eLearning Module Design Plan

Aviation Weather: Convection & Thunderstorms

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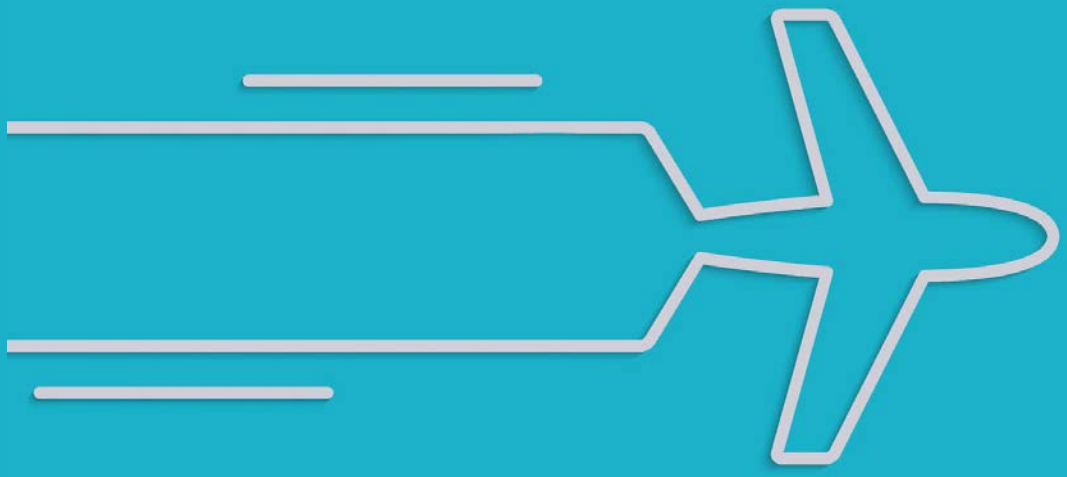

SKYHIGH AVIATION
FLIGHT SCHOOL

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OVERVIEW

INTRODUCTION

The Skyhigh Aviation Flight School currently holds an in-person, instructor-led course on aviation weather for students seeking a private pilot license. The course meets twice weekly for six weeks. The course presents overviews on five areas of aviation weather: Weather & Meteorology, Pressure & Wind, Cold Weather Flying Operations, Hot Weather Flying Operations, Convection & Thunderstorms, and Decoding METARs, TAFs, etc.

PROBLEM

Skyhigh Aviation Flight School wants to move away from in-person, instructor-led courses and convert them into self-paced courses. Students seeking their private pilot licenses have varying schedules and want to move through the curriculum at different paces. Skyhigh would like to develop self-paced courseware for students to meet this need.

Skyhigh has several training programs along with the private pilot program. If they convert their instructor-led courses into self-paced online courseware, they can offer these courses online to students in their other programs (commercial, airline transport, helicopter). They can also offer these courses online to those outside the programs, such as individuals in the aviation industry or current pilots who may need to gain continuing education credits.

Skyhigh's private pilot curriculum currently features an in-person, instructor-led course on aviation weather that meets twice weekly for six weeks. The school is finding that private pilot students come from all backgrounds and most of them have difficulty finding the time to meet in person.

Before converting most of their in-person courses to self-paced courseware, Skyhigh would like to convert their aviation weather course to see how well it is received by the students. This project is one portion of the course: Convection & Thunderstorms.

SOLUTION

Skyhigh Aviation wants to develop an online component to their training programs. They want to use the Aviation Weather course to find out how successful it is before converting many of their other ground school courses to an online format. The Aviation Weather course will replace their in-person course.

METHODOLOGY

The analysis effort included the following activities:

- Interviewed SMEs
- Interviewed current and past students through surveys
- Interviewed current instructor
- Reviewed content of similar courses
- Conducted basic literature review (books, magazines, web)

TARGET AUDIENCE

The target audience for this course is student pilots in the program's private pilot license track. These students are diverse in age, ranging from 17 to 62. The course is aimed towards students in the beginning portion of their training program. Most students live within 50 miles of the flight school, but others live further away. Because this program is for private pilots, the motivation for completing it varies. Some students are retired and trying to earn their private license for pleasure, and many are individuals who work full-time in non-aviation careers and don't have the time to come to campus twice weekly.

The students are interested in the course topic, but there have been noted comments from students who are frustrated by the class meeting times (twice a week) and a feeling that the topic could be covered either online or self-paced through workbooks. Moving this course online would greatly improve course completion rates and times, reach a broader number of students, and improve morale by not requiring students to come to the campus to complete it.

OBJECTIVES

The course objectives for the "Thunderstorm" module are:

- Identify cloud types associated with convective weather.
- Distinguish types of thunderstorms.
- Interpret the stages in the life of a thunderstorm.
- Describe aviation hazards associated with thunderstorms and convective weather conditions.
- Know about general rules when encountering thunderstorms and convective weather, and to identify potential weather hazards and plans of action when encountering these situations

CONTENT SOURCES

Federal Aviation Administration. (Aug. 23, 2016). Advisory Circular: Aviation Weather, AC 00-6B. Retrieved from https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_00-6B.pdf

http://www.weather.gov/source/zhu/ZHU_Training_Page/turbulence_stuff/turbulence/turbulence.htm

http://www.weather.gov/source/zhu/ZHU_Training_Page/icing_stuff/icing/icing.htm

http://www.weather.gov/media/zhu/ZHU_Training_Page/clouds/cloud_recognition/cloud_recognition.pdf

https://www.srh.noaa.gov/jetstream/tstorms/life.html

http://www.weather.gov/media/zhu/ZHU_Training_Page/clouds/cloud_recognition/cloud_recognition.pdf

TECHNICAL PLATFORM

The courseware will be designed and programmed to the following specifications (i.e., required student equipment):

- Resolution: 1280 x 800 screen resolution
- Connection: Internet connection is required

CONTENT SOURCES

The high level of design for each objective is as follows:

Objective 1: Identify and match cloud types associated with convective weather.

Objective 2: Distinguish types of thunderstorms.

Objective 3: Interpret the stages in the life of a thunderstorm.

Topic 1: Understanding Thunderstorms

Subtopic 1: Clouds & Types of Thunderstorms

Content Outline	Treatment
Detail 1: Clouds • Identifying clouds associated with convection • Cumulonimbus (CB), Altocumulus Castellanus (ACCAS), Mammatus, Shelf Clouds	Display images of cloud types. Drag and drop interaction matching cloud images with their definitions.
Detail 2: Types of Thunderstorms • Single Cell (rare, can be avoided by pilots with exceptions (when embedded in other clouds, at night, etc.) • Multi-Cell – Almost all thunderstorms are multicell, they are cluster of cells, usually several hours in duration • Squall-Lines – A barrier to air traffic – too tall to fly over, too dangerous to fly through or under, and difficult to circumnavigate. 25% of tornadoes spawn from these. • Supercell – Very dangerous, always accompanied by severe weather.	Each slide features text, photographs, radar/satellite images, and cross-cut illustration of that type of thunderstorm.

Subtopic 2: Life Cycle of a Thunderstorm	
Content Outline	**Treatment**
Detail 1: **Cumulus Stage** • Warm, moist air rises in a buoyant plume or in a series of convective updrafts. • The air begins to condense into a cumulus cloud. • The rising and cooling air results in the development of a positive feedback mechanism. • As the warm air within the cloud continues to rise, it eventually cools and condenses. • The condensation releases heat into the cloud, warming the air. This causes it to rise adiabatically.	Interactive menu. Learner clicks on stage of thunderstorm, and to the right is an illustration and text information about that particular stage.
Detail 2: **Mature Stage** • Characterized by the presence of both updrafts and downdrafts within the cloud. • The downdrafts are initiated by the downward drag of falling precipitation. • As it develops, the cumulus cloud continues to increase in size, height and width. • Cloud to ground lightning usually begins when the precipitation first falls from the cloud base. • During this phase of the life cycle, the top of the resulting cumulonimbus cloud will start to flatten out, forming an anvil shape often at the top of the troposphere.	Interactive menu. Learner clicks on stage of thunderstorm, and to the right is an illustration and text information about that particular stage.

Subtopic 2: Life Cycle of a Thunderstorm (cont.)	
Content Outline	**Treatment**
Detail 3: **Dissipating/Decaying Stage** • Characterized by downdrafts throughout the entire cloud. Decay often begins when the supercooled cloud droplets freeze. • Glaciation usually first appears in the anvil, which becomes more pronounced in this stage. • The cloud begins to collapse because no additional latent heat is released after the cloud droplets freeze, and because the shadow of the cloud and rain cooled downdrafts reduce the temperature below the cloud. • The decay of a thunderstorm can also be initiated when the precipitation within the storm becomes too heavy for the updrafts to support, when the source of moisture is cut off, or when lifting stops.	Interactive menu. Learner clicks on stage of thunderstorm, and to the right is an illustration and text information about that particular stage.

Objective 4: Distinguish aviation hazards associated with thunderstorms and convective weather conditions.

Topic 2: Aviation Hazards Relating to Thunderstorms

Slide will have interactive menu with 6 types of aviation hazards (subtopics 1-6) relating to convection. Learner will click on aviation hazard, which will open information on the right.

Subtopic 1: Convective Turbulence

Content Outline	Treatment
Detail 1: • Convective turbulence is turbulent vertical motions that result from convective currents and the subsequent rising and sinking of air.	Text about convective turbulence.
Detail 2: • Visible signs and conditions of convective turbulence	Text about convective turbulence.
Detail 3: • Aviation hazards relating to convective turbulence	Text about convective turbulence.

Subtopic 2: Icing

Detail 1: • Thunderstorms produce abundant supercooled liquid water above the freezing level. When temperature in the upward current cools to about -15 °C, much of the remaining water vapor sublimates as ice crystals. • Supercooled water can exist at temperatures as cold as -40 °C in the presence of vigorous upward vertical motion, such as in a thunderstorm updraft. • Thunderstorm icing can be extremely hazardous to pilots.	Text about icing.

Objective 4: Distinguish aviation hazards associated with thunderstorms and convective weather conditions.

Topic 2: Aviation Hazards Relating to Thunderstorms (cont.)

Subtopic 3: Rapid Altimeter Changes

Content Outline	Treatment
Detail 1: • Pressure usually falls rapidly with the approach of a thunderstorm, then rises sharply with gust frontal passage and arrival of heavy rain showers in the cold downdraft, falling back to normal as the storm moves away. • This cycle of pressure change may occur in as little as 15 minutes.	Text about rapid altimeter changes.

Subtopic 4: Static Electricity

Detail 1: • Static electricity is caused by intense corona discharges from sharp metallic points and edges of flying aircraft. It is encountered often in the vicinity of thunderstorms.	Text about static electricity.

Subtopic 5: Tornado

Detail 1: • A tornado is a violently rotating column of air in contact with the ground.	Text about tornadoes.

Subtopic 6: Hail

Detail 1: • Hail is precipitation in the form of balls or other irregular lumps of ice produced by thunderstorms. • Thunderstorms that are characterized by strong updrafts, large supercooled liquid water contents, large cloud-drop sizes, and great vertical height are favorable to hail formation.	Text about hail.

Objective 5: Interpret general rules when encountering thunderstorms and convective weather, and identify what to do when involved in situations involving turbulence, etc.

Topic 3: Thunderstorm Avoidance

Subtopic 1: General Rules for Pilots

Content Outline	Treatment
Detail 1: • General information on avoiding thunderstorms	Learner will click on interactive menu which will open information about each subtopic.

Subtopic 2: Guidance When Encountering Issues

Detail 1: • Technical information for pilots when encountering issues relating to turbulence, etc.	Learner will click on interactive menu which will open information about each subtopic.

EVALUATION STRATEGY

Objective	Strategy
OBJECTIVE 1: Identify and match cloud types associated with convective weather.	Provide a drag and drop matching activity. The learner drags an image of a cloud type to its correct definition.
OBJECTIVE 2: Distinguish types of thunderstorms.	The learner will be evaluated on their knowledge of the types of thunderstorms in the quiz at the end of the module.
OBJECTIVE 3: Interpret the stages in the life of a thunderstorm.	The learner will be evaluated on their knowledge of each life cycle in the quiz at the end of the module.
OBJECTIVE 4: Distinguish aviation hazards associated with thunderstorms and convective weather conditions.	The learner will be evaluated on their knowledge of aviation hazards in the quiz at the end of the module.
OBJECTIVE 5: Interpret general rules when encountering thunderstorms and convective weather, and identify what to do when involved in situations involving turbulence, etc.	The learner will be evaluated on their knowledge of each life cycle in the quiz at the end of the module.

PRODUCTION PATHWAY

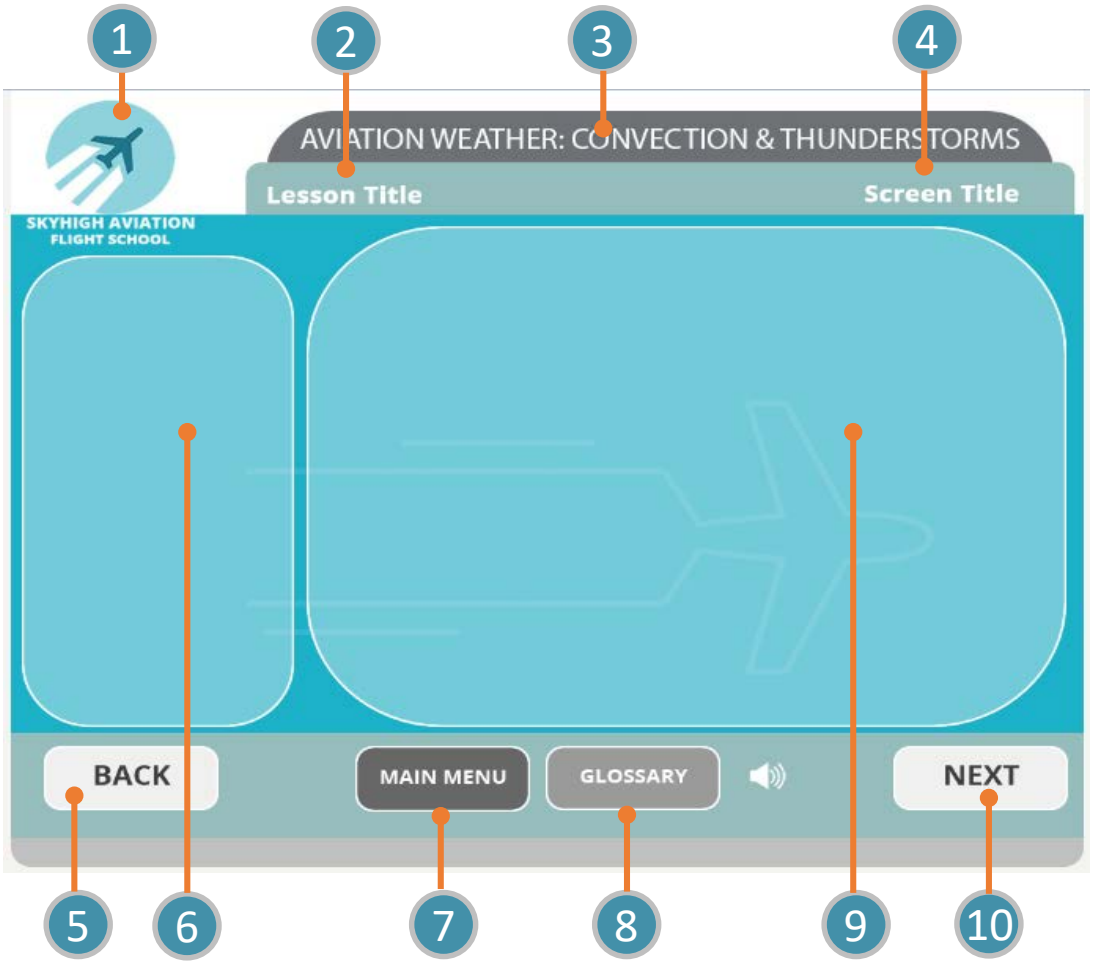
Element	Process	Tools	Notes
Design Docs	Create/Edit	Microsoft Word	I will use Word to write all of my text in, and then copy and paste it into Captivate.
Graphics - Photos	Select	I will source photos using United States government websites (NOAA, NWS, FAA).	I will source photos of • cloud types • Real thunderstorms during different stages • supercell thunderstorm • hail damage to aircraft
Graphics - Illustrations	Select/Purchase	I will source photos using United States government websites (NOAA, NWS, FAA).	I will source or graphics of: • depictions of thunderstorms • cross-cut illustrations of thunderstorms (life cycle,outflow downdrafts, hail formation) • altimeters • aircraft
Graphics – Navigation Buttons/Graphics	Create	Adobe Captivate Adobe Photoshop	Course navigation and other assets created using Adobe Captivate, Adobe Photoshop.
Audio	Record	N/A	N/A
	Edit/Export	N/A	N/A
Video	Record	N/A	N/A
	Edit/Export	N/A	N/A
Courseware Dev	Create Courseware	Adobe Captivate 2017	Course will be created using Captivate, and will import in all graphics, interface, etc.
LMS	Upload Courseware	GoDaddy	N/A
	Distribute Courseware	GoDaddy	Hosting on Godaddy.com and will link it to my portfolio.

INTERFACE DESIGN STANDARDS

This section provides an overview of the interface design standards that are utilized in this course.

INTERFACE AND NAVIGATION

This annotated image depicts the interface of the course.



Element	Name	Purpose
1	Company Logo	Logo of company
2	Lesson Title	Title of lesson
3	Module Title	Title of module
4	Screen Title	Title of current slide
5	Instructional Area #1	Area for content
6	Back Button	To move to previous screen
7	Main Menu	To go to main menu
8	Glossary	To go to the glossary
9	Instructional Area #2	Area for content
10	Next Button	To move to next screen

DESIGN STANDARDS

COLOR PALETTE

Primary Colors

#20758A #1BB1C9 #94BDBC # E6F1F2

Secondary Colors

#464646 #6D7075 #D5DCDE #FEFEFE

TYPOGRAPHY

The following types of typography have been carefully selected to be used in the course interface.

Open Sans

Course Title Headings
Subheadings
Body Text

SansSerifBookFLF — Body Text

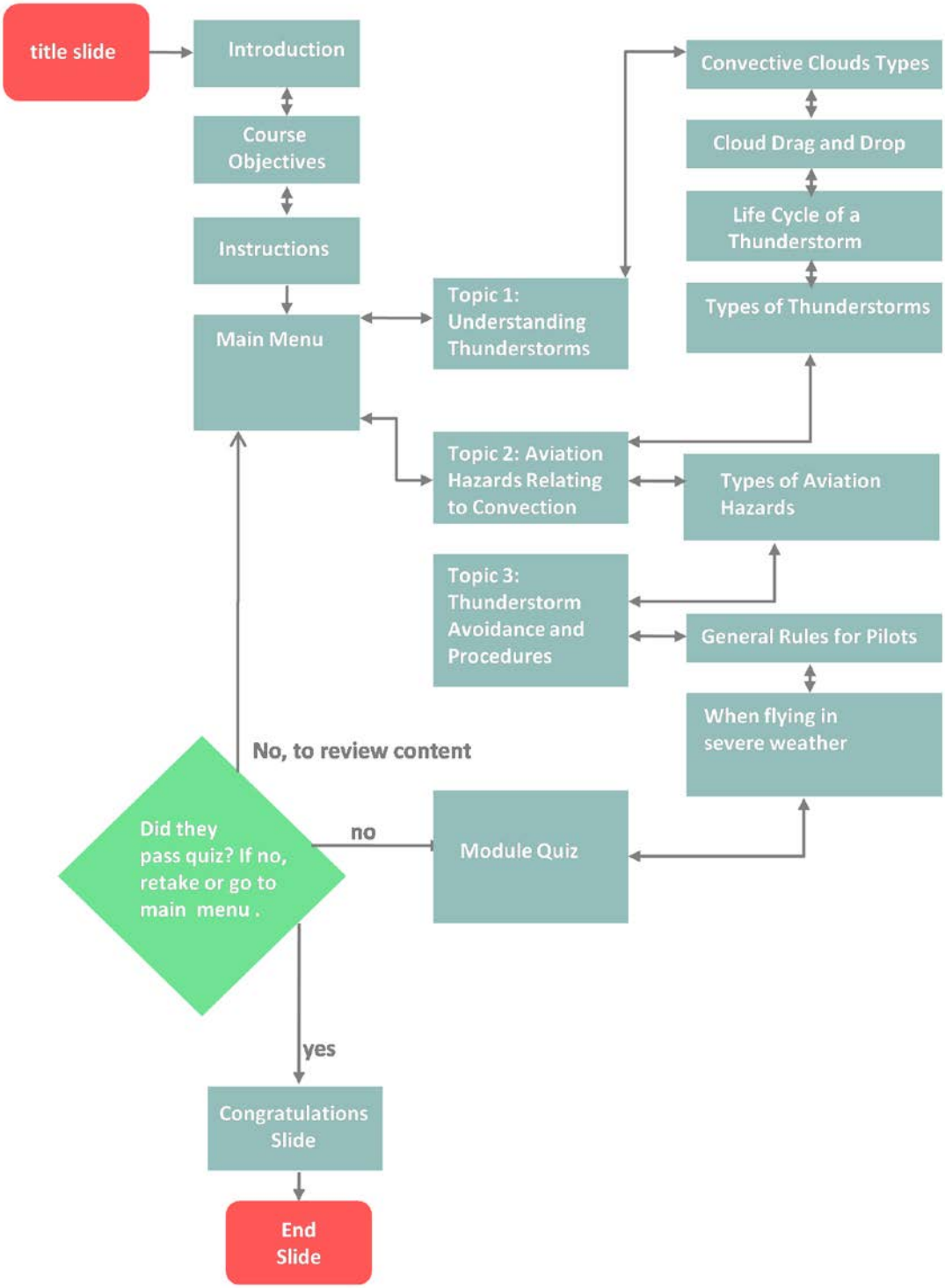
GRAPHIC STANDARDS

The colors utilized in this course fit with the theme of aviation and meteorology, hence the use of blue, grey, and white tones. Colored illustrations are the dominant type of graphic found throughout this course, as they are the best to demonstrate specific topics.

SECTION 508 COMPLIANCE

This course does not feature Section 508 compliance standards.

FLOWCHART


title slide
Introduction
Course Objectives
Instructions
Main Menu
Topic 1: Understanding Thunderstorms
Convective Clouds Types
Cloud Drag and Drop
Life Cycle of a Thunderstorm
Types of Thunderstorms
Topic 2: Aviation Hazards Relating to Convection
Types of Aviation Hazards
Topic 3: Thunderstorm Avoidance and Procedures
General Rules for Pilots
When flying in severe weather
Module Quiz
Did they pass quiz? If no, retake or go to main menu .
no
No, to review content
yes
Congratulations Slide
End Slide

PEER REVIEW STRATEGY

I have submitted the course for peer review utilizing my INTE 5660 classmates. I have asked them to provide feedback on:

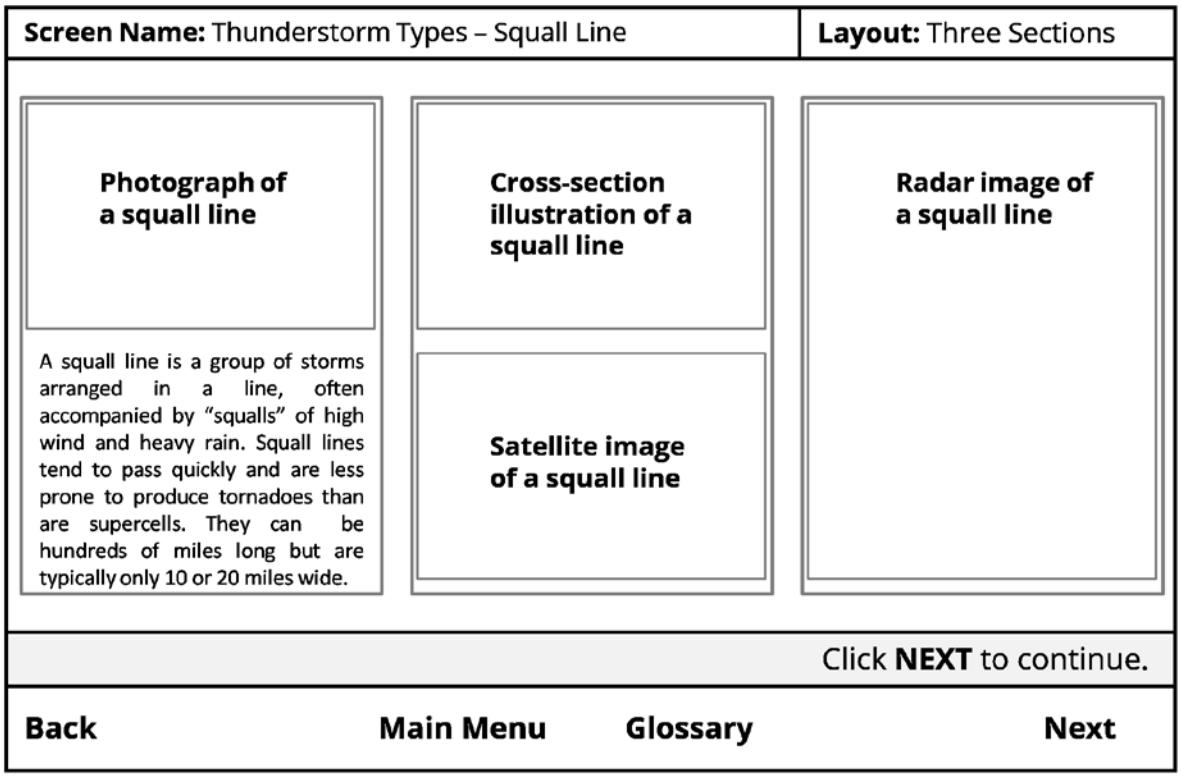
- Course design
- Course engagement
- Writing and grammar
- Media quality
- Technical quality
- Course assessment

Throughout this design process, I have gathered feedback from my peers on several occasions. I was able to make changes to my course throughout the semester based upon their valuable feedback.

This section highlights three storyboard examples for the courseware.

Global Navigation

Back	Unless otherwise specified in branching, go to previous screen in linear flow
Main Menu	Go to main menu
Glossary	Go to glossary
Next	Unless otherwise specified in branching, go to next screen in linear flow



GRAPHIC NOTE:
Photograph of a squall line seen from ground; Illustration (cross-section) of a squall line; Satellite image of a squall line; radar image of a squall line

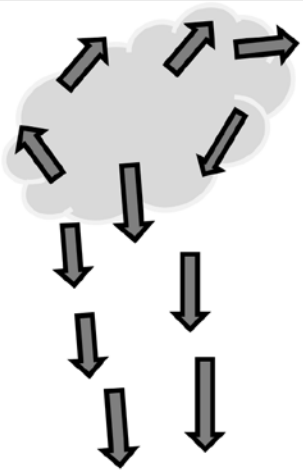
BRANCHING:
N/A

PROGRAMMER NOTE:
N/A

Screen Name: Thunderstorm Life Cycle	**Layout:** Menu Left

A thunderstorm undergoes three distinct stages during its life cycle: cumulous, mature, and dissipating. The total life cycle is typically about 30 minutes. Click on each stage below to learn more.

- Stage 1: Cumulous
- Stage 2: Mature
- Stage 3: Dissipating



Dissipating Stage

The final stage, the dissipating stage, is marked by a strong downdraft within the precipitation. Decreasing air replaces the updraft throughout the cloud, which cuts off the supply of moisture provided by the updraft. Precipitation tapers off and ends. Compression warms the decreasing air and the humidity drops. The convective cloud gradually vaporizes from below, leaving only a remnant anvil.

Back **Main Menu** **Glossary** **Next**

GRAPHIC NOTE:
Color illustration illustrating dissipating stage

BRANCHING:
n/a

PROGRAMMER NOTE:
Interactive menu

Screen Name: Aviation Hazards – Rapid Altimeter Changes	**Layout:** Menu Left – Roll Over Caption Right

Convection poses multiple hazards to pilots. Roll over a hazard below to learn more.

- Turbulence
- Lightning
- Hail
- Icing
- Rapid Altimeter Changes
- Tornadoes
- Static Electricity

Thunderstorms pose a threat to your aircraft's instruments. Thunderstorms produce rapid pressure changes, which can cause erroneous altimeter readings. Readings may be off by 100 feet or more. Pressure usually falls rapidly with the approach of a thunderstorm, then rises sharply with gust frontal passage and arrival of heavy rain showers in the cold downdraft, falling back to normal as the storm moves away. This cycle of pressure change may occur in as little as 15 minutes.

Back **Main Menu** **Glossary** **Next**

GRAPHIC NOTE:
N/A

BRANCHING:
N/A

PROGRAMMER NOTE:
Rollover Caption Menu

PROJECT REFLECTION

The process of developing this project has provided me with an opportunity to create a quality eLearning course. My goal for this module was to create a sample of a module that could be found in a private pilot licensing program's curriculum. I utilized best practices in developing all facets of an eLearning course from conception to end-product, in both the courseware and the design document. The sources that I used for my information come from trusted agencies in the aviation industry: the Federal Aviation Administration, and the National Oceanic and Atmospheric Administration. This project had space limitations, therefore, I was unable to include the whole gauntlet of information that would be found in a course covering this specific topic for private pilot students. However, I believe this course is able to provide a very detailed look at the topic of convection and thunderstorms in relation to flying in a way that is engaging to the learner.