# Digital Game Development

The Digital Game Development program provides students with the principles of game mechanics. Areas of study include programming, story and character development, and artistic theory and concepts to develop a game.

## Introduction

The competencies in this document are designed to clearly state what the student should know and be able to do upon completion of an advanced high school Digital Game Development program. These standards are designed for a two course sequence that prepares the student for technical assessments directly aligned to the standards.

These exit-level competencies are designed for the student to complete all competencies through their completion of a program of study. These competencies are intended to guide curriculum objectives for a program of study.

The standards are organized as follows:

* Competencies are general statements that identify major areas of knowledge, understanding, and the skills students are expected to learn in key subject and career areas by the end of the program.
* Standards follow each content standard. Standards identify the more specific components of each Competency and define the expected abilities of students within each Competency.
* Learning Targets are very specific criteria statements for determining whether a student meets the Standard. Learning Targets may also be used as learning outcomes, which teachers can identify as they plan their program learning objectives.

The crosswalk and alignment section of the document shows where the Learning Targets support the New Hampshire Content Standards. Where correlation with an academic content standard exists, students in the Digital Game Development program perform learning activities that support, either directly or indirectly, achievement of the academic Competencies that are listed.

All students are encouraged to participate in the career and technical student organization (CTSO) that relates to the Digital Game Development program. CTSOs are co-curricular national organizations that directly reinforce learning in the CTE classroom through curriculum resources, competitive events, and leadership development. CTSOs provide students the ability to apply academic and technical knowledge, develop communication and teamwork skills, and cultivate leadership skills to ensure college and career readiness.

The Employability Skills for Career Readiness identifies the “soft skills” needed to be successful in all careers and must be taught as an integrated component of all CTE course sequences. These Competencies are available in a separate document.

The Standards Reference Code is only used to identify or align Learning Targets listed in the Competency to daily lesson plans, curriculum documents, or national standards. The Standards Reference Code is an abbreviated name for the program, and the Competency, Standard, and Learning Targets are referenced in the program Competency. This abbreviated code for identifying competencies uses each of these items. For example, DGD is the Standards Reference Code for Digital Game Development. For Competency 2, Standard 3 and Learning Target 4 the Standards Reference Code would be DGD.2.3.4.

# Algorithms and Programming

Create meaningful and efficient programs including choosing which information to use and how to process and store it, breaking apart large problems into smaller ones, recombining existing solutions, and analyzing different solutions.

## 1.0 Foundations of Game Design and Development

### 1.1 Explain the Fundamentals of Production

1.1.1 Explain the interdependence of team members between artistic, technical, and production disciplines

1.1.2 Outline the process of developing a game from concept to delivery and support

1.1.3 Compare various types of collaboration tools, e.g., version control, shared storage, cloud services

1.1.4 Explain the value of version control

1.1.5 Describe good quality assurance practices

### 1.2 Explain Game Structure

1.2.1 Explore the components of game structure

1.2.2 Analyze the essentials of storytelling, including visual and environmental storytelling

1.2.3 Explain the characteristics of a nonlinear story

1.2.4 Create rules for a game, e.g., levels and/or interactive flow

1.2.5 Compare conflict and outcomes

1.2.6 Develop objectives and outcomes for a game

1.2.7 Explain the importance of usability and how it impacts user experience

1.2.8 Explain in-game economies, motivators, and point systems

### 1.3 Create Game Documentation

1.3.1 Research various styles of game documentation

1.3.2 Develop a technical design document (TDD)

1.3.3 Develop components of a game design document (GDD)

1.3.4 Develop a list of required game assets

1.3.5 Produce a game design document

1.3.6 Produce a game pitch document

1.3.7 Present game documentation

### 1.4 Describe Industry Standard Game Mechanics

1.4.1 Compare categories of game mechanics

1.4.2 Research victory condition mechanics of a game

1.4.3 Discuss relationships between game mechanics, game play, and interactivity

1.4.4 Investigate what makes a game engaging, “fun,” and playable to the user

## 2.0 Game Design

### 2.1 Apply Fundamentals of Design

2.1.1 Evaluate the use of layout and composition

2.1.2 Explain color theory

2.1.3 Describe the principles of animation

2.1.4 Describe the role of perspective

2.1.5 Compare design considerations for environmental, assets, characters and User Interface (UI) creation

2.1.6 Describe the characteristics and purposes of 2D, 2.5D, and 3D art

2.1.7 Evaluate the importance of artistic style and implement it with continuity

### 2.2 Design Levels

2.2.1 Identify components of a level and its environment

2.2.2 Compare processes of creating interior versus exterior environments

2.2.3 Compare level design of linear games to open world games

2.2.4 Research terrains for a specific environment

2.2.5 Discuss the concept of leveling up with increasing complexity

2.2.6 Describe the impact of story (explicit, implicit and emergent) on level design

2.2.7 Explain the importance of flow, distance, timing, and choke points

2.2.8 Storyboard levels including flow and choke points

### 2.3 Design Assets and Characters

2.3.1 Investigate the twelve major character archetypes

2.3.2 Contrast archetypes versus stereotypes as they relate to diversity and inclusion

2.3.3 Describe basic character backstory, strengths and weaknesses

2.3.4 Explain the visual design of characters in relation to the “game feel” and artistic style

2.3.5 Describe the connection between character arc and character progression

2.3.6 Conceptualize and illustrate original game characters and assets

2.3.7 Examine the roles, purpose, and design of non-player characters (NPC)

2.3.8 Explain the difference in design between static and dynamic game objects, e.g., props, decorations versus characters, morphing objects

2.3.9 Detail the difference between organic and hard surfaces

### 2.4 Design Custom Mechanics

2.4.1 Create a victory condition

2.4.2 Assemble immersive elements into a game

2.4.3 Establish a reward system and in-game economics

2.4.4 Apply game mechanics to a game world

2.4.5 Balance and test game mechanics

## 3.0 Programming For Digital Game Development

### 3.1 Utilize Logic In Game Development

3.1.1 Explain basic logic statements (e.g., if/then, cause/effect)

3.1.2 Explain the purpose and use of functions

3.1.3 Describe nested functions

3.1.4 Describe uses of Boolean operators and symbols associated with them

3.1.5 Demonstrate proper use of order of operations

3.1.6 Use logical thinking to create a diagram of code execution

3.1.7 Describe various types of loop structures used in programming

3.1.8 Describe the differences between compiled and interpreted code

3.1.9 Explain methods for producing artificial intelligence (AI) to control Non-Playable Characters (NPC)

3.1.10 Research design patterns in game programming (single, factory, and state)

### 3.2 Apply Programming Language Concepts

3.2.1 Differentiate between syntax and semantics

3.2.2 Identify differences between compile and runtime errors

3.2.3 List primitive data types

3.2.4 Describe how arrays are used to store objects in a list

3.2.5 Demonstrate input from different sources

3.2.6 Identify expected input and output of methods/functions

3.2.7 Explain the connection between visual programming and coding/scripting

3.2.8 Compare the use of constants and variables

3.2.9 Describe the implications of access modifiers (private/public, local/global)

3.2.10 Explore engine/programming documentation to understand available methods/functions

3.2.11 Describe object-oriented programming (OOP)

### 3.3 Perform Programming In Game Development

3.3.1 Utilize code to modify objects based on collision detection and player activation

3.3.2 Develop code or visual script that changes aspects of player movement (e.g., sprint, jump)

3.3.3 Develop code or visual script that responds to a graphic user interface (GUI) input (e.g., user interface design (UI) button press

3.3.4 Develop code or visual script that responds to hardware input (e.g., keyboard key or mouse press)

3.3.5 Generate test cases and expected results

3.3.6 Format and display the value of a variable to a GUI

3.3.7 Implement a basic point system for a game using visual scripting or code

3.3.8 Verify game functionality through testing and debugging

### 3.4 Develop Game Levels

3.4.1 Define the type, structure and size of player environment

3.4.2 Place and define non-player characters (NPC) into the environment

3.4.3 Build boundaries, borders, and obstacles of levels within the game

3.4.4 Place triggers and develop scripted events

3.4.5 Create multiple levels for a game including start and closing screens and playable level(s)

### 3.5 Utilize Graphical User Interface (GUI)

3.5.1 Research examples of GUI in digital and real-world environments (e.g., Heads Up Display [HUD] and road signs)

3.5.2 Define and implement required elements for various GUIs

3.5.3 Create flowcharts that map the GUIs’ functionality

3.5.4 Design GUIs that use standard text, 2-D, and 3-D elements (buttons, progress bars, icons, etc.)

# Data and Analysis

Synthesize concepts, practices and processes of data collection, resource management, and techniques to different types of data in order to discover useful information that can communicate storytelling and to inform decision-making.

## 4.0 Data and Analysis

### 4.1 Storage

4.1.1 Translate between different bit representations of real-world phenomena, such as characters, numbers, and images, e.g., convert hexadecimal colors to decimal percentages, ASCII/Unicode representation

4.1.2 Evaluate the tradeoffs in how data elements are organized and where data is stored

4.1.3 Demonstrate the ability to store bit representation of real-world phenomena, characters, numbers, and images

### 4.2 Collection, Visualization, And Transformation

4.2.1 Create interactive data visualizations or alternative representations using software tools to help others better understand real-world phenomena

4.2.2 Use data analysis tools and techniques to identify patterns in data representing complex systems

4.2.3 Select data collection tools and techniques to generate data sets that support a claim or communicate information

### 4.3 Inference And Models

4.3.1 Create computational models that represent the relationships among different elements of data collected from a phenomenon, process, or model

4.3.2 Evaluate the ability of models and simulations to test and support the refinement of hypotheses

# Networks and the Internet

Apply networking concepts, using various models to implement protocols and standards when moving data. Design systems with working switching and routing "packets" to ensure data flows to the correct destination. Ensure data traffic flows through the internet effectively.

# Computing Systems

Apply concepts of physical components and software that make up a computing system which communicate and process information in digital form, along with practices and methodology for troubleshooting issues in those systems.

# Cybersecurity

Prove how to detect, prevent and mitigate threats in order to secure a computing system or network in an ethical manner, and in accordance with international, federal,state, local and cyber laws and regulations.

## 5.0 System & Security

### 5.1 Explain Legal Considerations In Game Development

5.1.1 Research laws that govern intellectual property in diverse forms

5.1.2 Evaluate Creative Commons and open source licensure

5.1.3 Explain copyright, trademark, and other intellectual property protection

5.1.4 Identify key elements of non-disclosure agreements (NDA) and contracts

5.1.5 Adhere to intellectual property laws and regulations and cite proprietary content and derivative works

5.1.6 Explain Entertainment Software Rating Board (ESRB) and other rating systems for digital games

### 5.2 Describe Security Issues In Relation To Game Development And Design

5.2.1 Explain invasion of privacy in the use of technology

5.2.2 Explore the issues of piracy and digital rights management (DRM)

5.2.3 Model acceptable security practices

### 5.3 Explain Ethics, Diversity, And Inclusion

5.3.1 Discuss diversity and inclusivity in games and the gaming industry

5.3.2 Discuss social responsibility and issues concerning video gaming

### 5.4 Use Safety Procedures and Proper Tools

5.4.1 Demonstrate the proper use of safety devices

5.4.2 Research the environmental impact of production

5.4.3 Research local, state, and federal regulations related to material handling

5.4.4 Demonstrate secure disposal of technology materials

5.4.5 Explain the relationship between organization and safety

5.4.6 Demonstrate an organized work environment

5.4.7 Demonstrate electrical safety (e.g., grounding, ESD (static), etc.)

5.4.8 Apply installation safety (e.g., lifting, overhead movements, etc.)

### 5.5 Explain Network System Hardware

5.5.1 Define industry standard vocabulary

5.5.2 Identify internetworking equipment

5.5.3 Identify various networking topologies

5.5.4 Differentiate between various network transmission media

5.5.5 Describe the use of each of the classifications of hardware components

5.5.6 Compare and configure network devices

### 5.6 Explain Cybersecurity In Terms of Game Design

5.6.1 Illustrate how sensitive data can be affected by malware and other attacks

5.6.2 Recommend security measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts

5.6.3 Compare various security measures, considering tradeoffs between the usability and security of a computing system

5.6.4 Explain trade offs when selecting and implementing cybersecurity recommendations

5.6.5 Compare ways software developers protect devices and information from unauthorized access

# Game Design Curriculum Framework

## Program of Study

The program of study illustrates the sequence of academic and career and technical education coursework that is necessary for the student to successfully transition into postsecondary educational opportunities and employment in their chosen career path.

## Program Structure

The core course sequencing provided in the following table serves as a guide to schools for their programs of study. Each course is listed in the order in which it should be taught and has a designated level. Complete program sequences are essential for the successful delivery of all state standards in each program area.

**Digital Game Development I**

**Digital Game Development II**

**Digital Game Development III (optional)**

The core course sequencing with the complementary courses provided in the following table serves as a guide to schools for their programs of study. Each course is listed in the order in which it should be taught and has a designated level. A program does not have to utilize all of the complementary courses in order for their students to complete their program of study. Complete program sequences are essential for the successful delivery of all state standards in each program area.

## Digital Game Development I

This course is designed to introduce students to the elements and structure of game programming and design. The areas of major emphasis in the course are game methodology, programming, game genres, game theory, 2D and 3D interactive experiences, and immersive environments. Students will apply both creative and technical skills to design and refine in addition to implementing the adventure. The appropriate use of technology is an integral part of this course.

### Technical Competencies

**1.0 Foundations Of Game Design And Development**

1.1.1 - 1.1.5 Fundamentals Of Production

1.2.1 - 1.2.8 Game Structure

1.3.1 & 1.3.4 & 1.3.6 Game Documentation

1.4.1 - 1.4.4 Industry Standard Game Mechanics

**2.0 Game Design**

2.1.1 - 2.1.5 Fundamentals Of Design

2.2.1 - 2.2.6 Design Levels

2.3.1 Design Assets And Characters

2.4.1 - 2.4.4 Design Custom Mechanics

**3.0 Programming for Digital Games**

3.1.1 - 3.1.8 Logic In Game Development

3.2.1 - 3.2.3 & 3.2.7 - 3.2.11 Programming Language Concepts

**4.0 Data and Analysis**

4.1.1 - 4.1.3 Storage

4.2.1 - 4.2.3 Collection, Visualization, And Transformation

4.3.1 - 4.3.2 Inference And Models

**5.0 System & Security**

5.1.1 - 5.1.4 Legal Considerations In Game Development

5.2.1 - 5.2.3 Security Issues In Relation To Game Development And Design

5.3.1 - 5.3.2 Ethics, Diversity, And Inclusion

5.4.1 - 5.4.8 Use Safety Procedures and Proper Tools

5.5.1 - 5.5.6 Explain Network System Hardware

5.5.1 - 5.5.5 Explain Cybersecurity In Terms of Game Design

### CTE Professionalism and IT Essentials Competencies

Terminology and Communications

Tools and Equipment

Project Management

Applied Mathematics

Safety

## Digital Game Development II

This course is a continuation of Digital Game Development I. This course provides intermediate digital game development students with instruction in advanced techniques and processes. The areas of major emphasis in the course will be implemented in immersive environments and will include development of the student’s individual genre of choice and to explore the potential for multi-genre development. Students will apply both creative and technical skills to design and refine in addition to implementing the adventure. The appropriate use of technology and industry-standard equipment is an integral part of this course.

### Technical Competencies

**1.0 Foundations Of Game Design And Development**

1.1.1 - 1.1.5 Fundamentals Of Production

1.2.1 - 1.2.8 Game Structure

1.3.1 - 1.3.7 Game Documentation

1.4.1 - 1.4.4 Industry Standard Game Mechanics

**2.0 Game Design**

2.1.1 - 2.1.7 Fundamentals Of Design

2.2.1 - 2.2.8 Design Levels

2.3.1 - 2.2.9 Design Assets And Characters

2.4.1 - 2.4.5 Design Custom Mechanics

**3.0 Programming for Digital Games**

3.1.1 - 3.1.10 Logic In Game Development

3.2.1 - 3.2.11 Programming Language Concepts

3.3.1 - 3.3.8 Programming In Game Development

3.4.1 - 3.4.5 Develop Game Levels

3.5.1 - 3.5.4 Graphical User Interface (Gui)

### CTE Professionalism and IT Essentials Competencies

Terminology and Communications

Tools and Equipment

Project Management

Applied Mathematics

Safety

## Digital Game Development III

This course is offered to students who have achieved all content standards in a program whose desire is to pursue advanced study through investigation and in-depth research. Students are expected to work independently or in a team and consult with their supervising teacher for guidance. The supervising teacher will give directions, monitor, and evaluate the students’ topic of study. Coursework may include various work-based learning experiences such as internships and job shadowing, involvement in a school-based enterprise, completion of a capstone project, and/or portfolio development. This course may be repeated for additional instruction and credit

### Technical Competencies

Students have achieved all program content standards and will pursue advanced study through investigation and indepth research

### CTE Professionalism and IT Essentials Competencies

Students have achieved all program content standards and will pursue advanced study through investigation and indepth research.

### Sample Topics

* Internship
* Capstone Project
* Portfolio
* Class Project Manager
* Teaching Assistant
* CTSO Leadership