuals.
• Utilize dynamic visuals that display the work context.
• Leverage social presence through learning agents.
• Use relevant trigger visuals to catch the initial interest.
• Minimize graphics used solely as eye candy.
• Utilize style and real estate (Clark & Lyons, 2010) (how it is all going to fit together), considering the cognitive principles of directing attention and minimizing cognitive load.

Design Phase

In this phase, the question “How should the Interactive Course Organizer look in finished form?” was answered by developing the first version of the ICO. While building and constructing this version, each step of this process was documented. Therefore, the results of this documentation process was employed to the design and development of the ICO guidelines. To create this version, the components in (Table 6) was utilized as a sample syllabus because it contents all section present in course syllabi; next, a sample of the ICOs was developed.

According to Clark and Lyons (2010), a sample or a comprehensive is an estimated finished product in the medium used, form, size, and the arrangement of the element (often no textual or visual content); however, they have to show the exact way the elements will be incorporated together. In this stage, it is about the text font, colors, the placement of the visuals, and the layout. The emphasis is on the final look of the product, not the textual content and the information.

To construct this version, a data visualization website was used. Because many websites serve this purpose, an exploration of different data visualizations websites was concluded to choose a website that will best attend to ICOs objectives. Most of these websites provide their users with a platform to create and share digital charts, infographics, and maps through a free or paid subscription. Moreover, these products can be published, embedded, or shared on different
websites or social media platforms. The websites’ interfaces are user-friendly, and they do not require any coding skills to use these tools. Additionally, these data visualization websites offer a WYSIWYG (What You See Is What You Get) editor that “allows a developer to see what the end result will look like while the interface or document is being created” (Rouse, 2011). Table 7 lists the different data visualization websites that can be used to develop ICOs, and it includes a link to their websites.

Table 7: A List of Different Data Visualization Websites

<table>
<thead>
<tr>
<th>Website Name</th>
<th>Website Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genially</td>
<td><a href="https://www.genial.ly">https://www.genial.ly</a></td>
</tr>
<tr>
<td>Piktochart</td>
<td><a href="https://piktochart.com">https://piktochart.com</a></td>
</tr>
<tr>
<td>Infogram</td>
<td><a href="https://infogram.com">https://infogram.com</a></td>
</tr>
<tr>
<td>ThingLink</td>
<td><a href="https://www.thinglink.com">https://www.thinglink.com</a></td>
</tr>
<tr>
<td>Visme</td>
<td><a href="https://www.visme.co">https://www.visme.co</a></td>
</tr>
<tr>
<td>Blugraphic</td>
<td><a href="https://www.blugraphic.com">https://www.blugraphic.com</a></td>
</tr>
<tr>
<td>Slides</td>
<td><a href="https://slides.com">https://slides.com</a></td>
</tr>
<tr>
<td>Canva</td>
<td><a href="https://www.canva.com">https://www.canva.com</a></td>
</tr>
<tr>
<td>Venngage</td>
<td><a href="https://venngage.com">https://venngage.com</a></td>
</tr>
<tr>
<td>Ceros</td>
<td><a href="https://www.ceros.com">https://www.ceros.com</a></td>
</tr>
<tr>
<td>Visually</td>
<td><a href="https://visual.ly">https://visual.ly</a></td>
</tr>
</tbody>
</table>

For this version, the data visualization website Genially was used. Genially has a user-friendly interface that is easy to use and does not require any programming skills. The website
allows its users to develop visually interactive content, such as presentations, reports, infographics, and video presentations. Moreover, it offers educational resources, including games, interactive images, illustrations, icons, figures, and maps. What sets this website apart from others is its highly interactive and animated characteristics, which give a new layer to the content, one that is more visual and less saturated. Furthermore, the Genially website offers several sharing options; the projects can be presented live, embed into a website, uploaded to social media, sent via email, or downloaded as a pdf or jpg to print or in HTML to view without the Internet.

In an online display, particularly highly interactive content, Clark and Lyons (2010) discussed building the “look and feel.” Designing visual content typically goes through static phases, which is the look phase, a demonstration where each element is placed in a template, then a prototype, which shows the functions and features of the final product, “the feel.” Therefore, to begin the process of developing the first version of the ICO, the earliest focus should be on the static phases, with “the look” concentrating on the size and measurements of the ICO and how it has to be exact or as close as possible to the final product. Figure 3 shows a shot of the size of the ICO embedded on an LMS page.
To design “the feel”, the template will evolve to a prototype, which focuses on the selection of visuals and their interactive features. The prototype shows the final look of the ICO, not the textual content and the information, but the visuals and the unique functionality. To view the ICO prototype (first version), the Genially website provides the HTML sharing option so the product can be embedded in a web page, and the actual size of the ICO can be viewed directly. In Figure 4, a Screenshots of The ICO prototype embedded in an LMS page.

Figure 3: Screenshot of the template.

Figure 4: Screenshot of the ICO embedded in an LMS.
Screenshots of each section of ICO are provided in (Appendix A).

After designing the first ICO version, the next phase is developing the guidelines to design and develop the ICO. Based on the literature review of instructional message design, and utilizing the documented steps from this phase all will be incorporate to build these guidelines. Additionally, a systematic approach will be used to provide step-by-step guidance to create and construct an ICO.

**Development Phase**

The Interactive Course Organizer (ICO) is an artifact that contains the text and visual representation of a traditional course outline (i.e., course syllabus) and incorporates visual elements, such as timelines, drawings, charts, graphs, maps, or pictures, to show the sequencing and organization of major course topics while offering users an actively controlled progression of the amount of course information viewed. In other words, ICOs are interactive in the sense that learners have control over the information they are viewing, as well as the interactive features they can use to acquire more detailed information about the course content.

The main goal of the ICO is to function as a course syllabus that provides learners with interactive access to course activities and requirements, which can allow them to visualize the course “big picture,” identify the connections among course components, and support learners’ plans for the semester. By following the Clark and Lyons (2010) visual design model as a framework for developing ICOs, the guidelines constructed to ensure the ICO would reach its instructional needs. The ICO guidelines have to go through different phases to ensure the goal of utilizing the ICO is met. These guidelines offer a systematic process for designing and developing ICOs in three phases: analysis, design, and development. Educators should finish one phase before beginning the next phase. In each phase of the process, strategic elements are
identified and must be considered by the ICO designer. Directions and guidance, alongside with supporting research, for the critical factors in each phase are discussed accordingly.

Before beginning ICO development, it is important to look at the different factors that will influence the design and development process. Determining how much control one has over the final production of an ICO can aid the design decision-making procedure earlier in the process (Clark & Lyons, 2010). To prevent any production or technical restraints along the way, one needs to analyze different factors, such as learners, learning environment, delivery medium, and any potential pragmatic issues (Clark & Lyons, 2010). Table 8 provides guidelines on how to gather the information needed to build an ICO.

Table 8: Guidelines to Analyze the Context for ICO.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learners</td>
<td>When analyzing your learners, identify their;</td>
</tr>
<tr>
<td></td>
<td>• age.</td>
</tr>
<tr>
<td></td>
<td>• gender.</td>
</tr>
<tr>
<td></td>
<td>• socioeconomic status.</td>
</tr>
<tr>
<td></td>
<td>• cultural factors.</td>
</tr>
<tr>
<td></td>
<td>• language.</td>
</tr>
<tr>
<td></td>
<td>• prior knowledge is the primary key to identify learners’ individual differences. You can analyze your learners’ prior knowledge by looking at the following:</td>
</tr>
<tr>
<td></td>
<td>o Their knowledge of the subject at hand</td>
</tr>
<tr>
<td></td>
<td>o If they are a novice or expert learners</td>
</tr>
<tr>
<td></td>
<td>o Their familiarity with the field terminology and jargon (Clark &amp; Lyons, 2010; Lipton, 2007; Pettersson, 2010, 2015a; Soonpaa, 2018)</td>
</tr>
<tr>
<td>Learning environment</td>
<td>When analyzing the learning environment, identify the following:</td>
</tr>
<tr>
<td></td>
<td>• How is the ICO will be used (as a job aid, presentation, self-study, etc.)?</td>
</tr>
<tr>
<td></td>
<td>• Where the ICO is presented (face to face or online)?</td>
</tr>
<tr>
<td></td>
<td>• When the ICO is presented (beginning, during, or after the process)</td>
</tr>
</tbody>
</table>
class)?

- How much control learners have over reviewing the information in the ICO (time spent looking at the information and how many times they can review it)? (Clark & Lyons, 2010; Pettersson, 2010)

**Delivery medium**

When analyzing the delivery medium, you should choose a data visualization website that works best for your digital skill level. Before selecting a website, you need to run a trial test to avoid any technical difficulties. You will need to test the following:

- The learning management system’s (LMS) ability to host the ICO
- The display of visuals and text (size and resolution)
- The interactivity feature connectivity and the speed of displaying the content ( visuals and text; Clark & Lyons, 2010; Pettersson, 2010)

**Pragmatic issues**

Analyze any production issues and identify any potential problems you may face, such as the following:

- How much time you need to finish the ICO
- Technical knowledge related to the LMS or the visualization website or software you’re using
- Embedding or uploading the ICO to the LMS or the course website
- Any accessibility issues such as navigation, interactivity, and resolution (Clark & Lyons, 2010; Pettersson, 2010)

By looking at the information gathered in the analysis phase, one can make informed and efficient decisions that will guide the design process. The learners’ analysis can improve the selection process for the visuals, colors, symbols, and so on. The learning environment analysis will guide the choices one makes about the size, layout, contrast, and boldness of the design (Clark & Lyons, 2010). The delivery medium analysis helps identify any technical restrictions before beginning the ICO design. Finally, by identifying any practical issues from the beginning, people can be aware of any problems they may face and understand how to overcome them. Therefore, the analysis phase can work as a blueprint for ICO development.
Next, one needs to look at three correlated factors that form the effectiveness and the efficiency of this visual tool: “(1) properties of the visual itself, including its surface features, communication functions and psychological functions, (2) the goal of the instructions, and (3) differences in prior knowledge of the learners” (Clark & Lyons, 2010, p. 5). When it comes to the function of the ICO, Clark and Lyons (2010) specified three views to the functional characteristics of graphics:

- Surface feature (visual features) of the art, such as illustrations and graphics
- Communication function—how it transfers the information
- Psychological function—how it supports learning

Following the considerations of Clark and Lyons (2010), the ICO function is to organize the visuals (surface features) to show the relationships between the course content (communication function) that draw learners’ attention to important components of the course and to support their motivation by making the content interesting (psychological function). Next, the goal of instruction, the ICO, contains multiple types of content; thus, the overall goal of an ICO is to function as an organizational visual to show the relationships among the content of the course syllabus (Clark & Lyons, 2010). Last, one has to consider learners’ prior knowledge of the topic and familiarity with the content. Learners with low prior knowledge of the material tend to benefit more from added visuals and graphics than those with a high prior knowledge (Clark & Lyons, 2010).

After analyzing the ICO context and identifying its function, next is designing the visual approach for the ICO. Here, the process of crafting the ICO begins by developing the graphical user interface—the overall look and feel of the ICO (Clark & Lyons, 2010) in terms of text font
and size, color, space, layout organization, and the navigation functions. The following
guidelines (Table 9) cover the design phase of the ICO.

Table 9: Guidelines for Designing ICOs.

<table>
<thead>
<tr>
<th>Component</th>
<th>Directions and Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text font and size</td>
<td>Use text font that is clear, easy to read, and designed for screen display, such as Trebuchet, Verdana, or Georgia (Hoffman, White, &amp; Aquino, 2005; Lipton, 2007; Pettersson, 2015a) Limit the number of text fonts and restrict stylized text fonts to opening headings (Pettersson, 2015a) Use bold font to emphasize information, such as headings and titles (Lipton, 2007; Pettersson, 2015b) Use italics to emphasize captions or small parts of the running text, keep in mind that italics reduces the readability of the text, so avoid using it as running text (Lipton, 2007; Pettersson, 2015b) Use a regular combination of uppercase letters and lowercase letters in the running text (Pettersson, 2015b) Avoid using all capital letters because it reduces the readability of the text (Lipton, 2007; Pettersson, 2015b)</td>
</tr>
<tr>
<td>Color</td>
<td>Depending on the content, use light or dark background and contrast colors for the text and graphics (Lipton, 2007; Pettersson, 2015a) Use black text or dark-colored text on a light-colored background (Lipton, 2007; Pettersson, 2015b) Choose colors that are one or two colors apart on the color wheel to achieve contrast (Lipton, 2007) Use color to clarify the structure of the content. Parts of the content can be in the same color or presented using a same-colored background (Pettersson, 2015a) Use a consistent color for the text or background to present the same type of content and assist learners in moving through the material (Lipton, 2007; Pettersson, 2015b) Use color to show the similarities and differences in the content, either by the color of the text or the background (Lipton, 2007; Pettersson, 2015a) Use color to emphasize the information and draw learners’ attention to the content (Lipton, 2007; Pettersson, 2015b)</td>
</tr>
</tbody>
</table>
**Space**  
Use a standard screen size, margin, and grid to plan each section (Pettersson, 2015b)  
Use space to group textual or visual content. Close proximity shows the content is related (Clark & Lyons, 2010; Lipton, 2007; Pettersson, 2015b)  
Use a space between the content elements (margins, text, and visuals) to separate unrelated information and aid the readability of the content (Clark & Lyons, 2010; Lipton, 2007)  
Use space as a grid system to align textual or visual content and show a chunk of information (Clark & Lyons, 2010; Pettersson, 2015b)  
Use a space to structure the content and use extra space between textual or visual content for a new section (Clark & Lyons, 2010; Lipton, 2007; Pettersson, 2015b)

**Layout organization**  
Organize text and visuals covering related content close to each other to show connections or use distance to separate unrelated content (Clark & Lyons, 2010; Lipton, 2007; Pettersson, 2015a)  
Utilize repetition to unify and bring text and visuals together to convey the same information (Clark & Lyons, 2010; Lipton, 2007; Pettersson, 2015b)  
Use contrast in the placement of the content (text or visuals) to focus learners’ attention on the content (Clark & Lyons, 2010)  
Align the content (text and visuals) to help learners navigate through them and place visuals close to the text associated with it, so learners benefit from both textual and visual content (Clark & Lyons, 2010; Pettersson, 2015a, 2015b)  
Balance the use of textual and visual elements. Too many graphics can decrease learners’ interaction with the text (Lipton, 2007; Pettersson, 2015b)  
Use graphics that are bold, clear, and large enough to show on a screen (Lipton, 2007; Pettersson, 2015b)

**Navigation functions**  
Limit the size of the ICO to a screenful size to avoid scrolling, so learners do not miss any information (Leavitt & Shneiderman, 2006)  
Use familiar content organization and navigation functions to ease the process of learning and remembering the ICO layout (Leavitt & Shneiderman, 2006)  
Standardize the sequence of ICO sections, allowing learners to view the section’s content in a systematic way (Clark & Lyons, 2010; Leavitt & Shneiderman, 2006)
Consistently place valuable clickable items to help learners remember their locations (Leavitt & Shneiderman, 2006)
Align page items, such as text, visuals, and clickable buttons consistently in each section in a vertical or horizontal style (Leavitt & Shneiderman, 2006)

The next phase is the development phase, it starts developing the ICO by focusing on each ICO component and how to transform it into an interactive visual. The ICO components are parallel to the elements of a practical course syllabus (Table 6), and the analysis phase provides a framework for a course syllabus containing syllabus components with a description for each component. Identifying the components by following the QM higher education standards rubric, conducting a thorough investigation in the course syllabus literature, and examining various templates and checklists from higher education institutes for the course syllabus framework.

After identifying the ICO components, developing the interactive visual for each component of the ICO is next. When it comes to the development of the ICO, there are two main factors (a) developing the visual for each component and (b) developing the interactive features. Each component of the ICO will have a unique communication function, and different principles of psychology are applied to create these visuals. The two main psychological principles used are attention and cognitive load principles, plus the principles of the motivational visual.

As for interactivity, there are different definitions, theoretical methods, and classifications for the term “interactivity” in the literature (Black, Luna, Lund, & Walker, 2017). To develop interactivity for ICOs, the method that appears to be best employed is the definition of interactivity by different levels. As stated by Black et al. (2017), there are different levels of interactivity: low, medium, and high. The low level of interactivity is object interactivity (proactive inquiry), which occurs when users click on an object, such as buttons, people, and things, using a mouse, and it results in a particular form of audio or visual response. The medium
level of interactivity involves hierarchical and hyperlinked interactivity (reactive navigation), which provides users with access to predefined options they can navigate and choose. Last, the high level of interactivity refers to virtual interactivity, which offers users a real-world experience through a computer-generated interactive environment that responds to users’ movements and actions (as cited in Black et al., 2017). Using this consideration, ICOs have three different levels of interactivity: low (proactive inquiry), medium (reactive navigation), and high. The low level offered gives the learner options using clickable buttons to view and navigate through the ICO content. The medium level is presented by providing learners with visuals, such as charts, graphics, and timelines, with predefined objects they can select from the content and a high level to give the user the option to choose how to view and navigate the information. Table 10 offers directions and guidance on how to develop the interactive visual for ICOs.
Table 10: Guidelines to Develop Interactive Visuals for ICOs.

<table>
<thead>
<tr>
<th>Components</th>
<th>Guidelines for Visuals</th>
<th>Guidelines for Interactivity Features</th>
</tr>
</thead>
</table>
| **Home page**            | Because this page or layer will present all of the components of the ICO to help learners view the content, use organizational visual (organizational menu, map, etc.) to show learners how the components fit together (Clark & Lyons, 2010). *An optional visual supplement can be a decorative visual to add aesthetic or motivation; however, overusing them will affect the learning process (Clark & Lyons, 2010; Pettersson, 2015a). | • Minimize text in the first layer to headings for the major sections of the ICO, allowing learners to scan the content (Leavitt & Shneiderman, 2006).  
• Provide the option of clicking on each section so learners can easily navigate the content (Clark & Lyons, 2010; Leavitt & Shneiderman, 2006). |
| **Instructor and course information** | Use interpretive visuals of the content to help learners build an understanding of the course expectations (Clark & Lyons, 2010). The following visual types can be used:  
• A picture showing the learning environment (class), the subject field, or the job or career learners are pursuing (Clark & Lyons, 2010).  
• A picture of people in the class, working in the field, or the job will increase learners’ perceptions of the course content (Clark & Lyons, 2010; Pettersson, 2015a).  
• Interpretive visuals with reduced realism quality, such as a cartoon or sample drawings that can quickly convey an illustration of the idea | Visuals have clickable links to access more information so learners can easily find and locate more details (Black et al., 2017; Leavitt & Shneiderman, 2006; e.g., clicking on the course instructor picture to direct them to the instructor’s website, or the map icon takes learners to the class location). |
Use interpretive visuals of the content to help learners build an understanding of the course expectations (Clark & Lyons, 2010).

Type of visuals that can be used:
- A picture showing the learning environment (class), the subject field, or the job or career learners are pursuing (Clark & Lyons, 2010).
- A picture of a people in the class, working in the field, or the job will increase learners’ perception of the course content (Clark & Lyons, 2010; Pettersson, 2015a).
- Interpretive visuals with reduced realism quality such as; a cartoon or sample drawing that can quickly convey an illustration of the idea (Pettersson, 2015a).

Provide learners with clickable links to access more course information (Black et al., 2017; Leavitt & Shneiderman, 2006; e.g., link to the course department).

Here are different ways to visualize this component:
- Use signals to focus learners’ attention, such as typographic cues (text font, size, or color) or attention directing graphics (arrows, icons) (Clark & Lyons, 2010; Pettersson, 2015a).
- Use explanatory visuals to show what is expected from learners to pass the course. It can be charts, graphics, or maps (Clark & Lyons, 2010).
- The visual has rollovers or pop-ups with text callouts that become visible when learners click the mouse over various parts of the visuals (Black et al., 2017; Clark & Lyons, 2010).
- Give learners the option to manipulate one section or in this case, one goal at a time (Clark & Lyons, 2010).

Use representational visuals to support the textual information (Clark & Lyons, 2010), and place the visuals close to the related text (Clark & Lyons, 2010).

Visuals have clickable links to access more information about the course materials (Black et al., 2017; Leavitt & Shneiderman, 2006; e.g., clicking on the book’s picture, which directs them
The following visual types can be used:

- Picture of the book cover with the book title (Pettersson, 2015a).
- Symbols or icons that are clear and representational of articles, videos, etc. (Pettersson, 2015a).
- Visuals with reduced realism such as a cartoon or sample drawing that can easily convey an idea (Pettersson, 2015a).

Course outline (course schedule)

Use a simple visual to show learners what they expect to work on at a particular point in time during the course (Clark & Lyons, 2010). Interpretive visuals, such as timelines or calendars, can be used to show what is covered each week.

Assignments and evaluation

Use transformational visuals, such as bar graphics or pie charts to show how each assignment and test affects their overall grade (Clark & Lyons, 2010), and each assignment presented by comparing areas to show who they are part of the total grade (Pettersson, 2015a).

Specific days (assignment due dates or tests) will have feedback when clicking or using rollovers and pop-ups on those particular days to provide learners with more information about the assignment or test (Clark & Lyons, 2010). You can give learners the option of clickable links to access the assignments or tests (Black et al., 2017; Leavitt & Shneiderman, 2006).

Learner support

• Use clear pictures, symbols, or icons that represent each service and the resources available for the learners (Clark & Lyons, 2010; Pettersson, 2015a), and place the related textual information close to the visuals (Clark & Lyons, 2010).

Visually have clickable links to access more information about each service and the resources available so learners can easily find and locate them (Black et al., 2017; Leavitt & Shneiderman, 2006).
Institutional policy statements

- Avoid overusing visuals and minimizing graphics used solely as eye candy (Clark & Lyons, 2010; Pettersson, 2015a).
- Supplement text in institutional policies with visuals that represent each policy (Clark & Lyons, 2010; Pettersson, 2015a), align each visual with the text related to it, and position them close to each other (Clark & Lyons, 2010).
- Avoid distracting visuals and minimizing graphics used solely as eye candy (Clark & Lyons, 2010; Pettersson, 2015a).

Visuals have clickable links to access more information about each policy so learners can easily access them (Black et al., 2017; Leavitt & Shneiderman, 2006).
Validation Phase

In this phase, the question, “How did the guidelines assist in the design and development of the ICO?” will be answered and the guidelines will be completed. Using the data collected from the feedback of expert reviews and analyzing this data, the results will conclude the content validity and the practicality and effectiveness of the guidelines. A discussion of the results of the expert feedback, followed by their recommendations, then the revisions made to the original draft of the guidelines is presented in the following chapter.
Chapter 5: Expert Reviews Feedback

Introduction

To validate the guidelines for the Interactive Course Organizers (ICOs), expert reviewers were recruited to review and provide their views and evaluation of the guidelines. After obtaining approval from the Institutional Review Board (IRB) at Virginia Tech (Appendix B), experts in the field of instructional design, instructional message design, visual literacy, and teaching and learning were sent a recruitment email (Appendix C). Once the expert reviewers agreed to participate in the research, they received an email with a link to a website with the review material, including: (1) information about the study, (2) an example of an ICO (Appendix A), (3) guidelines to design and develop ICOs, (4) consent form (Appendix E), and (5) an evaluation rubric (Appendix F) to complete a review and offer their feedback via an online rubric created in Google Form. The expert reviewers were given a period of approximately 2 hours over a two-week review period. A reminder email (Appendix D) was sent to the expert reviewers after the first week.

Four expert reviewers participated in the validation of the guidelines. They were as follows:

- Dr. Rune Pettersson is an expert in visual literacy, information design, and visual communication. Dr. Pettersson is a former information design professor at Mälardalen University, a past president and past vice president of the International Visual Literacy Association (IVLA), and vice president of the International Institute for Information Design. His work centers around the study of the presentation of visual messages in learning environments and blending both text and visuals to investigate who the design factor can
assist in interpreting those visual messages. He has published 206 papers and 65 books in this area.

- Dr. MJ Bishop with an experience in message design, she is an author of several books in this area. Additionally, she is an expert in various instructional media and delivery systems to improve learning. She is the inaugural director of the University System of Maryland’s (USM) Center for Academic Innovation. The USM Center carries out research on best practices and publishes its findings. Dr. Bishop is an author of several national and international articles on innovative academic practices. Currently, Dr. Bishop serves as an editor of the Association for Educational Communications and Technology (AECT) research handbook.

- Dr. Susan G. Magliaro, emerita professor of Educational Psychology in the School of Education at Virginia Tech, is an expert in teaching and learning and instructional design. She has collaborated with many school systems on topics such as instructional design, teacher training, and aligning curriculum, instruction, and assessment. Dr. Magliaro is an author of four books, more than 50 book chapters, and peer-reviewed journal articles.

- Dr. Jung Lee, an expert in instructional technology and visual literacy, is a professor of Instructional Technology at the Richard Stockton College of New Jersey. She served on the Board of Directors for the International Visual Literacy Association (IVLA).

In the following discussion of the results, comments and feedbacks collected from the expert reviewers are presented anonymously. As such, the input they provided is not connected to individual reviewers by name. For this purpose, each of the expert reviewers is given a number (i.e., Reviewer One, Reviewer Two, etc.) to maintain their anonymity regarding specific comments.
Overall Expert Perspectives

In general, the results of the expert review’ feedback showed that the guidelines could support the design and development of ICOs and they are described in sufficient detail to meet their purpose and intended use. Expert Three stated, “The key thing is that your guidelines match the needs and motivation of your audience. Your guidelines are very detailed.” In regards to the guidelines assisting learners in making connections and linking different course content through the use of textual and visual components, Expert Two opined that, “I do think the guidelines recommended will help students see the ‘big picture’ for the course.” Although the proposed guidelines for ICOs were generally evaluated as meeting their intended use, experts offered a range of feedback and recommendations for improvement. Opportunities for improving the guidelines are discussed in the next section, including more detailed input for each phase of the guidelines.

Expert Reviews Recommendations

Comments and feedback collected from the expert reviewers were analyzed and examined to improve the guidelines. To help the process go efficiently, each section of the rubric used to evaluate the guidelines will be addressed individually, the rubric sections were as followed; the application of ICOs, overall design of the guidelines, analysis phase, design phase, development phase, as well as the application of the guidelines. For each section of the evaluation rubric, recommendations from the expert reviewers will be described, followed by how those recommendations were applied to revise and improve the final draft of the guidelines. All individual question in each section will be cited and presented in the results (i.e., question one, question two, etc.) to look at the questions refer to the evaluation rubric (Appendix G).
Focusing on each section separately can ensure that all recommended revisions collected for the expert reviewers are considered and reflected in terms of shaping the guidelines’ final form.

**The Application of ICOs**

Expert reviewers were provided with an example of an ICO to examine their function and application. This section focused on the application of ICOs starting by the first question, which asked the expert to determine if the guidelines will be used by the target users to achieve its goals. ICOs were targeted for use by instructors. One expert agreed that ICOs could be created by educators, two offered a neutral response, and one disagreed. Expert reviewers provided several related comments and suggestions. Expert Two stated, “I worry about the extent to which most faculty members (particularly the ones who really need to do this!) will be able to apply the instructional design principles recommended in the guidelines without a lot of scaffolding and a tool that will make much of this "plug-and-play." Would be nice if the LMS had a function that helped educators develop ICOs easily and within the guidelines you have suggested.” Similar to that, Expert Three said, “While the idea and application of ICOs makes some sense, the investment in the design and development by a single faculty member is unlikely. There would need to be a very easy, efficient electronic template for this to work. There is also the scaling up of general knowledge about the elements of the template. So, my question focuses on return on investment...”

Both suggestions centered around having a platform that is easy to use by educators, such as a template or added features to the LMS. While the purpose of this research study was to simplify the process of making design choices and the reduction of elements that distract from the message—skills that not many educators have. As stated by Clark and Lyons (2010), “The use and interpretation of graphics is a more neglected skill” (p. 3). The guidelines did not provide
examples of tools or websites that can be utilized to develop ICOs. Therefore, in the revised version of the guidelines a list of different data visualization websites has been added with links to those websites.

Another critical piece mentioned by the reviewers was the return on investment for developing an ICO. From the learners’ standpoint, in addition to the use of ICOs to navigate the course content, it is hoped that they can also enhance learner engagement and motivation for the learning process. An ICO is intended to create a learning environment that is welcoming and that builds excitement and anticipation for the course. From an educator’s standpoint, an ICO can act as a visually pleasing course syllabus, and depending on course content, it could be used for an extended period of time, as long as it serves its purpose.

Questions two in this section was the question of what constraints may affect the development of ICOs by educators. The question provided four different factors, allowing expert reviewers to specify as many factors as they think applicable as part of their answers rather than just one factor, with the option of adding more. The choices were time (ICO}s take time to develop), digital skills (skills required to make basic use of computer applications, websites, and other online platforms), openness (staying open minded and willing to try new things), and patience (the developing process can be slow going). As expected, several factors may affect the development of the ICO. All experts indicated that both time and digital skills were the main factors; the next was patience, chosen by three experts, then openness scored one choice; in addition, Expert Three added personal and professional satisfaction, student feedback, and access to the internet. Expert Two stated, “I generally think faculty are eager to do what they can to help their students learn.”
Next, expert reviewers responded to question three, evaluating how textual and visual components in an ICO may assist learners in organizing and making connections between course content. All expert reviewers either agreed or strongly agreed with that statement, with Expert One saying: “I like the “dynamic and interactive feeling” when you present a “numbered list” of items in this way.” Then added, “I like that an image of the required text “pops up.”” Expert Two pointed out the importance of aligning course goals and content and how they should reinforce one another by stating, “I wonder the extent to which we really need also to be focusing on the even bigger picture of curricular coherence? How does this course fit into my larger program of study? What are the larger, "career ready" skills I'm acquiring?” The guidelines offered a framework for a course syllabus, with different sections and specific components for each section. On the subject of curricular coherence, this hinges on how well written are the course goals and objectives and how the content supports them, which is not within the scope of these guidelines.

Expert Three raised the concern of the need for instructional designers to assist in developing the ICO. The reviewer specified, “Here is where a faculty member would need an instructional designer or someone with knowledge of visual literacy, advance organizers, etc. to help with the design of an ICO.” This concern was emphasized in several comments and suggestions throughout the expert reviewers’ responses to the evaluation rubric, which begs the question of whether the guidelines would be better suited to, and more useful for, instructional designers and course developers.

Question four addressed content interactivity, all experts agreed that an ICO is interactive and it allows learners to navigate, access, and view the course content. Correspondingly, in question five, expert reviewers were asked to evaluate if ICO provides innovative improvements
in terms of presenting course materials, they either strongly agreeing or agreeing while one 
reviewer selected “neutral.” Notwithstanding, the question of ROI was raised again here, with 
Expert Three offering, “I think that ICOs align with current expectations for information 
delivery. But this is an empirical question. For me, that would be the next step in determining 
ROI.” This concern was mentioned earlier; however, return on investment can be determined 
after the implementation of the ICO developed using the proposed guidelines.

Regarding question six, the ICO’s ability to attract learners’ attention and motivate them 
to work through course content, two expert reviewers agreed with the statement and two selected 
“neutral.” Expert Three stated, “Again, this matches current expectations, and current reliance on 
electronic devices.” Expert Two touched on the novelty effect, she stated, “There might be an 
initial novelty effect, but I’m not sure how long that will last.” The novelty effect is mostly 
related to computer-assisted learning and is explained as the increased level of engagement 
and/or performance when learners are presented with a new learning experience such as a new 
technology (Tsay, Kofinas, Trivedi, & Yang, 2019). In the case of the ICO, this effect can be 
significant because the tool’s goal is to inform and motivate learners, and the novelty effect can 
be tested after its implementation.

As for additional suggestions from expert reviewers to improve the application of ICOs, 
Expert Three emphasized the need for faculty support, stressing, “If these types of electronic 
templates are not currently available, the development of one would be helpful. It seems that 
CMS might have this as an element to make it align with the current platforms that universities 
are using. I do think that faculty support should be offered, not only technical support - but also 
support related to how people learn.” Having said that, it is possible that the guidelines are more 
befitting for course developers and instructional designers, or with the assistance of one.
Expert Two suggested that the development of the ICO, especially the sections related to course syllabus design, can be expanded to the whole degree program. She stated, “I realize this is beyond the scope of your current work, but I'm envisioning a much larger mapping of a student's progress through a degree program, with the course forming one stop along the pathway. That would be a huge contribution to the work happening around alternative credentialing, the comprehensive learner record, etc. out of organizations like Concentric Sky and the Lumina Foundation. Are there ways you can begin to anticipate the need for creating the infrastructure for more curricular coherence in what you're doing here?”

**Overall Design of the Guidelines**

In this section of the evaluation rubric, expert reviewers were asked to provide their comments and feedback on the overall design and organization of the guidelines, as well as their simplicity and stability. Two expert reviewers agreed, one strongly agreed, and one disagreed that the guidelines described in sufficient detail the ICO’s purpose and intended use (question one). Expert Two, who disagreed, said “I guess my response to this really depends on who the audience for the guidelines are. I think they get too detailed for faculty, but probably provide the right level of detail for instructional designers.” This was echoed by Expert Three: “I’m not sure that the general faculty member, say in engineering, architecture, or natural resources, will engage with all 16 pages.”

In question two, expert reviewers were asked about the clarity and sufficiency of the directions and guidance provided in the guidelines, two expert reviewers strongly agreed with, one selected “neutral”, and one disagreed with the statement expressing, “I like that you've walked the user through the Analysis, Design, and Development phases, but I don't believe most faculty will know how to move from Analysis to Design. The guidelines make a lot of
assumptions about the non-IDer's ability to take the information from the front-end analysis to organize the visuals in a way that shows relationships in the course content, motivate learners, and the like.”

The next question, question three, requested an evaluation of the organization and formatting of the guidelines, and if they are well designed to sustenance their purpose and use. Expert reviewers’ responses ranged from “strongly agree” to “disagree.” Expert Two stated: “I think detail is lacking if this is intended for non-IDers.” Then Expert Three suggested, “I think a shorter checklist will be more useful for the general faculty member.” These comments indicate that the guidelines are possibly too elaborate for faculty members, and perhaps are best suited for instructional designers and course developers, which is a theme that been identified throughout the expert reviewers’ responses.

In the additional suggestion section to improve the overall design of the guidelines, Expert Four suggested, “adding visuals in the guidelines”. This recommendation was considered and visual examples were added to the final revised version of the guidelines.

**Analysis Phase**

This section contains questions to evaluation the analysis phase in the guidelines. When expert reviewers were asked if the key factors discussed in the analysis phase were appropriate and applicable in question one, their responses ranged from “strongly agree” to “neutral.”. Expert Three stated, “While the content is good (from an ID perspective), how can you convey it for someone who is not an ID'er. For example, when you talk about prior knowledge, you just may want to talk about HOW to assess it. Maybe you need additional section that has tools for the faculty member? How could they do a pre-test?” As for question two in the clarity and
sufficiently of the table (Guidelines to Analyze the context for ICO), the expert reviewers’ responses also ranged from “strongly agree” to “natural.”

Question three asked whether or not the analysis phase reflects relevant research, along with important practices in the design of educational visual materials. Two expert reviewers agreed and two offered a neutral response. Expert Two who selected neutral responses, noted: “I don't believe there's any discussion here of whether learners will be using mobile devices.” Expert Three, the other reviewer who chose “neutral,” stated, “Actually, it's difficult to talk about the design of visual materials with no visuals.” Lastly, expert reviewers offered additional suggestions to improve the analysis phase of the guidelines. Expert Two noted “I guess what's missing for me here is a discussion of the ramifications of the findings for each. What difference does it make if the learners are older, adult learners? What difference does it make if the learning environment is online or F2F?” Furthermore, Expert Three recommended: “I’m thinking you need visuals, job aids, actual tools.” In the revised version of the guidelines adjustments were made to describe how each factor of the analysis will influence the design phase.

**Design Phase**

Questions in this section were about the design phase, expert reviewers were asked to give their feedback on the components of that phase. In question one, Expert reviewers were requested to evaluate the applicability of this phase, three expert reviewers agreed and one disagreed that the guidelines are appropriate and sufficient. Expert Two, who disagreed, noted: “I’m struggling with the extent to which these design phases spill over into the design of the course itself. What you've provided in the table are just interface design guidelines, but those can't really exist independently of the larger instructional design.” Expert Three said, “The information is good - but you still need visuals to help the faculty member actually understand
what you want or what is needed. You need to show examples and non-examples. Each of the components readily lends itself to visual examples.”

In question two, expert reviewers were asked to evaluate the table (Guidelines to Design the ICO) and if the guidelines for each component were clear and sufficient, three expert reviewers agreed and one selected “neutral.” Expert Two asked: “Any considerations about accessibility?” When expert reviewers were asked if the design phase reflects relevant research along with important practices in the design of educational visual materials in question three, all agreed with the statement. Expert Two pointed out: “Agree, but missing any discussion of the potential for auditory elements.”, while Expert Three noted: “But you need visuals.”

The expert reviewers offered additional suggestions to improve the design phase, with Expert Two mentioning: “No guidance is provided here about how to take the findings from the analysis and apply it to the design.” Expert Three added: “The information is excellent—but it’s the presentation that needs to be done differently.” All suggestions were taken into account, and the guidelines were revised to reflect each recommendation.

**Development Phase**

In regards to evaluating the development phase, and after expert reviewers examined the course syllabus framework, in question one they been asked to provide their feedback on the appropriateness and sufficiency of the framework, with their responses ranging from “strongly agree” to “neutral.” Expert Two said: “I agree, but this all seems pretty "standard" to me... how is this different based on having completed the front-end analysis?” additional guidance and direction were added to the analysis phase in how the data collected in the phase can be used to impact the design and development phase. Expert Three noted “I'm now wondering if you need an elaborated matrix presentation that actually tells folks why they need to do each of the steps,
then have a visual example... So you would have the course syllabus sections, specific components, rationale, then example... That said, then you've just created a more complex document. The larger and more complex it gets, the less likely you'll get the general faculty member to want to do this.” In response to this feedback, the course syllabus framework was enhanced by adding rationales for each section of the course syllabus followed by examples.

Question two asked about the clarity and appropriateness of each of the components in the course syllabus framework table, one expert reviewer strongly agreed and three agreed that the components were applicable to the course syllabus design. Expert Three said: “For the most part, you have all of the components that need to be there. I'm a little concerned about the evaluation components. What happens if the instructor doesn't use a point system? There's really no background on assessment and, if there is one place that general faculty truly violate educational research principles, it's evaluation. Also, I see where you cite university policies. I'm not sure faculty will even worry about some of those details.” This concern was addressed in the final draft of the guidelines by given rationale and examples for the sections of the course syllabus framework.

Question three asked the expert reviewers whether the framework for the course syllabus reflected relevant research in components of an effective course syllabus, their responses differed from “strongly agree” to “neutral.” Expert Two commented: “I'm not well read in this area, but this is typically what we're asked to include.” In question four, about the sufficiently of the development phase, the experts’ answers also varied from “strongly agree” to “disagree.” Expert Two mentioned: “It's not clear to me how the guidelines will lead the average faculty member to do anything different than what he/she is currently doing.” Responding to question five, a variation was seen in the responses of the clarity of the guidelines for developing visuals for
ICOs, with one expert strongly agreeing, one agreeing, and two selecting “neutral” for the statement. Expert Two suggested: “I think providing some concrete examples here would help,” while Expert Three noted: “The content is there—but you need visuals, examples/non-examples.”

In the topic of designing interactive visual materials, in question six, the expert reviewers were asked to evaluate if the guidelines reflected relevant research as well as practical practices in the field; their responses ranged from “strongly agree” to “neutral.” Expert Two said: “I think you've covered the scope of what's possible in an ICO, but not provided much *design* support.” On the additional suggestion to improve the development phase of the guidelines, Expert Two suggested: “You might consider providing specific examples from 3-4 clusters of content areas (STEM, humanities, social sciences, etc.).” Expert Three added “Similar to what was noted above. You have a wealth of information in these guidelines, but I'm not sure that they are accessible to the general course designer (a.k.a., faculty member). Remember that they are hired because they are experts in their discipline, not pedagogy or design or evaluation...”

**The Application of the Guidelines**

Lastly, in this section expert reviewers assessed the overall application of the guidelines, their effectiveness, and their ability to assist educators in the design and development of ICOs. In question one about the likelihood of the use of the guidelines by educators, expert answers varied from “strongly agree” to “disagree.” Expert Two stressed: “I think that, in order for these guidelines to have an impact in their current form, it would require support from an IDer.” Expert Three commented: “While the content is there, the examples to truly give them guidance in design need to be added.” In connection with the above, question two asked whether or not the guidelines were reasonable to be implement by educators and the intended user, expert
reviewers’ response differed from “agree” to “disagree.” Expert One commented: “In my experience many educators are conservative,” Expert Three noted: “The information is dense and complex. You need to simplify it.”

In question three, expert reviewers were asked to provide additional recommendations to improve the application of the guidelines. Expert Two suggested, “While I understand your motivation, I've come to recognize over the last few years that our expectations that we can make faculty into instructional designers is probably unrealistic and, maybe, a bit unfair. Better for us to ask faculty to stay focused on their day-to-day interactions with students and support their understandings of how to use data to make formative and summative adjustments to their course and leave this kind of design activity to the development of tools that support their efforts. My suggestion would be to make the audience for these guidelines IDers at higher education institutions and/or tool developers.” Expert Three added, “If you are trying to help educators design more accessible tools for their learners - remember that educators are learners, too. And, in terms of higher education, their focus on teaching is split between other expectations (e.g., research, outreach, campus expectations, etc.).” Reflecting these recommendations, even though the guidelines intended audience were educators, the guidelines’ audience changed to course developers and instructional designers.

**Summary**

After considering all recommendations from expert reviewers some adjustments and revisions were made to the final version of the guidelines. In the application of ICO section, comments were made about the platform that supports the presentation of the ICO. Although the proposed guidelines were aimed at facilitating and easing the design process of an ICO for average educators, the guidelines fall short in identifying examples of tools or websites that can
be used to develop ICOs. Thus, in the revised version of the guidelines, a list of various data visualization websites was added with links. Moreover, several of these data visualization websites have features that can be used to embed the product (ICO) in an LMS, which will maximize LMS use and aid in achieving their full potential. Another theme identified from the expert reviewers’ comments and feedback was that the guidelines were too elaborate and complex for a typical faculty member; therefore, the target audience of the guidelines shifted from average educators such as faculty members to course developers and instructional designers. In addition, discussions were had about ROI and the novelty effect aspect of the guidelines; both observations can be examined after the implementation of the guidelines.

In the overall design section of the evaluation rubric, one expert reviewer suggested the use of visuals in the guidelines, which is another theme that has been identified throughout the expert reviewers’ responses. Thus, modifications were made to the final revised version of the guidelines by supplementing them with varies visuals examples. In the analysis phase, there was a need to rationalize the ramification of analyzing each factor in the phase and how to utilize the data to aid the design process; therefore, additional guidance and direction information were added to improve and enhance the analysis phase.

As regards the design phase, concerns were evident about how this phase extends to the course design, specifically the ICO; reflecting on this recommendation, modifications were made to clarify the information in the design phase by adding examples of how it is presented in an ICO. Additionally, guidance and directions on integrating auditory elements and accessibility to an ICO were further added to the guidelines. In the development phase, adjustments were made to clarify the information and provided more design support, which was enhanced by adding examples. Finally, a link to an example of ICO was included in the final draft. In Appendix G, a
table that includes all changes that were made to the final version of the guidelines based on the suggestions provided by the expert reviewers, and Appendix H presents the revised guidelines for interactive course organizers (ICOs).
Chapter 6: Discussion

Introduction

This chapter provides a brief overview of the research study, and presents the limitations faced while conducting the study. Following, a discussion of the study contributions in terms of theoretical implications as well as practical implication. Lastly, the chapter offers recommendations for future research and practice.

Study Review

In recent years, online education has transformed higher education learning by offering various online programs and classes that are accessible to learners anywhere and at any time. Reports show that 6.3 million learners took a minimum of one online course in the year of 2016, a total 31.6%, and the trend toward growth in online enrollments has increased, despite a decline in overall higher education enrollments (Allen et al., 2018). One of the main influences that has played a significant role in online education is the adoption of Learning Management Systems (LMS) or Course Management Systems (CMS). Those systems function as a delivery and distribution medium for course materials such as course syllabi, documents, files, assignments, quizzes, and discussions. Currently, these systems are utilized by the majority educational institutions around the world (Dahlstrom et al., 2014). With this expansion of the use of LMSs in both online and face to face courses, there is a need to design new and innovative methods to present course materials to learners, rather than utilize LMSs as a distribution system for course materials (Azmi & Singh, 2015). To maximize the use of these systems, there is a need to identify new strategies and methods to make the learning experience more fulfilling.

One of the essential elements of any course is the course syllabus, where all course information is found, such as instructor information, course units, and the course evaluation.
Because of the significance of the course syllabus in presenting the course agenda to learners, it can function as a framework for the course. (Littlefield, 1999). Merrill (2020) emphasize that: “A first-class syllabus can help promote effective, efficient and engaging learning, but traditional syllabi too often fail to attain this purpose”. This raises the question of how to construct the course syllabus in a more interactive, visually pleasing approach could help learners comprehend the course organization, making it more useful and engaging. ICOs can support this kind of approach to a more helpful and interactive course syllabus design, they can offer a sound framework for the course, as well as guidance for learners.

This study employed a design and development research methodology with four phases: (1) the analysis phase, (2) the design phase, (3) the development phase, and (4) the validation phase (Richey & Klein, 2007). In the analysis phase, a literature review was conducted to identify the standard components of a course syllabus and transform these into the components of an ICO. To support this transformation, another literature examination was done to locate specific theoretical principles to design and develop the guidelines that assisted in building an ICO. In the second phase (design phase), the results collected from the analysis phase were applied to craft the first version of the ICO. In the development phase, the development of the guidelines was completed, as well as an evaluation rubric to validate how each of the theoretical principles supported each proposed guideline. Lastly, the validation phase included the feedback and recommendations from five expert reviewers to determine the validity and the prospective effectiveness of the guidelines.

**Study Limitations**

This study faced two major limitations, the time and the recruitment of expert reviewers. The time limitation was related to the timeline intended to complete this study, the time
anticipated to develop the guidelines was insufficiently limited. Like any type of research, especially design and development research, the development of the guidelines should have a carefully planned timeline, from the analysis phase, to the design phase, then the development phase, and later the validation phase. In this study, the analysis phase included two different literature analyses, examining the course syllabus components and the theoretical principles to develop the guidelines for ICOs. In the design phase, the first version of ICO was created. The development phase was the developing of the guideline and the evaluation rubric. Lastly, the validation phase to determine the content validity and effectiveness of the guidelines by collecting expert reviews' feedback, then revise the guidelines according to those feedbacks.

As a consequence, completion of the study took twice as long as forecasted, and ultimately some of the phases were rushed. For example, the development of the version of the ICO should have had more carefully selected visual representations for the content. Moreover, in the validation phase the limited time led to not considering any follow-up interviews with the experts, who may have offered more insights into the strengths and weaknesses of the original guidelines. Thus it is essential for future studies, particularly those similar to this one, that researchers allow more time to complete all phases.

The second limitation was having access to the expert reviewers. Finding direct access to expert reviewers was a difficult process. First, most experts in the field of visual literacy or message design were either retired or extremely busy. Second, after identifying the expert reviewers there was a need to obtain access to their contact information since recruitment was via email. The experts’ emails were found online, either through universities websites they affiliated with, or research papers and articles they published. However, there was a lack of response from some expert which could be due to not receiving the recruitment email or the
email addresses were not correct. For example, more than 10 experts were sent the expert review request email and most of them did not respond. Other expert reviewers responded that they did not have time to evaluate the guidelines, especially because it was a hectic time of the year, being December and the holidays. Furthermore, originally there were five experts who agreed to participate in the research; however, one expert was not able serve as an expert reviewer due to health reasons.

For future design and development research studies that incorporate a validation phase, researchers should plan to have at least 10–15 expert reviewers they might be able to contact, bearing in mind that not all expert reviewer would be able to participate in the evaluation of the work.

**Study Contributions**

According to Richey and Klein (2007), design and development research is aimed at contributing to the instructional design and development knowledge base. This study produced a set of guidelines to assist in designing ICOs that will help students visualize course content and its organization and recognize the connections between different content. These guidelines were designed and developed based on a theoretically-grounded foundation, as well as prior research in message design and visual literacy. The guidelines were built using several cognitive information processing theories, and they incorporated both text and visuals to help attract and maintain learners’ attention, minimize cognitive load, and support information retention (Paivio, 1986; Pettersson, 2002; Sweller et al., 1998). In this study, all information and data collected and assembled to develop these guidelines has both theoretical and practical implications.
Theoretical Implications

ICOs are an innovative tool aimed at offering a visual aid to help learners grasp the course’s “big picture” and how it is structured, specifically the course syllabus, through the use of both text and visuals and supported by several interactive features. As has been explored in the literature review, an ICO is built on the fundamental principles of a traditional course syllabus and visual organization of advance organizers, graphic organizers, and concept maps as well as interactivity and learner control.

The first theoretical contribution of this research study is to add to the literature on effective components of a course syllabus, given that the latter can operate as a contract between the course instructor and learners, a permanent record, and a learning tool (Parkes & Harris, 2002). A course syllabus offers learners directions and expectations for the course (McKeachie, 1978, 1999), as well as being a planning tool for educators (Littlefield, 1999). Regarding the development of syllabi, different educational institutions offer a variety of templates and checklists to assist in this process (Gannon, 2018). Although in the literature a number of articles from several disciplines consider common syllabus components, empirical studies of syllabus components were not evident in the literature. This research study provided a foundational knowledge of the components of an effective course syllabus by utilizing the Quality Matters QM higher education standards rubric (Quality Matters, 2018), different literature on the course syllabus components, and an exploration of various templates and checklists from higher education institutions. Future researchers can extend and expand this foundation and are encouraged to investigate other useful approaches to creating effective course syllabi.

The second theoretical contribution of this research study is to expand the literature on operationalizing cognitive information processing theories in support of the design of learning
solutions like the ICO. The study adapted and applied principles from the visual design model by Clark and Lyons (2010); the model provided theoretically-grounded and evidence-based principles to assist in developing instructional materials for both printed and online content. This adaptation offers additional evidence of the quality and usefulness of the visual design model principles that have developed from different learning theories on the use of both text and visuals to create instructional content. In fact, each of the principles used in developing these guidelines united empirical and current research that can help in designing not only ICOs but also other online or printed visual materials.

Furthermore, this research study contributes to the literature on instructional message design and visual literacy. Instructional message design “comprises analysis, planning, presentation and understanding of messages their content, language and form” (Pettersson, 2002, p. 1). The guidelines produced in this study were organized in a systemic way from an analysis phase, to a design phase, then development phase. Each phase considers different factors that influence the design of a message, and how to use text and visuals to deliver better conditions for learning (Pettersson, 2009).

Another theoretical contribution is to the field of content interactivity and learner control, in that this research study also produced a set of guidelines for creating interactive instructional content. In the development phase of the guidelines, guidance and direction concerning interactive content was provided. Interactive content can provide a more engaging learning environment and offer meaningful learning to students (Chen & Catrambone, 2014). Interactive content can be more effective in online courses because it offers additional support to learners by allowing them to sequence and choose the amount of information they can view and absorb at any time (Merrill, 1983). With the increasing number of online technologies, even free web-
based examples, and the various features that are available in LMSs (ATD Research, 2019a, 2019b), future researchers can benefit from the guidelines developed for interactivity and can add to and expand their uses.

**Practical Implication**

From an instructional design standpoint, the essence of the field is that it is a practical and interdisciplinary arena focused on solving an educational problem. As in any design and development research, the aim of this study was to minimize the gap between theory and practice (Richey et al., 2011). The guidelines developed in this study were designed for a specific practical use by educators such as faculty members, teachers, and instructors. Though these guidelines may have been intended to assist in developing ICOs, they can be utilized jointly to develop ICOs, or each section can be used separately to create course syllabi, visual instructional materials, or interactive instructional materials.

Any course, either online or face to face, at any educational level—K–12 or university level—and in any field, must have a syllabus. ICOs can explain learners’ expectations in a course in a clear and pleasant manner and anticipate positive learners’ outcomes. The guidelines for developing and designing ICOs were created to guide educators in developing new approaches to improve the course syllabus design process. As stated by Littlefield (1999), a well-designed syllabus also sets the course agenda, acts as a planning tool for faculty, and serves as a contract between the instructor and students. The framework for effective syllabus produced in this study provides the different sections essential for an effective syllabus, with a detailed explanation and examples for each component. Effective syllabus can support learner needs in terms of the pathway and expectations for courses, and educators can employ the guidelines exclusively to guide them in creating their syllabus and it can be used as a planning tool for their course.
Furthermore, the guidelines for designing ICOs can be used to build any visual instructional materials because they set out several components that must be considered when designing visual materials, with directions and guidance on how to organize both text and visuals. ICOs combine visual elements, such as timelines, drawings, charts, graphs, maps, or pictures to show the outline and organization of main course topics. Looking at an ICO at the beginning can give learners the chance to see how the content is related to each other and will open their eyes to the ending gain of the course. Likewise, the guidelines can be used to develop interactive content, they can enhance learner engagement and motivation in the course through adding interactive features to an otherwise static presentation of information. ICO can present the learners with an active relationship with the material, while allowing them to have an active control over the amount of course information covered.

Though the guidelines developed in this study are intended to guide the design process, they can also be used as an evaluation tool or checklist. As has been stated, the guidelines can be used separately or as a list of items required or components to be considered when creating course syllabi, visual instructional materials, or interactive instructional materials.

**Recommendations for Future Research**

As a result of the expert review process, the guidelines have been revised and improved to be more applicable for course developers and instructional designers with limited knowledge in learning theory, instructional message design, and visual literacy. Like any other design and development research studies, the next step is the implementation of the guidelines to assess their effectiveness and efficiency. Further examination and testing of the guidelines can enhance their application and utilization. Some of the expert reviewers suggested testing the return on investment after using ICOs. Also, the novelty effect and how long it will last after using an ICO.
Both aspects can be considered for exploration and testing when implementing the guidelines.

Another expert reviewer proposed expanding the use of the guidelines as a map for entire degree programs. The guidelines can be a start for designing and developing more coherence curriculums.
References


https://doiorg.ezproxy.lib.vt.edu/10.3991/ijep.v4i5.353


Mayer, R. E. (2005). Principles for reducing extraneous processing in multimedia learning:

Coherence, signaling, redundancy, spatial contiguity, and temporal contiguity principles.


http://www.technologysource.org/article/interactive_syllabus/


doi:10.1017/CBO9781139547369.025


Appendices

Appendix A

Screenshots of Each Section of ICO
Course Overview

English 101 provides students with the rhetorical foundations that prepare them for the demands of academic and professional writing. In this course, students will learn and practice the strategies and processes that successful writers employ as they work to accomplish specific purposes. In college, these purposes include comprehension, instruction, entertainment, persuasion, investigation, problem-resolution, evaluation, explanation, and refutation.

Class discussion and readings will address the function of rhetoric and of composing processes in a variety of contexts, with attention to various audiences. Throughout the course, students will learn to respond constructively to their peers’ texts and to use peer responses (along with extensive instructor feedback) to improve the quality of their own work.

Goals and Objectives

After taking English 101, students should be able to:

- Develop an ability to write about problems from historical, philosophical, rhetorical and/or cross-cultural and interdisciplinary perspectives
Required Text:
Note: Please bring the text with you to each class meeting.

Recommended Text:
The writing handbook recommended by the English Department is Diana Hacker’s A Pocket Style Manual, 4th ed. (Bedford/St. Martin’s).
Assignments and Evaluation

Point system:

- Project 1: Arguing Through Research—Pop Culture and Social Issues
  - Reading and Responding to Texts—Culture and Identity
  - 40%

- Project 2: Final Essay
  - 30%

- Project 3: Final Essay
  - 30%

Final Grades:
Letter grades for the quarter correspond to the points

Extra Credit

Learner Support

Admissions and Records:
Students can register for classes, request transcripts, file petitions for graduation, and drop classes at this office.

Writing Center:
Work with writing and reading assignments from any course in the University.

Library:
Offers a diversity of resources to produce, disseminate, use, share, workshops, service, and sustain data and information.

Counseling Department Office:
Seeks to provide a safe, welcoming, and affirming environment for all persons who seek our services.

Financial Aid:
Facilitate access to a university education through the timely and accurate administration of student financial assistance.
Diversity Statement:
The university does not discriminate on the basis of race, ethnicity, color, national origin, sex (including pregnancy), religion, age, disability, sexual orientation, gender identity, genetic information, veteran status, marital status, and/or political affiliation.

Technology Statement:
Students will be using a variety of software programs to accomplish their research tasks for this class. While students should expect to use Microsoft Office tools (and should duly equip themselves with this before class starts).

Academic Misconduct Statement:
Academic honesty is essential to the existence and integrity of an academic institution. The responsibility for maintaining that integrity is shared by all members of the academic community. The University’s Student Code of Conduct. Students who commit acts of academic dishonesty are subject to disciplinary action and are granted due process and the right to appeal any decision.

Accommodation of Students with Disabilities:
The University strives to make all learning experiences as accessible as possible. If you anticipate or experience barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can discuss options privately. To establish reasonable accommodations, I may request that you register with Services for Students with Disabilities (SSD). If you are eligible for services and register with their office, make arrangements with me as soon as possible to discuss your accommodations so they can be implemented in a timely manner.
Appendix B

IRB Approval

Memorandum

DATE: November 21, 2019

TO: Barbara B Lockee, Wejdan Ahmed Almunive

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires October 29, 2024)

PROTOCOL TITLE: The Design And Development Of Guidelines For Interactive Course Organizers

IRB NUMBER: 19-934

Effective November 21, 2019, the Virginia Tech Human Research Protection Program (HRPP) and Institutional Review Board (IRB) determined that this protocol meets the criteria for exemption from IRB review under 45 CFR 46.104(d) category(ies) 2(ii).

Ongoing IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities impact the exempt determination, please submit a new request to the IRB for a determination.

This exempt determination does not apply to any collaborating institution(s). The Virginia Tech HRPP and IRB cannot provide an exemption that overrides the jurisdiction of a local IRB or other institutional mechanism for determining exemptions.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

https://secure.research.vt.edu/external/irb/responsibilities.htm

(Please review responsibilities before beginning your research.)

PROTOCOL INFORMATION:

Determined As: Exempt, under 45 CFR 46.104(d) category(ies) 2(ii)

Protocol Determination Date: November 21, 2019

ASSOCIATED FUNDING:

The table on the following page indicates whether grant proposals are related to this protocol, and which of the listed proposals, if any, have been compared to this protocol, if required.
Appendix C

Expert Review Request

Dear Professor ____________

My name is Wejdan Almunive, and I am a Doctoral Candidate in the Instructional Design and Technology program at Virginia Tech. As a recognized expert in instructional message design, visual literacy, and effective development of visual instructional materials I would like to invite you to evaluate a guideline that I am designing and developing as part of my dissertation work under the supervision of my advisor Dr. Barbara B. Lockee (lockeebb@vt.edu). Your participation in this study is voluntary.

The purpose of my research study is to develop theoretical guidelines that can assist educators in creating Interactive Course Organizers (ICOs), Institutional Review Board (IRB) at Virginia Tech number 19-934. The aim of the guidelines is to aid in designing ICOs, considering their capability to help students visualize the course “big picture”, how a course is organized, clearly articulate the connections between course content, and serve as road maps that define the content and context of learning in online courses. The guidelines are designed and developed with a theoretically grounded foundation from several cognitive information processing theories. This study is categorized as model research (Type I) development research, and it includes four phases: (1) Analysis phase, (2) Design phase, (3) Development phase, and (4) Validation phase. The validation stage requires that the guidelines be formatively evaluated by experts for recommendations for improvement.

Should you elect to act as an expert reviewer, you will be provided with a link to the expert reviews package website. The website will contain five pages; (1) information about the study, (2) example of an Interactive Course Organizer (ICO), (3) guidelines to design and develop
ICOs, (4) consent form, (5) an evaluation rubric. You will have two weeks to complete a review and provide your feedback via the evaluation rubric. I estimate that your participation would take approximately 2 hours of your time over a two-week review period, beginning with receiving the materials.

Your expertise will help me to improve the guidelines before its dissemination as a practical tool for designing ICOs. I hope that you are able to participate! If you have any questions, please do not hesitate to contact me.

Thank you in advance for your valuable time and expertise.

Sincerely,

Wejdan Almunive

Ph.D. Candidate, Instructional Design & Technology
Appendix D

Reminder Email

Dear Professor __________

Recently, I contacted you to request your participation as an expert reviewer of Guidelines for Interactive Course Organizers (see below for original email). If you have completed the expert review, I want to thank you for your time and participation.

If you have not completed the expert review yet and are interested in doing so, I eagerly await your input! Please complete the review by Date***

Sincerely,

Wejdan Almunive

Ph.D. Candidate, Instructional Design & Technology
Appendix E

Consent Form

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Informed Consent for Participants

in Research Projects Involving Human Subjects

Title of Project: The Design and Development Of Guidelines For Interactive Course Organizers

Investigator(s): Wejdan Almunive wejdan3@vt.edu (540-629-1432)

I. Purpose of this Research Project

The purpose of this design and development study is to develop theoretical guidelines that can help educators in creating Interactive Course Organizers (ICOs). The aim of the guidelines is to assist in designing ICOs, considering their capability to help students visualize the course “big picture”, how a course is organized, clearly articulate the connections between course content, and serve as road maps that define the content and context of learning in online courses. The guidelines are designed and developed with a theoretically grounded foundation from several cognitive information processing theories. Furthermore, the guidelines will assist in crafting ICO content, integrating both text and visuals while they support each other, and minimizing cognitive load.

II. Procedures

Researcher will send an email with a link to expert reviews package website. The website will contain five pages; (1) information about the study, (2) example of an Interactive Course Organizer (ICO), (3) guidelines to design and develop ICOs, (4) consent form, (5) an evaluation rubric. You will have two weeks to complete a review and provide your feedback via the online
rubric formatted in Google Form and provided in the website.

III. Risks

There are no anticipated risks to you as a result of participating in this project.

IV. Benefits

The benefit of this design and development research is to create a set guideline that can help instructors effectively design ICOs. With the utilization of the design and development research method, the guidelines will produce a generalizable knowledge that aims to improve the instructional design process. The guideline will be validated by experts in the field, and their recommendations will be used to revise the guidelines. The guidelines will add to the literature on both instructional message design and visual literacy design. Nevertheless, this set of theoretical guidelines can assist in developing not only interactive course organizers, but also other visual materials. You may contact the researcher at any time for a summary of the research study results once completed and available. No promise or guarantee of benefits has been made to encourage you to participate.

V. Extent of Anonymity and Confidentiality

Your participation in this study will not be completely anonymous. Data will be analyzed, reported and described for a doctoral committee and dissertation/publications, using your identity. The Virginia Tech (VT) Institutional Review Board (IRB) may view the study’s data for auditing purposes. The IRB is responsible for the oversight of the protection of human subjects involved in research.

VI. Compensation

Participants will not be compensated for participating in this study.

VII. Freedom to Withdraw
It is important for you to know that you are free to withdraw from this study at any time without penalty. You are free not to answer any questions that you choose or respond to what is being asked of you without penalty.

Please note that there may be circumstances under which the investigator may determine that a subject should not continue as a subject.

Should you withdraw or otherwise discontinue participation, you will be compensated for the portion of the project completed in accordance with the Compensation section of this document.

VIII. Questions or Concerns

Should you have any questions about this study, you may contact one of the research investigators whose contact information is included at the beginning of this document. Should you have any questions or concerns about the study’s conduct or your rights as a research subject, or need to report a research-related injury or event, you may contact the Virginia Tech Institutional Review Board at irb@vt.edu or (540) 231-3732.

IX. Subject's Consent

I have read the Consent Form and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent:

_______________________________________________ Date__________

Subject signature

_______________________________________________

Subject printed name
Appendix F

Evaluation Rubric

I. Purpose of this Research Project
The purpose of this design and development study is to develop theoretical guidelines that can help educators in creating Interactive Course Organizers (ICOs). The aim of the guidelines is to assist in designing ICOs, considering their capability to help students visualize the course “big picture”, how a course is organized, clearly articulate the connections between course content, and serve as road maps that define the content and context of learning in online courses. The guidelines are designed and developed with a theoretically grounded foundation from several cognitive information processing theories. Furthermore, the guidelines will assist in crafting ICO content, integrating both text and visuals while they support each other, and minimizing cognitive load.

II. Procedures
Researcher will send an email with a link to expert review packet website. The website will contain five pages; (1) information about the study, (2) example of an Interactive Course Organizer (ICO), (3) guidelines to design and develop ICOs, (4) consent form, (5) an evaluation rubric. You will have two weeks to complete a review and provide your feedback via the online rubric formatted in Google Form and provided in the website.

III. Risks
There are no anticipated risks to you as a result of participating in this project.

IV. Benefits
The benefit of this design and development research is to create a set guideline that can help instructors effectively design ICOs. With the utilization of the design and development research method, the guidelines will produce a generalizable knowledge that aims to improve the instructional design process. The guideline will be validated by experts in the field, and their recommendations will be used to revise the guidelines. The guidelines will add to the literature on both instructional message design and visual literacy design. Nevertheless, this set of theoretical guidelines can assist in developing not only interactive course organizers, but also other visual materials. You may contact the researcher at any time for a summary of the research study results once completed and available.
No promise or guarantee of benefits has been made to encourage you to participate.

V. Extent of Anonymity and Confidentiality
Your participation in this study will not be completely anonymous. Data will be analyzed, reported and described for a doctoral committee and dissertation/publications, using your identity. The Virginia Tech (VT) Institutional Review Board (IRB) may view the study’s data for auditing purposes. The IRB is responsible for the oversight of the protection of human subjects involved in research.
VI. Compensation
Participants will not be compensated for participating in this study.

VII. Freedom to Withdraw
It is important for you to know that you are free to withdraw from this study at any time without penalty. You are free not to answer any questions that you choose or respond to what is being asked of you without penalty. Please note that there may be circumstances under which the investigator may determine that a subject should not continue as a subject. Should you withdraw or otherwise discontinue participation, you will be compensated for the portion of the project completed in accordance with the Compensation section of this document.

VIII. Questions or Concerns
Should you have any questions about this study, you may contact one of the research investigators whose contact information is included at the beginning of this document. Should you have any questions or concerns about the study’s conduct or your rights as a research subject, or need to report a research-related injury or event, you may contact the Virginia Tech Institutional Review Board at irb@vt.edu or (540) 231-3732.

IX. Subject's Consent
I have read the Consent Form and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent.

* Required
Email address *
Name: *
Informed Consent *
Check all that apply.
I have read the Consent Form and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent.

Section 1: The Application of ICOs
This section contains questions about the application of ICOs and will it be used by the target users to achieve its goals with effectiveness, efficiency and satisfaction. Please leave any comments you have regarding the application of ICOs. In particular, if you responded Disagree or Strongly Disagree to any item, please offer specific recommendations for improvement.

Q1: Educators will most likely develop ICOs *
Mark only one oval.
Strongly disagree
Disagree
Neutral
Agree
Strongly agree

Comments and suggestions:
Q2: Which of the following constraints may affect the development of ICOs: * Check all that apply.

- Time (ICOs take time to develop)
- Digital skills (skills required to make basic use of computer applications, websites, and other online platforms)
- Openness (keeping an open-minded and willing to try new things)
- Patience (the developing process can be slow going)

Other:

Comments and suggestions:

Q3: In ICOs textual and visual components assist learners in making connection and organize the course content. * Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Comments and suggestions:

Q4: ICOs are interactive and they allow learners to navigate, access and view the course content. * Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Comments and suggestions:

Q5: ICOs provide innovation improvement in presenting course materials * Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Comments and suggestions:

Q6: ICOs will attract learners’ attention and motivate them to go through course content * Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
Comments and suggestions:

Q7: Please provide additional suggestion to improve the application of ICOs *

Skip to question 16.

Section 2: Overall Design of The Guidelines

This section contains questions about the overall design and organization of the guidelines and questions about the simplicity as well as stability of the guidelines. Please leave any comments you have regarding the overall design of the guidelines. In particular, if you responded Disagree or Strongly Disagree to any item, please offer specific recommendations for improvement.

Q1: The guidelines describes in sufficient detail its purpose and intended use. * Mark only one oval.

Strongly disagree
Disagree
Neutral
Agree
Strongly agree

Comments and suggestions:

Q2: The directions and guidance for using the guidelines is clear and sufficient. * Mark only one oval.

Strongly disagree
Disagree
Neutral
Agree
Strongly agree

Comments and suggestions:

Q3: The organization and format of the guidelines are well designed to support its purpose and use. * Mark only one oval.

Strongly disagree
Disagree
Neutral
Agree
Strongly agree

Comments and suggestions:
Q4: Please provide additional suggestion to improve the overall design of the guidelines *

Section 3: Analysis Phase
This section contains questions about the guidelines for the analysis phase. Please leave any comments you have regarding the analysis phase of the guidelines. In particular, if you responded Disagree or Strongly Disagree to any item, please offer specific recommendations for improvement.

Q1: The key factors in the analysis phase are appropriate and sufficient * Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

Comments and suggestion:

Q2: In the table(Guidelines to Analyze the context for ICO), the guidelines for each factor are clear and sufficient * Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

Comments and suggestions:

Q3: The analysis phase reflects relevant research as well as important practices in the design of educational visual materials * Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

Comments and suggestions:

Q4: Please provide additional suggestion to improve the analysis phase of the guidelines *

Section 4: Design Phase
This section contains questions about the guidelines for the design phase. Please leave any comments you have regarding the design phase of the guidelines. In particular, if you responded Disagree or Strongly Disagree to any item, please offer specific recommendations for improvement.
Q1: The components in the design phase are appropriate and sufficient * Mark only one oval.
   Strongly disagree
   Disagree
   Neutral
   Agree
   Strongly agree

Comments and suggestion:

Q2: In the table (Guidelines to Design the ICO), the guidelines for each component are clear and sufficient * Mark only one oval.
   Strongly disagree
   Disagree
   Neutral
   Agree
   Strongly agree

Comments and suggestions:

Q3: The design phase reflects relevant research as well as important practices in the design of educational visual materials * Mark only one oval.
   Strongly disagree
   Disagree
   Neutral
   Agree
   Strongly agree

Comments and suggestions:

Q4: Please provide additional suggestion to improve the design phase of the guidelines *

Section 5: Development Phase
This section contains questions about the guidelines for the development phase. Please leave any comments you have regarding the analysis phase of the guidelines. In particular, if you responded Disagree or Strongly Disagree to any item, please offer specific recommendations for improvement.

Q1: The framework for course syllabus are appropriate and sufficient * Mark only one oval.
   Strongly disagree
   Disagree
   Neutral
   Agree
   Strongly agree
Comments and suggestion:

Q2: In the table (Framework for A Course Syllabus), the specific components for each course syllabus component are clear and sufficient * Mark only one oval.
   Strongly disagree
   Disagree
   Neutral
   Agree
   Strongly agree

Mark only one oval.
   Option 1

Comments and suggestion:

Q3: The framework for course syllabus reflects relevant research in components of an effective course syllabus * Mark only one oval.
   Strongly disagree
   Disagree
   Neutral
   Agree
   Strongly Agree

Comments and suggestions:

Q4: The components in the development phase are appropriate and sufficient * Mark only one oval.
   Strongly disagree
   Disagree
   Neutral
   Agree
   Strongly agree

Comments and suggestions:

Q5: In the table (Guidelines to Develop Visuals for ICOs), the guidelines for each component are clear and sufficient * Mark only one oval.
   Strongly disagree
   Disagree
   Neutral
   Agree
   Strongly agree

Comments and suggestions:
Q6: The development phase reflects relevant research as well as important practices in the design of interactive visual materials * Mark only one oval.

Strongly disagree
Disagree
Neutral
Agree
Strongly agree

Comments and suggestions:

Q7: Please provide additional suggestion to improve the development phase of the guidelines *

Section 6: The Application of The Guidelines

This section contains questions about the application of the guidelines. Please leave any comments you have regarding the analysis phase of the guidelines. In particular, if you responded Disagree or Strongly Disagree to any item, please offer specific recommendations for improvement.

Q1: Overall, the guidelines, when used by educators, will likely be effective in helping to design and develop ICOs * Mark only one oval.

Strongly disagree
Disagree
Neutral
Agree
Strongly agree

Comments and suggestion:

Q2: The guidelines will be reasonable to implement by educators, the intended user audience. * Mark only one oval.

Strongly disagree
Disagree
Neutral
Agree
Strongly agree

Comments and suggestion:

Q3: What additional recommendations do you have to improve this guidelines? *
## Appendix G

### List of Changes Made to The Revised Version of the Guidelines

<table>
<thead>
<tr>
<th>Suggested Revisions</th>
<th>Changes Made To The Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platform to support the presentation of the ICO</td>
<td>In page 2 of the guidelines, table 1 was added to provide a list of various data visualization websites were added with links, several of these data visualization websites have features that can be used to embed the product (ICO) in an LMS.</td>
</tr>
<tr>
<td>The target audience</td>
<td>In the document, the guidelines did not specified their target audience, thus there were no changes made to the guidelines, however, the target audience shifted from average educators such as faculty members to course developers and instructional designers.</td>
</tr>
<tr>
<td>The use of visuals</td>
<td>In page 7 of the final revised version of the guidelines, the table (Graphic types to use for varied goals) was added to illustrate varies visuals examples.</td>
</tr>
<tr>
<td>The analysis phase</td>
<td>There was a need to rationalize the ramification of analyzing each factor in the phase and how to utilize the data to aid the design process; therefore, in page 5 additional guidance and direction information were added to improve and enhance the analysis phase.</td>
</tr>
<tr>
<td>The design phase</td>
<td>Concerns were evident about how this phase extends to the course design, specifically the ICO; reflecting on this recommendation, modifications were made to clarify the information in the design phase by adding examples of how it is presented in an ICO. Additionally, guidance and directions on integrating auditory elements and accessibility to an ICO were further added to the guidelines. In page 11, table 4 (Guidelines for Designing ICOs) was enhanced by adding a new column was added to provide examples of how each component is presented in ICO. Also, the table was supplemented by two new components auditory elements and accessibility.</td>
</tr>
<tr>
<td>The development phase</td>
<td>Adjustments were made to clarify the information and provided more design support, which was enhanced by adding examples. In page 15, table 5 (A Framework for A Course Syllabus) was supplemented with a new column to provide rationale and examples for each course syllabus section. In the last page of the revised guidelines a link was provided to an example of ICO.</td>
</tr>
</tbody>
</table>
Appendix H

Revised Guidelines for Interactive Course Organizers (ICOs)

Guidelines for Interactive Course Organizers (ICOs) A Design and Development Research

By Wejdan Almunive

INTRODUCTION

The Interactive Course Organizer (ICO) is an artifact that contains the text and visual representation of a traditional course outline (i.e., course syllabus) and incorporates visual elements, such as timelines, drawings, charts, graphs, maps, or pictures, to show the sequencing and organization of major course topics while offering users an actively controlled progression of the amount of course information viewed. In other words, ICOs are interactive in the sense that learners have control over the information they are viewing, as well as the interactive features they can use to acquire more detailed information about the course content.

The main goal of the ICO is to function as a course syllabus that provides learners with interactive access to course activities and requirements, which will allow them to visualize the course “big picture,” identify the connections among course components, and support learners’ plans for the semester. By following the Clark and Lyons (2010) visual design model as a framework for developing ICOs, we constructed the guidelines to ensure the ICO would reach its instructional needs. The ICO guidelines have to go through different phases to ensure the goal of utilizing the ICO is met. These guidelines offer a systematic process for designing and developing ICOs in three phases: analysis, design, and development. Educators should finish one
phase before beginning the next phase. In each phase of the process, strategic elements are identified and must be considered by the ICO designer. Directions and guidance, along with supporting research, for the critical factors in each phase are provided accordingly.

To construct an ICO, there are several data visualization websites that can be used. Most of these websites provide their users with a platform to create and share digital charts, infographics, and maps through a free or paid subscription. Moreover, these products can be published, embedded, or shared on different websites or social media platforms. The websites’ interfaces are user-friendly, and they do not require any coding skills to use these tools. Additionally, these data visualization websites offer a WYSIWYG (What You See Is What You Get) editor that “allows a developer to see what the end result will look like while the interface or document is being created” (Rouse, 2011). Table 1 lists the different data visualization websites that can be used to develop ICOs, and it includes a link to their websites.

Table 1: A List of Different Data Visualization Websites

<table>
<thead>
<tr>
<th>Website</th>
<th>Website Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genially</td>
<td><a href="https://www.genial.ly">https://www.genial.ly</a></td>
</tr>
<tr>
<td>Piktochart</td>
<td><a href="https://piktochart.com">https://piktochart.com</a></td>
</tr>
<tr>
<td>Infogram</td>
<td><a href="https://infogram.com">https://infogram.com</a></td>
</tr>
<tr>
<td>ThingLink</td>
<td><a href="https://www.thinglink.com">https://www.thinglink.com</a></td>
</tr>
<tr>
<td>Visme</td>
<td><a href="https://www.visme.co">https://www.visme.co</a></td>
</tr>
<tr>
<td>Blugraphic</td>
<td><a href="https://www.blugraphic.com">https://www.blugraphic.com</a></td>
</tr>
</tbody>
</table>
Analysis Phase

Before beginning ICO development, it is important to look at the different factors that will influence the design and development process. Determining how much control one has over the final production of an ICO will aid the design decision-making procedure earlier in the process (Clark & Lyons, 2010). To prevent any production or technical restraints along the way, one needs to analyze different factors, such as learners, learning environment, delivery medium, and any potential pragmatic issues (Clark & Lyons, 2010). Table 2 provides guidelines on how to gather the information needed to build an ICO.

Table 2: Guidelines to Analyze the Context for ICO.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learners</td>
<td>When analyzing your learners, identify their age.</td>
</tr>
<tr>
<td></td>
<td>• gender.</td>
</tr>
<tr>
<td></td>
<td>• socioeconomic status.</td>
</tr>
<tr>
<td></td>
<td>• cultural factors.</td>
</tr>
<tr>
<td></td>
<td>• language.</td>
</tr>
<tr>
<td></td>
<td>• prior knowledge is the primary key to identify learners’ individual differences. You can analyze your learners’ prior knowledge by looking at the following:</td>
</tr>
<tr>
<td></td>
<td>• Their knowledge of the subject at hand</td>
</tr>
</tbody>
</table>
- If they are a novice or expert learners
- Their familiarity with the field terminology and jargon (Clark & Lyons, 2010; Lipton, 2007; Pettersson, 2010, 2015a; Soonpaa, 2018)

**Learning environment**

When analyzing the learning environment, identify the following:

- How will the ICO be used (as a job aid, presentation, self-study, etc.)?
- Where the ICO is presented (face to face or online)?
- When the ICO is presented (beginning, during, or after the class)?
- How much control learners have over reviewing the information in the ICO (time spent looking at the information and how many times they can review it)? (Clark & Lyons, 2010; Pettersson, 2010)

**Delivery medium**

When analyzing the delivery medium, you should choose a data visualization website that works best for your digital skill level. Before selecting a website, you will need to test the following:

- The Learning Management System’s (LMS) ability to host the ICO
- The display of visuals and text (size and resolution)
- The interactivity feature connectivity and the speed of displaying the content (visuals and text; Clark & Lyons, 2010; Pettersson, 2010)

**Pragmatic issues**

Analyze any production issues and identify any potential problems you may face, such as the following:

- How much time you need to finish the ICO
- Technical knowledge related to the LMS or the visualization website or software you’re using
- Embedding or uploading the ICO to the LMS or the course website
- Any accessibility issues such as navigation, interactivity, and resolution (Clark & Lyons, 2010; Pettersson, 2010)

By looking at the information gathered in the analysis phase, one can make informed and efficient decisions that will guide the design process. The learners’ analysis will improve the selection process for the visuals, colors, symbols, and so on. Identify certain characteristics about your learners for example their cultural background can be critical. Understanding the culture your learners come from will provide some insights on the colors choosing process, color can be interpreted differently cultures. Using the color red as an example, in Asian cultures red can mean good luck and prosperity and in Western cultures can mean alarm and warnings (Clark &
Lyons, 2010). The learning environment analysis will guide the choices one makes about the size, layout, contrast, and boldness of the design (Clark & Lyons, 2010). For example, if the content is presented in an online course (E-learning environment) make sure that you are using a graphic format that can be clearly displayed in a computer screen, if you are considering the use of mobile devices check the graphic display too. The delivery medium analysis helps identify any technical restrictions before beginning the ICO design. Using an LMS as a delivery medium, you need to look at how the website or software (tools) will plug into the LMS to display and run the visuals, and the interactivity features need to be tested for display resolution and connectivity and the speed of displaying the content. Finally, by identifying any practical issues from the beginning, people will be aware of any problems they may face and understand how to overcome them. Therefore, the analysis phase can work as a blueprint for ICO development.

**Design Phase**

By looking at the information gathered in the analysis phase, one can make informed and efficient decisions that will guide the design process. In the design phase, one needs to look at three correlated factors that form the effectiveness and the efficiency of this visual tool: “(1) properties of the visual itself, including its surface features, communication functions and psychological functions, (2) the goal of the instructions, and (3) differences in prior knowledge of the learners” (Clark & Lyons, 2010, p. 5). When it comes to the function of the ICO, Clark and Lyons (2010) specified three views to the functional characteristics of graphics:

- Surface feature (visual features) of the art, such as illustrations and graphics
- Communication function—how it transfers the information
- Psychological function—how it supports learning
Following the considerations of Clark and Lyons (2010), the ICO function is to organize the visuals (surface features) to show the relationships between the course content (communication function) that draw learners’ attention to important components of the course and to support their motivation by making the content interesting (psychological function). Next, the goal of instruction, the ICO, contains multiple types of content; thus, the overall goal of an ICO is to function as an organizational visual to show the relationships among the content of the course syllabus (Clark & Lyons, 2010). Last, one has to consider learners’ prior knowledge of the topic and familiarity with the content. Learners with low prior knowledge of the material tend to benefit more from added visuals and graphics than those with a high prior knowledge (Clark & Lyons, 2010). After analyzing the ICO context and identifying its function, we look at designing the visual approach for the ICO.

When it comes to visual components built into ICO, visuals refer to the photographs, illustrations, graphs, diagrams, icons, and shapes in the ICO design. The right visuals used in the right way are essential to many aspects of learning. Table 3 provides different graphic types to use for varied instructional goals (Table 3 - for better clarity, a picture, for example, is added).

Table 3: Graphic Types to Use for Varied Goals (Malamed, 2015)

<table>
<thead>
<tr>
<th>Instructional Purpose</th>
<th>Graphic Types To Use For Varied Goals</th>
<th>Example</th>
</tr>
</thead>
</table>
| Describe specific objects | • Photograph 3-D graphic  
• Illustration  
• Clip art (particularly in diagrams and as game elements) (Malamed, 2015; Meirelles, 2013; Black et al., 2017). | ![Example Image](image_url) |
Tell a story or provide a scenario
- Sequence of photographs
- Sequence of illustrations
- Timeline (Malamed, 2015; Meirelles, 2013; Black et al., 2017).

Persuade an audience
- Sequence of photos or illustrations to tell a story
- Photographs that evoke emotions
- Visualization of statistics and data (Malamed, 2015; Meirelles, 2013; Black et al., 2017).

Explain unfamiliar or complex concepts and theories
- Visual metaphor
- Diagram showing connections (Malamed, 2015; Meirelles, 2013; Black et al., 2017).

Demonstrate a procedure
- Show the steps in a sequence of photos or illustrations
- Flow chart
- Series of screen captures for software simulation (Malamed, 2015; Meirelles, 2013; Black et al., 2017).
Explain a process

- Diagram the stages or operations of the process
- Icons or simple illustrations to represent each component (Malamed, 2015; Meirelles, 2013; Black et al., 2017).

Point out something specific

- Arrow or pointed shape
- Highlight
- Outline of a circle (Malamed, 2015; Meirelles, 2013; Black et al., 2017).

Depict components of a system

- Illustrate object with labels Diagram of the structure (Malamed, 2015; Meirelles, 2013; Black et al., 2017).

Make comparisons

- Bar graph Pictograph
- Line graph with multiple lines
- A Table when specific values are important (Malamed, 2015; Meirelles, 2013; Black et al., 2017).

Demonstrate trends in data

- Line graph
- Scatter plot (Malamed, 2015; Meirelles, 2013; Black et al., 2017).
<table>
<thead>
<tr>
<th>Organization of information</th>
<th>• Various chart types (hierarchical, radial, etc.) Concept map (Malamed, 2015; Meirelles, 2013; Black et al., 2017).</th>
</tr>
</thead>
</table>
| Demonstrate motion without animation | • Show object moving along a path  
• Illustrations with motion lines  
• Illustrations with arrows or dashed lines depicting movement (Malamed, 2015; Meirelles, 2013; Black et al., 2017). |
| History or changes over time | • Timeline (these don’t have to be arrows)  
Sequence of photos or illustrations (Malamed, 2015; Meirelles, 2013; Black et al., 2017). |

Next, the process of crafting the ICO begins by developing the graphical user interface—the overall look and feel of the ICO (Clark & Lyons, 2010) in terms of text font and size, color, space, video or auditory elements layout organization, the navigation functions, and the accessibility of the ICO. The following guidelines (Table 4) cover the design phase of the ICO.
Table 4: *Guidelines for Designing ICOs.*

<table>
<thead>
<tr>
<th>Components</th>
<th>Directions and Guidance</th>
<th>Examples of how it is presented in ICO</th>
</tr>
</thead>
</table>
| Text font and size     | - Use text font that is clear, easy to read, and designed for screen display, such as Trebuchet, Verdana, or Georgia (Hoffman, White, & Aquino, 2005; Lipton, 2007; Pettersson, 2015a)   | • Bold headings for section in the ICO, such as; instructor name, course overview, etc.  
• Italics font for clickable text                                                                                                                             |
|                        | - Limit the number of text fonts and restrict stylized text fonts to opening headings (Pettersson, 2015a)                                                                                                               |                                                                                                                                                                                                                                                                  |
|                        | - Use bold font to emphasize information, such as headings and titles (Lipton, 2007; Pettersson, 2015b)                                                                                                               |                                                                                                                                                                                                                                                                  |
|                        | - Use italics to emphasize captions or small parts of the running text, keep in mind that italics reduces the readability of the text, so avoid using it as running text (Lipton, 2007; Pettersson, 2015b) |                                                                                                                                                                                                                                                                  |
|                        | - Use a regular combination of uppercase letters and lowercase letters in the running text (Pettersson, 2015b)                                                                                                            |                                                                                                                                                                                                                                                                  |
|                        | - Avoid using all capital letters because it reduces the readability of the text (Lipton, 2007; Pettersson, 2015b)                                                                                                        |                                                                                                                                                                                                                                                                  |
| Color                  | - Depending on the content, use light or dark background and contrast colors for the text and graphics (Lipton, 2007; Pettersson, 2015a)                                                                                     | • Use consistent color for heading and body for each section in the ICO.  
• Use darker shade of text color for clickable text.  
• Use highlighted color text or bright colored text to emphasize important information or dates such as; test, due date, etc. |
<p>|                        | - Use black text or dark-colored text on a light-colored background (Lipton, 2007; Pettersson, 2015b)                                                                                                               |                                                                                                                                                                                                                                                                  |
|                        | - Choose colors that are one or two colors apart on the color wheel to achieve contrast (Lipton, 2007)                                                                                                               |                                                                                                                                                                                                                                                                  |
|                        | - Use color to clarify the structure of the content. Parts of the content can be in the same color or presented using a same-colored background (Pettersson, 2015a)                                                        |                                                                                                                                                                                                                                                                  |
|                        | - Use a consistent color for the text or background to present the same type of content and assist learners in moving through the material (Lipton, 2007; Pettersson, 2015b) |                                                                                                                                                                                                                                                                  |
|                        | - Use color to show the similarities and differences in the content, either by the color of the text or the                                                                                                               |                                                                                                                                                                                                                                                                  |</p>
<table>
<thead>
<tr>
<th>Section</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background</td>
<td>- Use color to emphasize the information and draw learners’ attention to the content (Lipton, 2007; Pettersson, 2015a)</td>
</tr>
<tr>
<td></td>
<td>- Use a standard screen size, margin, and grid to plan each section (Pettersson, 2015b)</td>
</tr>
<tr>
<td></td>
<td>- Use space to group textual or visual content. Close proximity shows the content is related (Clark &amp; Lyons, 2010; Lipton, 2007; Pettersson, 2015b)</td>
</tr>
<tr>
<td></td>
<td>- Use a space between the content elements (margins, text, and visuals) to separate unrelated information and aid the readability of the content (Clark &amp; Lyons, 2010; Lipton, 2007)</td>
</tr>
<tr>
<td></td>
<td>- Use space as a grid system to align textual or visual content and show a chunk of information (Clark &amp; Lyons, 2010; Pettersson, 2015b)</td>
</tr>
<tr>
<td></td>
<td>- Use a space to structure the content and use extra space between textual or visual content for a new section (Clark &amp; Lyons, 2010; Lipton, 2007; Pettersson, 2015b)</td>
</tr>
</tbody>
</table>
| Video or auditory elements | - Use standard template size for each section of the ICO  
                          | - Use spacing in text to clearly present each sentence  
                          | - Space between text and visuals so they do not overlapping |
|                         | - Welcoming video or recording to the course  
                          | - Introductory video or recording to the course |
| Layout organization      | - Organize text and visuals covering related content close to each other to show connections or use distance to separate unrelated content (Clark & Lyons, 2010; Lipton, 2007; Pettersson, 2015a)  
                          | - Utilize repetition to unify and bring text and visuals together to convey the same information (Clark & Lyons, 2010; Lipton, 2007; Pettersson, 2015b)  
                          | - Use contrast in the placement of the content (text or visuals) to focus learners’ attention on the content (Clark & Lyons, 2010)  
                          | - Align the content (text and visuals) to help learners navigate through them and place visuals close to the text associated with it, so learners benefit from |
|                         | - Use a consistent placement for text and visuals in each section of the ICO  
                          | - When faced with a large amount text, break it down in different chunks so it is ease to organize |
both textual and visual content (Clark & Lyons, 2010; Pettersson, 2015a, 2015b)

- Balance the use of textual and visual elements. Too many graphics can decrease learners’ interaction with the text (Lipton, 2007; Pettersson, 2015b)
- Use graphics that are bold, clear, and large enough to show on a screen (Lipton, 2007; Pettersson, 2015b)

### Navigation functions

- Limit the size of the ICO to a screen size to avoid scrolling so learners do not miss any information (Leavitt & Shneiderman, 2006)
- Use familiar content organization and navigation functions to ease the process of learning and remembering the ICO layout (Leavitt & Shneiderman, 2006)
- Standardize the sequence of ICO sections, allowing learners to view the section’s content in a systematic way (Clark & Lyons, 2010; Leavitt & Shneiderman, 2006)
- Consistently place valuable clickable items to help learners remember their locations (Leavitt & Shneiderman, 2006).
- Any media files (videos/audio) are accessible (Vai & Sosulski, 2016).

### Accessibility

- ICO content (visuals, text, video, etc.) designed to aid readability (QM 8.2; Vai & Sosulski, 2016).
- Provide an accessibility statement on an ICO (QM 8.6)
- Use a format that is accessible by all learners, whether it is visuals, text, video, etc. (QM 8.4; Vai & Sosulski, 2016).
- Working and correct links are provided (QM 8.4; Vai & Sosulski, 2016).
- ICO content is provided to learners in a portable version, and can be downloaded and printed (QM 8.3; Vai & Sosulski, 2016).

*When it comes to accessibility statement, there are many website generators to build them with more consideration to several accessibility aspects.*

- Align ICO items, such as text, visuals, and clickable buttons consistently in each section in a vertical or horizontal style
- Use a consistent button for the Home page in each section of the ICO, to give learners the ability to easily navigate through the ICO
- Provide a printable version of the course syllabus
- Include an accessibility statement to show that you are committed to provide an accessible content, and list contact information to reporting difficulties in viewing the ICO content

**Development Phase**

In the development phase, where we start developing the ICO by focusing on each ICO component and how to transform it into an interactive visual. The ICO components are parallel
to the elements of a practical course syllabus (Table 5), provides a framework for a course
syllabus containing syllabus components with a description for each component. We identified
the components by following the QM higher education standards rubric, conducting a thorough
investigation in the course syllabus literature, and examining various templates and checklists
from higher education institutes for the course syllabus framework.

Table 5: A Framework for A Course Syllabus.

<table>
<thead>
<tr>
<th>Course Syllabus Sections</th>
<th>Specific Components</th>
<th>Rationale and Examples</th>
</tr>
</thead>
</table>
| Instructor and course information | A list including, but not limited to the following:  
    ❑ The course number, title, credits, prerequisites (previous courses, competencies, etc.), semester, time, and location of the class  
    ❑ The instructor’s name, title, and contact information (office address, phone number, email, office hours, and online attendance if needed), and teaching assistant contact information if applicable to the course;  
    ❑ Any relevant course web pages and emails (Albrecht, 2009; Barros, 2014; Davis, 1993; Hess & Whittington, 2003; Johnson, 2006; O’Brien et al., 2008; QM 1.7 & 1.8; Soonpaa, 2018; Wolfe, 2004). | ● To provide your learners with course information so they are prepared in terms of; course topics, location (with map if needed), time for both online and face to face course  
Example: Course Title: Introduction to College Writing  
Course Number: ENGL 101  
Credits: 3 semester hours |
The course description provided in the university catalog can be used if it accurately describes what will be covered in the class.

- Identify any expected prerequisite or prior knowledge in the discipline and/or any required proficiencies;
- Ask the learners to introduce themselves to the class, for fully online courses provide the learners with a section to introduce themselves (e.g., discussion board, or they can complete their profile in the LMS used for the courses; Albrecht, 2009; Barros, 2014; Davis, 1993; Hess & Whittington, 2003; Johnson, 2006; O’Brien et al., 2008; QM 1.1, 1.2, 1.4, 1.7, 1.9; Wolfe, 2004).

### Course goals and objectives

- Describe what the learners will know and comprehend by the end of the course. A list of three to five objectives identifying the competencies students will gain by completing the course.
- Consider the goals and objectives that are suited to the course level and describe the measurable outcomes.
- Clearly state the goals and objectives written from the learner’s perspective.
- Each module or unit-level learning goals and objectives describe outcomes that are measurable and consistent with the course-level goals and objectives.
- The relationship between learning goals and objectives are aligned with the learning activities (Albrecht, 2009; Barros, 2014; Davis, 1993; Hess & Whittington, 2003; Johnson, 2006; O’Brien et al., 2008; QM 2.1, 2.2, 2.3, 2.4, & 2.5; Soonpaa, 2018; Wolfe, 2004).

### Course instructional materials

- A detailed list of instructional and study materials, books, specific chapters, articles, and videos. These materials have to contribute to the achievement of the learning goals and objectives.
- Courses in fields such as; arts or labs may require specific materials, provide a detailed list of these tools.

English 101 provides students with the rhetorical foundations that prepare them for the demands of academic and professional writing. In this course, students will learn and practice the strategies and processes that successful writers employ as they work to accomplish specific purposes. In college, these purposes include comprehension, instruction, entertainment, persuasion, investigation, problem-resolution, evaluation, explanation, and refutation.

- To provide your learners with what they will be expected to know or do after this course in terms of; competencies/skills/knowledge and what they will be anticipated to demonstrate at the end of the course.

**Example:**
Develop an ability to write about problems from historical, philosophical, rhetorical and/or cross-cultural and interdisciplinary perspectives.

- To provide your learners with the kind of materials the will need in the course.

**Example:**
Books, software, lab equipment, or art supplies.
| Course outline (schedule) | Explain how these materials cover each topic presented in the course and make sure the materials are representing a current theory and practice in the discipline. A complete citation of the text will be used for the course. The title, author, edition, and publisher of the textbook is provided. Details on how to locate and obtain the materials, whether there is more than one location, whether learners can purchase the materials, which location(s) carry it, whether the materials can be found online, and how to buy them at a reduced cost. Provide a description of how to acquire any permissions to use the materials, such as library reserves, journal subscriptions, and accounts for online materials (Albrecht, 2009; Barros, 2014; Davis, 1993; Hess & Whittington, 2003; Johnson, 2006; O’Brien et al., 2008; QM 4.1, 4.2, 4.3, 4.4, & 4.5; Soonpaa, 2018; Wolfe, 2004). |
| Assignments and evaluation | Provide the instructional methods that will be used to cover each topic of the course (e.g., lecture, reading, discussion) with a description of the assignments and activities that will be used throughout the course (e.g., tests, assignments, research projects). Clearly state the instructional method, course activities, and course assignments in the course schedule, with the class date and the topic that will be covered each day and when each activity and assignment is planned. Each activity should support the learning objectives of the course and provide opportunities for interactivity to promote active learning (Albrecht, 2009; Barros, 2014; Davis, 1993; Hess & Whittington, 2003; Johnson, 2006; O’Brien et al., 2008; QM 5.1, 5.2, 5.3, & 5.4; Soonpaa, 2018; Wolfe, 2004). |

- To provide your learners with clear times and dates for weekly meetings and what will be covered in each class time so they can be prepared for the class. Example: Readings, assignments, quizzes.

- To provide your learners with a description of what they will be graded on, how they will be graded, and when major assignments and tests are due. To
<table>
<thead>
<tr>
<th>Instructor</th>
<th>Learner support</th>
<th>Institutional policy statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>instructor will use to evaluate each assignment;</td>
<td>Provide a detailed description or link to the services available for learners that can help them succeed in the course, with a description of how to obtain these services. Services, such as access to the campus internet, the library, technical support, academic support, and student services accessibility policies (Albrecht, 2009; Barros, 2014; Davis, 1993; Hess &amp; Whittington, 2003; Johnson, 2006; O’Brien et al., 2008; QM 3.1, 3.2, 3.3, &amp; 3.4; Soonpaa, 2018; Wolfe, 2004).</td>
<td>Include the following statements and institutional policies with which the learner is expected to comply or provide links to current policies. An example of the standards will be the following:</td>
</tr>
<tr>
<td>The due date for the assignments and the possible points earned for each of them;</td>
<td>● To provide your learners with the variety of support services they have outside the course to aid their academic success. Example: Tutoring services, technical support, writing center.</td>
<td>● Diversity statement: Explain how a range of social representation is welcome, including race, class, gender, religion, accessibility, and socioeconomic status.</td>
</tr>
<tr>
<td>Policies on attendance and late or missing assignments;</td>
<td></td>
<td>● Technology statement: Clearly state the computer skills and digital information literacy skills expected of the learner, outline the technology requirements and resources needed for the course, and provide information on how to obtain the technologies (e.g., software and hardware students are expected to use and have available). Explain the communication expectations for online discussions, email, and other interactions.</td>
</tr>
<tr>
<td>Penalties in grades, including their rationale;</td>
<td></td>
<td>● Academic misconduct statement: Provide the learners with a clear description of academic misconduct.</td>
</tr>
<tr>
<td>Requirements that are expected, even if not graded (Albrecht, 2009; Barros, 2014; Davis, 1993; Hess &amp; Whittington, 2003; Johnson, 2006; O’Brien et al., 2008; QM 3.1, 3.2, 3.3, &amp; 3.4; Soonpaa, 2018; Wolfe, 2004).</td>
<td></td>
<td>To provide a list of accommodations for learners’ differences in terms of; disabilities, gender, religion, etc. Also, to provide your learners with a set of guidelines for academic misconduct. Example: Diversity statement, technology statement, academic misconduct statement</td>
</tr>
</tbody>
</table>

Example:
Project 1(30% of Final Grade): Reading and Responding to Texts—Culture and Identity

● Rhetorical analysis essay 50 points
● Identity essay (+ rough draft) 100 points
conduct and guidelines for maintaining academic integrity in the course and an explanation of the implications and consequences learners will face in the case of cheating, plagiarism, or any other areas of academic misconduct.

- Accommodation of students with disabilities: Clearly describe the accommodation policies to the learners and state how learners who meet the Americans with Disabilities Act requirements can request appropriate accommodations or assistance (Albrecht, 2009; Barros, 2014; Davis, 1993; Hess & Whittington, 2003; Johnson, 2006; O’Brien et al., 2008; QM 1.3, 1.4, 1.5, 1.6, 7.1, 7.2, 7.3, & 7.4; Soonpaa, 2018; Wolfe, 2004).

*Most of these statements can be found on the university website.

**Other universities may have other specific standards.

<table>
<thead>
<tr>
<th>Accessibility and usability of the syllabus</th>
<th>To provide your learners with accessible electronically or printable content Example: A portable version of the syllabus that can be downloaded and printed</th>
</tr>
</thead>
<tbody>
<tr>
<td>For electronic syllabus and course content, make sure they are readable and easy to navigate.</td>
<td>To provide your learners with accessible electronically or printable content Example: A portable version of the syllabus that can be downloaded and printed</td>
</tr>
<tr>
<td>All documents, text, visuals, internet links, and LMS pages are set to rich diverse learners.</td>
<td>To provide your learners with accessible electronically or printable content Example: A portable version of the syllabus that can be downloaded and printed</td>
</tr>
<tr>
<td>With multimedia materials, make sure they are easy to use and provide an alternative means to access these materials (MQ 8.1, 8.2, 8.3, &amp; 8.4).</td>
<td>To provide your learners with accessible electronically or printable content Example: A portable version of the syllabus that can be downloaded and printed</td>
</tr>
</tbody>
</table>

After identifying the ICO components, we will develop the interactive visual for each component of the ICO. When it comes to the development of the ICO, there are two main factors (a) developing the visual for each component and (b) developing the interactive features. Each component of the ICO will have a unique communication function, and different principles of psychology are applied to create these visuals. The two main psychological principles used are attention and cognitive load principles, plus the principles of the motivational visual.
As for interactivity, there are different definitions, theoretical methods, and classifications for the term “interactivity” in the literature (Black, Luna, Lund, & Walker, 2017). To develop interactivity for ICOs, the method that appears to be best employed is the definition of interactivity by different levels. As stated by Black et al. (2017), there are different levels of interactivity: low, medium, and high. The low level of interactivity is object interactivity (proactive inquiry), which occurs when users click on an object, such as buttons, people, and things, using a mouse, and it results in a particular form of audio or visual response. The medium level of interactivity involves hierarchical and hyperlinked interactivity (reactive navigation), which provides users with access to predefined options they can navigate and choose. Last, the high level of interactivity refers to virtual interactivity, which offers users a real-world experience through a computer-generated interactive environment that responds to users’ movements and actions (as cited in Black et al., 2017). Using this consideration, ICOs have three different levels of interactivity: low (proactive inquiry), medium (reactive navigation), and high. The low level offered gives the learner options using clickable buttons to view and navigate through the ICO content. The medium level is presented by providing learners with visuals, such as charts, graphics, and timelines, with predefined objects they can select from the content and a high level to give the user the option to choose how to view and navigate the information. Table 6 offers directions and guidance on how to develop the interactive visual for ICOs.

Table 6: Guidelines to Develop Interactive Visuals for ICOs.

<table>
<thead>
<tr>
<th>Components</th>
<th>Guidelines for Visuals</th>
<th>Guidelines for Interactivity Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home page</td>
<td>Because this page or layer will present all of the components of the ICO to help learners view the content, use</td>
<td>☐ Minimize text in the first layer to headings for the major sections of the ICO, allowing learners to scan the</td>
</tr>
</tbody>
</table>
| Instructor and course information | Use representational visuals of the content to support the textual information (Clark & Lyons, 2010) and place visuals with related text close to each other to avoid spreading learner attention (Clark & Lyons, 2010).  
Type of visuals that can be used:  
☑ A real picture of the course instructor with the name (Clark & Lyons, 2010; Pettersson, 2015a).  
☑ Symbols or icons that are clear for the time, date, location, phone number, and email (Pettersson, 2015a).  
☑ Visuals with reduced realism and quality, such as a cartoon or sample drawing that can easily convey or illustrate an idea (Pettersson, 2015a). | Visuals have clickable links to access more information so learners can easily find and locate more details (Black et al., 2017; Leavitt & Shneiderman, 2006; e.g., clicking on the course instructor picture to direct them to the instructor’s website, or the map icon takes learners to the class location). |
| Course overview | Use interpretive visuals of the content to help learners build an understanding of the course expectations (Clark & Lyons, 2010).  
The following visual types can be used:  
☑ A picture showing the learning environment (class), the subject field, or the job or career learners are pursuing (Clark & Lyons, 2010).  
☑ A picture of people in the class, working in the field, or the job will increase learners’ perceptions of the course content (Clark & Lyons, 2010; Pettersson, 2015a).  
☑ Interpretive visuals with reduced realism quality, such as a cartoon or sample drawings that can quickly convey an illustration of the idea | Provide learners with clickable links to access more course information (Black et al., 2017; Leavitt & Shneiderman, 2006; e.g., link to the course department). |
| Course Goals and Objectives | Here are different ways to visualize this component:  
- Use signals to focus learners’ attention, such as typographic cues (text font, size, or color) or attention directing graphics (arrows, icons) (Clark & Lyons, 2010; Pettersson, 2015a).  
- Use explanatory visuals to show what is expected from learners to pass the course. It can be charts, graphics, or maps (Clark & Lyons, 2010).  
- The visual has rollovers or pop-ups with text callouts that become visible when learners click the mouse over various parts of the visuals (Black et al., 2017; Clark & Lyons, 2010).  
- Give learners the option to manipulate one section or in this case, one goal at a time (Clark & Lyons, 2010). | |
| Course Instructional Materials | Use representational visuals to support the textual information (Clark & Lyons, 2010), and place the visuals close to the related text (Clark & Lyons, 2010). The following visual types can be used:  
- Picture of the book cover with the book title (Pettersson, 2015a).  
- Symbols or icons that are clear and representational of articles, videos, etc. (Pettersson, 2015a).  
- Visuals with reduced realism such as a cartoon or sample drawing that can easily convey an idea (Pettersson, 2015a).  
- Visuals have clickable links to access more information about the course materials (Black et al., 2017; Leavitt & Shneiderman, 2006; e.g., clicking on the book’s picture, which directs them to a website where they can buy the book or links to book chapters, articles, videos. | |
| Course outline (course schedule) | Use a simple visual to show learners what they expect to work on at a particular point in time during the course (Clark & Lyons, 2010). Interpretive visuals, such as timelines or calendars, can be used to show what is covered each week.  
- Specific days (assignment due dates or tests) will have text feedback when clicking or using rollovers and pop-ups on those particular days to provide learners with more information about the assignment or test (Clark & Lyons, 2010). You can give learners the option of clickable links to access the assignments or tests (Black et al., 2017; Leavitt & Shneiderman, 2006). | |
<p>| Assignments and evaluation | Use transformational visuals, such as bar graphics or pie charts to show how each assignment and test affects their overall grade (Clark &amp; Lyons, 2010), and each assignment presented by comparing areas to show who they are part of the total | Provide text feedback when clicking or using rollovers and pop-ups on specific parts in the visual to allow learners to understand how each assignment, test, and so on will be graded (Black et al., 2017; Clark &amp; Lyons, 2010). |</p>
<table>
<thead>
<tr>
<th>Learner support</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Use clear pictures, symbols, or icons that represent each service and the resources available for the learners (Clark &amp; Lyons, 2010; Pettersson, 2015a), and place the related textual information close to the visuals (Clark &amp; Lyons, 2010).</td>
</tr>
<tr>
<td>- Avoid overusing visuals and minimizing graphics used solely as eye candy (Clark &amp; Lyons, 2010; Pettersson, 2015a).</td>
</tr>
<tr>
<td>Visuals have clickable links to access more information about each service and the resources available so learners can easily find and locate them (Black et al., 2017; Leavitt &amp; Shneiderman, 2006).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Institutional policy statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Supplement text in institutional policies with visuals that represent each policy (Clark &amp; Lyons, 2010; Pettersson, 2015a), align each visual with the text related to it, and position them close to each other (Clark &amp; Lyons, 2010).</td>
</tr>
<tr>
<td>- Avoid distracting visuals and minimizing graphics used solely as eye candy (Clark &amp; Lyons, 2010; Pettersson, 2015a).</td>
</tr>
<tr>
<td>Visuals have clickable links to access more information about each policy so learners can easily access them (Black et al., 2017; Leavitt &amp; Shneiderman, 2006).</td>
</tr>
</tbody>
</table>

**Example of an Interactive Course Organizer (ICO)**

To view an example of an ICO click the link below: