Program of Study Guide:
3D Animation & Game Design DRAFT

Comprehensive guidelines and course standards for the 3D Animation & Game Design pathway

Office of College and Career Pathways

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MARYLAND STATE DEPARTMENT OF EDUCATION

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DOCUMENT HISTORY

Document Version	Date	Summary of Change
1.0	October 2024	Initial Document
1.1	December 2024	Standards Reviewed by OCCP Leadership. Course descriptions reviewed and shortened. LMI data verified and updated. IRC selections reviewed and confirmed.

Purpose

The purpose of this document is to communicate the required Career and Technical Education (CTE) academic standards for the 3D Animation and Game Design Program of Study. The academic standards in this document are theoretical and performance based. The standards contain content from multiple state departments of education, the College Board, and the Adobe Certified Professional and have been reviewed and vetted by members of the Maryland business and industry community.

In addition to academic standards, the Maryland State Department of Education (MSDE) has incorporated into this document Labor Market Information (LMI) definitions and explanations for the Program of Study; program aligned Industry Recognized Credentials; and Work-Based Learning resources and requirements by course level.

This document is intended for use by educational administrators and practitioners. A similar document is available for each state-approved CTE Program of Study.

Sources of Standards

These sources ensure each course in the 3D Animation and Game Design pathway meets high-quality educational and industry standards, preparing students for certification and career success. Here are the sources of the standards for all four courses:

1. **Career and Technical Education (CTE) Standards**
   Description: CTE standards establish guidelines for skills and knowledge in technical education programs, including digital media, game design, and visual communication.
   Usage: CTE standards shape the foundational and advanced skills in 3D Animation and Game Design courses, ensuring alignment with industry standards for career readiness in fields like 3D modeling, animation, and game design.
   Source: CTE Standards – ACTE: https://www.acteonline.org/

2. **Adobe Education Exchange**
   Description: Adobe Education Exchange is a free online resource provided by Adobe, offering lesson plans, project-based learning activities, and instructional guides. It covers the fundamentals of Adobe software, including tools like Premiere Pro, After Effects, and Animate, curated to meet educational standards in creative fields.
   Usage: Teachers can use lesson plans and projects directly related to Adobe software to reinforce software skills, workflow management, and design principles in 3D Animation and Game Design I-IV. Adobe Exchange resources help align course instruction with skills needed for Adobe certification exams, including Adobe Certified Professional in Animate and After Effects.
   Source: Adobe Education Exchange: https://edex.adobe.com/

3. **Autodesk Design Academy**
   Description: Autodesk Design Academy provides free educational resources, tutorials, and certifications on Autodesk software, including Maya and 3ds Max, essential for 3D modeling and animation.
   Usage: This resource supports instruction in Autodesk software skills for 3D Animation and Game Design I-II, aligning course content with the Autodesk Certified User (ACU) in 3D Animation and Modeling certification.
   Source: Autodesk Design Academy: https://academy.autodesk.com/

4. **Unity Learn**
   Description: Unity Learn is an educational platform by Unity Technologies, offering courses, projects, and tutorials on Unity software. It covers game design principles, scripting, asset management, and Unity's visual and programming tools.
   Usage: Unity Learn resources are utilized in 3D Animation and Game Design II-IV to provide students with the skills needed to achieve the Unity Certified User: Artist and Programmer certifications, covering both the artistic and programming aspects of game design.
   Source: Unity Learn: https://learn.unity.com/

5. **National Core Arts Standards (NCAS)**
   Description: The National Core Arts Standards (NCAS) provide a framework for teaching and assessing skills in the arts, emphasizing creativity, production, presentation, and response in visual and media arts.

Usage: NCAS informs course standards for 3D Animation and Game Design I-IV, especially in visual design principles, creative processes, and professional presentation. It ensures that students' creative work meets recognized arts education standards.
Source: National Core Arts Standards: https://www.nationalartsstandards.org/

6. **Unity Certified User Standards**
Description: Unity provides certification pathways, including the Certified User program, which assesses skills in game design, programming, and asset management. The certification aligns with industry standards for entry-level Unity users, focusing on artistic and programming competencies.
Usage: Unity certification standards are used in 3D Animation and Game Design II-IV to guide instruction in Unity's software, ensuring students gain the skills necessary for Unity Certified User: Artist and Programmer certifications.
Source: Unity Certified User Program: https://unity.com/products/unity-certifications

7. **Blender Foundation - Blender Fundamentals Certification Standards**
Description: Blender Foundation offers a range of educational resources and certification standards, including the Blender Fundamentals Certification, which covers essential skills in 3D modeling, texturing, and animation within Blender.
Usage: Blender standards are integrated into 3D Animation and Game Design I, ensuring students develop a foundational proficiency in Blender, aligned with certification requirements for entry-level 3D modeling and animation skills.
Source: Blender Foundation: https://www.blender.org/education/

8. **CG Spectrum - Certified 3D Game Artist Standards**
Description: CG Spectrum's Certified 3D Game Artist program provides industry-aligned standards and curriculum for mastering 3D modeling, texturing, and asset creation for games. It is designed to meet the practical requirements of a 3D game artist in the gaming industry.
Usage: Certified 3D Game Artist standards inform advanced skills in 3D Animation and Game Design III-IV, guiding students in creating professional game assets and achieving technical proficiency for certification.
Source: CG Spectrum: https://www.cgspectrum.com/

Course Descriptions

Course Level	Course Information	Description
Required Core: Course 1	3D Animation and Game Design I SCED: <XX> Grades: 9-12 Prerequisite: None Credit: 1	This introductory course provides students with foundational skills in 3D modeling, animation, and digital design, laying the groundwork for careers in digital content creation. Students explore basic modeling techniques, principles of animation, and graphic design concepts while working in industry-standard software like Blender and Autodesk.
Required Core: Course 2	3D Animation and Game Design II SCED: <XX> Grades: 10-12 Prerequisite: 3D Animation and Game Design I Credit: 1	Building on skills from 3D Animation and Game Design I, this course delves deeper into complex modeling, environmental design, and basic game asset creation. Students work with advanced techniques in 3D animation, lighting, and texturing, transitioning to industry-standard tools like Unity to apply their models within interactive environments.
Optional Flex: Course 1	3D Animation and Game Design III SCED: <XX> Grades: 11-12 Prerequisite: 3D Animation and Game Design II Credit: 1	In this advanced course, students refine their animation, asset creation, and interactive design skills as they work on more complex game assets and animations. Emphasis is placed on mastering Unity tools, developing sophisticated environments, and implementing detailed animations for games.

Course Level	Course Information	Description
Optional Flex: Course 2	Career Connected Learning I SCED: <XX> Grades: 11-12 Prerequisite: 3D Animation and Game Design I and II Credit: 1	This flexible, work-based learning course introduces students to real-world applications of classroom knowledge and technical skills through on-the-job experiences and reflective practices. Students engage in career exploration, skill development, and professional networking by participating in youth apprenticeships, registered apprenticeships, pre-apprenticeships, internships, capstone projects, or other approved career-connected opportunities. Variable credit (1–3) accommodates the required on-the-job training hours and related instruction. By integrating industry standards, employability skills, and personalized learning goals, Career Connected Learning I equips students to make informed career decisions, develop a professional portfolio, and build a strong foundation for success in postsecondary education, training, or the workforce.
Optional Flex: Course 3	Career Connected Learning II SCED: <XX> Grades: 11-12 Prerequisite: Career Connected Learning I Credit: 1	Building on the foundational experiences of Career Connected Learning I, this advanced work-based learning course provides students with deeper on-the-job practice, leadership opportunities, and refined career exploration. Students continue to enhance their technical and professional skills, expanding their industry networks and aligning personal goals with evolving career interests. Variable credit (1–3) remains aligned with the required training hours and related instruction. Through elevated responsibilities and skill application, Career Connected Learning II prepares students to confidently transition into higher-level postsecondary programs, apprenticeships, or the workforce.

Dual Enrollment and Career Connected Learning Experiences Must be Aligned to the CTE Core.

Industry-Recognized Credentials and Work-Based Learning

Industry-Recognized Credentials
By the end of 3D animation and game design I or 3D animation and game design II: Blender Fundamentals Certification, Autodesk Certified User (ACU) in 3D Animation and Modeling, and Unity Certified User: Artist. **Optional Credentials (via the Flex Course options):** Adobe Certified Professional in Animate, Adobe Certified Professional in After Effects, Certified 3D Game Artist (CG Spectrum), and Unity Certified User: Programmer

Work-based Learning Resources		
3D Animation and Game Design I: **Career Awareness**	**3D Animation and Game Design II:** **Career Preparation**	**Flex Courses:** **Career Preparation**
• Industry Visits • Guest Speakers • Participation in Career and Technical Student Organizations • Postsecondary Visits – Program Specific Site Tours • Mock Interviews	• All of Career Awareness plus the following: • Job Shadow • Paid and Unpaid Internships	• Paid and Unpaid Internships • Apprenticeships

Labor Market Information: Definitions and Data

Labor market information (LMI) plays a crucial role in shaping Career and Technical Education (CTE) programs by providing insights into industry demands, employment trends, and skills gaps. This data helps education leaders assess the viability of existing programs and identify opportunities for new offerings. By aligning CTE programs with real-time labor market needs, schools can better prepare students for in-demand careers and ensure that resources are effectively used to support pathways that lead to high-quality, sustainable employment.

Standard Occupational Code (SOC) and Aligned Industry:

Indicator	Definition	Pathway Labor Market Data
High Wage[1]	Those occupations that have a 25th percentile wage equal to or greater than the most recent MIT Living Wage Index for one adult in the state of Maryland, and/or leads to a position that pays at least the median hourly or annual wage for the DC-VA-MD-WV Metropolitan Statistical Area (MSA). *Note: A 25th percentile hourly wage of $24.74 or greater is required to meet this definition.*	**Standard Occupational Classification (SOC) Code** 15-1255: Web and Digital Interface Designers 27-1014: Special Effects Artists and Animators 27-1021: Commercial and Industrial Designers 27-1024: Graphic Designers **Hourly Wage/Annual Salary:**
High Skill	Those occupations located within the DC-VA-MD-WV Metropolitan Statistical Area (MSA) with the following education or training requirements: completion of an apprenticeship program; completion of an industry-recognized certification or credential; associate's degree, bachelor's degree, or higher.	**Typical Entry-Level Education:**
In-Demand	Annual growth plus replacement, across all Maryland occupations, is <u>405</u> openings between 2024-2029.	**Annual Openings**

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[1] Living Wage Calculator: https://livingwage.mit.edu/states/24

Labor Market Information Data Source

Lightcast Q4 2024 Data Set. Lightcast occupation employment data are based on final Lightcast industry data and final Lightcast staffing patterns. Wage estimates are based on Occupational Employment Statistics (QCEW and Non-QCEW Employees classes of worker) and the American Community Survey (Self-Employed and Extended Proprietors). Occupational wage estimates are also affected by county-level Lightcast earnings by industry. Foundational data for the state of Maryland is collected and reported by the Maryland Department of Labor.

Methodology for High Wage Calculations

To combine labor market data across multiple Standard Occupational Classifications (SOCs), a weighted average approach was used to ensure accurate representation of the marketplace. Median wages for each SOC were weighted based on their respective employment levels, reflecting the relative demand for each occupation. This method ensures that occupations with higher employment contribute proportionately to the overall wage calculation. Additionally, job openings from all relevant SOCs were summed to determine the total projected demand. For example, if Mechanical Engineers account for 67% of total employment and Electrical Engineers for 33%, their respective wages are weighted accordingly, and job openings are aggregated to provide a comprehensive view of labor market opportunities. This approach delivers a balanced and accurate representation of both wages and employment demand for the program.

Methodology for In-Demand Calculations

The baseline for annual job openings, taking into account new positions and replacement positions, was determined by taking the average of all annual job openings between 2024 and 2029 across all 797 career sectors at the 5-digit SOC code level. For the 2024-2029 period, average job openings (growth + replacement) is 405.

Course Standards: 3D Animation and Game Design I

1. **GENERAL REQUIREMENTS.** This course is recommended for students in Grades 9-12.

2. **INTRODUCTION**
   A. Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
   B. The Arts, Entertainment and design Career Cluster combines creative roles in visual and performing arts, film, journalism, fashion, interior design, and creative technologies. This Cluster focuses on creating, producing, and sharing artistic and design work across multiple platforms, aiming to entertain, inform, beautify, and inspire.
   C. The 3D Animation and Game Design program of study careers encompasses the creation and production of visually engaging digital content such as visual marketing, graphic design, augmented and virtual reality, web design, and user interfaces/user experiences. This program of study combines artistic talent and technology to produce interactive content, entertainment, commercial product and packaging design, and promotional materials.
   D. 3D Animation and Game Design I is an introductory course within the Arts, Entertainment, and Design Career Cluster, aimed at high school students exploring foundational skills in digital content creation and production. This course immerses students in the creative processes and technical skills necessary to produce visually engaging digital content across various platforms. Students will learn to conceptualize, design, and edit projects using industry-standard tools such as Blender and Autodesk Certified User (ACU) in 3D Animation, building a portfolio of work that includes elements of visual marketing, graphic design, web design, and user interfaces.
   E. Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, which might include informational interviews or job shadowing relevant to the program of study.
   F. Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.

3. **KNOWLEDGE AND SKILLS**
   A. **The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:**
      1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work.
      2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn.
      3. Employ effective reading, writing, and technical documentation skills.
      4. Solve problems using critical thinking techniques and structured troubleshooting methodologies.
      5. Demonstrate leadership skills and collaborate effectively as a team member.
      6. Implement safety procedures, including proper use of software and following privacy guidelines.

7. Exhibit an understanding of legal and ethical responsibilities in the 3D animation and game design field, following data privacy laws and best practices for security.
8. Demonstrate time-management skills and the ability to prioritize tasks in a technical setting.

B. **The student identifies various career pathways in the 3D animation and game design field. The student is expected to:**
   1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles in 3D animation and game design.
   2. Create a professional resume and portfolio that reflect skills, projects, certifications, and recommendations.
   3. Demonstrate effective interview skills for roles in media and 3D animation and game design.

C. **The student develops technology and digital literacy skills. The student is expected to:**
   1. Collaborate effectively on complex projects, communicate design concepts clearly, and present professional portfolios that showcase technical and creative expertise on a variety of platforms
   2. Organize, manage, and document projects using file management systems, version control, and industry-standard terminology while adhering to ethical practices and copyright laws.
   3. Use industry-standard tools such as Blender, Autodesk Maya, and Adobe Animate to design, model, rig, and animate 2D and 3D assets, incorporating advanced techniques like texturing, rendering, and lighting.
   4. Use Unity to import assets, manage scenes, and create interactive experiences through animation controls, particle systems, shaders, and scripting using C# programming.
   5. Prepare 3D models, animations, and effects for efficient rendering and real-time performance, using techniques such as polygon reduction, UV mapping, and platform-specific optimization.
   6. Create visually engaging content using Adobe After Effects for compositing, motion graphics, and post-production while applying principles of color theory, composition, and visual hierarchy.

D. **The student integrates core academic skills into 3D animation and game design practices. The student is expected to:**
   1. Document design processes, create project proposals, and present ideas using clear, professional language tailored to technical and creative contexts.
   2. Use geometry, algebra, and proportional reasoning to create accurate 3D shapes, scale models, and optimize animations for timing, resolution, and performance.
   3. Apply concepts of physics, motion, lighting, and optics to simulate realistic environments, effects, and interactions in animations and game design.
   4. Write and debug scripts to control animations, game logic, and interactivity while using algorithms and problem-solving techniques to address technical challenges.
   5. Apply design principles such as balance, contrast, and color theory to create visually engaging animations and interactive environments.

E. **The student demonstrates foundational skills in 3D modeling and animation using industry-standard software. The student is expected to:**
1. Identify and navigate the user interface of 3D modeling software, including Blender and Autodesk tools.
2. Use basic 3D manipulation techniques such as transforming, rotating, and scaling objects.
3. Demonstrate the creation of simple 3D shapes and models using primitive objects.
4. Apply basic texturing and material techniques to enhance 3D models.
5. Demonstrate an understanding of rendering techniques to produce a final image from a 3D model.

F. **The student applies national standards in digital arts and graphic design as they relate to 3D animation. The student is expected to:**
1. Explain and apply principles of design such as balance, contrast, and emphasis in the context of 3D composition.
2. Demonstrate the use of color theory and lighting to convey mood and style in a 3D scene.
3. Apply industry-recognized file management practices for efficient project organization.
4. Explore careers in 3D animation, modeling, and game design, identifying relevant skills and job roles.

G. **The student develops skills in animation principles to produce basic animations. The student is expected to:**
1. Define and apply principles of animation, such as timing, spacing, and anticipation.
2. Demonstrate keyframing techniques to animate simple objects within 3D software.
3. Create a basic animated sequence involving movement, rotation, or scaling.
4. Analyze the impact of frame rates and resolution on animation quality and performance.

H. **The student integrates core academic skills into 3D animation and modeling practices. The student is expected to:**
1. Communicate project ideas and progress using clear, industry-standard terminology.
2. Document the design process and articulate project goals effectively in written and verbal formats.
3. Apply mathematical concepts, including proportional reasoning and measurement, to adjust models for accurate scaling and resolution.
4. Use geometric principles to understand and create accurate 3D shapes and objects.

I. **The student demonstrates technical proficiency with modeling and rendering tools to develop projects. The student is expected to:**
1. Model basic environments and scenes, applying spatial reasoning skills.
2. Demonstrate the use of modifiers in Blender or Autodesk to adjust the geometry and appearance of 3D models.
3. Export and import files across different formats, ensuring compatibility and quality preservation.
4. Conduct self-assessment and peer review to improve model accuracy and visual appeal.

Course Standards: 3D Animation and Game Design II

1. **GENERAL REQUIREMENTS.** This course is recommended for students in Grades 10-12.

2. **INTRODUCTION**
   A. Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
   B. The Arts, Entertainment and Design Career Cluster combines creative roles in visual and performing arts, film, journalism, fashion, interior design, and creative technologies. This Cluster focuses on creating, producing, and sharing artistic and design work across multiple platforms, aiming to entertain, inform, beautify, and inspire.
   C. The 3D animation and game design program of study careers encompasses the creation and production of visually engaging digital content such as visual marketing, graphic design, augmented and virtual reality, web design, and user interfaces/user experiences. This program of study combines artistic talent and technology to produce interactive content, entertainment, commercial product and packaging design, and promotional materials.
   D. 3D Animation and Game Design II is the second course within the Arts, Entertainment, and Design Career Cluster, aimed at high school students building skills in digital content creation and production. This course immerses students in the creative processes and technical skills necessary to produce visually engaging digital content across various platforms. Students will learn to conceptualize, design, and edit projects using industry-standard tools such as Autodesk Certified User (ACU) in 3D Animation and Modeling and Unity Certified User: Artist, building a portfolio of work that includes elements of visual marketing, graphic design, web design, and user interfaces.
   E. Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, which might include informational interviews or job shadowing relevant to the program of study.
   F. Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.

3. **KNOWLEDGE AND SKILLS**
   A. **The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:**
      1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work.
      2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn.
      3. Employ effective reading, writing, and technical documentation skills.
      4. Solve problems using critical thinking techniques and structured troubleshooting methodologies.
      5. Demonstrate leadership skills and collaborate effectively as a team member.

6. Implement safety procedures, including proper use of software and following privacy guidelines.
7. Exhibit an understanding of legal and ethical responsibilities in the 3D animation and game design field, following data privacy laws and best practices for security.
8. Demonstrate time-management skills and the ability to prioritize tasks in a technical setting.

B. **The student identifies various career pathways in the 3D animation and game design field. The student is expected to:**
1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles in 3D animation and game design.
2. Create a professional resume and portfolio that reflect skills, projects, certifications, and recommendations.
3. Demonstrate effective interview skills for roles in media and 3D animation and game design.

C. **The student develops technology and digital literacy skills. The student is expected to:**
1. Collaborate effectively on complex projects, communicate design concepts clearly, and present professional portfolios that showcase technical and creative expertise on a variety of platforms
2. Organize, manage, and document projects using file management systems, version control, and industry-standard terminology while adhering to ethical practices and copyright laws.
3. Use industry-standard tools such as Blender, Autodesk Maya, and Adobe Animate to design, model, rig, and animate 2D and 3D assets, incorporating advanced techniques like texturing, rendering, and lighting.
4. Use Unity to import assets, manage scenes, and create interactive experiences through animation controls, particle systems, shaders, and scripting using C# programming.
5. Prepare 3D models, animations, and effects for efficient rendering and real-time performance, using techniques such as polygon reduction, UV mapping, and platform-specific optimization.
6. Create visually engaging content using Adobe After Effects for compositing, motion graphics, and post-production while applying principles of color theory, composition, and visual hierarchy.

D. **The student integrates core academic skills into 3D animation and game design practices. The student is expected to:**
1. Document design processes, create project proposals, and present ideas using clear, professional language tailored to technical and creative contexts.
2. Use geometry, algebra, and proportional reasoning to create accurate 3D shapes, scale models, and optimize animations for timing, resolution, and performance.
3. Apply concepts of physics, motion, lighting, and optics to simulate realistic environments, effects, and interactions in animations and game design.
4. Write and debug scripts to control animations, game logic, and interactivity while using algorithms and problem-solving techniques to address technical challenges.
5. Apply design principles such as balance, contrast, and color theory to create visually engaging animations and interactive environments.

E. **The student demonstrates intermediate skills in 3D modeling and animation using industry-standard software. The student is expected to:**
    1. Expand proficiency in 3D modeling software by applying advanced modeling techniques, including extrusion, subdivision, and mesh editing.
    2. Create complex 3D models with attention to detail and accuracy in Blender and Autodesk applications.
    3. Apply UV mapping and texture painting techniques to enhance model realism and aesthetics.
    4. Demonstrate proficiency in rendering settings, including lighting adjustments and material applications for photorealistic output.

F. **The student applies national standards in graphic design and visual communication within the context of 3D animation and game design. The student is expected to:**
    1. Integrate principles of design such as unity, harmony, and visual hierarchy in the composition of 3D scenes.
    2. Use color grading and environmental lighting techniques to establish mood and focus in animations and game assets.
    3. Practice effective file management and version control methods to maintain project organization and consistency.
    4. Explore career pathways in 3D modeling, animation, and game art, including the skills, tools, and industry standards required for success.

G. **The student develops skills in Unity software to create and manage digital assets within a game environment. The student is expected to:**
    1. Navigate and customize the Unity interface, including asset management, scenes, and hierarchies.
    2. Import and organize 3D models, textures, and materials in Unity to create coherent and engaging game environments.
    3. Apply lighting, shading, and environmental effects in Unity to enhance visual quality and atmosphere.
    4. Use animation controllers and keyframing techniques to create basic object and character animations within Unity.

H. **The student integrates core academic skills into 3D animation and game design practices. The student is expected to:**
    1. Communicate complex design concepts and project requirements effectively, both in written and verbal formats.
    2. Document project progress and articulate design choices through informative texts and visual presentations.
    3. Apply geometric transformations and algebraic concepts to model dimensions, scaling, and proportions.
    4. Use problem-solving and critical thinking to address technical challenges in modeling, rendering, and asset integration.

I. **The student demonstrates technical proficiency in animation techniques and principles. The student is expected to:**
    1. Apply intermediate principles of animation, such as squash and stretch, arcs, and follow-through, to create more lifelike movements.

2. Create complex animation sequences that incorporate multiple objects and character interactions.
3. Demonstrate the use of physics-based animation settings in Autodesk or Unity to simulate real-world dynamics.
4. Export animations in appropriate formats for use in game engines or further editing.

J. **The student exhibits mastery of project-based skills and workflow optimization. The student is expected to:**
1. Plan, develop, and present a 3D animation project from concept to completion, documenting each stage of production.
2. Optimize models and textures for performance efficiency within game engines like Unity.
3. Implement feedback from peer reviews to refine and improve project quality.
4. Prepare a portfolio showcasing completed projects and technical skills relevant to industry standards.

Course Standards: 3D Animation and Game Design III

1. **GENERAL REQUIREMENTS.** This course is recommended for students in Grades 10-12.

2. **INTRODUCTION**
    A. Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
    B. The Arts, Entertainment and Design Career Cluster combines creative roles in visual and performing arts, film, journalism, fashion, interior design, and creative technologies. This Cluster focuses on creating, producing, and sharing artistic and design work across multiple platforms, aiming to entertain, inform, beautify, and inspire.
    C. The 3D animation and game design program of study careers encompasses the creation and production of visually engaging digital content such as visual marketing, graphic design, augmented and virtual reality, web design, and user interfaces/user experiences. This program of study combines artistic talent and technology to produce interactive content, entertainment, commercial product and packaging design, and promotional materials.
    D. 3D Animation and Game Design III is an advanced course within the Arts, Entertainment, and Design Career Cluster, aimed at high school students advancing skills in digital content creation and production. This course immerses students in the creative processes and technical skills necessary to produce visually engaging digital content across various platforms. Students will learn to conceptualize, design, and edit projects using industry-standard tools such as Unity Certified User: Artist, Adobe Certified Professional in Animate, and Certified 3D Game Artist (CG Spectrum) building a portfolio of work that includes elements of visual marketing, graphic design, web design, and user interfaces.
    E. Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, which might include informational interviews or job shadowing relevant to the program of study.
    F. Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.

3. **KNOWLEDGE AND SKILLS**
    A. **The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:**
        1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work.
        2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn.
        3. Employ effective reading, writing, and technical documentation skills.
        4. Solve problems using critical thinking techniques and structured troubleshooting methodologies.
        5. Demonstrate leadership skills and collaborate effectively as a team member.
        6. Implement safety procedures, including proper use of software and following privacy guidelines.

7. Exhibit an understanding of legal and ethical responsibilities in the 3D animation and game design field, following data privacy laws and best practices for security.
8. Demonstrate time-management skills and the ability to prioritize tasks in a technical setting.

B. **The student identifies various career pathways in the 3D animation and game design field. The student is expected to:**
1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles in 3D animation and game design.
2. Create a professional resume and portfolio that reflect skills, projects, certifications, and recommendations.
3. Demonstrate effective interview skills for roles in media and 3D animation and game design.

C. **The student develops technology and digital literacy skills. The student is expected to:**
1. Collaborate effectively on complex projects, communicate design concepts clearly, and present professional portfolios that showcase technical and creative expertise on a variety of platforms
2. Organize, manage, and document projects using file management systems, version control, and industry-standard terminology while adhering to ethical practices and copyright laws.
3. Use industry-standard tools such as Blender, Autodesk Maya, and Adobe Animate to design, model, rig, and animate 2D and 3D assets, incorporating advanced techniques like texturing, rendering, and lighting.
4. Use Unity to import assets, manage scenes, and create interactive experiences through animation controls, particle systems, shaders, and scripting using C# programming.
5. Prepare 3D models, animations, and effects for efficient rendering and real-time performance, using techniques such as polygon reduction, UV mapping, and platform-specific optimization.
6. Create visually engaging content using Adobe After Effects for compositing, motion graphics, and post-production while applying principles of color theory, composition, and visual hierarchy.

D. **The student integrates core academic skills into 3D animation and game design practices. The student is expected to:**
1. Document design processes, create project proposals, and present ideas using clear, professional language tailored to technical and creative contexts.
2. Use geometry, algebra, and proportional reasoning to create accurate 3D shapes, scale models, and optimize animations for timing, resolution, and performance.
3. Apply concepts of physics, motion, lighting, and optics to simulate realistic environments, effects, and interactions in animations and game design.
4. Write and debug scripts to control animations, game logic, and interactivity while using algorithms and problem-solving techniques to address technical challenges.
5. Apply design principles such as balance, contrast, and color theory to create visually engaging animations and interactive environments.

E. **The student demonstrates advanced skills in 3D animation and game design software to create sophisticated models and animations. The student is expected to:**

1. Apply advanced 3D modeling techniques, including sculpting, retopology, and high-poly to low-poly workflow for optimized performance.
2. Use UV unwrapping, texture mapping, and advanced texturing techniques to create realistic and stylized 3D assets.
3. Implement advanced lighting and shading techniques to enhance visual appeal and realism in 3D scenes.
4. Demonstrate proficiency in rendering workflows for animation and gaming, optimizing settings for quality and efficiency.

F. **The student applies national standards in design and visual communication to develop game-ready assets and animations. The student is expected to:**
   1. Integrate advanced principles of design, such as rhythm, pattern, and movement, to improve visual storytelling and engagement.
   2. Use color grading and post-processing effects to refine the aesthetic and mood of both static and animated scenes.
   3. Demonstrate project management skills, including file organization, version control, and efficient workflows for larger projects.
   4. Research and discuss professional roles and skills in 3D animation and game design, focusing on the technical and artistic demands of the industry.

G. **The student demonstrates technical proficiency in Unity for game asset integration and animation control. The student is expected to:**
   1. Use advanced Unity features, including particle systems, shaders, and lighting effects, to enhance game environments.
   2. Implement animation controllers, blend trees, and animation states to create fluid and interactive character movements.
   3. Import, configure, and manage 3D assets and animations in Unity with attention to performance optimization.
   4. Develop interactive elements using Unity to create user-driven experiences within game environments.

H. **The student integrates core academic skills into advanced 3D animation and game design practices. The student is expected to:**
   1. Document complex design processes and technical specifications using industry-standard terminology.
   2. Apply English language skills, such as informative writing, to articulate artistic choices and technical challenges in projects.
   3. Use mathematical concepts, such as physics and geometry, to simulate natural movements, collisions, and interactions in animated scenes.
   4. Demonstrate problem-solving skills to troubleshoot and resolve complex issues in animation, rendering, and asset management.

I. **The student develops proficiency in 2D animation techniques using Adobe Animate for game design applications. The student is expected to:**
   1. Create and animate characters, objects, and backgrounds using Adobe Animate's vector tools.
   2. Apply principles of traditional animation, such as exaggeration and timing, to develop engaging 2D sequences.

3. Integrate 2D animations within Unity to add layers of interaction and depth to game environments.
4. Export 2D animations in appropriate formats for integration into game and multimedia projects.

J. **The student showcases project-based skills and professional-quality work in a portfolio format. The student is expected to:**
   1. Plan, execute, and present a comprehensive animation or game project, documenting each stage from concept to final output.
   2. Incorporate feedback from peers and instructors to refine projects and meet quality standards.
   3. Prepare a professional portfolio that includes completed projects, assets, and animation sequences relevant to certification exams and industry expectations.
   4. Demonstrate readiness for certification exams by showcasing mastery of required skills in Unity, Adobe Animate, and 3D game art.

Course Standards: Career Connected Learning I and II

Career connected learning is an educational approach that integrates classroom instruction with real-world experiences, enabling high school students to explore potential careers and develop relevant skills before graduation. By participating in work-based learning opportunities—such as apprenticeships, internships, capstone projects, and school-based enterprises—students apply academic concepts in authentic settings, gain practical industry knowledge, and build professional networks. This hands-on engagement helps students connect their studies to future career paths, strengthens their problem-solving and communication skills, and supports a smoother transition into college, vocational programs, or the workforce.

All Career and Technical Education Programs of Study include aspects of work-based learning, and almost all of the programs include two Career Connected Learning (CCL) courses. Below are the course descriptions for CCL I and CCL II. The CCL standards can be found via this link: