Course Design Guide

Rebecca Argenbright
INTE5660: Self-paced eLearning Modules
University of Colorado – Denver, Fall 2015

Introduction

This document serves as a guide to all course design specifications considered during development of *Uh-Oh, Tomato!*, a self-paced eLearning module about common tomato pests and natural repellant methods. This course design guide includes analysis findings; a high-level design plan and production pathway; interface, key layouts, and color scheme; flowcharts and storyboards; and an assessment strategy.

Analysis findings

A principle of instructional design is that every project should begin with a healthy dose of analysis, as suggested by the first of the phases that make up the ADDIE acronym: Analysis, Design, Development, Implementation, and Evaluation. Following a model such as ADDIE "provides a means for sound decision making in order to determine the *who*, *what*, *when*, *where*, *why*, and *how* of a learning program" (Clark, 2015). The following section details the instructional problem that *Uh-Oh, Tomato!* aims to solve, as well as its learning objectives, target audience, content sources, and technical specifications.

Problem

Personal gardening is steadily on the rise. This New York Time article's title says it all: "Vegetable gardens are booming in a fallow economy" (Tavernise, 2011). Growing one's own produce (or purchasing locally-grown items) is quickly becoming the norm – especially in rural communities, where consumers find it to be less expensive than shopping at grocery stores. Some even find it to be profitable: Tavernise's article notes an increase in sales of garden surplus in rural communities.

Tomatoes are the most popular homegrown vegetable in the United States (Butterfield, 2009), and they can be grown all over the world. In fact, the countries that make up the top ten producers of tomatoes in 2012 represent all continents except Antarctica (Food and Agriculture Organization of the United Nations, 2014). A wealth of information exists online about cultivating this fruit–perhaps to an overwhelming degree. For example, a Google search for '*grow tomatoes*' yields nearly 3.5 million results. Even an attempt to zero in on a more specific facet of the craft ('*tomato pests*') yields more than 950,000 results.

Gardeners who choose hastily from their online results without considering their source are at risk of implementing dangerous pest control methods, especially application of pesticides. Consuming produce treated with pesticides can result in a range of side effects, including "cancer, birth defects, reproductive harm, neurological and developmental toxicity, immunotoxicity, and disruption of the endocrine system" (Mott, *et. al.*, 1997). Readers with concerns about the validity and/or environmental impact of their chosen pest repellant may seek information from scholarly outlets. However, upon finding such information, they are often met with written reports that contain few vivid graphics or multimedia elements.

The goal of this module is to present basic, evidence-based information about identifying and safely repelling tomato pests in an engaging delivery method. Based on the Multimedia, Modality, and Personalization principles introduced in *Six Principles of Effective e-Learning: What Works and Why*, the net result should be an increase in learning over text alone (Clark, 2002).

Objectives

This module enables learners to:

- Identify which class of pest is affecting a tomato plant based on the appearance of damage to the plant's roots, stem, fruit, and/or leaves.
- Identify and distinguish between common pests from each class, based on appearance.
- Match pests with appropriate biological and cultural control methods.

Content sources

Given the prevalence of information available on the subject and the potential dangers of using an inappropriate method of pest control, it is important that the content sources for this module are backed by valid research. Potential sources include the following (and similar) organizations:

- The North Carolina State University Center for Integrated Pest Management
- The Pennsylvania Integrated Pest Management program, an extension of the Pennsylvania State University College of Agricultural Sciences
- The University of Georgia College of Agricultural and Environmental Sciences
- The Ohio State University College of Food, Agricultural, and Environmental Sciences
- The University of Maryland College of Agricultural and Natural Resources

Target audience

This module is designed for tomato gardeners belonging to the Personal Gardening 101 Networked Learning Space (NLS)[1] who are interested in learning how to identify and safely repel the most common tomato pests. Though it is designed for this group, the module is meant to be suitable for anyone with interest in the topic.

Some audience considerations to be addressed during module development:

- Learners may not consume this content unless they already have a pest problem. So that such potential learners can evaluate the module's usefulness to their specific situation, a high-level overview of its contents should be visible without being required to launch the content, and learners must be able to easily skip through content at their discretion.
- Learners will come from many different cultural and linguistic backgrounds. The Personal Gardening 101 NLS has 199 different members across six continents[2].

[1] The NLS was established in October 2014 as an assignment for INTE 5665: Social Media and Digital Cultures, a requirement for the Master of Arts in Information & Learning Technologies at University of Colorado – Denver. All project deliverables are at http://goo.gl/gqQY6e.
[2] As of Friday, December 11, 4:32 AM Eastern Standard Time.

- Because the NLS is moderated in English, it is anticipated that learners will have some level of proficiency with the language. Even so, transcripts and other resources must be available in file formats that can be processed by automated translators such as Google Translate.

Technical specifications

To complete this module, learners must have access to a high-speed Internet connection and a computer, tablet, or smartphone with Internet connectivity. Following are technical specifications for this module's hosting and development:

- Authoring tool: Adobe Captivate 8
- Output format: HTML5, which ensures compatibility with mobile devices (Pappas, 2014).
- Host site: www.becca-argenbright.com
- Webserver: BlueHost

High-level design

The following tables describe the treatments to be employed for each objective.

Objective 1: Identify class of pest based on appearance of damage

Content Outline	Treatment
I. Assessing plant damage a. Damage of leaf-miner/fruit-borer i. Punctured fruit that ripens early ii. Snakelike "mining" pattern on leaves b. Damage of leaf-chewer i. Chewn leaf edges ii. Square-shaped droppings c. Damage of sap sucker i. Misshapen leaves ii. Stunted growth shoots d. Damage of root/stem feeder i. Chopped stalks ii. Chopped leaves near soil	Illustrated tomato plant appears with damage to 4 areas. Prompt asks learners to identify damage by scrolling over the plant and clicking interactive hot spots. Clicking each damaged area yields a new page highlighting specific indications for each class of pest. These indications are presented using zoom widgets that allow learners to get a close-up view of damage.

Objective 2: Characterize a common pest from each class by appearance

Content Outline	Treatment
I. Identifying pests a. Miner/borer: Fruitworm (moth larvae) i. Slender, dark brown w. long stripes (orange/white) ii. Young larvae mine into leaves; bore into fruit as they mature b. Leaf-chewer: Hornworm (moth larvae) i. Fat, green, w. horn on rear ii. Climbs plant, chews upper leaves, returns to soil to form cocoon c. Sap-sucker: Aphid i. Tiny green insect; wispy legs & antennae ii. Lays eggs & matures on plant, sucks moisture from leaves/stalks d. Root/stem-feeder: Cutworm (moth larvae) i. Like fruitworm in size/shape (and sometimes color); also green, grey, yellow, striped ii. Life cycle occurs at soil level; feeds on seedlings/new transplants	"Line-up" of pest silhouettes appears, labeled by class. Scrolling over each shadow reveals an image and the pest name (fruitworm, hornworm, aphid, cutworm). Each pest branches to a new page containing three photographs describing the appearance, life cycle, and other characteristics of the selected pest. Clicking on each photo reveals an image of a hand holding a notepad with notes about the image subject.

Objective 3: Match pests with appropriate control methods

Content Outline	Treatment
I. Repelling pests naturally a. Biological v. cultural controls i. Biological: Natural enemies that prey on the pest ii. Cultural: Human intervention b. Broadest-reaching controls: i. Biological: Wasps & ladybugs ii. Cultural: Control weeds to affect proximity of breeding, develop favorable conditions for biological controls	Images for biological and cultural controls appear; each branches to a new page with zoom widgets and examples of the selected controls as they pertain to the pests.

Assessment strategy

Peers and instructors will provide Level 1 feedback. Additionally, there is one knowledge check at the end of the course. It is comprised of three questions, each designed specifically with the objectives in mind. All three questions use Captivate's *drag and drop* functionality. Learners first identify what class pest caused the damage presented in images in Question 1. In Question 2, they distinguish between the three different worms discussed in the module. Finally, in Question 3, they assign each of the four pests to a biological or cultural control method. Learners must successfully answer each question before moving on to the next one and eventually completing the course.

Production pathway

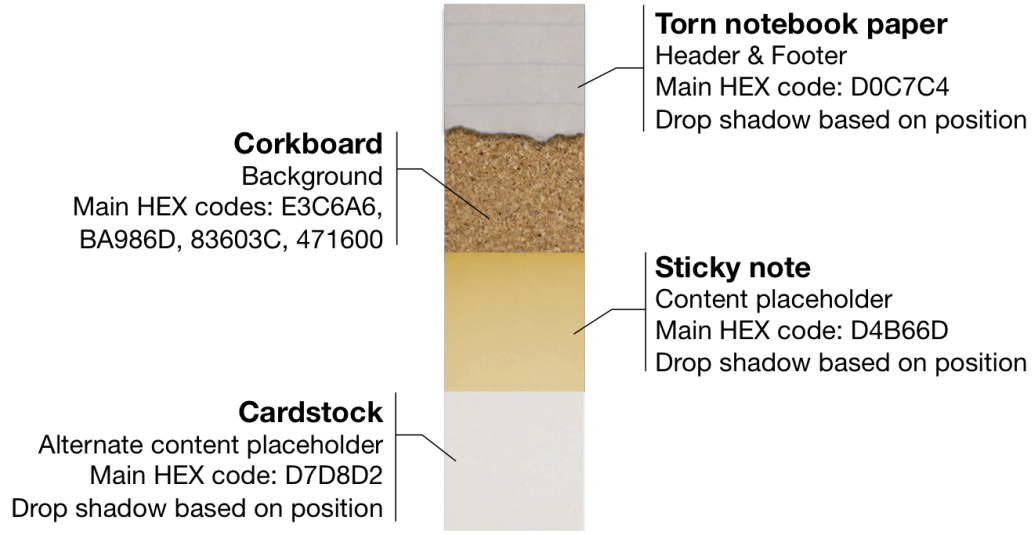
This table specifies the tools and processes involved in production of the various components of this module, such as documents, imagery, audio, and web hosting. All files will be stored locally and backed up on a web server.

Element		Process	Tools	Notes
Design Docs		Produce	Microsoft (MS) Office	.docx (working), .pdf (published)
Images	**Photos, Illustrations**	Create	Cited images	Cite images from scholarly sources and creative commons, request permission for copyrighted work and use accordingly .xcf (working), .png (produced)
		Edit	GIMP	
	Clipart	Create	GIMP	
Audio/Video		Record	iMac PhotoBooth	Record video introduction
		Produce	Camtasia	.mp4 output
Courseware Development		Create	Adobe Captivate 8	Assemble final components
LMS		Upload	Yummy FTP, BlueHost	Use Yummy FTP to create folder structure on BlueHost web server, upload accordingly
		Distribute	Personal website	Add to portfolio under Academic Projects
			Google+	Post to Google+ community Pests page

Design specifications

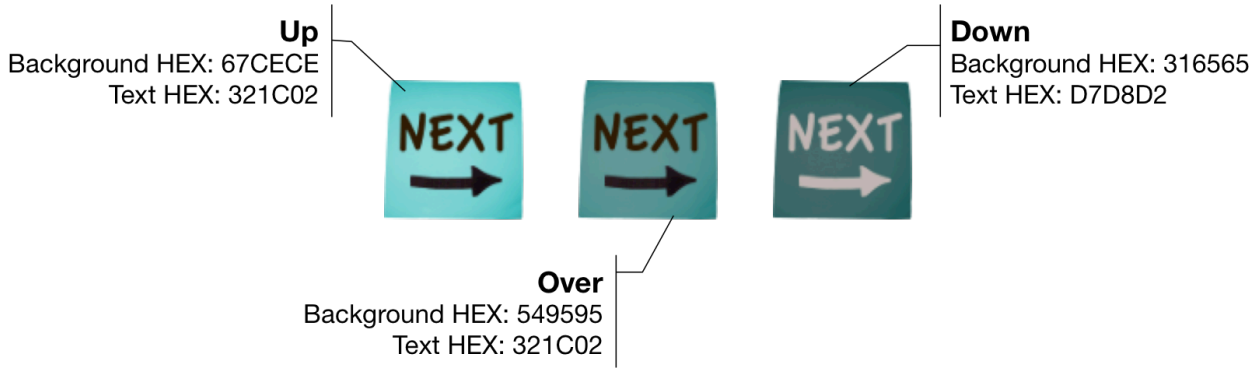
The following table specifies textural elements, colors, and fonts used in this module.

Textural elements



Navigation buttons

The course's navigation buttons are sticky notes with *Casual* font. There are three styles based on cursor activity: Up (no cursor activity), Over (cursor hovers over button), and Down (cursor click). Drop shadows are applied depending on placement.

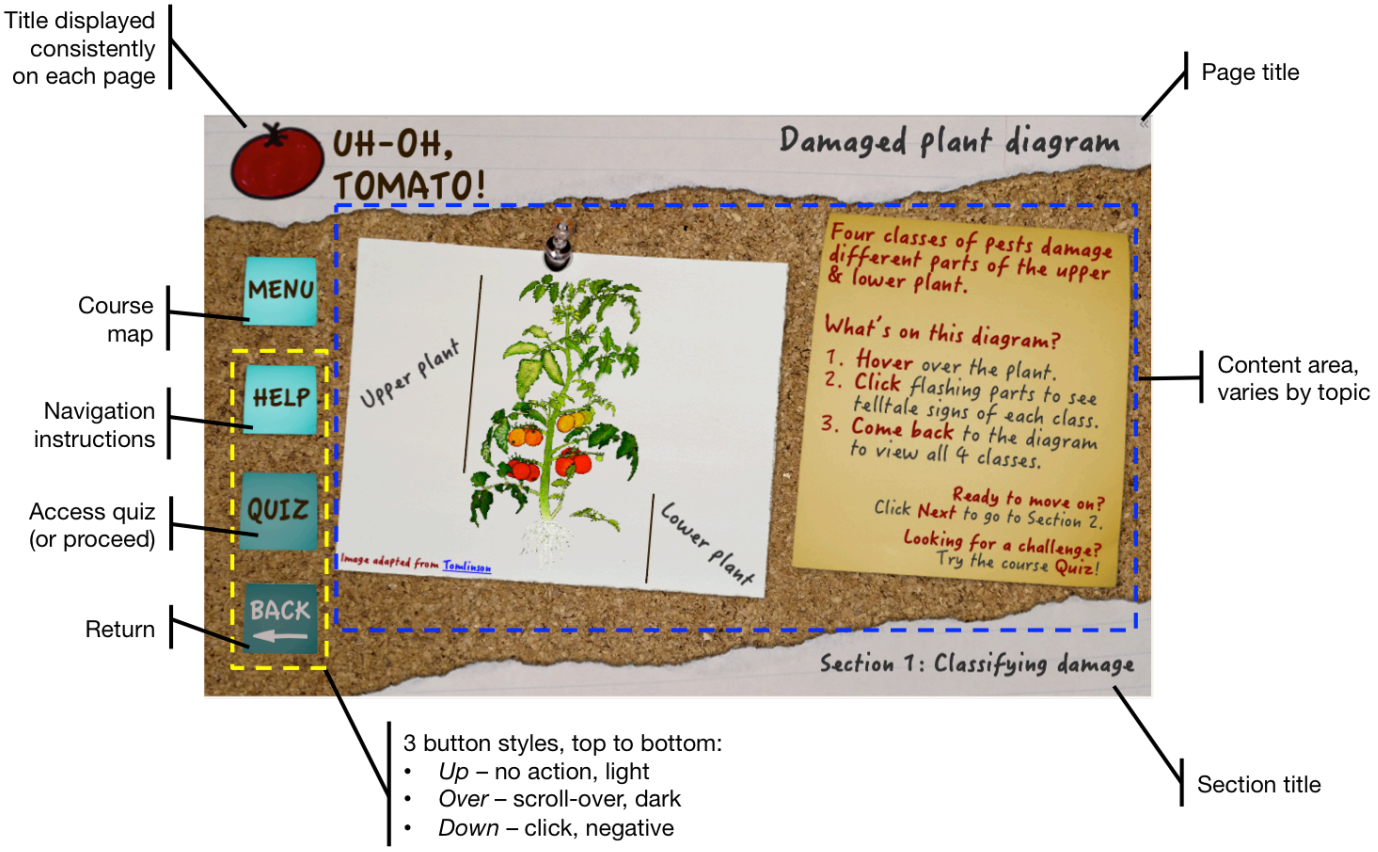


Other colors and fonts

The course title is a hand-drawn tomato with *Casual* font. All other text appears in *HanziPen SC* (HEX 343434). The decision to choose script-like fonts was deliberate to maintain continuity with the overall interface aesthetic.

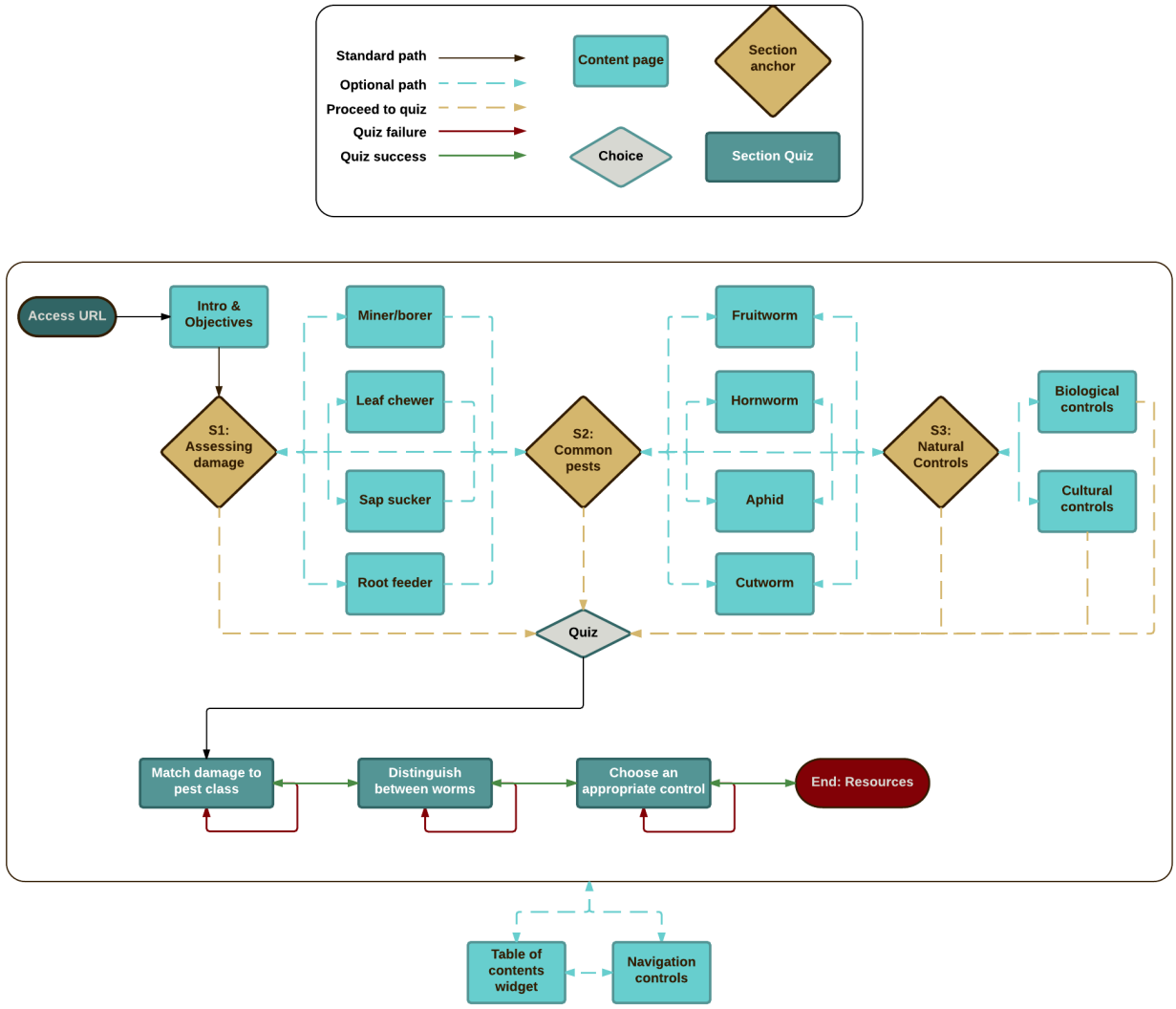
Interface Layout

Following is an annotated view of the core layout. Production resolution is 1024x627.



Flowchart

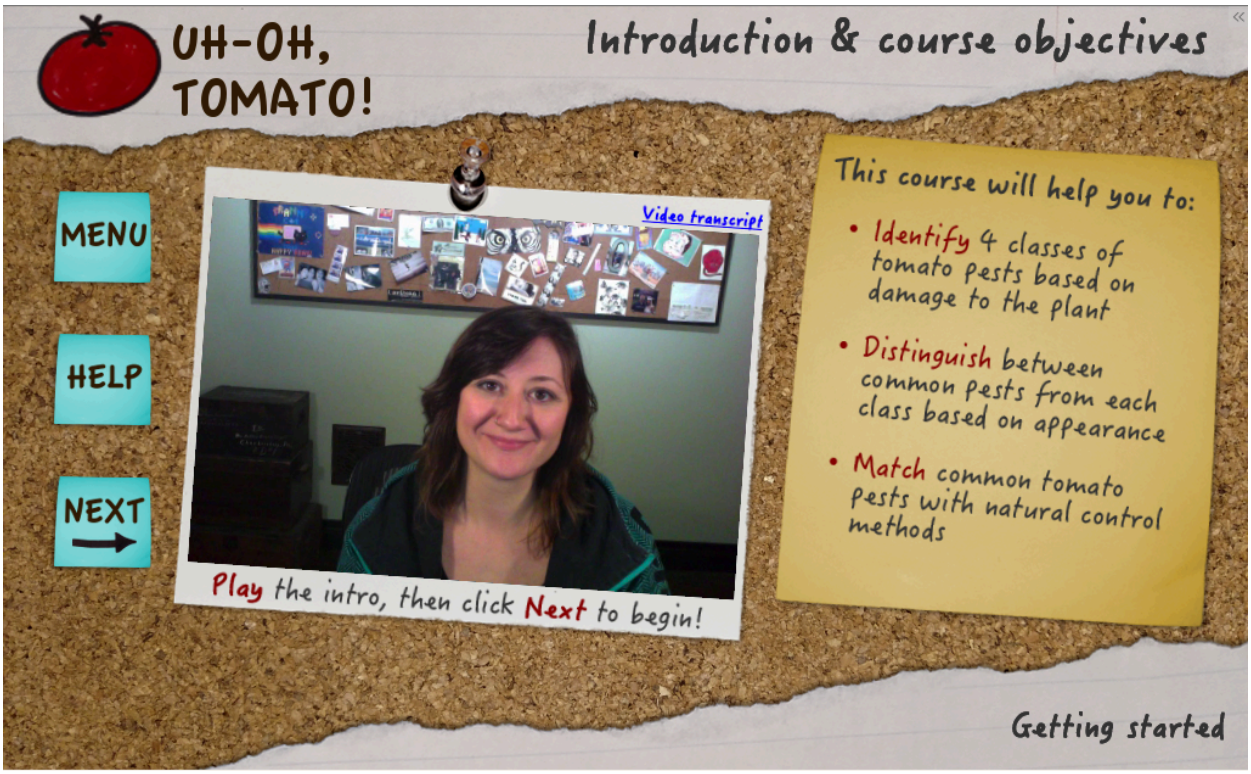
This image illustrates the intended flow from section to section in this module.



Storyboards

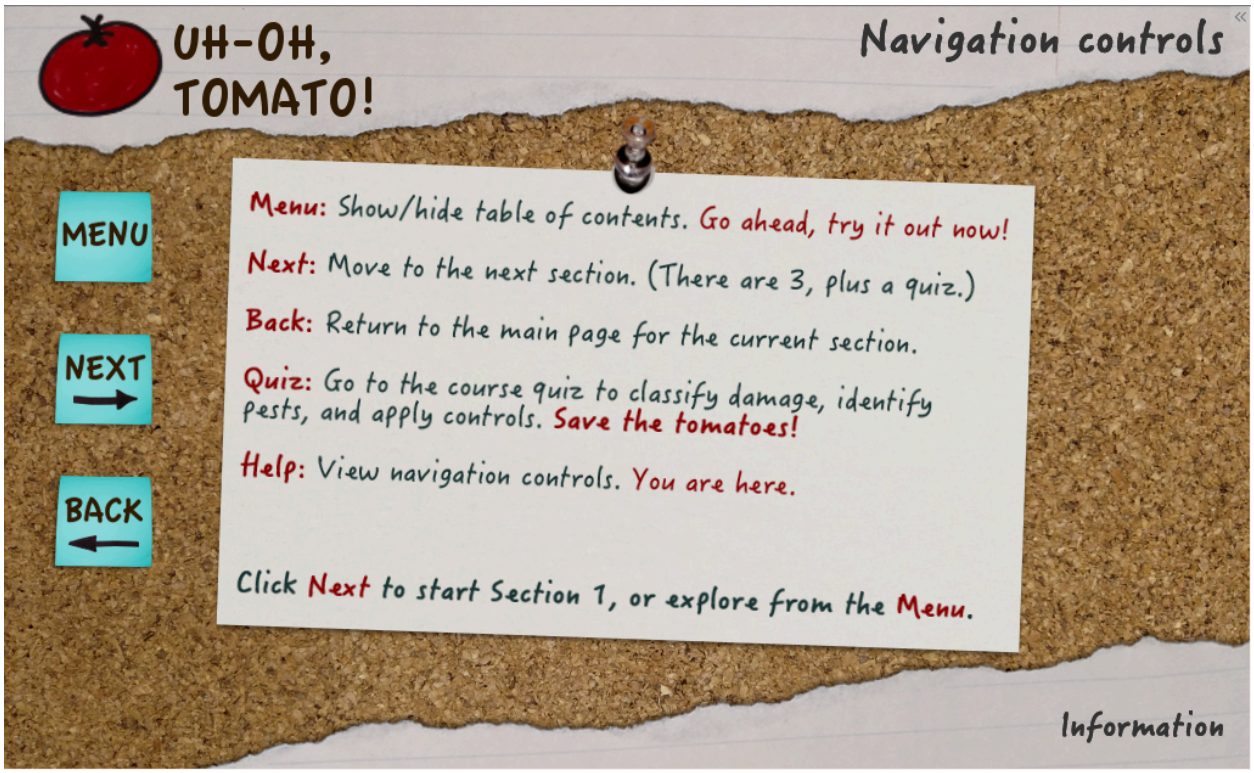
The remaining sections represent the final interface for this project, which have evolved through planning and implementation phases. Each entry provides the slide number, Course section and page title, script, shot list (where applicable), navigation plans, and additional notes considered during production.

Slide 1 – Getting Started: Introduction & course objectives



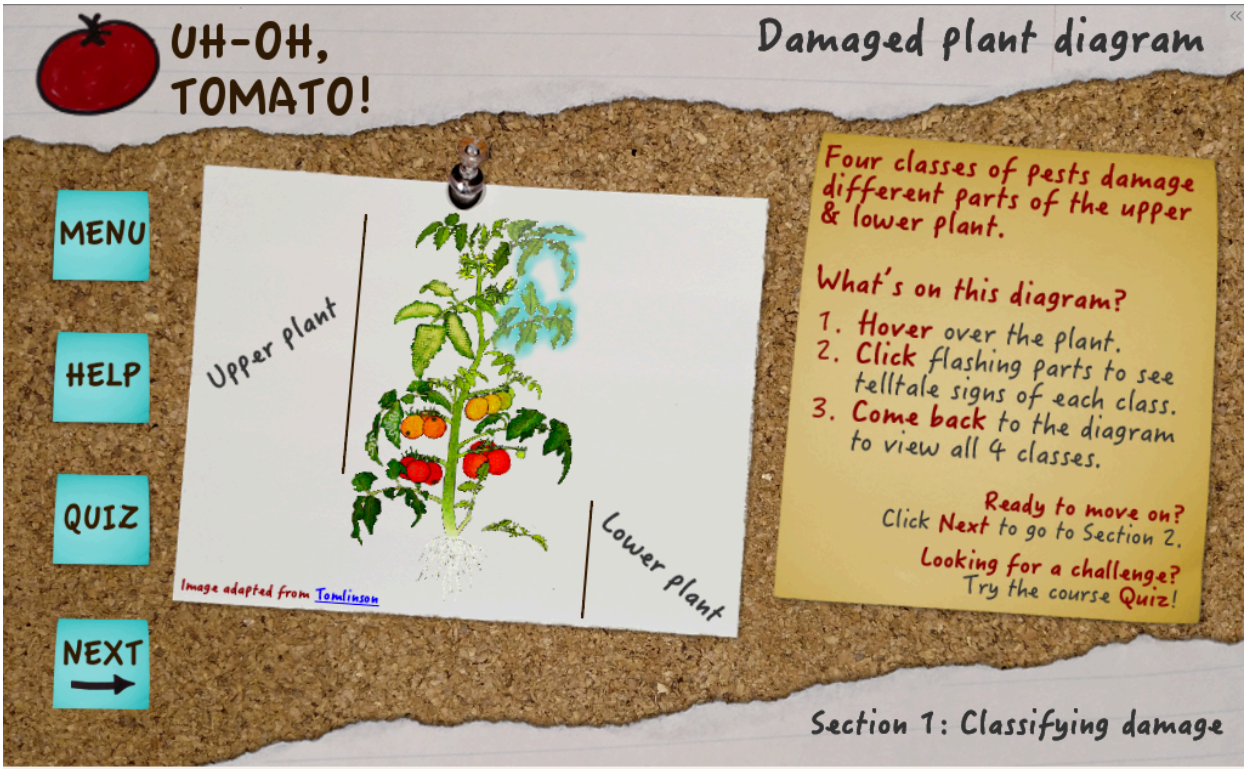
Narration script
Hi! My name is Becca. I get a lot of satisfaction out of growing my own tomatoes, and chances are if you're watching this, you probably do too. Stop for a moment and think about all the different kinds of cuisine that can include tomatoes in their dishes. Some that come to mind for me are Indian, Italian, and Mexican. I'd keep going, but I'm already pretty hungry as it is. It's no surprise, though, that tomatoes are one of the most popular crops grown all around the world. Unfortunately, there are a lot of different pests that can keep us from getting the most out of our plants. Sometimes it's hard to tell which pest is which, or what to do with them once we've found them. Pesticides are an option, but they aren't the healthiest. Lucky for you, I've done some research on the topic, and I've posted my findings on the bulletin board behind me. Wanna take a look at my notes? Then click *Next* to get started.
Navigation
Menu > Table of contents Help > Navigation controls Next > Section 1 anchor
Notes
Video duration: 1 minute Subject: Author in front of bulletin board Transcript link points to PDF of narration script.

Slide 2 – Information: Navigation controls



Navigation
Menu > Table of contents Next > Section 1 anchor Back > Introduction & Objectives
Notes
Table of contents slides in from right and allows learners to jump from one topic to another at will.

Slide 3 – Section 1: Classifying Damage - Damaged Plant Diagram



Navigation

Menu > Table of contents
Help > Navigation controls
Quiz > Course quiz
Next > Section 2 anchor

Branching:
Orange fruit/leaves > Signs of leaf miners/fruit borers
Upper-right leaf > Signs of leaf chewers
Yellow-flecked leaves > Signs of sap suckers
Lower-right leaf > Signs of root & stem feeders

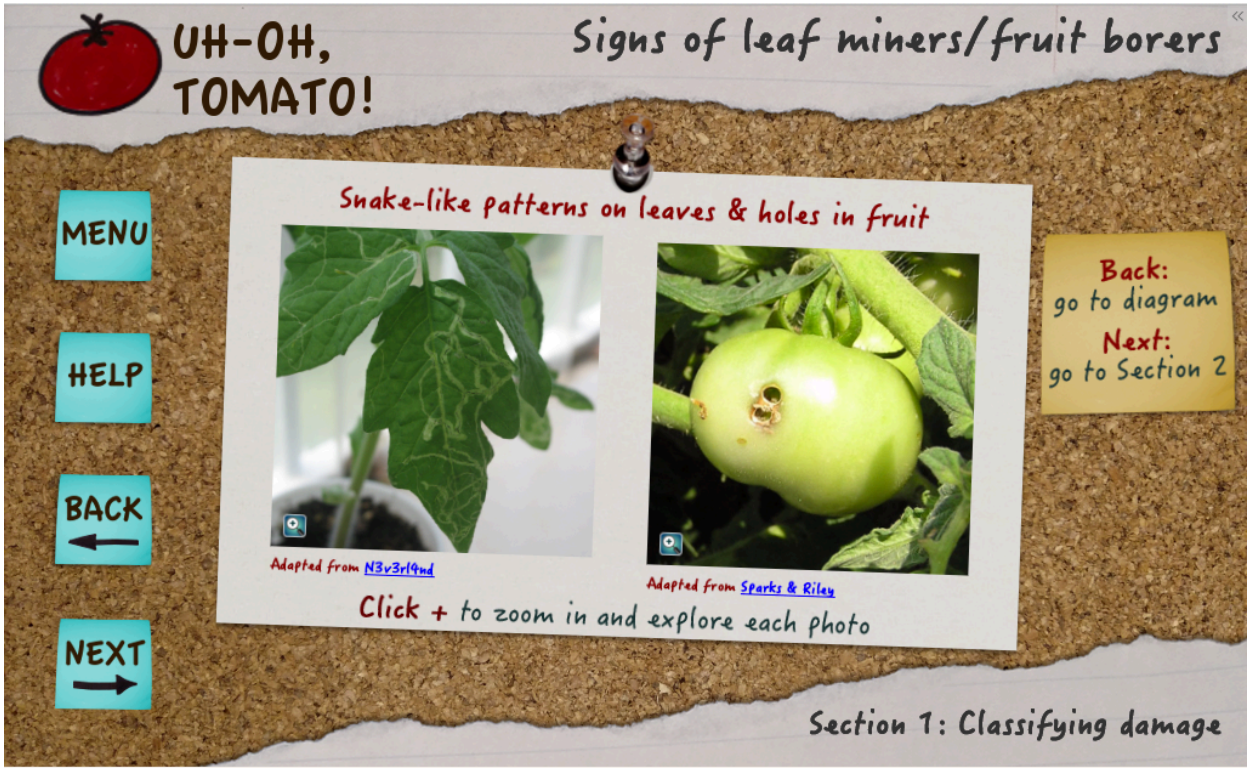
Notes

Tomlinson: http://ag.arizona.edu/hydroponictomatoes/pruning.htm

This is the anchor page for four Section 1 sub-pages.

Each branching point is responsive, as shown above. The blue highlight appears upon rollover.

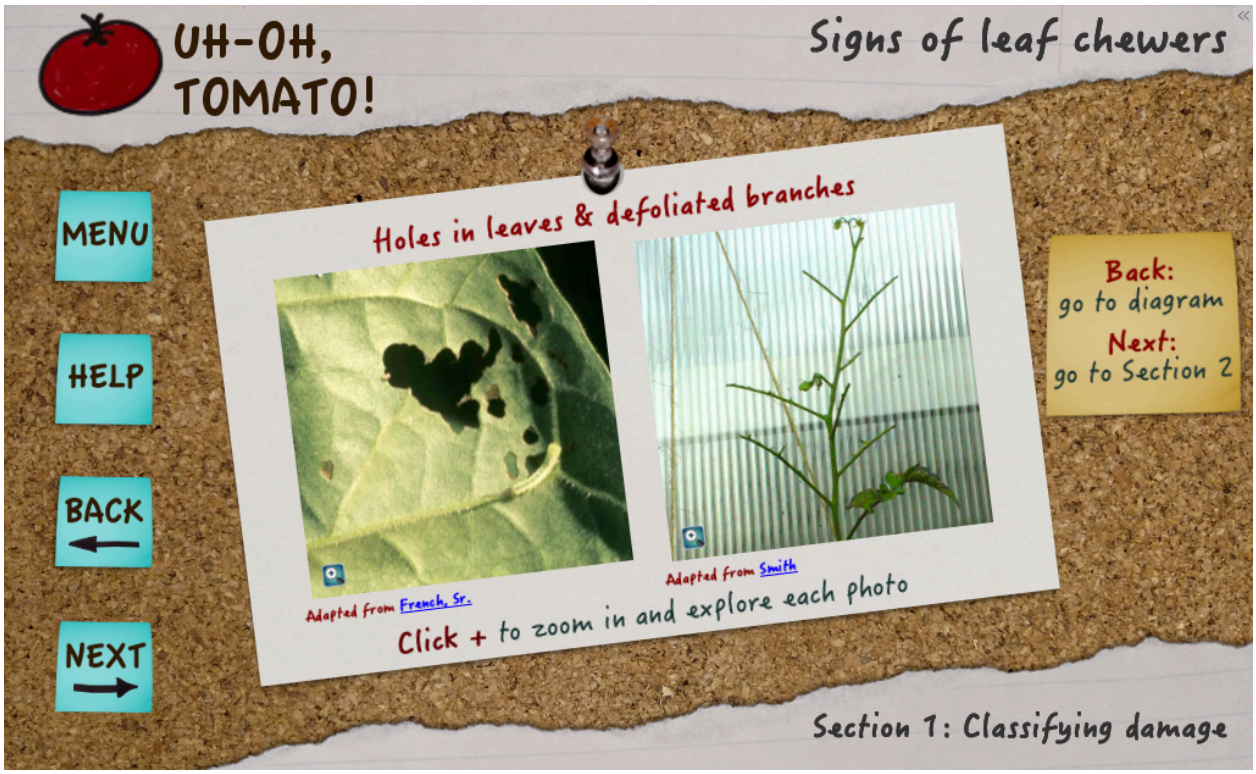
Slide 4 – Section 1: Classifying damage – Signs of leaf miners/fruit borers



Navigation
Menu > Table of contents Help > Navigation controls Back > Section 1 anchor Next > Section 2 anchor

Notes
Learners can click on each zoom icon to enlarge the images. N3v3rl4nd: https://en.wikipedia.org/wiki/Leaf_miner#/media/File:Leaf-miner-tomato.jpg Sparks & Riley: http://www.ent.uga.edu/veg/solanaceous/images/11worm-damage-large.jpg

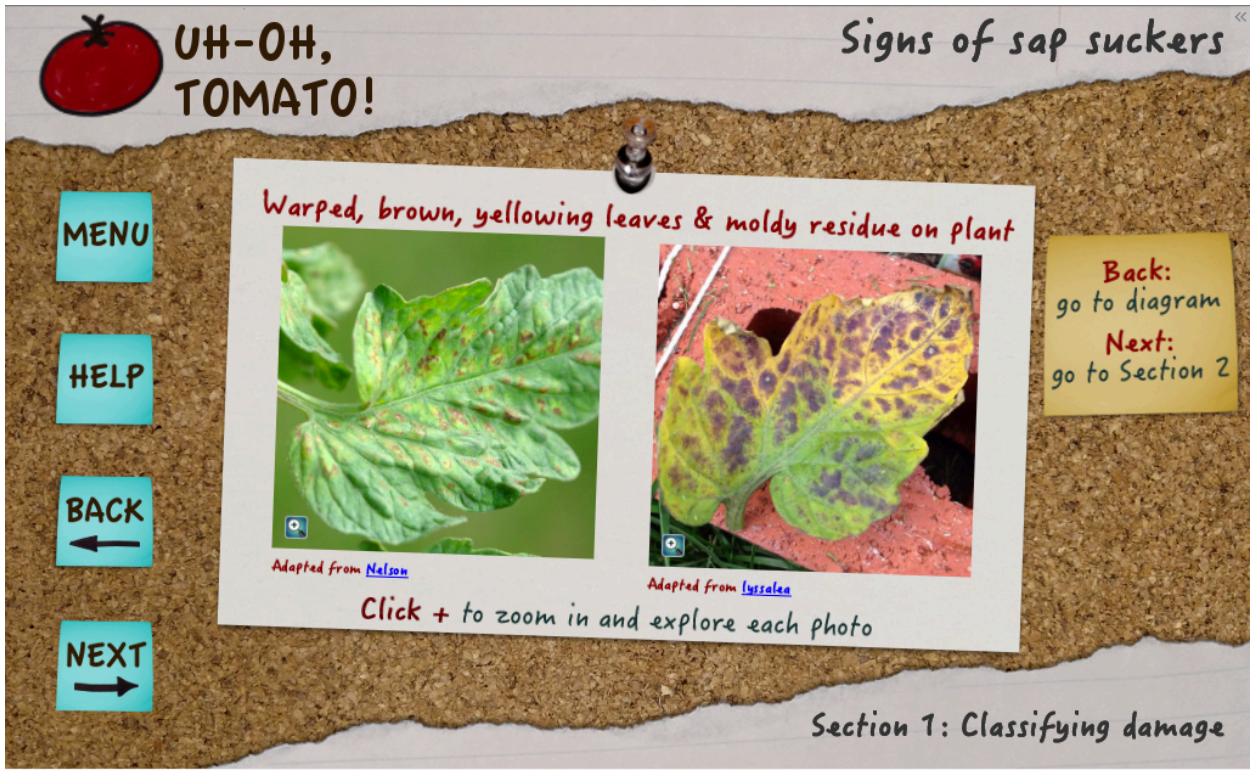
Slide 5 – Section 1: Classifying Damage – Signs of leaf chewers



Navigation
Menu > Table of contents Help > Navigation controls Back > Section 1 anchor Next > Section 2 anchor

Notes
Learners can click on each zoom icon to enlarge the images. French, Sr.: http://www.extension.umn.edu/Garden/diagnose/plant/annualperennial/petunia/leavesholesorchewed.html Smith: http://www.extension.umn.edu/garden/insects/find/tomato-hornworms-in-home-gardens/

Slide 6 – Section 1: Classifying Damage – Signs of sap suckers



Navigation
Menu > Table of contents Help > Navigation controls Back > Section 1 anchor Next > Section 2 anchor

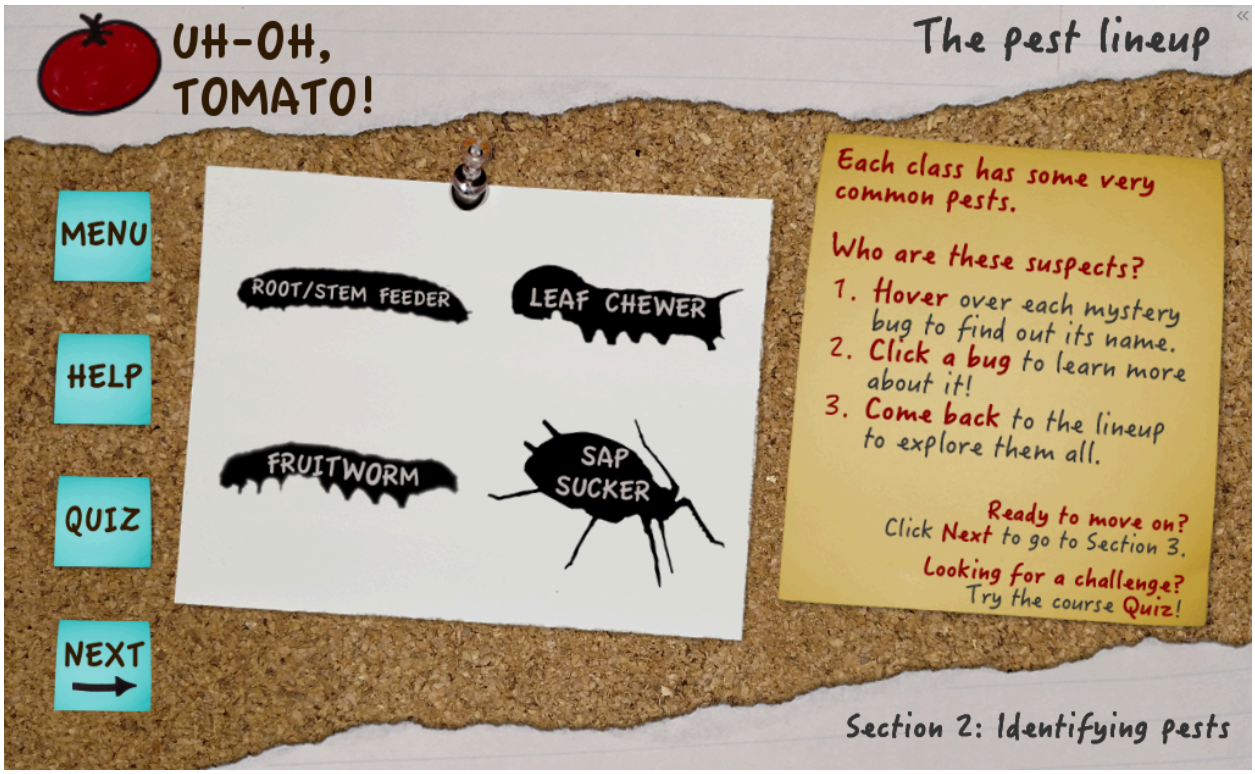
Notes
Learners can click on each zoom icon to enlarge the images. Nelson: https://www.flickr.com/photos/scotnelson/9416609961 Lyssalea: http://forums.gardenweb.com/discussions/2091974/leaf-mold-blight-aphids-all-of-them-help

Slide 7 – Section 1: Classifying Damage – Signs of root & stem feeders

Navigation
Menu > Table of contents Help > Navigation controls Back > Section 1 anchor Next > Section 2 anchor

Notes
Learners can click on each zoom icon to enlarge the images. McIntosh-Shetter: http://www.tomatocasual.com/2011/12/30/the-mystery-of-the-fallen-tomato-plants/ Tomato Dirt: http://www.tomatodirt.com/Tomato_Dirt-tomato-dirt-newsletter-43.html

Slide 8 – Section 2: Identifying pests – The pest lineup



Navigation
Menu > Table of contents Help > Navigation controls Quiz > Course quiz Next > Section 3 anchor Branching: Top left > About cutworms Top right > About hornworms Lower left> About fruitworms Lower right> About aphids

Notes
This is the anchor page for four Section 2 sub-pages. Each branching point is responsive, as shown above (refer to *Fruitworm*). The name on each pest silhouette changes on rollover to reveal the name of a common pest from that class.

Slide 9 – Section 2: Identifying pests – About fruitworms

Navigation
Menu > Table of contents Help > Navigation controls Back > Section 2 anchor Next > Section 3 anchor

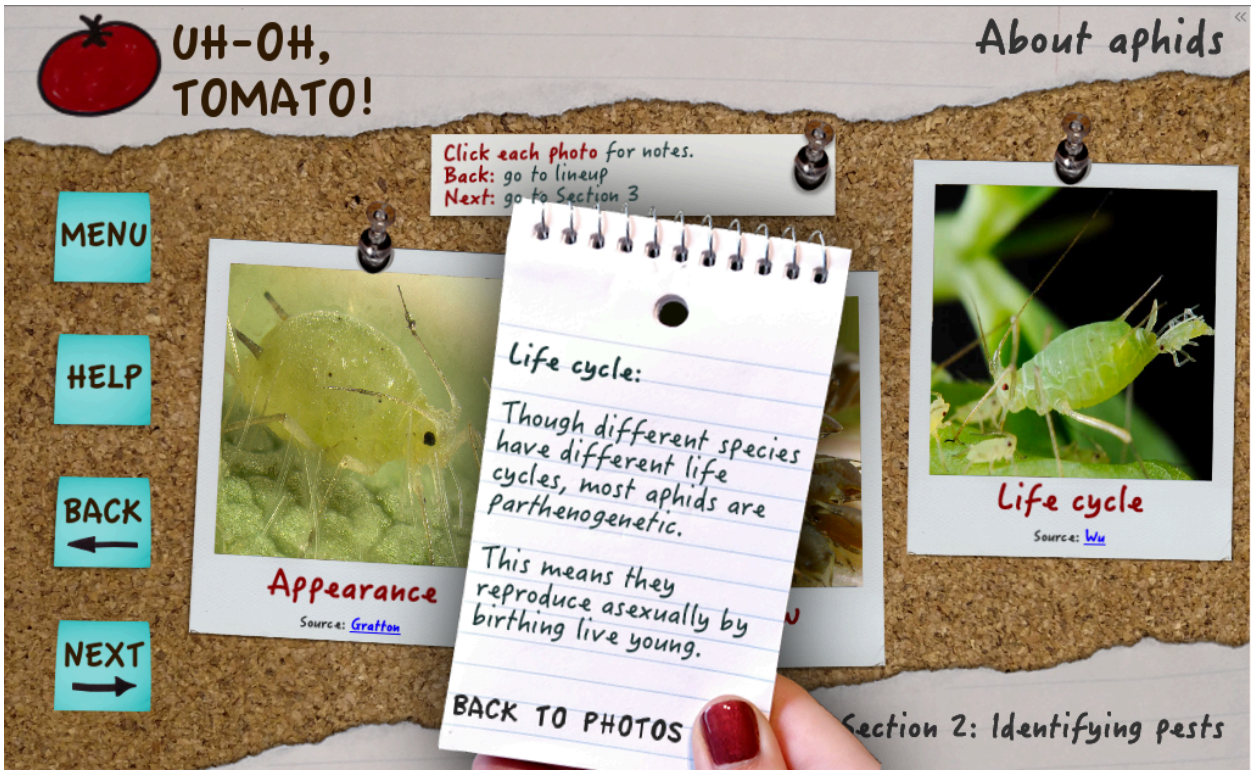
Notes
The photos are responsive. On click, each one reveals a hand and notepad describing the image. *Back to photos* hides each hand/pad. Rockamann: http://www.earthdancefarms.org/2012/08/field-update-priorities-lilies-and-fruitworms/ Manska: https://upload.wikimedia.org/wikipedia/commons/e/e4/Tomato_fruitworm.jpg Lymantria: https://upload.wikimedia.org/wikipedia/commons/b/b2/Helicoverpa_zea1.jpg

Slide 10 – Section 2: Identifying pests – About hornworms

Navigation
Menu > Table of contents Help > Navigation controls Back > Section 2 anchor Next > Section 3 anchor

Notes
The photos are responsive. On click, each one reveals a hand and notepad describing the image. *Back to photos* hides each hand/pad. Chiu: http://www.tienchiu.com/2011/08/tomato-hornworm/ Stalk of Fennel: http://www.chotelaboratories.com/garden_diary/?page_id=307&paged=3 Vogt: https://www.newscientist.com/article/dn13412-butterflies-remember-caterpillar-experiences/

Slide 11 – Section 2: Identifying pests – About aphids



Navigation
Menu > Table of contents Help > Navigation controls Back > Section 2 anchor Next > Section 3 anchor

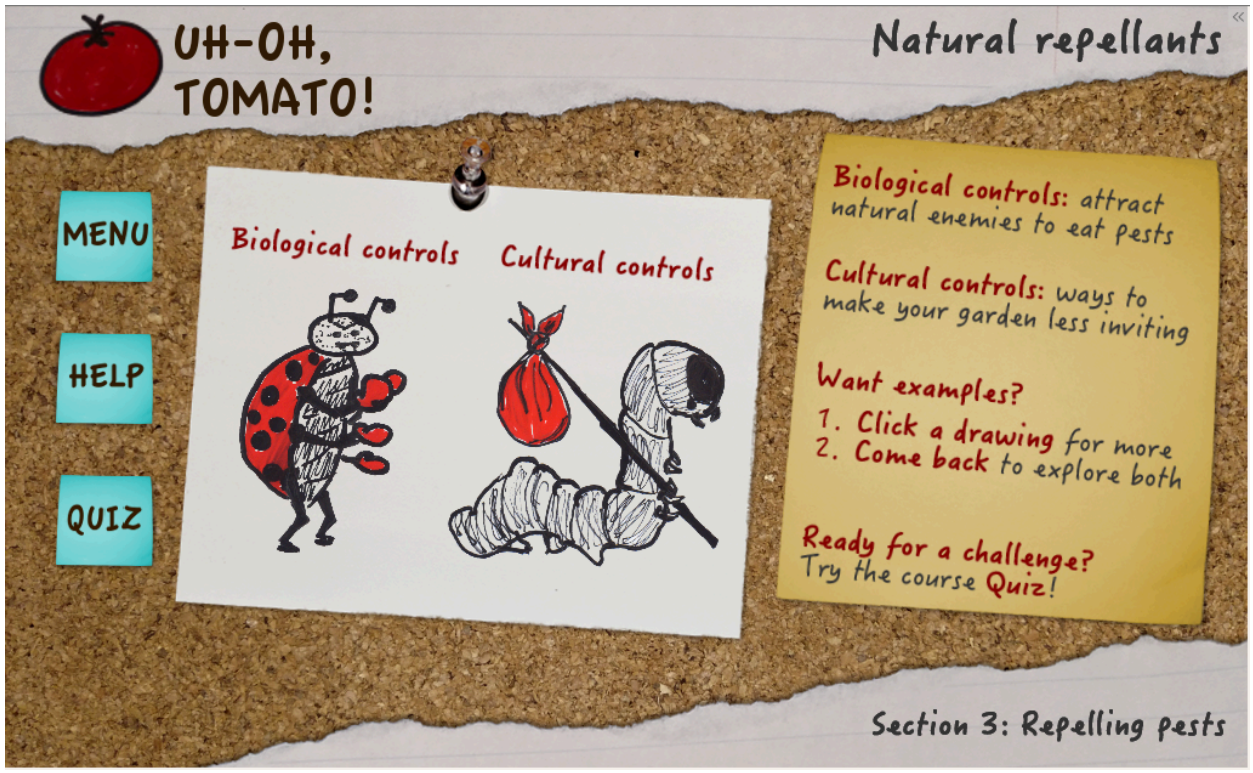
Notes
The photos are responsive. On click, each one reveals a hand and notepad describing the image. *Back to photos* hides each hand/pad. Gratton: https://commons.wikimedia.org/wiki/File:Soybeanaphid.jpg Chien: http://photo.net/photodb/photo?photo_id=937141 Wu: http://www.scienceimage.csiro.au/mediarelease/mr10-21.html

Slide 12 – Section 2: Identifying pests – About cutworms

Navigation
Menu > Table of contents Help > Navigation controls Back > Section 2 anchor Next > Section 3 anchor

Notes
The photos are responsive. On click, each one reveals a hand and notepad describing the image. *Back to photos* hides each hand/pad. Hahn & Wold-Burkness: http://www.extension.umn.edu/garden/insects/find/cutworms-in-home-gardens/ MUExtension417: https://flic.kr/p/eEKwkV Bennyboymothman: http://bensale-essexmoths.blogspot.com/2013/06/a-pupa-has-hatched.html

Slide 13 – Section 3: Repelling pests – Natural repellants



Navigation
Menu > Table of contents Help > Navigation controls Quiz > Course quiz Branching: Boxing ladybug > Biological controls Hobo caterpillar > Cultural controls
Notes
This is the anchor page for two Section 3 sub-pages.

Slide 14 – Section 3: Repelling pests – About biological controls

Navigation
Menu > Table of contents Help > Navigation controls Back > Section 3 anchor Next > Course quiz

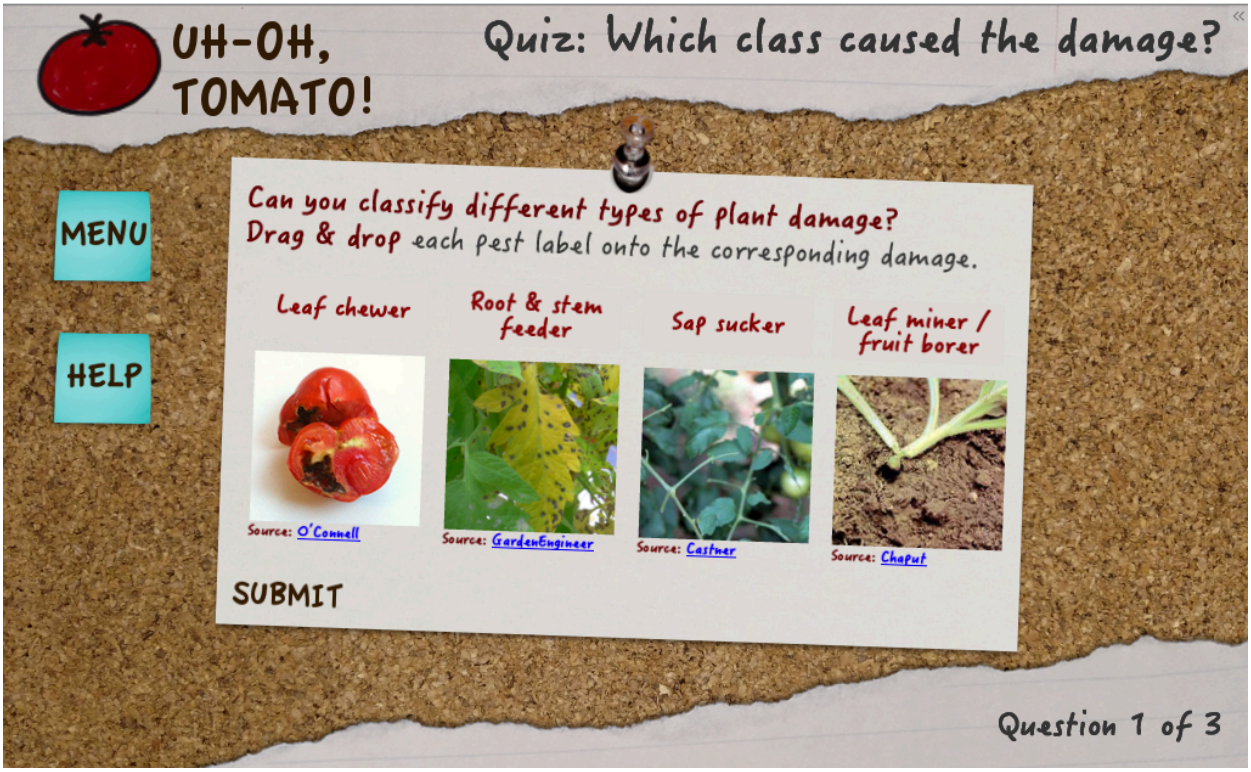
Notes
Learners can click on each zoom icon to enlarge the images. Carroll: https://flic.kr/p/frHnKv San Martin: https://flic.kr/p/bq6pN5 Stsmith: https://upload.wikimedia.org/wikipedia/commons/3/30/Tomato_Hornworm_Parasitized_by_Braconid_Wasp.jpg

Slide 15 – Section 3: Repelling pests – About cultural controls

Navigation
Menu > Table of contents Help > Navigation controls Back > Section 3 anchor Next > Course quiz

Notes
Learners can click on each zoom icon to enlarge the images. Friesel: https://flic.kr/p/57CWfg Sand Holler Farms: http://sandhollerfarm.com/die-cutworm-die/ Ilovebutter: https://flic.kr/p/8qZQSh

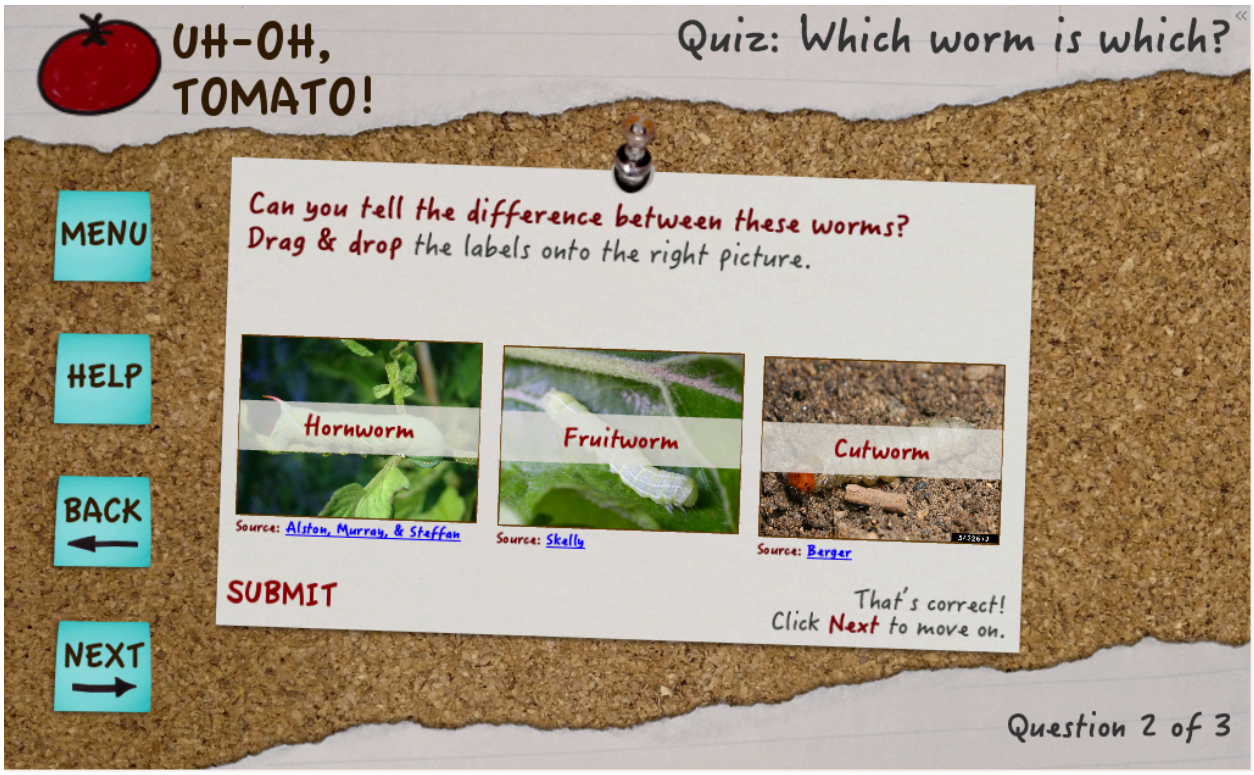
Slide 16 – Quiz: Question 1 – Which class caused the damage?



Navigation
Menu > Table of contents Help > Navigation controls Next > Question 2 (hidden until success)

Notes
Learners drag and drop each label to the appropriate image, then click *Submit*. Correct response reveals the Next button to move on and a "success" caption. Incorrect response reveals a "retry" caption, along with recommendation to revisit Section 1. Correct answers: Leaf chewer > Castner Root & stem feeder > Chaput Sap sucker > GardenEngineer Leaf miner/fruit borer > O'Connell Castner: http://entnemdept.ufl.edu/creatures/field/hornworm.htm Chaput: http://www.omafra.gov.on.ca/english/crops/facts/00-055.htm GardenEngineer: https://gardenengineer.wordpress.com/2013/10/23/september-27-2013/ O'Connell: https://flic.kr/p/aWtrRz

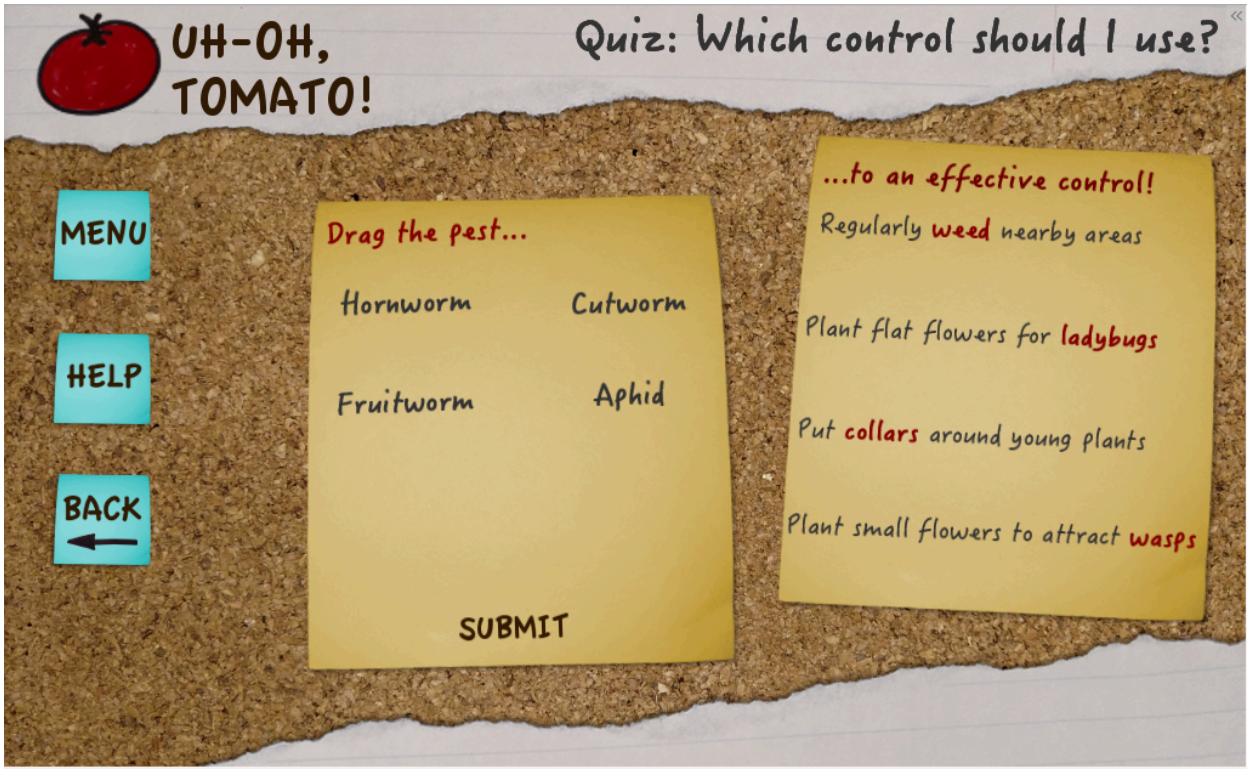
Slide 17 – Quiz: Question 2 – Which worm is which?



Navigation
Menu > Table of contents Help > Navigation controls Next > Question 3 (hidden until success)

Notes
Learners drag and drop each label to the appropriate image, then click *Submit*. Correct response reveals the Next button to move on and a "success" caption. Incorrect response reveals a "retry" caption, along with recommendation to revisit Section 2. Correct answers: Cutworm > Berger Fruitworm > Skelly Hornworm > Alston, Murray & Steffan Alston, Murray, & Steffan: http://utahpests.usu.edu/ipm/htm/fruits/fruit-insect-disease/fruitworm10 Skelly: http://www.growyourownnevada.com/hornworms/ Berger: https://www.myfields.info/pests/pale-western-cutworm

Slide 18 – Quiz: Question 2 – Which worm is which?



Navigation

Menu > Table of contents
Help > Navigation controls
Next > Exit course and view references (hidden until success)

Notes

Learners drag and drop each label to the appropriate image, then click *Submit*. Correct response reveals a “success” caption and the Next button. Incorrect response reveals a “retry” caption, along with recommendation to revisit Section 2.

Correct answers:
Cutworm > Berger
Fruitworm > Skelly
Hornworm > Alston, Murray & Steffan

Alston, Murray, & Steffan: http://utahpests.usu.edu/ipm/htm/fruits/fruit-insect-disease/fruitworm10

Skelly: http://www.growyourownnevada.com/hornworms/

Berger: https://www.myfields.info/pests/pale-western-cutworm

Summary

This document has reviewed a number of critical design decisions for *Uh-Oh, Tomato!*. The module is designed particularly with learner autonomy in mind, considering the previously mentioned possibility for learners to approach the module with an existing issue and interest in a specific area rather than the entire course. A primary goal was to ensure that learners can move easily through each topic and between section.

References

Adobe Corporation, (2012). *Adobe Captivate help: Creating accessible projects*. Retrieved from https://helpx.adobe.com/captivate/using/creating-accessible-projects.html

Butterfield, B. (2009). *The impact of home and community gardening in America.* South Burlington: National Gardening Association. Retrieved from http://www.nativeseeds.org/pdf/2009-impact-of-gardening-in-America-white-paper.pdf

Clark, D. R. (2015). *Why instructional system design and ADDIE?* Big Dog & Little Dog's Performance Juxtaposition. Retrieved from www.nwlink.com/~donclark/hrd.sat1.html

Clark, R. (2002). *Six principles of effective e-learning: what works and why.* The eLearning Developers' Journal, 1-9.

Food and Agriculture Organization of the United Nations. (2014). *FAOSTAT*. Retrieved from http://faostat.fao.org/site/567/default.aspx#ancor

Mott, L., Fore, D., Curits, J., & Solomon, G. (1997). *Our children at risk – the five worst environmental threats to their health, chapter 5: pesticides.* New York: National Resources Defense Council. Retrieved from http://www.nrdc.org/health/kids/ocar/chap5.asp

Pappas, C. (2014). *The ultimate list of html5 elearning authoring tools*. Retrieved from http://elearningindustry.com/the-ultimate-list-of-html5-elearning-authoring-tools

Tavernise, S. (2011). *Vegetable gardens are booming in a fallow economy.* The New York Times. Retrieved from http://www.nytimes.com/2011/09/09/us/09gardening.html?_r=0