

Glendale Unified School District

Middle School

May 4, 2021

Department: Career Technical Education

Course Title: Advanced Virtual Reality Video Game Design and Programming

Course Code: 9057GV/9058GV

Grade Level(s): 7-8

School(s)
Course Offered: Roosevelt Middle School

UC/CSU Approved
(Y/N, Subject): N/A

Length of course: Year

Semester Credits: 5

Recommended
Prerequisite: Virtual Reality Video Game Design and Programming

Recommended
Textbooks:

- Unity Certified Programmer: Exam Guide, by Phillip Walker
Published by Packt Publishing Limited, 2020
ISBN: 978-1-83882-842-4
- Learn C# By Developing Games with Unity 2020, 5th ed., by Harrison Ferrone, Published by Packt Publishing Limited, 2020
ISBN: 978-1-80020-780-6
- Unity 2020 Virtual Reality Projects, 3rd ed., by Jonathan Linowes
Published by Packt Publishing Limited, 2020
ISBN 978-1-83921-733-3

Course Overview: Advanced Virtual Reality Video Game Design and Programming is an two semester course in the Arts, Media & Entertainment - Game Design Industry sector. Students from the beginning class will continue on with their education into video game design for both 2D and 3D games, and then the ability to program their game using C# and Visual Scripting(Bolt).

Specialized curriculum in the field of virtual reality games will be included, and the games that are built will be played on a virtual reality headset (Oculus and HTC Vive). This course prepares students for the technology and software packages that they will use to build video games and software applications for careers in the Arts, Media, and Entertainment – Game Design sector. The foundation and pathway standards make explicit the appropriate knowledge, skills, and practical experience students should have to pursue their chosen profession through whatever course of postsecondary, collegiate, and graduate training or apprenticeship it may require. Also certain unity certification tests may be offered.

First Semester-Course Content

Unit 1: Review of Video Games Technology and Unity

(2 weeks)

STANDARDS

Common Core Standards: English Language Arts.7-8.LS.C.1.1, 7-8.

Career Technical Education Arts, Media & Entertainment - Game Design Pathway Standards: D1.2, D1.3, D2.1, D2.2, D2.4,

- A. This module will reintroduce students to latest changes in video game technology, software, and related fields. Students are instructed of the class rules and policies and the safety guidelines of all equipment use for computer lab and virtual reality lab
- B. Students will create a folder on their hard disk, create a project in Unity, save their scene, and then compress and saving the project to their Google Drive. They will then practice downloading and extracting their project on their computer hard drive, and opening it again in Unity. This will insure they do not lose their projects.
- C. We will go over the latest software additions to unity, and changes in their interface, and removal of previous comments

EQUIPMENT/SOFTWARE: Unity, Google Drive

Unit 2: Unity UI Interface

(2 weeks)

STANDARDS

Common Core Standards: English Language Arts ELA.7-8.R.CAGT.2.3, ELA.7-8.R.CAGT.2.5

Career Technical Education Arts, Media & Entertainment - Game Design Pathway Standards: D3.1, D632, D3.3, D3.4

- A. This module will teach students how to work with the Unity interface to create buttons, text, images. Then creating new scripts and working to link their button functionality with their code.
- B. Students will then implement all the buttons, text, images required for the game screen and ensure all game objects are properly named and ready for action

- C. Students will assess what needs to be refactored or changed in order to have their code work with their user interface. They will then refactor the code including player input mechanism.

EQUIPMENT/SOFTWARE: Unity, Visual studio

Unit 3: Laser Defender Project

(6 weeks)

STANDARDS

Common Core Standards: Ela -LITERACY.WHST.6-8.1.B

Common Core Standards: ELA.7-8.R.CAGT.2.5

Career Technical Education Arts, Media & Entertainment - Game Design Pathway Standards: : D1.2, D1.3, D1.4, D1.5, D2.6, D2.7, D3.1, D3.2, D3.3, D3.4, D3.5, D3.6, D3.7

- A. This module is designed to teach student how to create a fun top-down shooter game.
- B. Students will discuss the features, player experience and core loop for their game.
- C. Students will set up background, player, enemy, camera and aspect ratio to their own specifications.
- D. Students will then set aspect ratio, sizes and proportions they want for their game and scene.
- E. Students will then move the player on horizontal axis using `Input.GetAxis()`, and use `Time.deltaTime` to make their game framerate independent. They will then also add vertical movement for their player.
- F. Students will construct gameplay boundaries using the method `ViewPortToWorldPoint()`., They will then `Math.Clamp` their horizontal and vertical movement based upon their boundaries. and add padding so that the player does not go off screen.
- G. Students will create a projectile and connect it to the player. They will then instantiate a the projectile using `GetButtonDown()`, and give the projectile some velocity so that it shoots upwards.
- H. Students will create a coroutine to call when firing, and loop the coroutine using a while (true) loop. They will then create a means in which to stop the coroutine.
- I. Students will create `EnemySpawner.cs` to instantiate enemies into their scene. They will then craft a coroutine that spawns an enemy then waits for time, and use a for loop to continue instantiating enemies until the wave is complete.
- J. Students will create an if statement to destroy enemy if its health goes below zero. We will discuss in more detail the mechanism of creating a method which requires a parameter to be passed into it.
- K. Students will then build and run, and publish their game for other students to play and provide feedback

EQUIPMENT/SOFTWARE: Unity, Visual studio, Unity Standard Assets Package

Unit 4: **Object Oriented Programming Concepts and Game Objects**

(3 weeks)

STANDARDS

Common Core Standards: ELA.7-8.LS.C.1.1, ELA.7-8.R.CAGT.2.5

Career Technical Education Arts, Media & Entertainment - Game Design Pathway Standards:
D4.1, D4.2, D4.3, D4.4, D4.5, D4.6

- A. This module focuses on defining classes, creating and using classes, defining functions, accessing Game Objects, constructor and properties
- B. Students will learn to create prefabs, create and destroy objects, activating and deactivating objects, and controlling object lifespans with invoke
- C. Students will learn to create Run-time Exceptions, finding Run-time Errors, and using the debugger
- D. Students will learn to how to create arrays, for() and foreach() loops, and while() Loops

EQUIPMENT/SOFTWARE: Unity, Visual Studio

Unit 5: **Advanced Unity Concepts**

(4 weeks)

STANDARDS

Common Core Standards: ELA.7-8.LS.C.1.1, ELA.7-8.R.CAGT.2.6

Career Technical Education Arts, Media & Entertainment - Game Design Pathway Standards:
D3.1, D3.2, D3.3, D3.4, D3.5. D3.6

- A. This module focuses on 2D physics concepts, rigidbody components, Unity colliders, physics materials, and scripting collision events
- B. Students will learn about the concepts of Primitive Data and math, data types and variables, mathematical operations, variable scope and access, and displaying data
- C. Students will learn and practice decisions and flow control, logical expressions "if/else" Statements, and "switch" Statements
- D. Students will learn the difference and in the process of organizing game objects, Parent-Child Objects, sorting layers, tagging game objects and collision layers
- E. Students will learn how to correctly apply physics to interact with the virtual world they created

EQUIPMENT/SOFTWARE: Unity, Visual Studio, Computergraphics.com,

Unit 6: **Object Oriented Programming Concepts and Game Objects**

(3 weeks)

STANDARDS

Common Core Standards: ELA.7-8.LS.C.1.1, ELA.7-8.R.CAGT.2.5

Career Technical Education Arts, Media & Entertainment - Game Design Pathway Standards:
D3.1, D3.2, D3.3, D3.4, D3.5, D4.1, D4.2, D4.3, D4.4, D4.5,

- A. This module focuses on defining classes, creating and using classes, defining functions, accessing Game Objects, constructor and properties
- B. Students will learn to create Prefabs, create and destroy objects, activating and deactivating objects, and controlling object lifespans with invoke
- C. Students will learn to create Run-time Exceptions, finding Run-time Errors, and using the debugger
- D. Students will learn to how to create arrays, for() and foreach() loops, and while() Loops

EQUIPMENT/SOFTWARE: Unity, Visual Studio

Second Semester-Course Content

Unit 7: Virtual Reality

(4 weeks)

STANDARDS

Common Core Standards: ELA.7-8.LS.C.1.3, ELA.7-8.R.

Career Technical Education Arts, Media & Entertainment - Game Design Pathway Standards:
D3.1, D3.2, D3.3, D3.4, D2.7, D2.8

- A. This module is designed to teach the students about the Presence in VR: What is it? How do you quantify it? How do you foster it?
- B. Students will learn about VR tracking, latency, Field of View in real life, HMDs, caves, Desktop VR, fidelity, depth, isolation, smell, range of motion (DoF).
- C. Students will define sensory influence: Kinetics, Spatial Audio, Haptics, Other senses?
- D. Students will learn what to do in their projects to encourage presence, and the importance of presence to the experience they are creating?
- E. Students will experiment to solve the problems of VR movement, interaction, limited area of movement, and VR sickness.
- F. Students will experiment using unity for spatial knowledge acquisition, orientation, and wayfinding in virtual environments., cognitive maps and GPS.

EQUIPMENT/SOFTWARE: Unity, Visual Studio, Oculus Rift, HTC Vive

Unit 8: VR Game Setup

(4 weeks)

STANDARDS

Common Core Standards: ELA.7-8.W.2.5d, ELA.7-8.R.CAGT.2.6,

Career Technical Education Arts, Media & Entertainment - Game Design Pathway Standards:
D3.1, D3.2, D3.3, D3.4, D3.5, D4.1, D4.2, D4.3, D4.4

- A. This module is designed to teach the students how to set up their game for virtual reality and install the Unity SDK
- B. Students will learn how to set up the VR Player Controller
- C. Students will learn how do you set up and use the Camera Rig
- D. Students will learn how do a VR Walkthrough
- E. Students will learn about motion in VR, position, orientation Tracking
- F. Students will learn how to setup Desk Space vs. Room Space, latency, and accuracy precision
- G. Students will learn about VR sickness and perceptual augmentation

EQUIPMENT/SOFTWARE: Unity, Visual Studio, Bolt

Unit 9: **Create A Virtual Reality Video Game**

(6 weeks)

STANDARDS

Common Core Standards: ELA.7-8.LS.C.1.1, ELA.7-8.R.CAGT.2.5

Career Technical Education Arts, Media & Entertainment - Game Design Pathway Standards:
D3.1, D3.3, D3.5, D4.1, D4.2, D4.3, D5.1 D5.2 D5.3,

- A. This module is to introduce students into exciting new world of virtual reality. Students will set up unity and using the Unity SDK(Software Development Kit) from the Unity Assets Store bring in the packages and change the settings so that their game will be built to run on both the Oculus, and HTC Vive, Virtual Reality Headsets
- B. Students will also download and use the SteamVR plugin because it renders to both the Oculus Rift and the HTC Vive when they run the game, so it is an easy way to build for leading VR headsets.
- C. Students will learn how to set up the Oculus, HTC Vive and Virtual Reality Toolkit (VRTK integrations) in Unity as well as how to set up a basic VR scene.
- D. Students will get the best practices for making their VR experience comfortable and learn how to implement a teleportation system.
- E. Students will learn how hand interactions work in VR, how to design interactions to manipulate objects and how to overcome challenges with item placement.
- F. Students will learn how to Transition from 2D to VR, review well-established VR interaction paradigms, and to also find out how to design a user-friendly interface for VR.

EQUIPMENT/SOFTWARE: Unity, Oculus VR Headset, HTC Vive Headset, SteamVR SDK package, Unity SDK package, Unity Asset Store, Visual Studio, Google classroom

Unit 10: Build- Publish and Play a VR Game in Unity.

(6 weeks)

STANDARDS

Common Core Standards: ELA.7-8.R.CAGT.2.6

Career Technical Education Arts, Media & Entertainment Pathway Standards: D10.1, D10.2, D10.3, D10.4, D10.5, D10.6, D5.1, D5.2, D5.3, D5.4, D5.5

- A. This module is to introduce students how to set up unity and their virtual reality headset to publish and play their game.
- B. Students will learn how to setup all the cameras in their scenes to be able to render directly to the head-mounted display (HMD). View and Projection matrices are automatically adjusted to account for head tracking, positional tracking and field of view.
- C. Students will learn that Head tracking and the appropriate Field of View (FOV) is automatically applied to their camera if their device is head-mounted.
- D. Students will learn head tracking and positional tracking are automatically applied, so that the position and orientation most closely matches the user's position and orientation before the frame is rendered. This gives a good VR experience, and prevents the user from experiencing nausea.
- E. E Students will learn that each camera that is rendering to the device automatically overrides the field of view of the camera with the field of view the user has input in the software settings for each VR SDK.
- F. Students will learn that the left eye is rendered to the Game View window if they have stereoTargetEye set to left or both. The right eye is rendered if they have stereoTargetEye set to right. To see a side-by-side view in the Game View, they need to create two cameras, set one to the left and one to the right eye, and set the viewport of display them side by side.
- G. Students will learn that their build application initializes and enables devices in the same order as the Player Settings list. Devices not present in the list at build time are not available in the final build.
- H. Students will learn that achieving a frame rate similar to your target HMD is essential for a good VR experience. This must match the refresh rate of the display used in the HMD. If the frame rate drops below the HMD's refresh rate, it is particularly noticeable and often leads to nausea for the player.
- I. Students will establish an account on Itch.io to publish their games.
- J. Students will build and run their game using the virtual reality settings in unity, and then test it out on the oculus an HTC Vive headsets.
- K. Students will be required to play at least three games during designated class time gameplay on designated headsets and then provide detailed feedback on their opinion of

the game and if there are any glitches or things that need to be fixed. They will be graded on their comments

- L. Students will take the feedback given to them by the different classes and work to correct any issues or problems with their game and to add more features and then publish the game again for more gameplay and comments

EQUIPMENT/SOFTWARE: Unity, Visual Studio, Oculus Rift and Quest 2, HTC Vive