Curricular Framework

A resource for educators and administrators to bring interactive application and game design into the classroom

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Introduction to the Unity Curricular Framework

This document provides a framework and resources for designing or implementing courses for game design, game development, and Unity skill-building. Educators, instructors and administrators can use this framework for a variety of courses and in diverse classroom settings. Game development instructors and instructional designers will find guidance for the entire game design process, from prototype to the production of a final capstone project.

Some subjects that the Curricular Framework can be used to support include:

Game Design and Development

Computer Science

Graphic and User Interface Design

3D Graphics and Imaging

Interactive Application Design

00.A Why the Curricular Framework

The global media and entertainment industry is complex, expansive and rapidly growing. Within it, two exciting, highly creative, and increasingly lucrative fields have emerged that are capturing the hearts and minds of millions: digital interactive development and video game creation.

The Unity Curricular Framework simplifies the process of creating and delivering courses that allows educators to more easily teach the tools and methodologies of interactive application creation in a classroom setting, using Unity as a primary development tool. Through the use of this framework, students can gain the technical skills of developing applications in Unity, as well as a broader understanding of the design principles that go into the development of video games and interactive applications, including:

- User Experience/User Interface
- Player Motivation and Incentivization
- Game Balance and Game Design Theory
- Visual Design
- Asset Development
- Environment Design
- Collaboration, Communication, and Teamwork

These skills are transferable to a variety of contexts outside of the field of game design and prepare learners with a set of technical and soft skills that, if used correctly, can be invaluable to their future studies and career prospects.

00.B How to Use This Document

The Curricular Framework is meant to be a jumping-off point for the development of a full semester or year-long course in game development. Each unit offers an outline of material, including suggestions for lessons and topics to be covered within those lessons, along with some suggested activities or assignments that will help to deliver the intended content in those units. The Activities and Resources Document is an adjunct to the Curricular Framework, and offers educators detailed assignments, resources and tutorials that can be used to bring the Curricular Framework to life in the classroom. Despite all of the resources provided, we strongly encourage educators to tune the content to the interests of their students, either by revising assignments and activities from the Activities and Resources Document or by developing their own.

Each unit includes standards alignment for a variety of different educational standards, including:

- Professional Standards for Interactive Application and Video Game Creation
- Common Core State Standards (CCSS)
- STEM Career Clusters (SCC)
- 21st-Century Skills (T21C)
- ISTE Standards

These will help both educators and administrators align the various units to the needs of their educational institution.

00.C Overview of the Curricular Framework

This framework consists of 14 units, each containing a number of lessons that cover a variety of topics which together serve as an introduction to video game and interactive application design, Unity skill development, and game design theory. The units are as follows:

01

Introduction to Game Design
This unit introduces the basic concepts of game design and begins the process of familiarizing learners with the Unity engine.

02

Critical Thinking in Game Design
This unit introduces game analysis as an important tool for understanding how games function and guides learners through setting up their first simple Unity projects.

03

Game Design Theory
This unit introduces some of the functional tools that designers use and asks learners to begin adding to and modifying the projects they're building.

04

Story and Game Creation
This unit introduces learners to the unique possibilities that games hold for telling stories and asks them to begin thinking about how to build 3D environments in Unity.

05

System Dynamics and Scripting Fundamentals
This unit introduces the fundamentals of writing C# scripts in Unity as well as the Game Design Document, an industry-standard tool that game designers and engineers can use.

06

Game Development Tools, Formats, and Asset Management
This unit introduces concepts around file formats and usage of intellectual property and discusses how to manage assets in the Unity Editor.

07

Physics and Animation
This unit deepens learners' understanding of Unity's physics system and introduces them to some simple animation tools.

08

Environments and Level Design
This unit introduces concepts related to level design, including gameplay flow and dynamics, and deepens learners' understanding of the ways that rich environments can be developed in Unity.

09

Principles of Cameras and Lighting in Game Environments
This unit introduces concepts around Unity's camera system, including placement and management of cameras, and focuses on how to light scenes effectively.

10

Principles of Sound and Audio for Games
This unit introduces basic sound design in Unity as well as issues of intellectual property and copyright.

11

Basic Interfaces and the Build Process
This unit introduces concepts around building UI elements such as buttons and menus and takes learners through the build process to create playable game files.

12

Intermediate Animation and UI
This unit deepens learners' understanding of UI and introduces more complex animation, including rigging of humanoid avatars.

13

Principles of Quality and Functionality Assurance in Game Development
This unit introduces the concept of a QA process and asks learners to build and execute test plans for their capstone games.

14

Principles of Versioning and Game Release
This unit guides learners through the final steps of creating their release candidates.

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Each unit contains a complete lesson outline with lesson titles, topics within those lessons, and some suggested activities or resources for that content.

00.D Assessment

00.D.1: Learning Objectives & Bloom's Taxonomy
Each unit in the Curricular Framework comes complete with Learning Objectives and corresponding Demonstrations of Learning. Each of these objectives is aligned with a specific level in Bloom's Taxonomy, designed to cover the full range of assessment, from lower-level cognitive skills to higher-order thinking.

00.D.2: Assessment Rubrics
The various assignments and activities in this document and in the Activities and Resources document are designed so that learners can experience hands-on learning and gain first-hand technical experience as they go through the course.

To evaluate this work, the Curricular Framework offers two broad rubrics that can be applied throughout the entire curriculum to assess student progress: the Technical Rubric and the Grit Rubric.

00.D.2.A: Technical Rubric
A technical rubric is provided to help educators assess students on technical projects.

Technical Rubric ⌄

	Exceeds Expectations	Meets Expectations	Below Expectations
Technical Proficiency	Project is technically complete, without bugs or errors Extra project elements are implemented, or student has crafted project elements particularly well Student has achieved learning objectives	Project compiles as expected Project elements are present Project achieves learning objective	Project does not compile or has fatal errors Project cannot be played to completion Project does not demonstrate goal or learning objective at all
Technical Familiarity	Student demonstrates a fluid understanding of their process and results Student can identify and offer a plan for resolving bugs in their code or their output	Student demonstrates a basic understanding of their development process Student can identify but not resolve the source of bugs in their code or output	Student cannot answer questions about their process Student cannot answer questions about their results Student can not identify the source of bugs or flaws in the code or the project
Design Sense	Project demonstrates a clear design sensibility Project displays information in thoughtful or especially concise way Project is easy to use	Project takes users into account Project displays information accurately and clearly Project can be used without student input	Project does not demonstrate an awareness of the user Project is not user friendly or has elements that cannot be accessed or understood without student guidance Project communicates information incoherently or not at all

00.D.2.A: Grit/Effort Rubric

A "grit"-focused rubric is included to measure effort and perseverance rather than technical mastery. This is often useful for teachers with students who have a wide range of experience at the outset of the class and as a mechanism to encourage students to challenge themselves rather than "playing it safe."

⌄ Grit/Effort Rubric

		No Evidence	Some Evidence	Solid Evidence	Excess Evidence
Academic Focus	Student is on-task and engaged				
	Student participates in classwork and class discussion by asking good questions or contributing observations and connections				
	Student has and works to achieve a clear goal				
Effort	Student plans to achieve high-quality work				
	Student pushes their skills and tries to create more complex things				
	Student applies feedback and incorporates it into future work				
Perseverance	Student applies new strategies when faced with difficulty, doesn't give up				
	Student researches new avenues or new tactics to tackle problems				
Process	Student can describe the process of their work and incorporates previous failures as lessons for next time				

01

Introduction to Game Design

01.A Unit Description

Activities in this unit of study are designed to provide a high-level overview of game design and the game creation process. Learners will be introduced to various game genres during this unit. They will also become familiar with elements of gameplay and project management concepts as related to interactive application and video game creation. Learners will also become familiar with the basic operations of the Unity Editor.

01.B Curriculum Overview

Lesson Title	Lesson Topics	Suggested Activities/Resources

1. Game/application design overview	**What is a game/application and how is it created?**
	    Where do we play games?
	    Platforms; console, PC, mobile
	    Who makes games?
	What makes a game enjoyable?
	    What makes a game unenjoyable?
	    • Unfair
	    • Can't do anything
	    • Confusing
	    • Game Balance
	    • Player Agency
	    • UX/UI
	Knowing the players
	    Bartle Types
	Game genres
	    Genres are linked to gameplay, not story or theme
	Game Platforms
	    Xbox, Playstation, Switch, PC, Mobile, etc.
		Have students describe games they've played, and identify their parts such as assets, narrative, objectives, etc.

2. Game element exploration	**Narrative formation**
	    Stories in games
	Game design
	    How the designer sees the game
	Objectives
	    The player's goal or goals
	Player options
	    What players can do to affect the game
	Sequences
	    Linking moments in games together for deeper, more interesting play
	Mechanics
	    Rules that control how players act in the game
	Game aesthetics
	    The look-and-feel of a game
	Dramatic elements
	    Draws elements from traditional novels, cinema, theater, etc.
	Multimedia inclusions
	    Some games are text, some are still images, some are moving pictures, 2D, 3D, music, sound
		Use the **Game Analysis Activity** in the Activities and Resources document to get students started thinking about games in a scholarly/critical way.

Lesson Title	Lesson Topics	Suggested Activities/Resources

3. **Gameplay**	**Game theory introduction**
	    Games as systems, interconnected
	    Player-centered design
	Balance
	    Game economies
	    Some consume resources in-game, some consume player time
	Challenge development
	    Keeping challenge levels appropriate for players
	    "Flow"
	Level design
	    What happens where, when?
	    How can levels surprise players?
		Use the **Game Modification Activity** in the Activities and Resources document to start students thinking of games as something they can change and manipulate.

4. **Project management for game development**	**What is project management?**
	    Tools and skills that help projects thrive
	Why is project management important?
	    Communication, clarity, collaboration
	The Four Phases of Project Management (model)
		Have students take a scene from a game they're familiar with and list every asset present in the scene – objects, lighting, animations, sound, etc. Ask students to estimate how long it might take to make each object.

5. **Unity Editor for game creation**	**Setting up a new project**
	    Create a project
	    Import assets
	Navigating within the Unity Editor
	    Move, rotate, pan, select
	    Game, hierarchy, inspector, asset panels
	    Game mode, edit mode
		Use the **Exploring the Unity Editor Activity** in the Activities and Resources document to get students set up and familiar with the basics of the Unity Editor.
		
		Make sure students are familiar with the basic layout of the editor and know how to move around and highlight objects in the editor.

01.C Learning Objectives and Assessments

	Learning Objective	**Demonstration of Learning**	**Bloom's Domain**
01.1	Identify basic game design principles, reciting common (visual, audial, interactive, narrative, etc.) choices, styles, and/or aesthetics.	From memory, learners can list or label basic game design principles.	1. Remember
01.2	Demonstrate the ability to review and summarize contemporary video games, examining intent, form, and functionality.	Learners can research online game reviews, citing the vocabulary related to game play and design elements.	2. Understand
01.3	Implement the fundamental concepts of project management within the context of the interactive application and video game development process.	Learners can consistently and correctly apply project management fundamentals as an essential function of game development.	3. Apply
01.4	Use the Unity Editor to open and organize a simple project or scene.	Learners can demonstrate how to open a predeveloped scene, view its components, and configure the user interface within the game editor.	1. Remember
01.5	Differentiate primary components within the game editor, examining their purpose and function.	Learners will be able to differentiate the following game development components: Assets Hierarchy Inspectors/properties Parenting/nesting Views: Scene Game animation Light mapping Occlusion culling Prefabs	2. Understand
01.6	Distinguish contemporary game genres and platforms.	Supplied with a list of contemporary games, learners will consistently and correctly characterize genre inclusion, providing adequate justification for genre selection. Learners can also differentiate popular gaming platforms, describing the advantages and disadvantages in terms of hardware (i.e., peripheral) features and gameplay modalities.	4. Analyze

	Learning Objective	Demonstration of Learning	Bloom's Domain
01.7	Devise systems to organize and illustrate the interactivity and player immersion that exist within contemporary video games.	Learners can design a game rating system to rank interactivity and player immersion.	4. Analyze
01.8	Reconstruct the rules of contemporary games, in order to improve the gameplay experience.	Based on the review created by the learner, the learner will formulate a *Game Modification Task Sheet* and a *Game Modification Plan*, identifying key differentiators of the game, possible issues, and/or areas for improvement.	5. Evaluate
01.9	Critique contemporary video games, providing adequate arguments and justification.	Upon selecting a game of their liking, learners can write a critique using appropriate standards and terminology.	5. Evaluate
01.10	Interpret the role of game narrative and gameplay, evaluating its impact on the interactive storytelling environment.	Within small group interactions, learners can argue or defend the value of game narrative and game play, evaluating its impact on the game being discussed and influencing others within the group.	5. Evaluate

01.D Standards Alignment Guide

01.D.1: Professional Standards for Interactive Application and Video Game Creation

> **01.1.3:** Explain the role of iteration in the design process.
> **01.1.4:** Explain the difference between game mechanics and gameplay.
> **01.6.2:** Demonstrate understanding and ability to use game mechanics to improve gameplay.
> **01.1.6:** Assess and describe the basic gameplay from an existing game.
> **01.1.7:** Analyze and evaluate the effectiveness of several game mechanics used in a contemporary game.
> **01.1.8:** Investigate the concept of "Interactive Narrative" and explain how it could pertain to game design.
> **01.1.9:** Explain the relevance of ambiance and environment in game design.
> **01.1.10:** Determine the relevance of character development, backstory, and attributes (power, speed, intelligence, empathy, etc.) in game design.
> **01.1.11:** Differentiate basic game player types and objectives with examples (thrill seekers, socializers, explorers, achievers).
> **01.1.12:** Evaluate and describe various 2D and 3D, single and multiuser genre.
> **01.1.16:** Describe available target platforms, their capabilities and constraints.
> **01.1.20:** Examine an existing game and critique its design with respect to functionality and usability.
> **01.1.21:** Examine an existing game and critique its design with respect to artistic impression and emotional response.
> **01.1.22:** Examine an existing game and attempt to determine the developer's target demographics and its appeal for basic player types and objectives.

01.D.2: Common Core State Standards (CCSS)

> **CCSS.ELA-Literacy.WHST.6-8.2:** Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
> **CCSS.ELA-Literacy.CCRA.SL.1:** Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

01.D.3: Stem Career Clusters (SCC)

> **SCC01 Academic Foundations:** Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.
> **SCC02 Communications**: Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.

01.D.4: 21st Century Skills

> **Creativity and Innovation:** Think Creatively. Implement Innovations
> **Critical Thinking and Problem-Solving:** Reason Effectively, Making Judgments and Decisions
> **Communication and Collaboration:** Communicate Clearly

01.D.5: Next-Generation Science Standards (NGSS)

NGSS3: Planning and carrying out investigations

NGSS4: Analyzing and interpreting data

01.D.6: ISTE Standards

1A: Students articulate and set personal learning goals, develop strategies that leverage technology to achieve them and reflect on the learning process itself to improve learning outcomes.

1D: Students understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.

2D: Students manage their personal data to maintain digital privacy and security and are aware of data-collection technology used to track their navigation online.

02

Critical Thinking in Game Design

02.A Unit Description

Activities in this unit of study are designed to develop critical thinking and problem-solving skills. Learners will be introduced to various strategies and techniques for idea generation, problem-solving, and critical analysis.

02.B Unit Outline

Lesson Title	Lesson Topics	Suggested Activities/Resources
1. Introduction to creative and critical thinking practices	**What does it mean to think critically? Think creatively?** Critical thinking terms • Ambiguity • Assumptions • Values • Emotions • Argument • Fallacy • Thinking barriers • Language **Tools for critical thinking (e.g., SWOT analysis)** • Strengths • Weaknesses • Opportunities • Threats **Critical thinking and the evaluation process**	**Quick Critical Thinking Exercise: Alien Tour Guide** Have students describe a familiar environment (classroom, school, etc.,) as if they were talking to an alien with no knowledge of human culture. Which parts are easy to describe? Which parts are hard? What implicit assumptions about the space do we hold? Go back to the **Game Modification Assignment** from the previous unit. Have students perform a SWOT analysis on their modifications. Hold a class discussion analyzing the phrase in the **Critical Thinking Assignment** in the Activities and Resources document.
2. Idea generation	**Introduction to brainstorming and mind mapping** Idea sorting • Immediate usefulness • Areas for exploration • New approaches to problem-solving	Students should get into groups and brainstorm ideas for a new game to work on. They should come up with ideas for: • Story and theme • Protagonist • Antagonist
3. Phases of decision-making/problem-solving	**Problem identification** What, as specifically as possible, is the problem? **Information gathering** What do we need to know about the problem? When does it happen? How? To whom? Why? **Brainstorm solutions** Develop a list of possibilities **Compare the pros and cons of each option** Examine each possibility and choose one to test **Test selected solution & evaluate the effectiveness of the solution** Did it solve the problem? Did it create new problems? **Repeat**	Have students finish the **Design Analysis Assignment** provided in the Activities and Resources document to identify specific changes to a game and guess about what effects those changes would have on the game.

4. Setting Up a Project in the Unity Editor	**Navigating in the Unity Editor** **Importing Assets** **The Game View and the Scene View**	Have students complete the **Implement a Microgame Assignment** in the Activities and Resources document. This will give them all the resources they need to put together a small playable game and begin tweaking it.

02.C Learning Objectives and Assessments

	Learning Objective	Demonstration of Learning	Bloom's Domain
02.1	Define creative and critical thinking.	Learners can define the meaning of critical thinking and creative thinking.	1. Remember
02.2	Learners can explain contemporary problem solving methods, providing examples.	Learners can explain the Six-step Problem-solving Process and can associate the steps with real-world examples.	1. Remember
02.3	Demonstrate the ability to determine essential questions, issues, and/or problems.	Given a paragraph, learners can determine the key questions or issues within the content.	2. Understand
02.4	Use contemporary problem-solving techniques.	Learners can use brainstorming techniques to generate at least five possible solutions for a given situation or problem.	3. Apply
02.5	Differentiate between a game review and a critical analysis of a game.	Learners can distinguish a game review versus a critical analysis of a game.	2. Understand
02.6	Break down a problem into its component parts, set priorities, and explore methods of resolution.	Given a series of scenarios, learners can recognize and prioritize likely failure points, studying common modifications used to avoid such failure points.	5. Evaluate

	Learning Objective	Demonstration of Learning	Bloom's Domain
02.7	Gather, generate, and evaluate relevant information through effective research.	When supplied with an unfamiliar topic, learners can demonstrate an ability to research the topic, correlating multiple sources of relevant information.	3. Analyze
02.8	Develop informed conclusions/ solutions.	Learners can compile all information to propose the most valid solutions.	5. Evaluate
02.9	Use logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.	Supplied with a particular problem scenario, learners can generate a range of solutions and courses of action with benefits, costs, and risks associated with each.	6. Create
02.10	Consider the relative costs and benefits of potential actions to choose the most appropriate one.	After being presented with an application design problem that includes multiple possible solutions, the learner will analyze the strengths and weaknesses of each solution, deciding on the best option.	3. Analyze
02.11	Use oral and written communication skills to clearly communicate and defend their positions or conclusions with regard to a story-specific issue or evaluation.	Learners can play a game reviewed in an online gaming magazine, write their own review, and compare it with the online reviewers, defending their opinions and conclusions.	5. Evaluate
02.12	Predict when problems arise or are likely to arise within a given scenario.	Given a series of scenarios, learners can predict failure points and recommend modifications to avoid the failure points.	5. Evaluate

02.D Standards Alignment Guide

02.D.1: Professional Standards for Interactive Application and Video Game Creation

1.1.7: Analyze and evaluate the effectiveness of several game mechanics used in an existing game.

1.1.20: Examine an existing game and critique its design with respect to functionality and usability.

1.1.21: Examine an existing game and critique its design with respect to artistic impression and emotional response.

1.2.3: Describe problem-solving processes and their application.

1.2.5: Describe methods for establishing priorities.

1.2.6: Explain the concept of "trade-offs" in the design process.

1.2.7: Explain how the "optimum solution" is not always the "best" solution.

1.3.8: Use brainstorming techniques to creatively generate a multitude of possible solutions to a stated problem.

02.D.2: Common Core State Standards (CCSS)

CCSS.ELA-Literacy.RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

CCSS.ELA-Literacy.RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

CCSS.ELA-Literacy.RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

CCSS.ELA-Literacy.W.11-12.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

CCSS.ELA-Literacy.W.11-12.2 Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

02.D.3: Stem Career Clusters (SCC)

SCC02 Communications: Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.

SCC04 Information Technology Applications: Use information technology tools specific to the career cluster to access, manage, integrate, and create information.

02.D.4: 21st Century Skills

Creativity and Innovation: Think Creatively

Critical Thinking and Problem-solving: Reason Effectively, Making Judgments and Decisions

Communication and Collaboration: Communicate Clearly

02.D.5: Next-Generation Science Standards (NGSS)

    NGSS1: Asking questions (for science) and defining problems (for engineering)

    NGSS3: Planning and carrying out investigations

    NGSS8: Obtaining, evaluating, and communicating information
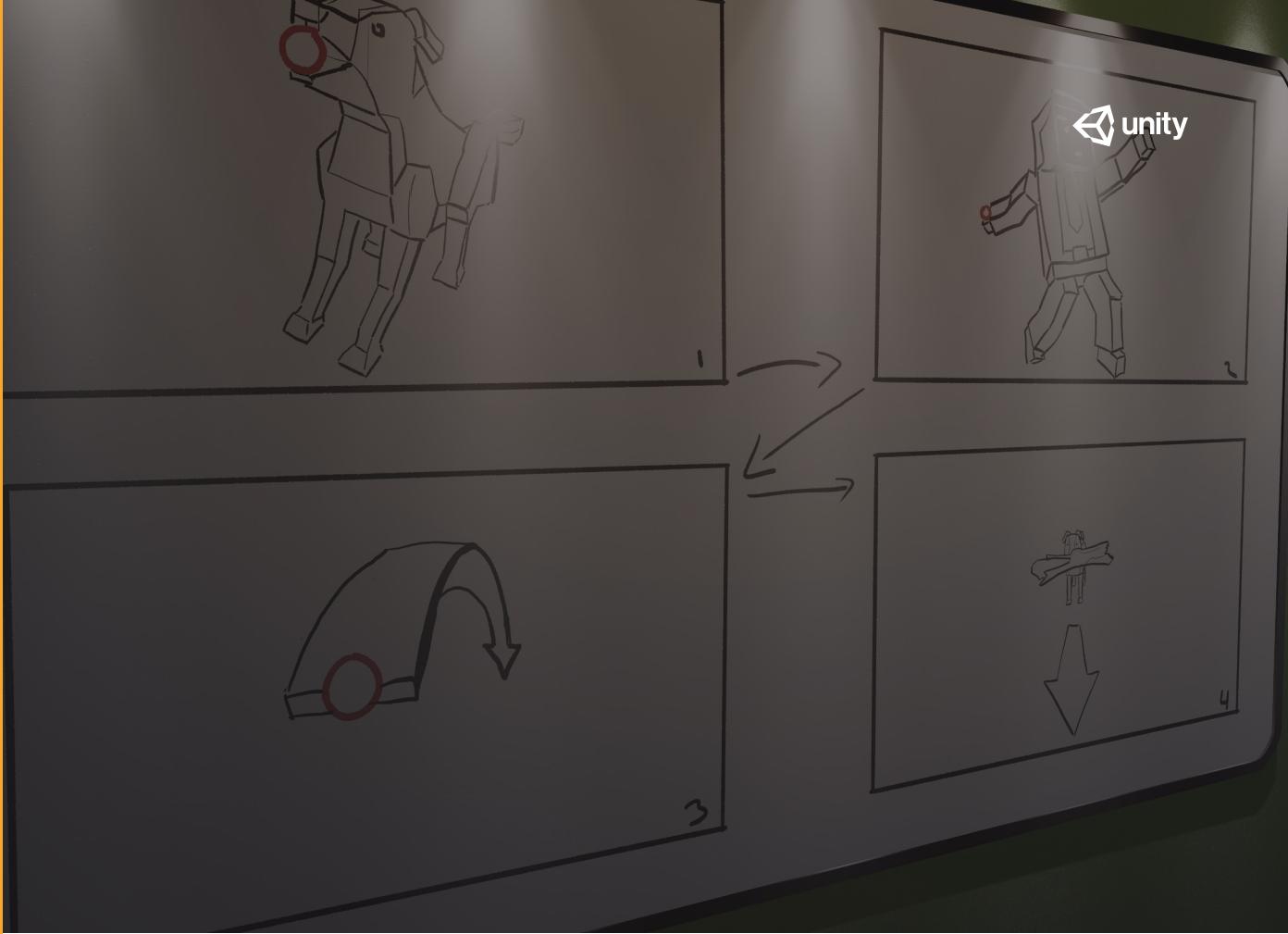
02.D.6: ISTE Standards

    3.A: Students plan and employ effective research strategies to locate information and other resources for their intellectual or creative pursuits.

    3.B: Students evaluate the accuracy, perspective, credibility and relevance of information, media, data or other resources.

    4.B: Students select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.

03

Game Design Theory

03.A Unit Description

Activities in this unit of study are designed to foster an understanding of fundamental game design principles, including genres, goals, mechanics, player motivation, structure, and gameplay. Learners will analyze different types of 2D and 3D games, create proposals for building common game types, and begin learning the process of building games using the Unity Editor.

03.B Unit Outline

Lesson Title	Lesson Topics	Suggested Activities/Resources
1. **Introduction to game genres**	**Broad categories and distinguishing characteristics** Games are grouped in genres based on how they're played, as opposed to their themes or narrative. **Comparison of 2D and 3D game environments** **Common environment mechanics, player views, and player controls** Player controls describe how the players interact with the game.	Hold a class discussion about the difference between genres in movies and novels vs video games. Genres in games are connected to how they're played: • FPS (first-person shooter) • RPG (role-playing game) • Action • Puzzle • Bullet hell, etc. Have students complete the **Genre Exploration Assignment** in the Activities and Resources Document to solidify their understanding of genre in games.

Lesson Title	Lesson Topics	Suggested Activities/Resources
2. **Overview of key components of video game design**	**Game concept** • Description • Platform • Genre **Backstory** • World and character construction • Emotion, Mood and Theme **Game mechanics** Rules • Operational • Constitutive • Implicit • Game flow • Gameplay **Game balance** Game balance refers to the ways that games can be fair or unfair to their players. Games can test player intellect, memory, or reflexes, and "fair" can mean different things in each case. **Goals and objectives** Goals and objectives demark player progress. **Reward and motivation** Rewards motivate player behavior towards goals. **Logic and challenges** Some games demand skill, others demand that players use logic and deductive reasoning to advance. **Game physics and mathematics** Accurate physics models are some of the most resource intensive tasks that games do. **Art/sound** The visual style and sound of a game are crucial to connect to an audience and communicate the game's ideas to players. **Resource management** Computing resources are finite. Memory and CPU cycles (processing power) can't be wasted by game designers indiscriminately.	Have students complete the **Student-Led Game Analysis Assignment** for Unit 3 in the Activities and Resources document to help them think critically about games they're familiar with. Have students complete the **Game Design Document Outline Assignment** in the Activities and Resources document to begin sketching out their design document for their capstone project.

3.	Introduction to rapid iteration and prototyping	**The iterate-test cycle** Designers build prototypes, test them, refine them, and then test them again! **How to know what to test** Tests should have a clear question they're trying to answer. **How to know what changes to make** Similarly, when designers refine their prototypes, they should change only a few things at a time to make sure their changes are the right ones.	Have students complete the **Rules on Three Levels Assignment** in the Activities and Resources document. When they're done, discuss how you might test this new game, and what rules you might iterate on.
4.	Puzzle Design (Optional)	**What is a puzzle in a game?** Puzzles ask players to use their deductive skills, logic, or memory to move forward. **Why are puzzles fun?** Puzzles can break up action sequences, flesh out story, and provide a different type of challenge. **How to make a good puzzle** • Good puzzles should be tough to solve, but their solutions should be obvious in retrospect. • Think carefully about what the player needs to know to solve the puzzle. Make sure they have that information!	
5.	Modifying content in the Unity Editor	**Use premade assets to change how a microgame works in Unity.** **Develop new assets, import them into Unity, and use them in a microgame.**	Have students complete the **Implementing a New Microgame Activity** in the Activities and Resources document to reinforce the learning they've done around downloading and modifying assets.

03.C Learning Objectives and Assessments

	Learning Objective	**Demonstration of Learning**	**Bloom's Domain**
03.1	Identify common game genres.	Supplied with a list of video game descriptions, the learner will be able to identify the correct genre(s).	1. Remember
03.2	Categorize contemporary game genres.	Supplied with a list of gameplay characteristics, the learner will be able to categorize each	2. Understand
03.3	Summarize important considerations in game design.	Upon request, the learner will be able to verbally summarize the important considerations in	3. Apply
03.4	Describe rule creation and elements of player challenge	Following the Rules on Three Levels Assignment, the learner, in writing, will be able to identify, summarize, and interpret the implicit, operational, and constitutive rules of several contemporary video games.	4. Analyze
03.5	Explain the theories behind player motivation.	The learner will be able to explain, in writing, the 11 basic psychological needs that people can meet by playing video games.	4. Analyze
03.6	Generate models and materials for project(s) created within the Unity Editor.	Using the Unity Editor, the learner will be able to create models and materials (per technical guidelines set by the instructor) within the confines of the Unity Editor training assignments.	6. Create

	Learning Objective	Demonstration of Learning	Bloom's Domain
03.7	Apply fundamental concepts of project management.	Supplied with a Project Charter Form (PCF), learners will be able to integrate the principles of project management toward the completion of a basic project charter for their capstone project.	3. Apply
03.8	Create a game proposal for a one-button game.	The learner will be able to write a game proposal for a one-button game.	6. Create
03.9	Differentiate 2D from 3D game environments.	Within live, small group settings, learners will be able to communicate the difference between top-down 2D game environments and ground-up 3D game environments, citing contemporary examples as necessary to illustrate key points of differentiation.	4. Analyze
03.10	Examine the critical elements of puzzle design.	The learner will be able to compose a written analysis of puzzle design; categorizing and contrasting popular, contemporary puzzle examples and debating the quality and effectiveness (i.e., good vs bad) of puzzle design products in the market.	5. Evaluate
03.11	Evaluate the importance of iteration and rapid prototyping in game design.	Supplied with a complete review of several contemporary games, learners will be able to evaluate (in writing) the role and importance of rapid prototyping and iteration with the game production process, citing specific examples for each game. Within live, small-group environments, the learner will also be able to select a game and judge the importance of iteration and rapid prototyping within the production process, defending their statements and debating opposing views.	5. Evaluate

03.D Standards Alignment Guide

03.D.1: Professional Standards for Interactive Application and Video Game Creation

1.1.1: Identify the primary steps in the design process (Conceptualize, Prototype, Test, Analyze).

1.1.3: Explain the role of iteration in the design process.

1.1.4: Explain the difference between game mechanics and gameplay.

1.1.12: Evaluate and describe various 2D and 3D, single and multiuser genre.

1.2.8: Describe the difference between goals and objectives.

1.6.2: Demonstrate understanding and ability to use game mechanics to improve gameplay.

03.D.2: Common Core State Standards (CCSS)

CCSS.ELA-Literacy.RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

CCSS.ELA-Literacy.CCRA.R.10 Read and comprehend complex literary and informational texts independently and proficiently.

CCSS.ELA-Literacy.W.11-12.2 Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

CCSS.ELA-Literacy.W.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem, narrow or broaden the inquiry when appropriate, and synthesize multiple sources on the subject, demonstrating an understanding of the subject under investigation.

03.D.3: Stem Career Clusters (SCC)

SCC01 Academic Foundations: Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.

SCC02 Communications: Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information

03.D.4: 21st Century Skills

Learning and Innovation

 Creativity and Innovation: Think Creatively, Implement Innovations

 Critical Thinking and Problem-solving: Reason Effectively, Making Judgments and Decisions

 Communication and Collaboration: Communicate Clearly

Information, Media and Technology Skills

 Information Literacy: Access and Evaluate Information

Life and Career Skills

 Initiative and Self-direction: Manage Goals and Time, Work Independently, Be Self-directed Learners

03.D.5: Next Generation Science Standards (NGSS)

NGSS8: Obtaining, evaluating, and communicating information

03.D.6: ISTE Standards

1D: Students understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.

4C: Students develop, test and refine prototypes as part of a cyclical design process.

6C: Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.

04

Story and Game Creation

04.A Unit Description

This unit of study introduces the learners to the major elements of narrative for interactive environments. The focus is on the concepts of storytelling in relation to game design. Learners will explore the fundamentals of narrative creation and the crucial importance of interactive storytelling. Learners will also use storyboards to create a visual sequence of story development and gameplay.

04.A Unit Description (Cont'd)

Games offer some unique opportunities for storytelling. This unit will discuss simple ways to use branching narratives and environmental storytelling, two narrative techniques unique to games. Branching narratives (like Choose Your Own Adventure stories) use the procedural nature of computers to let games respond to simple choices made by the player. Environmental storytelling relies on the physical environment that the player moves through to tell part of the story. Both have simple implementations that students can use.

04.B Unit Outline

Lesson Title	Lesson Topics	Suggested Activities/Resources
1. **Parts of a story**	**Events/structure** • An "inciting event" sets the story in motion. • What events help propel the story along? • How do the player's choices change the story's direction, if at all? • A climax resolves the events of the story **Characters and character development** • Main characters change and evolve over the course of a game. • Is there a relationship between the character's mechanical abilities in the game and their position in the story? **Character archetypes** • What are character archetypes and why are they useful? • Archetypes like "Hero," "Helper," and "Foil" help us make sense of stories by giving us familiar dynamics. • We can use archetypes to subvert expectations, too. **Visual design of characters** • How characters look communicates a lot about the character and the world that they're in. • How do you make a visually compelling character? • Environments • This is the location or locations where the story takes place. • Some games have lots of environments, some of them have very few. • Environments are crucial for helping players make sense of the game world. **Theme** • The theme of a game or story is a central concern that comes up again and again. • Themes can be broad like "What is a hero?" or more specific like "Betrayal from within a family." **Genre** • Game genres have as much to do with how the game is played as they do with the content of the story. • Genre can also contain elements like "tone" or "mood."	Story diagram: Have students pick a story they're familiar with and diagram the inciting incident, rising action, climax, and falling action.

Lesson Title	Lesson Topics	Suggested Activities/Resources
2. Storytelling in games	**Player agency** • Agency is the ability to make choices. • As a designer, it's your job to determine how the choices players make affect the story and the game. **Branching structures** • When players make some choices, they might see different outcomes, this is called a "branching" storyline. • Sometimes branches can come back together, but be careful that players don't feel like their choices are meaningless. **Environmental storytelling** • Environmental storytelling is when information about the story is in the environment that players encounter, instead of having a character say it out loud. • Murder mysteries are a good example of environmental storytelling: readers must understand the story of what happened from the scene of the crime.	Have students get into groups and complete the **Group Story Generation Activity** in the Activities and Resources document to generate ideas for stories that might be turned into video games. Discuss specific dramatic points in those stories. How can designers make those dramatic moments feel exciting? How can we give players the feeling of being there instead of just watching?
3. Tools for stories	**Storyboards** • A storyboard is a tool used to show different shots or scenes in a story. • Storyboards are an important tool for communicating an idea visually. • Storyboards can be short, or very complex. **Game Design Document** • The Game Design Document is a record of every concept, asset, and mechanic that is going to go into a game. • It is the most important tool for a team to collaborate on, because it gives everyone information about the state of the game. **Terrain tools and environmental objects** • The Unity Editor has a powerful terrain editing tool. • This lets users create realistic environments such as meadows, canyons, or urban scenes. **Work Breakdown Structure** A Work Breakdown Structure document shows each task in the creation of a game, along with a clear estimate of how long that task will take.	Have students make a storyboard for the story that they diagrammed above. Have students complete the **Game Design Document Storyboard Assignment** in the Activities and Resources document to deepen their understanding of the stories in their proposed prototype games. Have students complete the **Work Breakdown Structure Exercise** in the Activities and Resources document and focus on trying to get good estimates for how much time each asset will take to create. Think about learning time, and how to reuse work. Have students complete the **Terrain Activity** in the Activities and Resources document to begin practicing with Unity's powerful Terrain Tool.

04.C Learning Objectives and Assessments

	Learning Objective	Demonstration of Learning	Bloom's Domain
04.1	Deconstruct and review the general principles of storytelling.	Given a brief storyline, the learner will create character profiles of the protagonist and antagonist.	4. Analysis
04.2	Explain the benefits of storytelling and the power of narrative.	Given a set of character descriptions, the learner will be able to categorize the archetype.	2. Comprehension
04.3	Describe the process of creating characters and designing character actions within the storyline.	Given a specific archetype, the learner will be able to summarize the characteristics and typical function	1. Knowledge
04.4	Explain the use of storyboarding in game design.	Given a storyboard, the learner will be able to identify the important narrative and gameplay beats in the storyboard.	3. Application
04.5	Identify the benefits of creating a storyboard.	Given a storyboard, the learner will be able to identify the important narrative and gameplay beats in the storyboard.	2. Comprehension
04.6	Explain how storyboard techniques can be used to further a storyline.	Given a story, the learner will be able to construct a storyboard showing the important transitions and beats.	5. Synthesis
04.7	Create and control terrain within the Unity Editor.	The learner is able to build recognizable terrain in the Unity Editor.	3. Application
04.8	Differentiate between the Concept Document, the Story Treatment, and the Game Design Document (GDD).	The learner is able to identify the uses of the GDD, the Concept Document, and the Story Treatment.	1. Knowledge
04.9	Distinguish components of a Work Breakdown Structure (WBS)	Given a project, a learner will be able to break down tasks and assign estimated times to those tasks.	6. Evaluation

04.D Standards Alignment Guide

04.D.1: Professional Standards for Interactive Application and Video Game Creation

1.1.8: Investigate the concept of "Interactive Narrative" and explain how it could pertain to game design.

1.1.10: Determine the relevance of character development, backstory and attributes (power, speed, intelligence, empathy, etc.) in game design.

1.3.1: Use appropriate, accurate terminology when communicating about artistic concepts and technology.

1.3.2: Write effectively, producing clear, correct, and coherent prose adapted to the purpose and audience.

1.3.13: Assemble sketches and annotations into storyboards and presentations for both print and web.

1.3.14: Create a narrative and storyboard for a new interactive app/video game.

2.3.10: Explain what differentiates characters from other objects.

04.D.2: Common Core State Standards (CCSS)

CCSS.ELA-Literacy.W.11-12.2 Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

CCSS.ELA-Literacy.W.11-12.3 Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.

CCSS.ELA-Literacy.W.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to the task, purpose, and audience.

CCSS.ELA-Literacy.W.11-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

CCSS.ELA-Literacy.W.11-12.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

CCSS.ELA-Literacy.W.11-12.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

04.D.3: Stem Career Clusters (SCC)

SCC02 Communications: Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.

SCC04 Information Technology Applications: Use information technology tools specific to the career cluster to access, manage, integrate, and create information.

SCC07 Leadership and Teamwork: Use leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives.

04.D.4: 21st Century Skills

Learning and Innovation

Creativity and Innovation: Think Creatively, Work Creatively with Others

Critical Thinking and Problem-solving: Reason Effectively, Making Judgments and Decisions

Communication and Collaboration: Communicate Clearly, Collaborate with Others

Information, Media and Technology Skills

Information Literacy: Access and Evaluate Information, Use and Manage Information

ICT (Information, Communications and Technology) Literacy: Apply Technology Effectively

Life and Career Skills

Initiative and Self-direction: Manage Goals and Time, Work Independently, Be Self-directed Learners

Productivity and Accountability: Manage Projects, Produce Results

04.D.5: Next-Generation Science Standards (NGSS)

NGSS8: Obtaining, evaluating, and communicating information

04.D.6: ISTE Standards

4C: Students develop, test and refine prototypes as part of a cyclical design process.

6A: Students choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.

6B: Students create original works or responsibly repurpose or remix digital resources into new creations.

05

System Dynamics and Scripting Fundamentals

05.A Unit Description

The focus of this unit of study is to introduce learners to the concepts of system thinking, using a set of simple examples developed in Unity. Learners will begin to understand the interdependent elements of game design – for example, the connection between the velocity of a game object, and the difficulty of the game. Learners will also recognize the need for game documentation and begin developing their own scripts.

05.B Unit Outline

Lesson Title	Lesson Topics	Suggested Activities/Resources
1. **Components of a Game Design Document (GDD)**	**System thinking and system awareness** What are the inputs (e.g., player controls) and outputs (e.g., movement) of the system? How does changing inputs change outputs? **Design for game development** What makes a game fun? What makes a game challenging? What makes a game boring? **Establishing the game purpose** What do you want this game to feel like? How might you make that happen? **Identifying the audience and understanding the player** Who do you think would like to play your game? (Be specific!) Why would your game appeal to that person? **Goals and objectives for games** How does your game end? How does a player win? How does a player lose? **Creating the game script and narrative** What is the story of your game? What is the conflict in the story? How is it resolved?	Have students complete the **Project Proposal for Capstone Activity** in the Activities and Resources document. This helps them focus their design skills on the game they're planning on making for their capstone project. Consider following this assignment with the **Systems Thinking and Game Development Assignment** in the Activities and Resources document.
2. **Systems thinking and design**	**Using the script and storyboard** Narrative fundamentals Storyboarding Player Progress **Sequences and triggers** Player actions vs system actions Player triggers System triggers **Flowcharting the player process** Inputs → Outputs **Creating a complete Game Design Document (GDD)** Project: Build a GDD for a simple game. Every element of the game that the player encounters should be represented in the GDD. Use a simple project as an example.	Have students complete the **Systems Thinking and Game Development Planning Assignment** in the Activities and Resources document. Ask them to think about their capstone project as they work on this assignment. Consider following this assignment with the **Creating a Game Development Plan Assignment** in the Activities and Resources document.

Lesson Title	Lesson Topics	Suggested Activities/Resources

3. Anatomy of creating scripts	**Class**
	    A class is a set of methods and data that are grouped together in order to be used together.
	Declarations
	    A declaration is when values are assigned to variables.
	Variables
	    Variables are containers that hold different types of data.
	Event sequencing
	    Events in a script proceed from top to bottom, unless the script contains a loop (FOR, WHILE) or a branching statement (IF)
		Have students complete the **Building Learner Scripting Skills Assignment** in the Activities and Resources Document. Students will set up new projects, download new assets, and begin writing simple scripts.

05.C Learning Objectives and Assessments

	Learning Objective	Demonstration of Learning	Bloom's Domain
05.1	Describe the system model as related to game development.	The learner will be able to summarize, in writing, the components of the design and problem-solving process.	1. Remember
05.2	Create a system model to describe the connections between inputs and outputs in a game.	The learner will be able to diagram a "system model" that clearly depicts the game development process and interdependence of game components.	3. Apply
05.3	Create a basic script and attach it to one or more game objects.	Within the Unity Editor, learners are able to create simple script(s) to perform specific actions in a game.	1. Remember
05.4	Populate properties with values or other game objects.	Within the Unity Editor, learners are able to populate properties with values or other game objects.	3. Apply
05.5	Sequence events by writing simple functions within a script.	Learners will create scripts that affect game functions and connect them to game objects in order to see those functions in action.	3. Apply
05.6	Analyze the sequencing of game actions.	When provided with several examples, learners are able to effectively analyze the sequencing of game actions.	4. Analyze
05.7	Critique Game Design Documents (GDD).	When provided samples, learners will be able to critique the completeness of a Game Design Document (GDD) for a simple interactive application or video game.	5. Evaluate

05.D Standards Alignment Guide

05.D.1: Professional Standards for Interactive Application and Video Game Creation

1.2.2: Develop problem statements and design briefs.

1.2.3: Describe problem-solving processes and their application.

1.2.4: Develop specifications (criteria and constraints) to optimize solutions.

1.2.12: Sequence objectives and tasks logically.

1.2.13: Explain and demonstrate project management techniques.

1.3.1: Identify and apply appropriate, accurate terminology when communicating about artistic concepts and technology.

1.3.5: Develop, analyze and communicate design ideas using annotated sketches, technical drawings, graphical, mathematical and/or physical models.

1.3.8: Apply brainstorming techniques to creatively generate a multitude of possible solutions to a stated problem.

1.3.14: Create a narrative and storyboard for a new interactive app/video game.

1.8.4: Create, iterate and maintain a full set of game design documentation.

2.7.1: Demonstrate an understanding of mathematical concepts, logic and syntax shared by various programming languages.

2.7.2: Demonstrate an understanding of "if" and "switch" statements.

2.7.3: Demonstrate an understanding of loops to manage recurring events.

2.7.4: Demonstrate an understanding of coroutines.

2.7.5: Demonstrate an understanding of Functions, Constants and Variables.

2.7.6: Declare and update Fields and Properties with varied access modifiers.

2.7.9: Demonstrate an understanding of proper use of Classes and Functions

05.D.2: Common Core State Standards (CCSS)

CCSS.ELA-Literacy.RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

CCSS.ELA-Literacy.RST.9-10.3 Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

CCSS.ELA-Literacy.RST.11-12.3 Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

CCSS.ELA-Literacy.RST.11-12.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

CCSS.ELA-Literacy.RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon,or concept, resolving conflicting information when possible.

05.D.3: Stem Career Clusters (SCC)

SCC01 Academic Foundations: Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.

SCC02 Communications: Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.

05.D.4: 21st Century Skills

Learning and Innovation

Creativity and Innovation: Think Creatively, Implement Innovations

Critical Thinking and Problem-solving: Reason Effectively, Making Judgments and Decisions

Communication and Collaboration: Communicate Clearly

Information, Media and Technology Skills

Information Literacy: Access and Evaluate Information

Life and Career Skills

Initiative and self-direction: Manage Goals and Time, Work Independently, Be Self-directed Learners

05.D.5: Next-Generation Science Standards (NGSS)

NGSS1: Asking questions (for science) and defining problems (for engineering)

NGSS8: Obtaining, evaluating, and communicating information

05.D.6: ISTE Standards

3C: Students curate information from digital resources using a variety of tools and methods to create collections of artifacts that demonstrate meaningful connections or conclusions.

4C: Students develop, test and refine prototypes as part of a cyclical design process.

5D: Students understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.

06

Game Development Tools, Formats, and Asset Management

06.A Unit Description

Activities in this unit of study are constructed to facilitate the design, development, and analysis of existing tools used for game development. This unit will answer some questions about what the Unity Engine actually is and how it's best used in the creation of interactive applications and video games. Additionally, the unit covers strategies for good asset management and discusses different file formats supported by Unity and how to import and apply them to projects.

06.B Unit Outline

Lesson Title	Lesson Topics	Suggested Activities/Resources
1. **Game engines**	**What is a game engine?** Game engines are sets of tools that make the design process easier. **3D engines** Many game engines are 3D engines, which allow users to build 3D environments.	Have students brainstorm a list of all of the platforms they can think of, and then research them. Which ones have similar architecture? Which ones are very different? (For example, Xbox is basically PC architecture, but the Mac and the iPhone are very different.
2. **Resource development tools**	**Graphic file formats and editors** .jpg, .gif, .png, .img **Video file formats and editors** .mp4, .avi, .mov **Sound file formats and editors** .wav, .ogg **Asset file formats** Assorted	Ask students what kinds of file formats work best for what kinds of media. Discuss "lossy" vs lossless audio.
3. **Asset management in Unity**	**The Hierarchy window** How is it organized? Parent-child relationships **The Project window** Importing assets Good file management strategies	Give students a chance to do some free building in Unity. What's easy to build? What's hard? Talk students through organizing their assets. How do assets get grouped by type? Why might they use nested folders?
4. **Physics engines**	**Collision detection** Dynamic simulation: rigid body and soft-body	Have students complete the Simple Coding Introduction in the Activities and Resources document. This will help students understand the basic relationships in code.
5. **Libraries**	**What is a software library:** Purpose and examples **Dynamic versus static**	Show students how to access the Unity Asset Store. Demonstrate the wealth of free libraries on the store containing assets, scripts, etc.

06.C Learning Objectives and Assessments

	Learning Objective	Demonstration of Learning	Bloom's Domain
06.1	Explain the function and purpose of physics engines.	Learners will be able to hypothesize several ways in which a physics engine might be used within a game	4. Analyze
06.2	Identify contemporary game development tools.	Learners will be able to discuss the principles of ray casting and explain why it is used.	1. Remember
06.3	Write scripts that perform specific functions.	Learners will be able to write scripts that move an object in response to player input.	3. Apply
06.4	Understand basic Asset management.	The learner will understand how and why to group assets into folders, and the nature of parent-child relationships in objects.	3. Apply
06.5	Explain the purpose of dynamic libraries.	The learner will be able to compare purposes of static and dynamic libraries and justify recommendations for the use of each in particular situations.	1. Remember
06.6	Explain the function and purpose of sound editing tools.	Learners will be familiar with at least one free sound editor.	1. Remember
06.7	Build simple scripts that take player input and translate it into game actions.	Learners will be able to write scripts that use Start and GetKeyDown keywords, and which run fixed Updates within a given project development.	3. Apply
06.8	Understand the relationships between different types of assets.	Learners will be familiar with the suite of tools they'll need to use to build their capstone projects.	5. Evaluate

06.D Standards Alignment Guide

06.D.1: Professional Standards for Interactive Application and Video Game Creation

1.7.1: Assess and adapt technology tools and processes for producing deliverables that meet requirements and quality standards.

1.7.9: Demonstrate a working knowledge of game development tools.

1.7.12: Explain the usage of graphic files formats and file interoperability.

1.7.13: Explain the usage of video file formats and file interoperability.

1.7.14: Explain the usage of audio file formats and file interoperability.

2.3.1: Import assets from appropriate file formats for use in development.

2.7.13: Demonstrate an understanding of various programming interfaces.

06.D.2: Common Core State Standards (CCSS)

CCSS.ELA-Literacy.RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

CCSS.ELA-Literacy.RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

CCSS.ELA-Literacy.RST.11-12.10 By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

CCSS.ELA-Literacy.L.11-12.6 Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

06.D.3: Stem Career Clusters (SCC)

SCC01 Academic Foundations: Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.

SCC02 Communications: Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.

SCC04 Information Technology Applications: Use information technology tools specific to the career cluster to access, manage, integrate, and create information.

06.D.4: 21st Century Skills

Learning and Innovation

Critical Thinking and Problem-solving: Reason Effectively, Making Judgments and Decisions

Communication and Collaboration: Communicate Clearly

Information, Media and Technology Skills

Information Literacy: Access and Evaluate Information

ICT (Information, Communications and Technology) Literacy: Apply Technology Effectively

Life and Career Skills

Flexibility and Adaptability: Be Flexible

06.D.5: ISTE Standards

3A: Students plan and employ effective research strategies to locate information and other resources for their intellectual or creative pursuits.

5A: Students formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.

07

Physics and Animation

07.A Unit Description

Activities in this unit of study are designed to engage the learner, providing rich skill-building opportunities in areas of game interface creation for Human Computer Interfaces and Graphical User Interfaces.

07.B Unit Outline

Lesson Title	Lesson Topics	Suggested Activities/Resources
1. **Developing the game environment**	**Components of the game environment** The game environment comprises both the level that the player can see, and the scripts and elements that are invisible to the player. **If-then statements** One of the most basic and powerful tools in code is the ability to use if-then statements. These statements check a condition and activate if that condition is true. **Scale and position** Unity offers a simple and powerful way to change the scale of an object.	Have students write a simple branching narrative using if-then language to describe how the story would change based on the actions of the player.
2. **Physics in Unity**	**Collisions and Rigidbody components** • Rigidbody is a component that tells Unity to apply physics to an object. Without one, objects are like holograms. • Rigidbody components also note "collisions," when two objects intersect. • Learners can use Rigidbody components to check if two things have collided and if-then statements to say what happens if this is the case.	Have students complete the **Character Controllers Activity** in the Activities and Resources Document to set up some simple physics interactions between objects in their environments and their players.
3. **Creating animations in Unity**	Simple animations • Unity can also use the Animation system to move objects. • Animations are created through the animation editor.	Have learners complete the **Animation within an Interface Activity** in the Activities and Resources document.

07.C Learning Objectives and Assessments

	Learning Objective	Demonstration of Learning	Bloom's Domain
07.1	Differentiate a graphical user interface (GUI) and a human machine interface (HMI).	The learner will be able to differentiate a graphical user interface from a human machine interface.	4. Analyze
07.2	Identify contemporary game development tools.	Learners will be able to summarize the role and purpose of controls that are (or should be) included in a GUI/HMI.	2. Understand
07.3	Use game interfaces across platforms and game genres.	Learners will be able to explain why GUI needs might be different across different game genres, and develop a plan for the GUI for their own games.	2. Understand
07.4	Structure the game environment to enhance the player experience.	The learner will accurately choose appropriate game assets and effectively assemble them into the game environment.	3. Apply
07.5	Explain the importance of hierarchical structures for managing game objects and transformations within the Unity Editor.	Learners will be able to apply proper asset management techniques, employ effective hierarchical strategies, and perform adequate asset transformations within specific game development projects.	3. Apply
07.6	Create, manipulate, and transform animation controllers.	The learner will be able to integrate animator controllers, animator components, and blend trees that meet the requirements of a given project.	1. Remember
07.7	Create blended animations using blend trees.	Learners will be able to apply and manage humanoid avatars within the requirements of a given project.	6. Create

	Learning Objective	Demonstration of Learning	Bloom's Domain
07.8	Create animator components.	The learner will be able to use animation curves, adjust animation properties and events (as necessary) to meet the requirements of a given project.	6. Create
07.9	Use scripts to manage animators.	Learners will be able to write and execute animation scripts that meet specific project guidelines.	3. Apply
07.10	Integrate navigation and character controllers within the game environment.	The learner will be able to evaluate effective from ineffective uses of interface controls.	5. Evaluate
07.11	Manage object properties and object transformations in the Unity Editor.	Learners will be able to write scripts that activate game objects and adjust scope and access modifiers within a given project.	6. Create

07.D Standards Alignment Guide

07.D.1: Professional Standards for Interactive Application and Video Game Creation

2.8.1: Explain and demonstrate principles of visual communication.

2.8.7: Explain how target platform capabilities and constraints affect the choice of user interfaces.

2.8.8: Apply structured methods to user interface development.

2.8.9: Implement a new user interface system, test and evaluate its usability.

2.8.10: Modify and adapt user interfaces for different target platforms and genre.

07.D.2: Common Core State Standards (CCSS)

CCSS.ELA-Literacy.RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

CCSS.ELA-Literacy.RST.9-10.3 Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

CCSS.ELA-Literacy.RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

CCSS.ELA-Literacy.RST.9-10.10 By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.

CCSS.ELA-Literacy.RST.11-12.3 Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

CCSS.ELA-Literacy.RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

07.D.3: Stem Career Clusters

SCC01 Academic Foundations: Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.

SCC02 Communications: Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.

SCC04 Information Technology Applications: Use information technology tools specific to the career cluster to access, manage, integrate, and create information.

07.D.4: 21st Century Skills

Learning and Innovation

Critical Thinking and Problem-solving: Reason Effectively, Making Judgments and Decisions

Communication and Collaboration: Communicate Clearly

Information, Media and Technology Skills

Information Literacy: Access and Evaluate Information

ICT (Information, Communications and Technology) Literacy: Apply Technology Effectively

Life and Career Skills

Flexibility and Adaptability

07.D.5: ISTE Standards

4D: Students exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.

5A: Students formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.

7C: Students contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal.

08

Environments and Level Design

08.A Unit Description

In this unit of study, learners will explore concepts fundamental to the ideal level design. Learners will understand the principles of navigation and the importance of a balanced layout to providing good game flow. Learners will also explore principles of functionality.

08.B Unit Outline

Lesson Title	Lesson Topics	Suggested Activities/Resources

1. **Level design theory**	**Game flow types**
	    Games that are too simple or too easy (or too confusing) are boring.
	    Games that are too complicated or too difficult cause anxiety.
	    Games that are well balanced encourage a state called "flow" in players, where they're engaged and focused on play.
	Creating a balanced layout
	    Game balance is the practice of finding the right balance of difficulty and reward to keep players engaged.
	    Level design has a huge impact on flow, as it helps designers determine how to keep the player engaged without either boring or overwhelming them.
	Support of the game narrative
	    Stories in games can help to support the flow of the game by contextualizing player actions.
	    "Stealth" sections can be exciting, even if the play isn't action-packed.
	Conveying the design
	    Level design combines environmental design and game play to create a cohesive, exciting experience for players.
		Have students do a design analysis on a video game level.
		• Where are the most exciting parts of the level?
		• How does the player know how to move through that environment?

Lesson Title	Lesson Topics	Suggested Activities/Resources
2. Level design: Soup to nuts	**The big idea** • What's the overall concept of the level? • Where does it take place? • What happens over the course of the level? **From research to reference** It's important to research real-world counterparts for the levels the players are making. **Creating the floor plan(s)** Draw out and diagram the physical space of the level. **Gameplay elements** • It's important to mark out where specific gameplay interactions will happen in the level. • Elements include ambushes, explosions, anything that will trigger when a player interacts with it. Objects • Objects fill space, tell stories, and provide cover. • Other effects (lighting, sound, etc.)	Have students do the **"Block Out" A Level Activity** in the Activities and Resources document. This will help students think about level design before building digital assets, and start to understand how to choreograph a level.
3. Understanding the flow of space: Explore how players tend to move through space in several different situations	**2D platformers** **3D first-person shooters** **3D narrative spaces**	Look at some classic 2D levels (Super Mario Bros. 1-1 is a good example) and talk about how the levels are choreographed.
4. Level editors: Tools and tricks of the trade	Scene Editor (Unity 3D game engine)	Have students do the **Capstone Project Activity** in the Activities and Resources document to begin building the environments they're going to need to have in their capstone projects.

08.C Learning Objectives and Assessments

	Learning Objective	**Demonstration of Learning**	**Bloom's Domain**
08.1	Plan and draw maps on paper, collect references, and create top down sketches for gameplay.	Using a pencil and paper, the learner will be able to design a complete level map.	4. Analyze
08.2	Explain the principles of level design.	Learners will be able to create a thorough and detailed written level walkthrough, including map sketches, for at least two levels of their capstone project.	5. Evaluate
08.3	Compare and contrast various game flows.	Learners will be able to understand the concept of "flow" and give examples of how to design to encourage it.	2. Understand
08.4	Use the fundamentals of level design to critique game levels.	Learners will be able to define and implement game pathways, choke points, spawn points, and methods of defining where game objects will meet at choke points.	1. Remember
08.5	Explain the concept of a balanced layout.	Learners will be able to design a game level incorporating (at least 6 of the 8 dimensions of) flow and indicate how the layout and challenges of the level achieve each element.	5. Evaluate
08.6	Describe how game levels are used to support game story.	Learners will be able to create level designs that reflect and explain the game narrative.	6. Create
08.7	Communicate level design ideas, concepts, and models in a variety of ways.	Learners will be able to critique level design, offering alternate maps or layouts to improve gameplay.	5. Evaluate

08.D Standards Alignment Guide

08.D.1: Professional Standards for Interactive Application and Video Game Creation

1.6.1: Explain principles of user navigation and level progression.

1.6.2: Demonstrate understanding and ability to use game mechanics to improve gameplay.

1.6.3: Demonstrate knowledge and understanding of balancing layouts.

1.6.4: Demonstrate understanding of pathways, choke points, control points, spawn points and other design methods for creating balance, timing, pacing and flow.

1.6.5: Develop level designs with planning maps and use research and references to sketch characters and environments

1.6.6: Analyze and describe level features & progression from a level in an existing title

1.6.7: Explain how game levels relate to or support an interactive narrative.

1.6.8: Design and develop intuitive levels in 2D & 3D

2.4.1: Implement environmental designs into 2D and 3D levels.

2.4.2: Select appropriate models and materials for creating environments.

2.4.3: Understand and use terrain generation and manipulation tools.

2.4.4: Create, edit and enhance environments to optimize quality.

2.4.5: Create and modify procedural effects like skyboxes, fog and lens flare.

08.D.2: Common Core State Standards (CCSS)

CCSS.Math.Content.HSG.GMD.B.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

CCSS.Math.Content.HSG.MG.A.1 Use geometric shapes, their measures, and their properties to describe objects.

CCSS.ELA-Literacy.SL.11-12.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11-12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

CCSS.ELA-Literacy.SL.11-12.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.

CCSS.ELA-Literacy.SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

08.D.3: Stem Career Clusters (SCC)

SCC01 Academic Foundations: Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.

SCC02 Communications: Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.

SCC03 Problem-Solving And Critical Thinking: Solve problems using critical thinking skills (analyze, synthesize, and evaluate) independently and in teams. Solve problems using creativity and innovation.

SCC07 Leadership And Teamwork: Use leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives.

08.D.4: 21st Century Skills

Learning and Innovation

Creativity and Innovation: Think Creatively, Work Creatively with Others, Implement Innovations

Critical Thinking and Problem-solving: Reason Effectively, Making Judgments and Decisions, Solve Problems

Communication and Collaboration: Communicate Clearly, Collaborate with Others

Life and Career Skills

Flexibility and Adaptability: Adapt to Change, Be Flexible

Initiative and Self-direction: Manage Goals and Time, Work Independently, Be Self-directed Learners

Social and Cross-Cultural Skills: Interact Effectively with Others, Work Effectively in Diverse Teams

Productivity and Accountability: Manage Projects, Produce Results

Leadership and Responsibility: Guide and Lead Others, Be Responsible to Others

08.D.5: Next-Generation Science Standards (NGSS)

HS-ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

08.D.6: ISTE STANDARDS

1D: Students understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.

4B: Students select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.

6C: Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.

09

Principles of Cameras and Lighting in Game Environments

09.A Unit Description

Activities in this unit of study are designed to introduce effective use of cameras and lighting within game design. The focus will be on effective placement of lights and cameras to engage the learner in the game environment and create the atmosphere for the overall game experience.

09.B Unit Outline

Lesson Title	Lesson Topics	Suggested Activities/Resources
1. **Fundamentals of lighting**	**Understand how real-world, practical lighting works** • Basic color theory • Types: • Point • Area • Directional • Ambient • Spot **Lighting models** • Ambient • Diffuse • Emissive • Specular **Properties of light** • Color • Shape/size • Direction • Intensity **Three-point lighting** • Key light (or Main) • Fill light • Rim light (or Backlight)	Have students give examples of how lighting might change an environment. How does lighting change how a room feels? How can we use lighting to make a space inviting? Scary? How do we draw attention to something using lighting?
2. **Fundamentals of camera use in video game design**	**Essentials of scene composition and the Rule of Thirds** **Types** • Fixed camera systems • Tracking cameras • Interactive camera systems **Understanding the 3D camera view** • Position • Aim direction • Field of view **Introduction to projection types** • Perspective • Orthographic • Oblique	Have students complete the **Cameras and Effects Assignment** in the Activities and Resources document, to understand the basics of camera placement and basic camera effects.

Lesson Title	Lesson Topics	Suggested Activities/Resources
3. **Viewpoint and perspective**	**2D** • Top-down • Side-scroller **3D** • Fixed 3D • First person • Third person **2.5** • 3/4 perspective • Pseudo-3D **Projection types** • Orthographic • Perspective	If students haven't already, have them finish the **Setting up 2D Games in a 3D Environment Assignment** in the Activities and Resources document, and talk about how the camera in that project is used to represent a 2D board using 3D assets.
4. **Bringing it all together:** How cameras and lighting are used to engage and immerse the gamer.	**Mood boards**	

09.C Learning Objectives and Assessments

	Learning Objective	Demonstration of Learning	Bloom's Domain
09.1	Apply the Rule of Thirds	Learners will be able to create visual images in Unity that follow the Rule of Thirds and demonstrate good balance	3. Apply
09.2	Demonstrate the importance of scene balancing	The learner will be able to compare and contrast various ways to simulate light in a computer graphics environment. This includes light mapping to light placement, explaining the advantages and disadvantages of each method, and hypothesizing on when each type of light is best employed.	4. Analyze
09.3	Explain how viewpoint impacts gameplay.	Learners will be able to explain the difference between 2D and 3D perspective and the difference between orthographic and perspective cameras.	2. Understand
09.4	Create atmosphere and enhance emotion through the principles of lighting.	The learner will be able to light a basic room, evoking three different emotions (i.e., sadness, fear, and comfort).	3. Apply
09.5	Position lighting and cameras in order to focus attention within a game.	Learners will create a focal point lighting scheme, focusing the viewer's attention to a specific element of an image.	6. Create

09.D Standards Alignment Guide

09.D.1: Professional Standards for Interactive Application and Video Game Creation

1.1.9: Explain the relevance of ambiance and environment in game design.

2.5.1: Explain the role of cameras and lighting with respect to ambiance.

2.5.2.1: Create, transform and modify area lights.

2.5.2.3: Create, transform and modify directional lights.

2.5.2.4: Create, transform and modify point and spot lights.

2.5.4: Explain the use of cameras to create alternative views of gameplay (first-, second- and third-person perspectives).

2.5.5: Effectively use framing and camera views to create visual cues for users.

2.5.6 : Use cameras and lighting to create specific emotional experiences such as tension, fear, excitement.

09.D.2: Common Core State Standards (CCSS)

CCSS.ELA-Literacy.RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

CCSS.ELA-Literacy.RST.9-10.3 Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

CCSS.ELA-Literacy.RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

CCSS.Math.Content.HSG.CO.A.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

CCSS.Math.Content.HSG.CO.A.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).

09.D.3: Stem Career Clusters (SCC)

SCC01 Academic Foundations: Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.

SCC02 Communications: Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.

SCC03 Problem-Solving And Critical Thinking: Solve problems using critical thinking skills (analyze, synthesize, and evaluate) independently and in teams. Solve problems using creativity and innovation.

SCC07 Leadership And Teamwork: Use leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives.

09.D.4: 21st Century Skills

Learning and Innovation

Creativity and Innovation: Think Creatively, Implement Innovations

Critical Thinking and Problem-solving: Reason Effectively, Making Judgments and Decisions

Communication and Collaboration: Communicate Clearly

Information, Media and Technology Skills

Information Literacy: Access and Evaluate Information

Life and Career Skills

Initiative and Self-direction: Manage Goals and Time, Work Independently, Be Self-directed Learners

09.D.5: ISTE Standards

3C: Students curate information from digital resources using a variety of tools and methods to create collections of artifacts that demonstrate meaningful connections or conclusions.

4A: Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.

6C: Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.

10

Principles of Sound and Audio for Games

10.A Unit Description

Activities in this unit of study are designed to explore the various applications of sound and music, including the selection of appropriate choices, and the optimization of asset formats. Students will add sound to their games, using both background and triggered sound effects. Students will learn how to connect sound effects to in-game events, and how to deploy audio elements that help to create the illusion of a 3D space.

10.B Unit Outline

Lesson Title	Lesson Topics	Suggested Activities/Resources
1. **Enhancing game experience with sound and audio**	**Sounds for game realism** • Motors, lasers, other sounds • What kinds of sounds exist in your scene? • What do they tell the player about the world of your game? **Adding dialogue to the game** Narrator • A narrator is someone who describes the action but generally is not part of the story. Character • Characters can use dialogue to talk to each other, or directly to the player. **Selecting appropriate music for game experience** • What kind of music will help your game come alive? • How can music help your player feel safe, excited, happy, sad, or scared? • Finding sound and music sources • Proper use of copyrighted music and sound files	Have students choose a favorite scene from a movie. Discuss how sound (or silence) plays an important role in the scene. Have students complete the **Sound and Audio Sources for Game Development** assignment in the Activities and Resources document, which will give them some more practice setting up a new project, and some ideas about how to use sound to add depth and interest to a simple scene.
2. **Audio sources**	**Choosing correct sound file types** • WAV files • MP3 files • MIDI Files • API sources: OGG Vorbis, FMOD, SD	Have students implement a simple sound cue in a scene. Talk about why they might want to use one file format over another.
3. **2D and 3D sound**	**Overview of mono and stereo format and 2D/3D sound** • 3D sound settings and applications • 2D sound settings and applications	Have students listen to a stereophonic piece (google "Esquivel See It In Sound" for some good early examples) and then the same piece in mono sound. Discuss the differences. When might one be more useful than the other?

Lesson Title	Lesson Topics	Suggested Activities/Resources
4. **Sound FX:** Compression, Doppler, priority settings, playback	**What is audio compression and when to use it** **Introduction to the Doppler effect** • The Doppler effect is a pitch-shift applied to sound-emitting objects as they move past a listener. • It is an important part of making the illusion of real sound in a game. • Applying the Doppler effect to game Assets **Setting sound priorities** **Volume rolloff and rolloff settings**	Have a brief discussion about different sound file formats, lossy vs lossless audio, and when compressed audio might be useful in a game.
5. **Audio scripting**	**Using scripts to sequence audio events**	Have students finish the **Implementing Simple Sounds** tutorial in the Activities and Resources document, which will give them more practice setting up projects as well as using scripts to control audio.

10.C Learning Objectives and Assessments

	Learning Objective	Demonstration of Learning	Bloom's Domain
10.1	List the different types of audio files used in most game engines.	The learner will compare and contrast common audio and sound file formats, their applications in the game, and the methods for acquiring the assets.	1. Remember
10.2	Describe how sound files and music are used to enhance game experience and provide realism.	Learners will summarize the science of how each sound effect works and can recommend use case scenarios for common sound effects within the game environment.	2. Understand
10.3	Apply audio and audio effects to create realistic game environments.	Through individual research activities, learners will identify genres of music and will record judgments as to which genre is most appropriate for a given type of video game.	5. Evaluate
10.4	Manage priority settings of multiple sound sources.	Learners will implement "audio listeners" in a Unity Scene in order to create believable audio.	5. Evaluate
10.5	Explain the Doppler effect and describe how to apply it within the game environment.	Through the creation of a game snippet, the learner will integrate the Doppler effect in the game environment.	3. Apply
10.6	Create scripts to manage audio files within the game environment.	The learner will write scripts to position sounds within the game environment.	3. Apply
10.7	Manipulate sound to create realistic effects like rolloff in a game.	The learner will demonstrate a basic ability to use Unity's audio mixers to affect how a sound is perceived by a player.	3. Apply
10.8	Manage external sound and music assets that contain intellectual property protection agreements.	The learner, in writing, will summarize and paraphrase the various rules and laws pertaining to the proper use of external intellectual property within a game	4. Analyze

10.D Standards Alignment Guide

10.D.1: Professional Standards for Interactive Application and Video Game Creation

1.7.1: Assess and employ various technology and processes for producing deliverables that meet requirements and quality standards.

1.7.14: Explain the usage of audio file formats and file interoperability.

1.7.10.2: Define "codec" and describe its use.

1.7.6: Demonstrate a working knowledge of audio capture and editing tools.

2.4.1: Implement environmental designs into 2D and 3D levels.

2.4.4: Create, edit and enhance environments to optimize quality.

10.D.2: Common Core State Standards (CCSS)

CCSS.ELA-Literacy.RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

CCSS.ELA-Literacy.RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

CCSS.ELA-Literacy.RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

10.D.3: Stem Career Clusters (SCC)

SCC01 Academic Foundations: Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.

SCC02 Communications: Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.

SCC04 Information Technology Applications: Use information technology tools specific to the career cluster to access, manage, integrate, and create information.

10.D.4: 21st Century Skills

Learning and Innovation

    Critical Thinking and Problem-solving: Reason Effectively, Making Judgments and Decisions

    Communication and Collaboration: Communicate Clearly

Information, Media and Technology Skills

    Information Literacy: Access and Evaluate Information

    ICT (Information, Communications and Technology) Literacy: Apply Technology Effectively

Life and Career Skills

    Flexibility and Adaptability: Be Flexible

10.D.5: ISTE Standards

1C: Students use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.

1D: Students understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.

2B: Students engage in positive, safe, legal and ethical behavior when using technology, including social interactions online or when using networked devices.

2C: Students demonstrate an understanding of and respect for the rights and obligations of using and sharing intellectual property.

4B: Students select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.

11

Basic Interfaces and the Build Process

11.A Unit Description

Activities in this unit of study place emphasis on managing the build process within game creation. Learners will develop skills through a project approach in a team environment as they create a simple 2D/3D game from an existing game template.

11.B Unit Outline

Lesson Title	Lesson Topics	Suggested Activities/Resources
1. Managing the build process	**Work in progress (WIP)** • It's important to differentiate between a working project and a release candidate. • Get students into the habit of naming their projects in a way that indicates which part of the lifecycle of the work they're in. "Alpha candidate 1.0, Beta 0.4, Release candidate 0.1," etc. **Quality assurance** QA is a crucial step in game development, where projects are checked for bugs. **Development milestones** Most studios use the following project milestones: prototype, Alpha, Beta, Gold • Prototype is the rough draft. • Alpha is a working project that is missing significant features. • Beta is feature complete but has bugs. • Gold (or "Release" is ready for publishing.	Review the **Naming Conventions Assignment** in the Activities and Resources document with students, and work with them to determine where in the build process they are. Have them name their subsequent releases accordingly.
2. Graphical user interfaces	**What is a GUI?** • A user interface lets users interact with the system inside a game or a computer. • Windows is an example of a GUI. • Most games have a GUI, sometimes called a "HUD" (heads-up display) **Making UI** • Buttons and menus • Communicating flow • User experience **What kind of UI does your game need?** • What choices are players making? • How do you make the effect of a choice clear? • How do you encourage players to interact with the correct element?	Have students complete the **User Interface Activity** in the Activities and Resources document to get a feel for what a UI is and how it can be implemented well (or poorly.) Have students complete the **GUI Practice Activity** in the Activities and Resources document to get familiar with Unity's basic UI components. Ask students to think about their capstone games and about what kinds of UI components they might need for those games.

11.C Learning Objectives and Assessments

	Learning Objective	Demonstration of Learning	Bloom's Domain
11.1	Select the appropriate assets for projects of adequate format, size and use in a game.	The learner will create a Resource List that indicates how to acquire digital assets and all resources related to digital assets.	3. Apply
11.2	Sequence game activities from start to finish in regard to both gameplay sequence and build process.	The learner will analyze a variety of game development plans before designing a plan of their own.	4. Analyze
11.3	Write scripts that enable and disable components, script Game Objects, move players and camera, pick up objects, and perform other specific tasks.	Within the assigned game project, the learner will create and write scripts that enable/disable components and manipulate and transform game assets.	3. Apply
11.4	Import and manage game assets, including player game objects, cameras, lights, and backgrounds.

Set up and load a game and a development project. | The learner will write code that moves players in the game space and correctly applies and integrates cameras, lighting, and background into the assigned game project. | 6. Create |
11.5	Use best practices for file naming.	The learner will adhere to the conventions for naming files to communicate position in the development process.	2. Understand
11.6	A Use scripts to control player actions.	The learner will create and manage game controllers within the assigned game project.	2. Understand
11.7	Integrate audio, counting points, scores, and game controllers into a simple game.	The learner will integrate audio and spawning waves into the assigned game project.	2. Understand
11.8	Project manage the build process from start to finish for a game.	The learner will design and write code required to integrate counting points and score displays into the assigned game project.	3. Apply

11.D Standards Alignment Guide

11.D.1: Professional Standards for Interactive Application and Video Game Creation

    1.5.2: Use physics to create realistic motions with objects and characters.

    1.5.3: Explain the use of collision geometry for physics-based interactions and as programming triggers.

    1.5.4: Apply and manage the use of Colliders.

    1.5.9: Demonstrate the ability to handle object collisions and physics simulations in a realistic manner.

    1.6.2: Demonstrate understanding and ability to use game mechanics to improve gameplay.

    1.6.3: Demonstrate knowledge and understanding of balancing layouts.

    1.6.4: Demonstrate understanding of pathways, choke points, control points, and spawn points and other design methods for creating balance, timing, pacing and flow.

    1.7.15: Describe the basic logic, concepts and key structures behind computer programming languages.

    1.7.17: Determine appropriate programming and scripting languages to create desired game mechanics, control the environment, UI and gameplay.

    1.7.18: Create a hypothetical technology pipeline for an interactive application or video game project.

    1.8.3: Define game design documentation (GDD), its purpose and components.

    1.8.4: Create, iterate and maintain a full set of game design documentation.

    1.8.5: Prepare a plan of work based on an approved GDD including deliverables, tasks, resources, schedule, Gantt and PERT charts.

    2.1.6: Demonstrate the use of object preferences and inspector tools.

    2.1.7: Accurately transform objects with respect to coordinate systems (translate, rotate and scale).

    2.1.8: Describe and change the active status of objects.

    2.1.9: Describe and change the enabled status of components.

    2 .2.2: Understand and use hierarchical structures for organization.

    2.2.3: Create effective naming conventions for objects and assets.

    2.2.4: Apply descriptive tags, labels, and use layers for asset management.

    2.5.3: Demonstrate the creation, transformation, modification and use of cameras.

    2.6.1: Use various techniques for effectively animating objects and component properties.

    2.7.1: Demonstrate an understanding of mathematical concepts, logic and syntax shared by various programming languages.

    2.8.3: Using examples, describe key principles behind graphical user interfaces (GUIs).

    2.8.4: Define usability as a quality objective for user interfaces (UIs).

    2 .8.4: Differentiate between diegetic and non-diegetic user interface elements.

    2.8.5: Explain how specific UI characteristics can affect usability.

    2.8.6: Determine the UI functionality required by a specific project to improve outcomes and meet the needs of users.

    3.2.4: Deploy, use and demonstrate a revision control system for a new or existing project.

11.D.2: Common Core Learning Standards (CCSS)

CCSS.ELA-Literacy.RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

CCSS.ELA-Literacy.RST.9-10.3 Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

CCSS.ELA-Literacy.RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

CCSS.ELA-Literacy.RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

CCSS.ELA-Literacy.RST.9-10.10 By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.

11.D.3: Stem Career Clusters (SCC)

SCC01 Academic Foundations: Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.

SCC02 Communications: Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.

11.D.4: 21st-Century Skills

Learning and Innovation

>**Creativity and Innovation: Think Creatively, Implement Innovations**
>**Critical Thinking and Problem-solving:** Reason Effectively, Making Judgments and Decisions
>**Communication and Collaboration:** Communicate Clearly

Information, Media and Technology Skills

>**Information Literacy:** Access and Evaluate Information

Life and Career Skills

>**Initiative and self-direction:** Manage Goals and Time, Work Independently, Be Self-directed Learners

11.D.5: Next-Generation Science Standards (NGSS)

>**NGSS5:** Using mathematics and computational thinking

11.D.6: ISTE Standards

5C: Students break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving.

6B: Students create original works or responsibly repurpose or remix digital resources into new creations.

6C: Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.

12

Intermediate Animation and UI

12.A Unit Description

Activities in this unit of study are designed to focus on the creation of intermediate animations and graphical user interfaces (GUIs) that are adaptable to a variety of platforms and play levels.

12.B Unit Outline

Lesson Title	Lesson Topics	Suggested Activities/Resources
1. **Creating intermediate-level game interfaces**	**Using externally created skins in Unity** **Custom GUI styles in Unity**	Have students complete the **Scriptable Objects for UI** tutorial in the Activities and Resources document, which will show them how to create UI objects that respond to script commands.
2. **Creating intermediate-level animations in Unity**	**Intermediate animations** **Preparing models for animation** **Humanoid avatars** **States and blend trees** **Avatars**	Have students complete the **Intermediate Concepts in Animation** tutorial in the Activities and Resources document. This will introduce them to important tools for animation, including Cinemachine (controls the camera for more complex cutscenes, etc.,) and Anima2D, a tool that makes animating humanoid avatars relatively easy.
3. **Project creation**	**Project build**	Student capstone projects should be in the late Alpha or early Beta stages. Have students complete a **GDD Progress Check** in the Activities and Resources document to determine if they're on schedule.

12.C Learning Objectives and Assessments

	Learning Objective	Demonstration of Learning	Bloom's Domain
12.1	Design engaging and efficient user interfaces for a variety of devices and platforms.	The learner will be able to create UI that clearly communicates game concepts to users and discuss how that interface would need to be adapted for a different platform.	6. Create
12.2	Create unique interface skins that are applicable to multiple devices.	Learners will be able to create unique skins or graphic user interfaces (GUIs) to an interactive application or video game.	6. Create
12.3	Create animator components.	Learner will be able to implement animator components such as keyframes and timing.	6. Create
12.4	Create animations that use blend trees.	The learner will be able to create and manage blend trees and states of animated models.	6. Create
12.5	Assemble animator assets that are part of a project.	The learner will be able to download an implement animation assets from the Unity Asset Store.	3. Apply
12.6	Manage animators with scripts.	The learner will be able to play and stop animations on command through scripts.	3. Apply
12.7	Manipulate humanoid avatars and animation properties.	Within their capstone project, the learner will demonstrate their ability to rig and animate a humanoid avatar in a game environment.	6. Create

12.D Standards Alignment Guide

12.D.1: Professional Standards for Interactive Application and Video Game Creation

1.5.2: Use physics to create realistic motions with objects and characters.

1.5.3: Explain the use of collision geometry for physics-based interactions and as programming triggers.

1.5.4: Apply and manage the use of Colliders.

1.5.9: Demonstrate the ability to handle object collisions and physics simulations in a realistic manner.

1.6.2: Demonstrate understanding and ability to use game mechanics to improve gameplay.

1.6.3: Demonstrate knowledge and understanding of balanced layouts.

1.7.15: Describe the basic logic, concepts and key structures behind computer programming languages.

1.7.17: Determine appropriate programming and scripting languages to create desired game mechanics, control the environment, UI and gameplay.

2.1.6: Demonstrate the use of object preferences and inspector tools.

2.1.7: To reposition objects using the transform (translate, rotate, scale) tools, with respect to World and Local coordinate systems.

2.1.8: Describe and change the active status of objects.

2.1.9: Describe and change the enabled status of components.

2.2.2: Assess and employ strategies for hierarchical structures, used for organization.

2.2.3: Create an effective naming conventions for objects and assets.

2.2.4: Apply descriptive tags, labels, and use layers for asset management.

2.5.3: Demonstrate the creation, transformation, modification and use of cameras.

2.6.1: Use various techniques for effectively animating objects and component properties

2.7.1: Demonstrate an understanding of mathematical concepts, logic and syntax shared by various programming languages.

3.2.4: Assess and execute strategies for a revision control system within a new or existing project.

3.3.7: Demonstrate the use of a debugger to inspect code at run time.

12.D.2: Common Core State Standards (CCSS)

CCSS.ELA-Literacy.RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

CCSS.ELA-Literacy.RST.9-10.3 Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

CCSS.ELA-Literacy.RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

12.D.3: Stem Career Clusters (SCC)

SCC01 Academic Foundations: Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.

SCC02 communications: Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.

12.D.4: 21st Century Skills

Learning and Innovation

Creativity and Innovation: Think Creatively, Implement Innovations

Critical Thinking and Problem-solving: Reason Effectively, Making Judgments and Decisions

Communication and Collaboration: Communicate Clearly

Information, Media and Technology Skills

Information Literacy: Access and Evaluate Information

Life and Career Skills

Initiative and Self-direction: Manage Goals and Time, Work Independently, Be Self-directed Learners

12.D.5: Next-Generation Science Standards (NGSS)

NGSS5: Using mathematics and computational thinking

12.D.6: ISTE Standards

6A: Students choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.

5C: Students break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving.

6C: Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.

13

Principles of Quality and Functionality Assurance in Game Development

13.A Unit Description

Activities in this unit of study are designed to introduce learners to quality and functionality assurance. This unit will focus specifically on the testing, troubleshooting, and debugging of an interactive application or video game.

13.B Unit Outline

Lesson Title	Lesson Topics	Suggested Activities/Resources
1. **Overview of testing**	**What is QA testing?** QA testing is the process of certifying that a game is ready for public consumption. QA testers play games trying to break them, to make sure that players don't break them accidentally. Some examples of QA testing include: • Wall testing, where the tester tries to run into every wall • Input testing, where the tester tries to give the game confusing or unexpected inputs **Types of bugs** Bugs are generally categorized by • a. How they appear • b. How serious they are "Showstopper" bugs prevent the game from running and must be fixed. "Reproducibility" is a description of the steps that it takes to encounter the bug.	Have students complete the **In-Class Debugging Activity** in the Activities and Resources document to get some hands on experience debugging their code.
2. **Relationship between testing, quality assurance, and quality control**	**QA is the team that tests.** Quality control is the process of finding bugs and, crucially, sending them back to the designers and the engineers to fix. **Levels of software testing** • Functional • Acceptance testing: alpha, beta • Non-functional • Performance: load and stress testing • Usability • Security • Portability	Have students write test plans for their games and then hand those plans off to other students to test.
3. **Testing documentation: Test plan, test cases/ scenarios**	Writing a test plan for a game means that the designer identifies potential problem/buggy areas and offers suggestions on how to find those bugs	Have students write test plans for their games and then hand those plans off to other students to test.

13.C Learning Objectives and Assessments

	Learning Objective	**Demonstration of Learning**	**Bloom's Domain**
13.1	Explain the importance of QA and testing.	The learner will be able to describe the function and process of QA testing.	2. Understand
13.2	Explain the importance of documentation during testing stages.	The learner will create test documents and keep track of bugs, both open and closed, as their game approaches Gold Status.	3. Apply
13.3	Describe basic troubleshooting strategies.	The learner will be able to troubleshoot a bug, reproduce it, identify it in code, and fix it.	5. Evaluate
13.4	Perform successful debugging and troubleshooting activities within a game environment.	Given a program with a bug, the learner will identify the defects/inconsistencies and enter them appropriately into the bug-tracking database.	4. Apply
13.5	Locate bugs within a game environment using debugging software tools.	Given a section of code with at least 15 bugs, the learner will resolve the problems, updating their progress in the bug-tracking database.	5. Evaluate

13.D Standards Alignment Guide

13.D.1: Professional Standards for Interactive Application and Video Game Creation

3.3.1: Graphically describe a multi-step testing methodology.

3.3.2: Use general troubleshooting strategies to identify and resolve application problems.

3.3.4: Develop a troubleshooting log.

3.3.5: Discuss the benefits of using bug tracking software.

3.3.6: Research and compare the pros and cons of several specific bug tracking software solutions.

3.3.7: Demonstrate the use of a debugger to inspect code at run time.

3.3.9: Create a cause and effect diagram to account for possible causes of a particular problem.

13.D.2: Common Core State Standards (CCSS)

CCSS.ELA-Literacy.RST.11-12.3 Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

CCSS.ELA-Literacy.W.11-12.2 Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

CCSS.ELA-Literacy.W.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

13.D.3: Stem Career Clusters (SCC)

SCC02 Communications: Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.

SCC03 Problem-Solving And Critical Thinking: Solve problems using critical thinking skills (analyze, synthesize, and evaluate) independently and in teams. Solve problems using creativity and innovation.

SCC10 Technical Skills: Use the technical knowledge and skills required to pursue the targeted careers for all pathways in the career cluster, including knowledge of design, operation, and maintenance of technological systems critical to the career cluster.

13.D.4: 21st Century Skills

Learning and Innovation

    Critical Thinking and Problem-solving: Reason Effectively, Making Judgments and Decisions, Solve Problems

    Communication and Collaboration: Communicate Clearly, Collaborate with others

Information, Media and Technology Skills

    Information Literacy: Access and Evaluate Information, Use and Manage Information

    ICT (Information, Communications and Technology) Literacy: Apply Technology Effectively

Life and Career Skills

    Initiative and self-direction: Manage Goals and Time, Work Independently

    Social and Cross-cultural Skills: Interact Effectively with Others

    Productivity and Accountability: Manage Projects, Produce Results

13.D.5: Next Generation Science Standards (NGSS)

NGSS: Asking questions (for science) and defining problems (for engineering)

13.D.6: ISTE Standards

4C: Students develop, test and refine prototypes as part of a cyclical design process.

4D: Students exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.

14

Principles of Versioning and Game Release

14.A Unit Description

Activities in this unit of study are designed to focus on the deployment of a custom game or interactive application as a final result (i.e., final product release) of the course.

14.B Unit Outline

Lesson Title	Lesson Topics	Suggested Activities/Resources
1. **Version names and numbering systems**	• **Development stages** • **Numbering schemes** • **Sequencing** • **Release candidates**	Double check with students that each project is numbered according to a clear rubric to indicate which phase of development it's in.
2. **Purpose of game versions**	• **Significance in game development** • **Significance in technical support** • **Significance in marketing**	Have students complete the **Versioning Significance Narrative** research paper in the Activities and Resources document, to give them a clear understanding of why versioning is so important.

3. **Managing release candidates**	**Preparing for official release**
	
	Distribution
	   • Options
	   • Process
	   • Shareware/For Profit
		Have students submit their Final Release Candidate as described in the Activities and Resources document. This represents the end of their game development journey!

14.C Learning Objectives and Assessments

	Learning Objective	**Demonstration of Learning**	**Bloom's Domain**
14.1	Explain the concepts and rationale behind versioning schemes and procedures.	The learner will be able to compare and contrast the various types of versioning.	2. Understand
14.2	Describe how versions are used by different groups in the development process.	The learner will summarize major concepts related to game versioning in writing.	1. Remember
14.3	Create a versioning system for a game development project.	The learner will summarize, in writing, the significance and importance of versioning to members of a design team, a technical support team, and a product marketing team.	2. Understand
14.4	Use numbering systems to version complex development projects	The learner will number their release candidates using a clear methodology that helps them keep track of which version of their project they're working on.	3. Apply
14.5	Describe the factors that constitute a release candidate.	The learner will understand the steps they need to complete to deliver a final release candidate.	2. Understand
14.6	Demonstrate understanding of the utility of versioning.	The learner will be able to explain how versions are used by different processes in the lifecycle of a game.	2. Understand
14.7	Describe the various distribution options for release candidates.	The learner will be able to define the following terms: • Pre-Alpha • Alpha • Beta • Release candidate • Versioning numbers • Commercial distribution • Shareware	1. Remember
14.8	Complete the lifecycle of a game project.	The learner will deliver a final release candidate, demonstrating a clear understanding of the game design and development process.	6. Create

14.D Standards Alignment Guide

14.D.1: Professional Standards for Interactive Application and Video Game Creation

3 .2.1: Explain the stages of game deployment (pre-Alpha, Alpha, Beta stages, release candidate, "going gold," etc.).

3.2.2: Explain how software versioning is used and why.

3.2.3: Compare revision control software options and discuss pros and cons from several specific examples.

3.2.4: Deploy, use and demonstrate a revision control system for a new or existing project.

14.D.2: Common Core State Standards (CCSS)

CCSS.ELA-Literacy.RST.9-10.3 Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

CCSS.ELA-Literacy.RST.9-10.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

14.D.3: Stem Career Clusters (SCC)

SCC02 Communications: Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.

SCC04 Information Technology Applications: Use information technology tools specific to the career cluster to access, manage, integrate, and create information.

14.D.4: 21st Century Skills

Information, Media and Technology Skills

    Information Literacy: Access and Evaluate Information

    ICT (Information, Communications and Technology) Literacy: Apply Technology Effectively

Life and Career Skills

    Flexibility and Adaptability: Be Flexible

14.D.5: ISTE Standards

6D: Students publish or present content that customizes the message and medium for their intended audiences.

7B: Students use collaborative technologies to work with others, including peers, experts or community members, to examine issues and problems from multiple viewpoints.