

# Game Development in Unity Syllabus

High School (140 Contact Hours)

## Course Overview and Goals

Students will embark on an exciting journey to master the fundamentals of game design and programming. Through hands-on projects and engaging challenges using the Unity game engine and CodeHS lessons, students will learn to create interactive and visually captivating 2D and 3D games. This course equips students with essential programming skills in C# and Unity's scripting system while honing their problem-solving abilities and fostering creativity in game development. By the end of this course, students will be able to apply the design planning process, describe industry-related careers, and utilize the Unity game engine to create fun digital games.

## Learning Environment

While this course adapts the blended learning approach, it can also be delivered within a virtual learning environment. Course content is a combination of web-based and offline activities. Students will access lessons through the CodeHS platform and perform activities directly within the Unity game engine. Students and instructors will need to sign up for a Unity account, download and install Unity Hub, and download and install the Unity game engine in order to complete this course. Installation and setup instructions are included within this course.

While the course includes a module on virtual reality (VR) game development, students will use Unity's XR Display Simulator plugin to test out their Unity projects. No VR headsets or head-mounted displays are required.

## Programming Environment

Students demonstrate their game design skills and create Unity C# scripts, or programs, with the CodeHS platform and develop their game worlds using the Unity game engine. Students will develop their game worlds, configure script and game object properties, and publish their digital games with the Unity game engine. They'll share their Unity projects with their teacher and classmates.

## Presentations

Some lessons include an activity where students create a presentation. Teachers have the choice of structuring these assignments as either having students deliver an oral presentation with a slide deck or having students complete and submit a slide deck as a hands-on, visual activity.

## Prerequisites

Game Development in Unity is designed for high school students with a basic level of technical proficiency or experience with digital design. While students do not need a background in programming, some previous coding exposure may be beneficial.

## More Information

Browse the course content: <https://codehs.com/course/21443>

## Course Breakdown

### Module 1: Game Design (2 weeks / 10 hours)

Explore the world and evolution of video games. Students will learn about the history of video games and be introduced to the MDA framework as a tool to analyze and design games. Students explore game mechanics and discover methods for designing accessible games. They'll also practice creating a basic game design document.

Objectives / Topics Covered	<ul style="list-style-type: none"><li>● History of Video Games</li><li>● Mechanics, Dynamics, and Aesthetics Game Design Framework</li><li>● Game Design Documents</li></ul>
Example Assignments / Labs	<ul style="list-style-type: none"><li>● History of Video Games<ul style="list-style-type: none"><li>○ Students learn about the basic history of video games and the industry. Students get a glimpse of how games and consoles have developed over time.</li></ul></li><li>● Types of Games<ul style="list-style-type: none"><li>○ Students explore game experience types and perspectives that are used to categorize different video games.</li></ul></li><li>● MDA Framework and Game Design Documents<ul style="list-style-type: none"><li>○ Students explore and learn to analyze games using the MDA (mechanics, dynamics, and aesthetics) game design framework.</li><li>○ Students learn about game design documents and how they're used to design a game and assist with its development process.</li></ul></li><li>● Accessible Games<ul style="list-style-type: none"><li>○ Students learn about the importance of designing accessible games. They explore resources and learn how to design games with the Accessible Player Experiences (APX) model.</li></ul></li></ul>

### Module 2: Unity: A Game Engine (2 weeks / 6 - 10 hours)

Get hands-on with the Unity game engine. Students learn about different types of game engines and how to weigh benefits and tradeoffs of selecting a game engine for a development project. They'll also learn how to obtain and import game assets, set up a code editor, and import Unity C# scripts.

Objectives / Topics Covered	<ul style="list-style-type: none"><li>● Intro to Game Engines and Unity</li><li>● Unity Setup</li><li>● Unity Basics and Code Editors</li><li>● Asset Library</li></ul>
Example Assignments / Labs	<ul style="list-style-type: none"><li>● Intro to Unity<ul style="list-style-type: none"><li>○ Students learn more about Unity as a game engine and what sort of games have been developed with it.</li></ul></li><li>● Unity Setup<ul style="list-style-type: none"><li>○ They set up their own Unity accounts and install the free software on their computer.</li></ul></li></ul>

	<ul style="list-style-type: none"> <li>● Unity Basics <ul style="list-style-type: none"> <li>○ Students learn about Unity's interface and GameObjects. Students will create a GameObject, add a material, and transform it.</li> <li>○ Students learn how to use C# scripts from the CodeHS editor and import them into their Unity projects.</li> <li>○ Students learn how to obtain and manage assets from multiple sources in a Unity project.</li> </ul> </li> </ul>
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### Module 3: Unity Scripting Basics (2 weeks / 8 - 10 hours)

Sharpen your Unity C# scripting skills. Students begin using the Unity scripting API with basic C# scripts in simple 2D Unity projects. They begin using functions, declaring variables, and defining classes.

Objectives / Topics Covered	<ul style="list-style-type: none"> <li>● Unity Scripting API</li> <li>● Functions</li> <li>● Declaring Variables</li> <li>● Defining Classes</li> <li>● Player Controls</li> </ul>
Example Assignments / Labs	<ul style="list-style-type: none"> <li>● Scripting API <ul style="list-style-type: none"> <li>○ Tapping into Unity's API, students learn how to begin scripting for Unity projects. They'll start working with the Unity API boilerplate code and create a new script file.</li> <li>○ Breaking down the common Unity script structure, students explore the Start( ) and Update( ) functions and discover the importance of the game loop.</li> </ul> </li> <li>● Declaring Variables and Defining Classes <ul style="list-style-type: none"> <li>○ Students begin declaring public and private variables, learn the differences of each, work more with Unity's API, and trace variables to identify errors.</li> <li>○ Students will continue to work with basic scripts using Unity's API classes and learn how to develop their own classes to make blueprints for cloned sprites and GameObjects.</li> </ul> </li> <li>● Player Controls and Input <ul style="list-style-type: none"> <li>○ Students explore the Unity Input Manager and reflect on different ways C# scripts can impact player device inputs.</li> </ul> </li> </ul>

### Module 4: Develop 2D Games (4 weeks / 18 - 20 hours)

Create your first 2D game in Unity. Students walk-through the process of developing a 2D skiing game based on a provided game design document. This gives students a model design document to work from as they learn technical Unity and scripting skills.

Objectives / Topics Covered	<ul style="list-style-type: none"> <li>● Sprites and Animations</li> <li>● Tilemaps</li> <li>● Game Mechanics</li> <li>● AI in Games</li> <li>● Menus and Heads-up Displays</li> </ul>
Example Assignments / Labs	<ul style="list-style-type: none"> <li>● Sprites and Animations <ul style="list-style-type: none"> <li>○ Students learn more about sprites, sprite sheets, and tilesets.</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ They create sprite animations, configure Unity's animator for a sprite, and code a movement script to control animation transitions.</li> <li>● Tilemaps <ul style="list-style-type: none"> <li>○ Students build tilemaps based on a tileset and learn to create layers of tilemaps for the ground, obstacle or collision, and decorative tiles.</li> </ul> </li> <li>● Game Mechanics <ul style="list-style-type: none"> <li>○ Students dive into game mechanics by analyzing the representation, decisions, and goals impacted by different mechanics in popular 2D games.</li> <li>○ Students begin coding and configuring scripts to handle different types of game mechanics. They'll script collisions with dynamic game elements and add audio/visual feedback for players.</li> </ul> </li> <li>● AI in Games <ul style="list-style-type: none"> <li>○ Students explore different types of artificial intelligence (AI) used in video games.</li> <li>○ They learn about programmed AI and non-player character (NPC) behaviors.</li> <li>○ Students code NPC scripts for a 2D Unity game project.</li> </ul> </li> <li>● Menus and Heads-up Displays <ul style="list-style-type: none"> <li>○ Students create multiple UIs, including a start menu screen, an options menu, and a timer heads-up display for a 2D game.</li> <li>○ They'll build out the elements in Unity and write C# scripts to control and manage the scenes and UI elements.</li> </ul> </li> </ul>
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### Module 5: Develop 3D Games (4 weeks / 18 - 20 hours)

Building on their 2D game development skills, students learn game world building techniques unique to 3D games, such as lighting effects, camera angles and movement, particle systems, and sound sources. Students learn about different game elements and environments, and the impact they have on gameplay.

<p>Objectives / Topics Covered</p>	<ul style="list-style-type: none"> <li>● 3D Scene Building and Prefabs</li> <li>● Game Physics</li> <li>● Projectiles and Character Controllers</li> <li>● Character Rigging and Animation</li> <li>● Gameplay and Effects</li> <li>● Cameras and Multiplayers</li> <li>● Lighting Effects</li> <li>● Particle Systems</li> <li>● Sound Effects</li> </ul>
<p>Example Assignments / Labs</p>	<ul style="list-style-type: none"> <li>● Game Physics <ul style="list-style-type: none"> <li>○ Students dive into rigidbodies and colliders while learning about Unity's built-in physics engine.</li> <li>○ Students create scripts to manipulate GameObjects and trigger events through collisions.</li> </ul> </li> <li>● Projectiles <ul style="list-style-type: none"> <li>○ Students continue to learn about game physics in Unity by creating prefab GameObjects and scripting spawns of multiple GameObjects in order to launch spheres at boxes.</li> </ul> </li> <li>● Cameras and Multiplayers</li> </ul>

	<ul style="list-style-type: none"> <li>○ Students learn how to change the camera locations positions relative to players, including following a player with a C# script.</li> <li>○ Students extend cameras with special views like top-down and two-player views.</li> <li>● Lighting Effects <ul style="list-style-type: none"> <li>○ Students examine how to place lights and the effects they have on the scene.</li> <li>○ Students learn how to update different lighting properties.</li> </ul> </li> <li>● Particle Systems <ul style="list-style-type: none"> <li>○ Students learn about particles in Unity and how to add them to objects to enhance gameplay.</li> </ul> </li> <li>● Sound Effects <ul style="list-style-type: none"> <li>○ Students add audio sources to 3D environments to provide location proximity sound effects.</li> <li>○ Students add background music to enhance the gameplay experience and create mood.</li> </ul> </li> <li>● Make It Your Own <ul style="list-style-type: none"> <li>○ Students extend lesson projects to a game using the skills they learned in this module</li> </ul> </li> </ul>
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### Module 6: Project: Design Your Game (2 weeks / 10 hours)

Students begin designing either a 2D or 3D role-playing game. Students create their game design document and define their game’s world, characters, and rules. They also learn to create storyboards to describe the flow of their gameplay.

Objectives / Topics Covered	<ul style="list-style-type: none"> <li>● Design Core Gameplay</li> <li>● Developing Game Ideas</li> <li>● Storyboarding</li> </ul>
Example Assignments / Labs	<ul style="list-style-type: none"> <li>● Design Core Gameplay <ul style="list-style-type: none"> <li>○ Students are introduced to the game design and development process.</li> <li>○ They begin planning a 2D or 3D game development project of their own design.</li> <li>○ Students begin creating their project’s game design document to start describing their game’s rules, characters/objects, and world.</li> </ul> </li> <li>● Storyboarding <ul style="list-style-type: none"> <li>○ Students learn about storyboarding and review case studies.</li> <li>○ Students create their own storyboards to help illustrate the flow of their project’s gameplay.</li> </ul> </li> </ul>

### Module 7: Virtual Reality Environments (3 weeks / 12 - 15 hours)

Building on their 3D game world development skills, students expand their understanding of developing virtual reality (VR) gaming experiences. Students learn about VR hardware, raycasting, and designing immersive environments.

Objectives / Topics Covered	<ul style="list-style-type: none"> <li>● Developing for VR</li> <li>● Create a 3D World in VR</li> <li>● VR Catch Game</li> </ul>
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<p>Example Assignments / Labs</p>	<ul style="list-style-type: none"> <li>● Developing for VR <ul style="list-style-type: none"> <li>○ Students build on their knowledge of 3D game world development and expand their understanding of unique VR techniques and concepts.</li> <li>○ Students explore various types of VR devices while comparing and contrasting mixed reality, augmented reality, and virtual reality.</li> </ul> </li> <li>● Create a 3D World in VR <ul style="list-style-type: none"> <li>○ Students design and create a 3D world using various GameObject assets and models.</li> <li>○ They test their VR game scenes using Unity's XR Device Simulator.</li> </ul> </li> <li>● VR Catch Game <ul style="list-style-type: none"> <li>○ Using their 3D game world building skills and VR knowledge, students create a basic game to catch spawning items using VR interactions.</li> </ul> </li> </ul>
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### Module 8: Project: Develop Your Game (4 weeks / 18 - 20 hours)

Students begin building and developing their game prototype using their game design document as a guide. They begin creating a prototype in Unity with the grayboxing technique, select or create assets, and develop Unity C# scripts. They'll test their prototype as they continue to follow the design process.

<p>Objectives / Topics Covered</p>	<ul style="list-style-type: none"> <li>● Prototyping and Testing</li> <li>● Building and Testing a Minimal Viable Product</li> </ul>
<p>Example Assignments / Labs</p>	<ul style="list-style-type: none"> <li>● Prototyping and Testing <ul style="list-style-type: none"> <li>○ Students reflect on industry examples of how prototyping and testing are utilized.</li> <li>○ Create a prototype for their game development project using grayboxing or placeholder techniques.</li> </ul> </li> <li>● Building and Testing a Minimal Viable Product (MVP) <ul style="list-style-type: none"> <li>○ Students create an MVP of their game.</li> <li>○ They test and update MVP based on feedback.</li> </ul> </li> </ul>

### Module 9: Explore the Industry (2 weeks / 8 - 10 hours)

Dive deeper into the video game industry. Students explore careers in the industry, game studios, and ethical practices in the video game development process.

<p>Objectives / Topics Covered</p>	<ul style="list-style-type: none"> <li>● Careers in Game Development</li> <li>● Game Studio and Industry Insights</li> <li>● Copyright Rules</li> <li>● Ethical Considerations</li> <li>● Representation in Technology</li> <li>● Impact of Video Games</li> </ul>
<p>Example Assignments / Labs</p>	<ul style="list-style-type: none"> <li>● Careers in Game Development <ul style="list-style-type: none"> <li>○ Students watch videos that shadow employees at game design studios in order to get insight into what it means to be a game designer / developer.</li> <li>○ Students reflect on what they saw and where their interests lie.</li> </ul> </li> <li>● Game Industry Insights</li> </ul>

	<ul style="list-style-type: none"> <li>○ Students conduct research about a game design studio. They investigate everything from the size and location of the studio, to the roles on the development teams, to the studio’s game design philosophy.</li> <li>○ Students present their research findings as a presentation or slide deck.</li> <li>● Applying Copyright Laws to Video Game Design <ul style="list-style-type: none"> <li>○ Students learn about copyright laws as they apply to games and examine the case between Atari v. North American Phillips.</li> </ul> </li> <li>● Ethical Consideration and Impact of Video Games <ul style="list-style-type: none"> <li>○ Students learn about the role of governing bodies and developers in the context of developing games.</li> <li>○ Students explore the huge impact the video game industry has had economically and on other non-gaming industries.</li> </ul> </li> <li>● Representation in Technology <ul style="list-style-type: none"> <li>○ Students learn about the lack of representation of women and minorities in the game design industry, think about the effects this has on the industry, and identify ways a developer or design studio can address these issues.</li> </ul> </li> </ul>
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### Module 10: Project: Release Your Game (3 weeks / 12 - 15 hours)

Students wrap up their final game projects in this module. Applying all the different techniques from earlier modules as well as incorporating feedback from the previous module, students will complete and present their final game design. They’ll also create a gameplay trailer to learn about game promotion.

Objectives / Topics Covered	<ul style="list-style-type: none"> <li>● Finish Your Game</li> <li>● Promoting Your Game</li> </ul>
Example Assignments / Labs	<ul style="list-style-type: none"> <li>● Finish Creating Game <ul style="list-style-type: none"> <li>○ Students use feedback from testing and develop a final game.</li> <li>○ Students present their learnings and describe how their game meets the project objectives.</li> </ul> </li> <li>● Promote Your Game <ul style="list-style-type: none"> <li>○ Students learn about gameplay trailers and styles used to highlight the awesomeness of a game to potential players.</li> <li>○ Students create a gameplay trailer and share their video.</li> </ul> </li> </ul>

### Optional Supplemental Materials (Remainder of school year)

These supplemental materials should be used following the Prerequisite Units mentioned:

Supplementary Lessons	Prerequisite/Recommended Module(s)	Number of Activities
Game Jam!	Complete <i>Develop 2D Games</i> module and prior modules	6