

Department of College and Career Readiness

# Game Development: 2D/3D Modeling Curriculum

5.0 Credits



## Unit Three

## **Game Development: 2D/3D Modeling**

### **Course Description**

This course provides an introduction to 2D and 3D video game history, design, theory, development, and programming. Emphasis is placed on understanding the history of video games and analyzing industry roles, game genres, game play, art design, playability, storytelling, rule dynamics and what makes quality game. In the first half of the course, students will be responsible for every aspect of creating a 2D game. This will entail preplanning, 2D art creation, 2D animation creation, creating music and sound effects, creating rules and balance for the game, and testing the game for bugs and playability. The second half of the course extends to the introduction to 3D modeling, 3D Animation, and creating a 3D game. Topics include geometric transformation, 3D object models, understanding what makes up a mesh, texturing, lighting, animation, creating physics, and creating interactivity in a 3D world.

## Game Development: 2D/3D Modeling

| Pacing Guide |   |                  |
|--------------|---|------------------|
| Unit         | Topic   | Suggested Timing |
| Unit 1       | Video Game History & Theory, and Understanding and Creating 2D Graphics | approx. 6 weeks  |
| Unit 2       | 2D Game Development, Design, and Creation                               | approx. 10 weeks |
| Unit 3       | 3D Modeling, Texturing, and Lighting                                    | approx. 9 weeks  |
| Unit 4       | 3D Game Development, Design, and Creation                               | approx. 10 weeks |

## Educational Technology Standards

8.1.12.A.2, 8.1.12.A.3, 8.1.12.B.2, 8.1.12.D.1, 8.1.12.D.1, 8.1.12.F.1

### ➤ **Technology Operations and Concepts**

- Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.
- Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.

### ➤ **Creativity and Innovation**

- Apply previous content knowledge by creating and piloting a digital learning game or tutorial.
- Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs.

### ➤ **Digital Citizenship**

- Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.

### ➤ **Critical Thinking, Problem Solving, Decision Making**

- Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

## Career Ready Practices

*Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.*

### **CRP1. Act as a responsible and contributing citizen and employee**

Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

### **CRP2. Apply appropriate academic and technical skills.**

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

### **CRP3. Attend to personal health and financial well-being.**

Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

### **CRP4. Communicate clearly and effectively and with reason.**

Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

## Career Ready Practices

### **CRP5. Consider the environmental, social and economic impacts of decisions.**

Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

### **CRP6. Demonstrate creativity and innovation.**

Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

### **CRP7. Employ valid and reliable research strategies.**

Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

### **CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.**

Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

### **CRP9. Model integrity, ethical leadership and effective management.**

Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they

## Career Ready Practices

apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.

### **CRP10. Plan education and career paths aligned to personal goals.**

Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

### **CRP11. Use technology to enhance productivity.**

Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

### **CRP12. Work productively in teams while using cultural global competence.**

Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

## Differentiated Instruction

### Strategies to Accommodate Students Based on Individual Needs

| <u>Time/General</u>  | <u>Processing</u>  | <u>Comprehension</u>  | <u>Recall</u>   |
|--|--|---|---|
| <ul style="list-style-type: none"> <li>• Extra time for assigned tasks</li> <li>• Adjust length of assignment</li> <li>• Timeline with due dates for reports and projects</li> <li>• Communication system between home and school</li> <li>• Provide lecture notes/assignments, and tutorials outline</li> </ul> | <ul style="list-style-type: none"> <li>• Extra Response time</li> <li>• Have students verbalize steps</li> <li>• Repeat, clarify or reword directions</li> <li>• Mini-breaks between tasks</li> <li>• Provide a warning for transitions</li> <li>• Video lessons online</li> </ul> | <ul style="list-style-type: none"> <li>• Precise step-by-step directions</li> <li>• Short manageable tasks</li> <li>• Brief and concrete directions</li> <li>• Provide immediate feedback</li> <li>• Small group instruction</li> <li>• Emphasize multi-sensory learning</li> </ul> | <ul style="list-style-type: none"> <li>• Teacher-made checklist</li> <li>• Use visual graphic organizers</li> <li>• Reference resources to promote independence</li> <li>• Visual and verbal reminders</li> <li>• Graphic organizers</li> </ul> |
| <u>Assistive Technology</u>  | <u>Tests/Quizzes/Grading</u>   | <u>Behavior/Attention</u>   | <u>Organization</u>   |
| <ul style="list-style-type: none"> <li>• Computer/whiteboard</li> <li>• Video lesson</li> <li>• Spell-checker</li> <li>• Text speech software</li> </ul>   | <ul style="list-style-type: none"> <li>• Adjusted rubrics for projects</li> <li>• Study guides</li> <li>• Shortened tests</li> <li>• Read directions aloud</li> </ul>  | <ul style="list-style-type: none"> <li>• Consistent daily structured routine</li> <li>• Simple and clear classroom rules</li> <li>• Frequent feedback</li> </ul>  | <ul style="list-style-type: none"> <li>• Individual daily planner</li> <li>• Display a written agenda</li> <li>• Note-taking assistance</li> <li>• Color code materials</li> </ul>  |



## Enrichment

### **Strategies Used to Accommodate Based on Students Individual Needs:**

- Adaption of Material and Requirements
- Evaluate Vocabulary
- Elevated Text Complexity
- Elevated Projects Rubrics
- Independent Written and Video Online Tutorials
- Projects completed individual or with Partners
- Self Selection of Research
- Tiered/Multilevel Activities
- Online Learning Communities
- Individual Response Board
- Independent Book Studies
- Open-ended activities
- Community/Subject expert mentorships

## Assessments

### Suggested Formative/Summative Classroom Assessments

- Storyboards
- Teacher-created Unit Assessments, Topic Assessments, Quizzes
- Teacher-created DBQs, Essays, Short Answer
- Accountable Talk, Debate, Oral Report, Role Playing, Think Pair, and Share
- Projects, Portfolio, Presentations, Prezi, Gallery Walks
- Homework
- Concept Mapping
- Primary and Secondary Source analysis
- Photo, Video, Political Cartoon, Radio, Game Analysis
- Create an Original Song, Animation, Board Game
- Game salad Video Tutorials
- Khan Academy intro to coding.

## Interdisciplinary Connections

### English Language Arts

- Story writing
- Close reading of industry-related content
- Keep a running word wall of industry vocabulary

### Social Studies

- Research the history of a given industry/profession
- Use historical references to solve problems
- Research the social impact of a given career or industry

### World Language

- Translate industry-content
- Create a translated index of industry vocabulary

### Math

- Use geometry to create objects
- Create objects and shapes on a coordinate plane
- Assign variables and values for the variables

### Fine & Performing Arts

- Create graphics (landscapes, menus, characters etc.) for use in game.
- Design 2D images that appear 3D.

### Science

- Research latest developments in industry technology
- Investigate applicable-careers in STEM fields
- Use physics to create believable movements in game

## New Jersey Student Learning Standards

### 8.2 Technology

#### TECHNOLOGY AND SOCIETY

- 8.2.12.B.1 Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic or political need and publish for review.

#### COMPUTATIONAL THINKING: PROGRAMMING:

- 8.2.12.E.4 Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements)

### 9.1 Personal Financial Literacy

- 9.1.12.E.4: Evaluate how media, bias, purpose, and validity affect the prioritization of consumer decisions and spending.

### 9.3– Career and Technical Education

#### CAREER CLUSTER: ARTS, A/V TECHNOLOGY & COMMUNICATIONS (AR)

- 9.3.12.AR.1: Analyze the interdependence of the technical and artistic elements of various careers within the Arts, A/V Technology & Communications Career Cluster.
- 9.3.12.AR.3: Analyze the lifestyle implications and physical demands required in the arts, audio/visual technology and communications workplace.

- 9.3.12.AR.4: Analyze the legal and ethical responsibilities required in the arts, audio/visual technology and communications workplace.
- 9.3.12.AR.5: Describe the career opportunities and means to achieve those opportunities in each of the Arts, A/V Technology & Communications Career Pathways.
- 9.3.12.AR.6: Evaluate technological advancements and tools that are essential to occupations within the Arts, A/V Technology & Communications Career Cluster.

### **PATHWAY: VISUAL ARTS (AR-VIS)**

- 9.3.12.AR-VIS.2 Analyze how the application of visual arts elements and principles of design communicate and express ideas.
- 9.3.12.AR-VIS.3: Analyze and create two and three-dimensional visual art forms using various media.

### **INFORMATION TECHNOLOGY CAREER CLUSTER**

- 9.3.IT.3: Demonstrate the use of cross-functional teams in achieving IT project goals.
- 9.3.IT.6: Describe trends in emerging and evolving computer technologies and their influence on IT practices.

### **PATHWAY: INFORMATION SUPPORT & SERVICES (IT-SUP)**

- 9.3.IT-SUP.2: Manage operating systems and software applications, including maintenance of upgrades, patches and service packs.
- 9.3.IT-SUP.3: Apply appropriate troubleshooting techniques in resolving computer hardware, software and configuration problems.

### **CAREER CLUSTER : SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS (ST)**

- 9.3.ST.5: Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.
- 9.3.ST.6: Demonstrate technical skills needed in a chosen STEM field.

**PATHWAY: ENGINEERING & TECHNOLOGY CAREER PATHWAY (ST-ET)**

- 9.3.ST-ET.3: Apply processes and concepts for the use of technological tools in STEM.

## Common Career Technical Core (CCTC)

### Career Pathway: Design/Pre-Construction

AC-DES 7 - Employ appropriate representational media to communicate concepts and design.

- AC-DES 7.1 - Convey graphic information using multi-dimensional drawings.
- AC-DES 7.2 - Build models using referenced drawings and sketches.
- AC-DES 7.3 - Utilize computer technology when communicating concepts and designs.

### Arts, A/V Technology & Communications Career Cluster (AR)

AR 1– Analyze the interdependence of the technical and artistic elements of various careers within the Arts, A/V Technology & Communications Career Cluster.

- AR 1.1 Summarize the features of the partnership that technology and the arts have in developing presentations and productions.
- AR 01.4 – State how various Career Pathways within the cluster work together to generate productions, media and other activities.

AR 05 – Describe the career opportunities and means to achieve those opportunities in each of the Arts, A/V Technology & Communications Career Pathways.

- AR 05.1 – Locate career opportunities that appeal to personal career goals.
- AR 05.2 – Match personal interests and aptitudes to selected careers.
- AR 05.4 – Identify pathways with common knowledge and skills that provide a worker with the potential for mobility.

AR 06 - Evaluate technological advancements and tools that are essential to occupations within the Arts, A/V Technology & Communications Career Cluster.

- AR 06.1 – Research the impact of potential new technological advancements related to this cluster in the future.
- AR 06.2 – Analyze the technological systems that are apparent within the various pathways in this cluster.

AR VIS 1 - Analyze how the application of visual arts elements and principles of design communicate and express ideas.

- AR VIS 01.5 – Analyze the development of tools and technologies employed in the visual arts.

AR VIS 3 - Analyze and create two- and three-dimensional art forms using various media.

- AR VIS 03.4 – Analyze art elements and principles of three-dimensional forms of visual art in various media.

## **Information Technology Career Cluster (IT)**

IT 02 - Use product or service design processes and guidelines to produce a quality information technology (IT) product or service.

- IT 1.1 Summarize the process of IT product/service design.
- IT 1.2 Identify and implement new products/services.

IT 06 - Describe trends in emerging and evolving computer technologies and their influence on IT practices.

- IT 06. - 1. Identify new IT technologies.

IT 07 - Perform standard computer backup and restore procedures to protect IT information.

- IT 07.1 – Explain the need for regular backup procedures.
- IT 07.2 – Configure, perform and maintain backup procedures.

IT WD 04 - Demonstrate the effective use of tools for digital communication production, development and project management.

- IT WD 04.1 - Select and use appropriate software tools.



## Common Core State Standards (CCSS)

### CCSS - English-Language Arts

#### Range of Writing:

- 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.

#### Comprehension and Collaboration:

- CCSS.ELA-LITERACY.SL.12.1a. Come to discussions prepared, having read material under study; explicitly draw on that preparation by referring to evidence from texts on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas

#### Craft and Structure:

- CCSS.ELA-LITERACY.RI.12.4 Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings.

#### Research to Build and Present Knowledge:

- CCSS.ELA-LITERACY.W.12.9b. Draw evidence from informational texts to support analysis, reflection, and research; apply *grade 12 Reading standards* to literary nonfiction

## Common Core State Standards (CCSS)

### CCSS - Mathematics

#### Extending to Three Dimensions:

- CCSS.MATH.CONTENT.HSS.G.GMD.4 Identify the shape of a two-dimensional cross-section of a three-dimensional figure and identify three-dimensional objects created by the rotation of two-dimensional objects.
- CCSS.MATH.CONTENT.HSS.G.MG.1 Use geometric shapes, their measures, and their properties to describe objects
- CCSS.MATH.CONTENT.HSS.G.MG.14 Solve design problems using geometric methods.

#### Congruence, Proof, and Construction:

- CCSS.MATH.CONTENT.HSS.G.CO.2, G.CO.3, G.CO.4, G.CO.5 Develop and perform rigid transformations that include reflections, rotations, translations and dilations using geometric software, graph paper, tracing paper, and geometric tools and compare them to non-rigid transformations.

### CCSS – Social Studies

- CCSS.MATH.CONTENT.WHST.9-10.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

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|---|--|
| <p><b>Course:</b> Game Development<br/>2D/3D Modeling</p> <p><b>Unit:</b> 3 – Basics of 3D model creation, texturing, lighting, and animation.</p> <p><b>Grade Level:</b> 9-12</p>  | <p><b>Unit Overview:</b> In this unit students will learn the step-by-step process of creating three-dimensional graphics including modeling with NURBs, polygons, and subdivisions using sophisticated three-dimensional software such as Blender. They will also acquire skills in texture design, lighting, scene set up, rendering, adding “bones”, and animation.</p> |
| <p><b>New Jersey Student Learning Standards (NJSLs):</b> 8.2.12.B.1, 8.2.12.E.4, 9.1.12.E.4, 9.3.12.AR.1, 9.3.12.AR.3, 9.3.12.AR.4, 9.3.12.AR.5, 9.3.12.AR.6, 9.3.12.AR-VIS.2, 9.3.12.AR-VIS.3, 9.3.IT.3, 9.3.IT.6, 9.3.IT-SUP.2, 9.3.IT-SUP.3, 9.3.ST.5, 9.3.ST.6, 9.3.ST-ET.3</p>   |  |
| <p><b>Common Career Technical Core (CCTC):</b> AC-DES.7.1, AC-DES.7.2, AC-DES.7.3, AR 1.1, AR 1.4, AR 05.1, AR 05.2, AR 05.4, AR 06.1, AR 06.2, AR VIS 01.5, AR VIS 03.1, AR VIS 03.3, AR VIS 03.4, IT 06-1, IT 07.1, IT 07.2, IT WD 04.1</p>   |  |
| <p><b>Common Core State Standards (CCSS):</b> CCSS.ELA-LITERACY.W.11-12.10, CCSS.ELA-LITERACY. SL.12.1a, CCSS.ELA-LITERACY. RI.12.4, CCSS.ELA-LITERACY. W.12.9b, CCSS.MATH.CONTENT.HSS.G.GMD.4, CCSS.MATH.CONTENT.HSS.G.MG.1, CCSS.MATH.CONTENT.HSS.G.MG.14, CCSS.MATH.CONTENT.HSS. G.CO.2, G.CO.3, G.CO.4, G.CO.5, CCSS.MATH.CONTENT.WHST.9-10.8</p> |  |

| Student Learning Objectives (SLOs)  | Essential Questions   | Skills & Indicators   | Sample Activities  | Resources  |
|---|---|---|--|--|
| <p>Examine the history of 3D video games, its visual and technical evolution, and how video games have changed because of 3D graphics.</p> <p><b>NJSLs:</b> 8.2.12.B.1,</p> | <p>How has 3D media evolved throughout history?</p> <p>What jobs are available in the field of 3D media creation and animation and printing?</p> <p>What industries benefit</p> | <ul style="list-style-type: none"> <li>▪ Identify the various ways 3D media affects different industries.</li> <li>▪ Understand the evolution of 3D technology.</li> <li>▪ Understand how video games have changed since the</li> </ul> | <p><b>Editorial</b><br/>Students write an editorial comparing CGI effects and practical effects used in the film industry</p> <p><b>Think Pair Share</b><br/>How has 3D media changed over time?</p> | <p><b>History of CGI in Movies</b><br/><a href="http://www.empireonline.com/movies/features/history-cgi/">http://www.empireonline.com/movies/features/history-cgi/</a></p> <p><b>The Evolution of 3D Games</b><br/><a href="http://www.techradar.com/news/gaming/the-">http://www.techradar.com/news/gaming/the-</a></p> |

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|--|---|--|---|--|
| <p>9.1.12.E.4, 9.3.12.AR.3, 9.3.12.AR.4, 9.3.12.AR.5, 9.3.12.AR.6, 9.3.IT.6, 9.3.IT-SUP.2, 9.3.ST.5,</p> <p><b>CCTC:</b> AR 1.1, AR 1.4, AR 05.1, AR 05.2, AR 05.4, AR 06.1, AR 06.2, IT 06.1,</p> <p><b>CCSS:</b> CCSS.ELA-LITERACY.W.11-12.10, CCSS.ELA-LITERACY.SL.12.1A, CCSS.ELA-LITERACY.RI.12.4, CCSS.ELA-LITERACY.W.12.9B, CSS.MATH.CONTENT.W HST.9-10.8</p> | <p>from 3D graphics and animation and what are the benefits?</p> <p>How is 3D media different from 2D media?</p> <p>What are the pro and cons of having video games that look so realistic?</p> | <p>introduction of 3D graphics.</p> <ul style="list-style-type: none"> <li>▪ Acquire the proper technical vocabulary used when referring to 3D media.</li> <li>▪ Compare and contrast 2D and 3D graphics, genres, art styles, and mechanics.</li> <li>▪ Discuss controversial issues and be able to express views both verbally and in writing.</li> </ul> | <p>What industries have been effected by 3D media and how?</p> <p><b>Graphic Organizer</b><br/>           Create a three column graphic organizer detailing the evolution of 3D media as it relates to art, technology, and story telling capabilities.</p> | <p><a href="http://www.youtube.com/watch?v=hTehcvSgyWI">evolution-of-3d-games-700995</a></p> <p><b>A Visual History of 3D Video Games</b><br/> <a href="https://www.youtube.com/watch?v=hTehcvSgyWI">https://www.youtube.com/watch?v=hTehcvSgyWI</a></p> |
| <p>Understand and utilize the basics of creating, 3D media, arranging objects</p>  | <p>What advantage does a 3D model have over 2D</p>  | <ul style="list-style-type: none"> <li>▪ Identify the difference between orthographic and perspective</li> </ul>   | <p><b><u>Recreate the Wizard of Oz Tin Man using simple shape meshes</u></b></p>  | <p><b><u>What is Orthographic and Perspective projection in Blender</u></b></p>  |

| Student Learning Objectives (SLOs)  | Essential Questions  | Skills & Indicators  | Sample Activities  | Resources  |
|---|--|--|--|--|
| <p>in a 3D world, and maneuvering the viewpoint in a 3D world.</p> <p><b>NJSLS:</b> 8.2.12.B.1, 8.2.12.E.4, 9.3.12.AR.1, 9.3.12.AR.3, 9.3.12.AR.4, 9.3.12.AR.5, 9.3.12.AR.6, 9.3.12.AR-VIS.2, 9.3.12.AR-VIS.3, 9.3.IT.6, 9.3.IT-SUP.3, 9.3.ST.5, 9.3.ST.6, 9.3.ST-ET.3</p> <p><b>CCTC:</b> AC-DES 7.1, AC-DES 7.2, AC-DES 7.3, AR 1.1, AR 01.4, AR 05.1, AR 05.1.2, AR 05.4, AR 06.1, AR 06.2, AR VIS 01.5, AR VIS 03.4, IT 06.1, IT 07.1, IT 07.2, IT WD 04.1</p> <p><b>CCSS:</b> CCSS.ELA-LITERACY.SL.12.1A, CCSS.ELA-LITERACY.RI.12.4, CCSS.ELA-</p> | <p>graphics?</p> <p>What is the difference between rotating an object and moving the viewport around an object?</p> <p>What is the Cartesian coordinate system?</p> <p>What are the fundamental differences between Orthographic and Perspective views?</p> <p>Why is it useful to have multiple live views of your model on screen at once?</p> | <p>projections.</p> <ul style="list-style-type: none"> <li>▪ Understand the difference between rotating an object and rotating the viewpoint</li> <li>▪ Arrange and line up objects in a 3D world.</li> <li>▪ Create and combine basic shape meshes to design a more complex 3D model.</li> <li>▪ Understand how to rotate, scale and position objects using an editor window.</li> <li>▪ Define Context sensitivity and how it is relevant when working in a 3D modeling software.</li> <li>▪ Locate and manipulate the X, Y, and Z coordinates of an object</li> </ul> | <p>Use a photo of the Tin Man from the Wizard of Oz as a visual reference and model for students how simple 3D shapes meshes can be used to create a part of his body. Then have students complete the rest of the Tin Man on their own.</p> <p><b>Reimagine a real life object using simple shape meshes.</b><br/>           Use 3D modeling software to recreate a simple version of an object from real life (car, house, street light, TV etc.). (The model will be rough looking but this lesson can be revisited later in the unit when the students have more skills. At that point students can recreate the object using more advanced techniques</p> | <p><a href="https://www.youtube.com/watch?v=flkzql1W2CY">https://www.youtube.com/watch?v=flkzql1W2CY</a><br/> <b>Open Source 3D Modeling Software</b><br/> <a href="https://www.blender.org/">https://www.blender.org/</a></p> <p><b>3D Modeling with Blender for Beginners</b><br/> <a href="http://gryllus.net/Blender/3D.html">http://gryllus.net/Blender/3D.html</a></p> |

| Student Learning Objectives (SLOs)  | Essential Questions   | Skills & Indicators   | Sample Activities  | Resources  |
|---|---|---|--|--|
| LITERACY.W.12.9B  |   |   | and compare the differences)<br><br><b>Guided Notes</b><br>Prepare handouts that outline the keyboard shortcuts and names of tools used in 3D modeling software but leave blank spaces for students to fill in.  |  |
| Edit 3D meshes, using vertices, edges, faces, NURBS, subdivisions, extrusion, bevels, editing tools, and modifiers.<br><br><b>NJSLS:</b> 8.2.12.B.1, 8.2.12.E.4, 9.3.12.AR.1, 9.3.12.AR.3, 9.3.12.AR.4, 9.3.12.AR.5, 9.3.12.AR.6, 9.3.12.AR-VIS.2, 9.3.12.AR-VIS.3, 9.3.IT.6, 9.3.IT-SUP.3, 9.3.ST.6, 9.3.ST-ET.3<br><br><b>CCTC:</b> AC-DES 7.1, AC-DES 7.2, AC-DES 7.3, | How do vertices, lines and faces create a mesh object?<br><br>How is extrusion different from simply stretching an edge, face, or vertices?<br><br>What are NURBS?<br><br>What is Boolean Editing?<br><br>What are modifiers for and what are the | <ul style="list-style-type: none"> <li>▪ Edit basic meshes using subdivision.</li> <li>▪ Create a model with edited vertices, edges and/or faces.</li> <li>▪ Utilize NURBS in a 3D modeling software.</li> <li>▪ Use modifiers on 3D objects.</li> <li>▪ Access and utilize the editing tools in a 3D modeling software.</li> <li>▪ Create bevel edges in a 3D model.</li> <li>▪ Create a complex model using just one</li> </ul> | <b>Create Fantastic Creature</b><br>Create a creature using your imagination and just one cube, editing tools and techniques, and modifiers.<br><br><b>Recreate Previous Model</b><br>Using more advanced skills recreate a 3D model you created in the past and give it more detail.<br><br><b>Team 3D Model Create</b> | <b>Beginners Blender Tutorial 5 -Working in Edit Mode</b><br><a href="https://www.youtube.com/watch?v=R5XZJ5FFK_0">https://www.youtube.com/watch?v=R5XZJ5FFK_0</a><br><br><b>Using Mirror Modifier</b><br><a href="https://www.youtube.com/watch?v=3FqjSWFXtEg">https://www.youtube.com/watch?v=3FqjSWFXtEg</a><br><br><b>Edit Mode in Blender</b><br><a href="https://www.blender.org/manual/modeling/meshes/introduction.html">https://www.blender.org/manual/modeling/meshes/introduction.html</a><br><br><b>Curves in Blender</b><br><a href="https://www.blender.org/">https://www.blender.org/</a> |

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| <p>AR 01.4, AR 06.1, AR 06.2, AR VIS 01.5, AR VIS 03.4, IT 06.1, IT 07.1, IT 07.2, IT WD 04.1</p> <p><b>CCSS:</b> CCSS.ELA-LITERACY.SL.12.1A, CCSS.ELA-LITERACY.RI.12.4, CCSS.ELA-LITERACY.W.12.9B</p>   | <p>benefits and draw backs of using them?</p>  | <p>basic shape.</p> <ul style="list-style-type: none"> <li>▪ Understand how to extrude in a 3D modeling software.</li> </ul>  | <p>The teacher starts by taking 60 seconds to begin to edit an object on the smart board for the class to see. Once time is up, a student takes over and is given 60 seconds to make their own edits to that same object. This process is repeated until every student has had a chance to edit the object.</p>                    | <p><a href="http://manual.blender.org/manual/modeling/curves/index.html">manual/modeling/curves/index.html</a></p> <p><b>Modifiers in Blender</b><br/> <a href="https://www.blender.org/manual/modeling/modifiers/index.html">https://www.blender.org/manual/modeling/modifiers/index.html</a></p>  |
| <p>Create, add, modify, and edit materials, textures and lights in a 3D environment.</p> <p><b>NJSLS:</b> 8.2.12.B.1, 8.2.12.E.4, 9.3.12.AR.1, 9.3.12.AR.3, 9.3.12.AR.4, 9.3.12.AR.5, 9.3.12.AR.6, 9.3.12.AR-VIS.2, 9.3.12.AR-VIS.3, 9.3.IT.3, 9.3.IT.6, 9.3.IT-SUP.3, 9.3.ST.6, 9.3.ST-ET.3</p> | <p>Why would you use 2D textures to create the illusion of detail and depth in a 3D environment?</p> <p>How does lighting affect a 3D object or environment?</p> <p>How is an object changed or affected</p> | <ul style="list-style-type: none"> <li>▪ Create 2D textures for use on a 3D object.</li> <li>▪ Edit 2D textures within the 3D software,</li> <li>▪ Create digital materials that mimic real life materials.</li> <li>▪ Add lights to a 3D environment.</li> <li>▪ Use lighting to create atmosphere and mood in a 3D</li> </ul> | <p><b>Group Room Remodel</b><br/>           Students take a bare and empty 3D room and furnish it with object they create (stove, microwave, couch, lamps, outlets, windows, flooring, etc.)</p> <p><b>Create a Realistic Looking Scape</b><br/>           Use texture mapping and editing to create a 3D realistic landscape.</p> | <p><b>The Basics of Good Texturing in Blender</b><br/> <a href="https://www.youtube.com/watch?v=rzXNZkEoTAK">https://www.youtube.com/watch?v=rzXNZkEoTAK</a></p> <p><b>How to Apply Textures in Blender 2.7x</b><br/> <a href="https://www.youtube.com/watch?v=6gRUUeFteQg">https://www.youtube.com/watch?v=6gRUUeFteQg</a></p> <p><b>Blender 2.6 Tutorial 16 - Lighting</b><br/> <a href="https://www.youtube.com/watch?v=4UL28bEABR">https://www.youtube.com/watch?v=4UL28bEABR</a></p> |

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| <p><b>CCTC:</b> AC-DES 7.1, AC-DES 7.2, AC-DES 7.3, AR 1.1, AR 01.4, AR 06.1, AR 06.2, AR VIS 01.5, AR VIS 03.4, IT 06.1, IT 07.1, IT 07.2, IT WD 04.1</p> <p><b>CCSS:</b> CCSS.ELA-LITERACY.SL.12.1A, CCSS.ELA-LITERACY.RI.12.4, CCSS.ELA-LITERACY.W.12.9B</p> | <p>when you add a martial?</p> <p>How can obscuring an object or objects with fog or blur be used in a 3D video game?</p> <p>Why would you have different render setting in a 3D video game?</p> | <p>environment.</p> <ul style="list-style-type: none"> <li>▪ Create a detailed 3D space using objects, textures, materials and lighting.</li> <li>▪ Create artificial fog.</li> <li>▪ Create the illusion of detail and depth using 2D textures on 3D objects</li> </ul>  | <p><b>3D Pictionary</b></p> <p>A student is given a card with a word on it. They then use the 3D modeling software and the smart board to try to get one of the other students to guess what was on the card. The student that guesses properly is next to receive a card.</p> | <p><a href="#">0</a></p>  |
| <p>Create and rig bones for a 3D mesh. Understand and utilize 3D object parent child relationship.</p> <p><b>NJSLS:</b> 8.2.12.E.4, 9.3.12.AR.1, 9.3.12.AR.3, 9.3.12.AR.4, 9.3.12.AR.5, 9.3.12.AR.6, 9.3.12.AR-VIS.3, 9.3.IT.6, 9.3.IT-</p>                     | <p>Why is the child parent relationship important when rigging bones?</p> <p>What do you have consider when making a mesh you plan to rig bones to?</p>  | <ul style="list-style-type: none"> <li>▪ Plan and rig bone for a 3D Mesh</li> <li>▪ Create bones that utilize a parent child relationship.</li> <li>▪ Rig bones that avoid volume loss.</li> <li>▪ Set bone weights.</li> <li>▪ Understand and utilize inverse</li> </ul> | <p><b>Planning for bones</b></p> <p>Apply bones to an object a student has already made. See what happens when a mesh is created with out bones in mind.</p> <p><b>T Shaped Man</b></p> <p>Create a T shaped</p>   | <p><b>Essential Skills in Character Rigging</b></p> <p><a href="https://www.crcpress.com/Essential-Skills-in-Character-Rigging/Zeman/p/book/9781482235234">https://www.crcpress.com/Essential-Skills-in-Character-Rigging/Zeman/p/book/9781482235234</a></p> <p><b>Noob to Pro/Bones</b></p> <p><a href="https://en.wikibooks.org/">https://en.wikibooks.org/</a></p> |



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| <p>SUP.3, 9.3.ST.5, 9.3.ST.6, 9.3.ST-ET.3</p> <p><b>CCTC:</b> AC-DES 7.3, AR 1.1, AR 01.4, AR 06.1, AR 06.2, AR VIS 01.5, AR VIS 03.4, IT 06.1, IT 07.1, IT 07.2, IT WD 04.1</p> <p><b>CCSS:</b> CCSS.ELA-LITERACY.SL.12.1A, CCSS.ELA-LITERACY.RI.12.4, CCSS.ELA-LITERACY.W.12.9B</p> | <p>What is kinematics and how does it effect the movement of bones?</p> <p>Why is it important to remember to label/name everything, as your projects get more complicated?</p> <p>How can bones be used for objects that are not modeled as “living” things?</p> | <p>Kinematics</p> <ul style="list-style-type: none"> <li>▪ Pose a bipedal character in multiple poses.</li> <li>▪ Name/Label bones using industry standard language.</li> <li>▪ Create target bones.</li> </ul> | <p>character with a cube and subdivide it. Apply bones and pose him in many different poses.</p> <p><b>Backwards Build</b><br/>Build a bone rig then build a mesh around the rig.</p> | <p><a href="http://wiki/Blender_3D:_Noob_to_Pro/Bones">wiki/Blender 3D: Noob to Pro/Bones</a></p> <p><b>Bone IK Pole Targets and Multiple IK</b><br/><a href="https://www.youtube.com/watch?v=Ut-AwWxu9Fs">https://www.youtube.com/watch?v=Ut-AwWxu9Fs</a></p> <p><b>IK Rigging Pt. 1 / 3</b><br/><a href="https://www.youtube.com/watch?v=4yiC6pEQMAw">https://www.youtube.com/watch?v=4yiC6pEQMAw</a></p> |

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| <p>Explore tools and techniques used in the 3D animation industry to design convincing.</p> <p><b>NJSLS:</b> 8.2.12.E.4, 9.3.12.AR.1, 9.3.12.AR.3, 9.3.12.AR.4, 9.3.12.AR.5, 9.3.12.AR.6, 9.3.12.AR-VIS.2, 9.3.12.AR-VIS.3, 9.3.IT.3, 9.3.12.AR-VIS.3, 9.3.IT.6, 9.3.IT-SUP.3, 9.3.ST.5, 9.3.ST.6, 9.3.ST-ET.3</p> <p><b>CCTC:</b> AC-DES 7.3, AR 1.1, AR 01.4, AR 05.1, AR 05.2, AR 05.4, AR 06.1, AR 06.2, AR VIS 01.5, AR VIS 03.4, IT 06.1, IT 07.1, IT 07.2, IT WD 04.1</p> <p><b>CCSS:</b> CCSS.ELA-LITERACY.SL.12.1A, CCSS.ELA-</p> | <p>How is 2D animation different from 3D animation?</p> <p>How does camera placement and movement affect 3D animation?</p> <p>How does tweening help the animation processes?</p> <p>How can an object's relationships with other objects in the scene factor into the animation?</p> <p>How can the animation properties of objects be controlled and customized?</p> | <ul style="list-style-type: none"> <li>▪ Create a storyboard for 3D animation.</li> <li>▪ Create a 3D animation.</li> <li>▪ Utilize the tools in 3D software to create different points of view.</li> <li>▪ Exhibit understanding of sequential events and time through keyframe animation.</li> <li>▪ Identify careers in animation for the web, advertising, entertainment and other industries.</li> <li>▪ Implement animation controls and constraints on objects, text, characters, cameras and lighting.</li> <li>▪</li> </ul> | <p><b>Bouncing 3D Ball</b><br/>           Create a ball bouncing animation. Animation should include the fall, change in shape during impact, and the reduction of energy for every bounce.</p> <p><b>Use bones to create a walk cycle</b><br/>           Rig a character with bones and create the characters walk cycle using keyframe animation.</p> <p><b>Class Critique and Discussion</b><br/>           Watch a 3D animated short and critique in class. Discuss what was done well and how you think the animated pulled it off technically.</p> | <p><b>Johnny Express 3D Short</b><br/> <a href="https://www.youtube.com/watch?v=cSGZyRBpMBE">https://www.youtube.com/watch?v=cSGZyRBpMBE</a></p> <p><b>Blender Tutorial For Beginners: Animation</b><br/> <a href="https://www.youtube.com/watch?v=rZC8i7nq32k">https://www.youtube.com/watch?v=rZC8i7nq32k</a></p> <p><b>Making a Simple Walk Animation</b><br/> <a href="https://www.youtube.com/watch?v=kSDWfx6ib9k">https://www.youtube.com/watch?v=kSDWfx6ib9k</a></p> <p><b>Blender Tutorial For Beginners: Cloth Napkin</b><br/> <a href="https://www.youtube.com/watch?v=2zd1AI198I8">https://www.youtube.com/watch?v=2zd1AI198I8</a></p> |

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|--|---------------------|---------------------|-------------------|-----------|
| LITERACY.RI.12.4,<br>CCSS.ELA-<br>LITERACY.W.12.9B |                     |                     |                   |           |

## Unit 1 Vocabulary

3D Model  
Baking  
Bevel  
Blocking  
Bump Maps  
Constraints  
Curve  
Deform  
Digital Sculpting  
Edge  
Edge Loop  
Extrude  
Faces  
Frame Rate  
Hierarchy  
Inverse Kinematics  
Joints  
Keyframe

Loop Cut  
Materials  
Mesh  
NURBS  
Object  
Orthographic  
Perspective  
Pivot Point  
Reflection  
Shaders  
Skinning  
Subdivision  
Texture Map  
Timeline  
Tweening  
UV Map  
Vertex  
Volume loss

## Suggested Unit Projects

*Choose At Least One*

Student groups preplan and create a fully detailed setting. Each student contributes different elements to the setting. The group will present the setting to the rest of the class.

Create a 3-minute 3D movie. Movie should include camera changes, keyframe animation, lighting and textures.

## Suggested Structured Learning Experiences

Museum of Play-  
 1 Manhattan Square  
 Rochester, NY 14607  
<http://www.museumofplay.org/about/icheg>

Nintendo NY  
 10 Rockefeller Plaza  
 New York, New York 10020  
<http://nintendonyc.com/faq/>

Cooper Hewitt  
 2 East 91<sup>st</sup> Street  
 New your, New York 10128  
<http://www.cooperhewitt.org/visit/getting-here/>