Digital Visualization

8459 36 weeks

Table of Contents

Acknowledgments ......................................................................................................................................... 1
Course Description........................................................................................................................................ 2
Task Essentials Table.................................................................................................................................... 3
Curriculum Framework ................................................................................................................................. 4
Introducing Digital Visualization .................................................................................................................. 4
Exploring Fundamentals of Graphics ........................................................................................................... 8
Exploring Computer Animation .................................................................................................................. 15
Exploring Storyboards ................................................................................................................................ 20
Exploring Computer Modeling ................................................................................................................... 23
Creating Computer Animation .................................................................................................................... 26
Exploring Interactive Animation .................................................................................................................. 32
SOL Correlation by Task ............................................................................................................................... 34
Entrepreneurship Infusion Units ................................................................................................................ 36
Appendix: Credentials, Course Sequences, and Career Cluster Information ............................................. 37

Acknowledgments

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The following educators served on the curriculum development team:
Course Description

Suggested Grade Level: 10 or 11 or 12

Students gain experiences related to computer animation by using graphics and design concepts. Students solve problems involving 3-D object manipulation, storyboarding, texturing/mapping, lighting concepts, and environmental geometry. Students create a variety of animations that reflect real-world applications and are introduced to interactive and 3-D animation software. Production of a portfolio showcasing examples of original student work is included.

Recommended prerequisite(s): Communication Systems 8415 (36 weeks) or 8418 (18 weeks); Technical Drawing 8435 (36 weeks) or (18 weeks) 8434
# Task Essentials Table

- Tasks/competencies designated by plus icons (⁺) in the left-hand column(s) are essential
- Tasks/competencies designated by empty-circle icons (〇) are optional
- Tasks/competencies designated by minus icons (⁻) are omitted
- Tasks marked with an asterisk (*) are sensitive.

<table>
<thead>
<tr>
<th>Task Number</th>
<th>8459</th>
<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introducing Digital Visualization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>⁺</td>
<td>Explain digital visualization.</td>
</tr>
<tr>
<td>40</td>
<td>⁺</td>
<td>Create a multimedia portfolio of examples of student’s digital visualization work.</td>
</tr>
<tr>
<td>41</td>
<td>⁺</td>
<td>Analyze legal and ethical considerations related to digital visualization.</td>
</tr>
<tr>
<td><strong>Exploring Fundamentals of Graphics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>⁺</td>
<td>Compare raster and vector images.</td>
</tr>
<tr>
<td>43</td>
<td>⁺</td>
<td>Explain standard file-naming conventions.</td>
</tr>
<tr>
<td>44</td>
<td>⁺</td>
<td>Create an image.</td>
</tr>
<tr>
<td>44</td>
<td>⁺</td>
<td>Edit an image, using image-editing software.</td>
</tr>
<tr>
<td>45</td>
<td>⁺</td>
<td>Describe the design process.</td>
</tr>
<tr>
<td>46</td>
<td>⁺</td>
<td>Explain the elements of design.</td>
</tr>
<tr>
<td>47</td>
<td>⁺</td>
<td>Analyze the principles of design.</td>
</tr>
<tr>
<td><strong>Exploring Computer Animation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>⁺</td>
<td>Describe computer input devices.</td>
</tr>
<tr>
<td>49</td>
<td>⁺</td>
<td>Outline the evolution of animation technology.</td>
</tr>
<tr>
<td>50</td>
<td>⁺</td>
<td>Examine the mutual influence between animation and society.</td>
</tr>
<tr>
<td>51</td>
<td>⁺</td>
<td>Analyze fundamental principles of animation.</td>
</tr>
<tr>
<td>52</td>
<td>Explore careers related to computer animation.</td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>-----------------------------------------------</td>
<td></td>
</tr>
</tbody>
</table>

**Exploring Storyboards**

<table>
<thead>
<tr>
<th>53</th>
<th>Explain the storyboard.</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
<td>Analyze an existing storyboard.</td>
</tr>
<tr>
<td>55</td>
<td>Create a storyboard.</td>
</tr>
</tbody>
</table>

**Exploring Computer Modeling**

<table>
<thead>
<tr>
<th>56</th>
<th>Describe the computer-modeling process.</th>
</tr>
</thead>
<tbody>
<tr>
<td>57</td>
<td>Create computer models of basic 3D forms.</td>
</tr>
<tr>
<td>58</td>
<td>Modify basic computer-generated 3D forms.</td>
</tr>
</tbody>
</table>

**Creating Computer Animation**

<table>
<thead>
<tr>
<th>59</th>
<th>Analyze an existing animation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>Create an animation of a graphic image.</td>
</tr>
<tr>
<td>61</td>
<td>Create an animated product for the purpose of informing.</td>
</tr>
<tr>
<td>62</td>
<td>Create an animated product for the purpose of instructing.</td>
</tr>
<tr>
<td>63</td>
<td>Create an animated product for the purpose of persuading.</td>
</tr>
<tr>
<td>64</td>
<td>Create an animated product for the purpose of entertaining.</td>
</tr>
</tbody>
</table>

**Exploring Interactive Animation**

<table>
<thead>
<tr>
<th>65</th>
<th>Explain interactive animation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>66</td>
<td>Create an interactive animation.</td>
</tr>
</tbody>
</table>

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**Curriculum Framework**

**Introducing Digital Visualization**
Task Number 39

Explain digital visualization.

Definition

Explanation should include

- definition of visualization
- uses of computer graphics and animation
- key terminology (e.g., three-dimensional [3D] forms, faces, polygon count, vertices)
- use of mathematics in creating 3D forms, including the Cartesian coordinate system and the six orthographic views.

Process/Skill Questions

- What are the differences among faces, polygons, and vertices?
- Why are mathematical concepts relevant to modeling and animation?
- How has technology influenced digital visualization?
- What would be the consequences of not visualizing your product before development?

ITEEA National Standards

Information and Communication Technologies

The Characteristics and Scope of Technology

TSA Competitive Events

Digital Video Production

Future Technology Teacher

Scientific Visualization (SciVis)

Task Number 40
Create a multimedia portfolio of examples of student’s digital visualization work.

Definition

Creation should include examples of student’s use of

- storyboarding
- environmental geometry
- character geometry
- texture/materials
- lighting
- graphic imaging
- animation.

Portfolio should also include a self-reflection (e.g., analyses of work and work habits).

Process/Skill Questions

- In what ways can a portfolio be used to illustrate your work?
- Why should a portfolio have balanced and varied examples of your work?
- Why is it important to self-reflect about your own work in your portfolio?
- What are some styles or methods for presenting your portfolio?

ITEEA National Standards

Apply Design Processes

Information and Communication Technologies

The Core Concepts of Technology

Use and Maintain Technological Products and Systems

TSA Competitive Events

Digital Video Production

Scientific Visualization (SciVis)

Task Number 41
Analyze legal and ethical considerations related to digital visualization.

Definition

Analysis should include such considerations as

- copyright
- intellectual property
- fair use
- patents
- plagiarism
- liability
- obtaining permissions.

Process/Skill Questions

- Why do we have regulations and laws pertaining to copyright, intellectual property, and patents?
- What is the difference between a consumer and a producer/prosumer of media?
- Where can one learn current copyright regulations regarding animations/multimedia?
- What can be the consequences of plagiarism within an animation?
- How is fair use limited?

ITEEA National Standards

Relationships Among Technologies and the Connections Between Technology and Other Fields

The Role of Society in the Development and Use of Technology

TSA Competitive Events

Debating Technological Issues

Digital Video Production

Essays on Technology

Video Game Design

Webmaster
Exploring Fundamentals of Graphics

Task Number 42

Compare raster and vector images.

Definition

Comparison should include

- defining each type of image
- describing the use of each.

Process/Skill Questions

- Why are there two types of images?
- Why would one change a vector image into a raster image?
- What are some examples of the use of raster images in real-world applications?
- What are some examples of the use of vector images in real-world applications?
- What might be some consequences of not knowing what image type to use?

ITEEA National Standards

Information and Communication Technologies

TSA Competitive Events

Geospatial Technology (Virginia only)

Scientific Visualization (SciVis)

Video Game Design

Task Number 43
Explain standard file-naming conventions.

Definition

Explanation should include

• identifying different file types (e.g., jpg, gif, tiff, png, avi, wav)
• describing the use of each type
• listing rules for naming files.

Process/Skill Questions

• Why are there rules for naming files?
• What are the benefits of correct file naming in the real world?
• What might be some consequences of using an incorrect file extension?
• What is the significance of accurate file naming?

ITEEA National Standards

Information and Communication Technologies

Use and Maintain Technological Products and Systems

TSA Competitive Events

Computer-Aided Design (CAD), Architecture

Computer-Aided Design (CAD), Engineering

Digital Video Production

Geospatial Technology (Virginia only)

Scientific Visualization (SciVis)

Video Game Design

Webmaster

Task Number 44
Create an image.

Definition

Creation may include

- using a computer-input device
- following recommended procedures for using image-editing software.

Process/Skill Questions

- How can a graphic image be created using an input device, such as a scanner?
- What is the process of creating and importing an image with the use of a digital camera?
- What are the benefits of creating an image, using a computer-input device?
- What is the procedure for creating an image, using image-editing software?
- What might be the consequences of not following recommended procedures for using image-editing software?
- What are the benefits of using a tablet for 3D sculpting? For painting?

ITEEA National Standards

Use and Maintain Technological Products and Systems

TSA Competitive Events

Computer-Aided Design (CAD), Architecture

Computer-Aided Design (CAD), Engineering

Digital Video Production

Geospatial Technology (Virginia only)

Scientific Visualization (SciVis)

Video Game Design

Webmaster

Task Number 45
Edit an image, using image-editing software.

Definition

Editing should include

- cropping
- resizing
- resolution adjustment
- exposure correction
- color correction.

Process/Skill Questions

- What is the relationship between dots per inch (dpi) and file size?
- How is image-editing affected by the type of file being used?
- How is image-editing software used in conjunction with animation software?
- What are some industry-standard image-editing software programs?
- What are the differences between exposure correction and color correction?
- What is the importance of image resolution?

ITEEA National Standards

Relationships Among Technologies and the Connections Between Technology and Other Fields

Use and Maintain Technological Products and Systems

TSA Competitive Events

Computer-Aided Design (CAD), Architecture

Computer-Aided Design (CAD), Engineering

Digital Video Production

Geospatial Technology (Virginia only)

Scientific Visualization (SciVis)

Video Game Design
Task Number 46

Describe the design process.

Definition

Description should include the design process as a systematic, creative process for turning ideas into real products and environments, including

- identification of a design problem
- identification of criteria and constraints
- brainstorming of possible solutions
- performance of research concerning the possible solutions
- creation of a preliminary draft
- refinement of the design
- evaluation of the design
- development of a final product or system
- reevaluation of final solution.

Process/Skill Questions

- How can design problems be identified?
- Why is it important to identify criteria and constraints?
- What techniques are used to refine a design?
- How can a design be evaluated?
- Why should final solutions be reevaluated? How is this done?
- What is the importance of a preliminary draft?
- What other scenarios require the design process?
- What criteria would be used to evaluate the success of a design?
- Why is it important to use a systematic process? Are the steps always followed in sequential order?

ITEEA National Standards

The Attributes of Design

TSA Competitive Events

Architectural Design

Computer-Aided Design (CAD), Architecture

Dragster Design
Task Number 47

Explain the elements of design.

Definition

Explanation should include examples of the following elements:

- Shape
- Form
- Line
- Color
- Texture
- Size
- Space
- Direction
- Value

Process/Skill Questions

- What is the importance of the elements of design?
- How do the elements of design help you visualize a design?
- How do you determine which elements of design are more important to a particular project?
- How are the elements of design incorporated into a preliminary draft?

ITEEA National Standards

The Attributes of Design

TSA Competitive Events
Task Number 48

Analyze the principles of design.

Definition

Analysis should include explanation and examples of the following principles:

- Rhythm
- Balance
- Proportion
- Variety
- Emphasis
- Harmony

Process/Skill Questions

- How can the principles of design strengthen a project?
- How can balance and proportion be incorporated simultaneously in creating a project?
- In what other contexts can the principles of design be applied?

ITEEA National Standards

The Attributes of Design
### Exploring Computer Animation

#### Task Number 49

**Describe computer input devices.**

**Definition**

Description should include the definition and use of such devices as

- scanners
- digital still cameras
- digital video cameras
- optical microscopes
- digital tablets
- microphones.

**Process/Skill Questions**
• How can a scanner aid in the computer-animation process?
• Why might you use an optical microscope to create an animation?
• What resources are available to learn about recent advances in input devices?
• What considerations influence the selection of a computer input device?

ITEEA National Standards

Relationships Among Technologies and the Connections Between Technology and Other Fields

The Core Concepts of Technology

TSA Competitive Events

Computer-Aided Design (CAD), Architecture
Computer-Aided Design (CAD), Engineering
Geospatial Technology (Virginia only)
On Demand Video
Scientific Visualization (SciVis)
Video Game Design
Webmaster

Task Number 50

Outline the evolution of animation technology.

Definition

Outline should include materials, processes, important developers, and techniques of animation from its inception.

Process/Skill Questions

• What was the influence of the work of Walt Disney, Walter Lantz, and other early animators in the evolution of animation?
• Who are current leaders in animation?
• What is celluloid (cel) animation?
• How does software develop as a result of the demands of animators?
• What resources are available for staying current with new technologies?

ITEEA National Standards

The Influence of Technology on History

The Role of Society in the Development and Use of Technology

TSA Competitive Events

Computer-Aided Design (CAD), Architecture

Digital Video Production

Scientific Visualization (SciVis)

Video Game Design

Task Number 51

Examine the mutual influence between animation and society.

Definition

Examination should include examples of

• animation’s influence on society (e.g., culture, economics, entertainment, education)
• society’s influence on animation.

Process/Skill Questions

• What influence has animation had on education?
• What economic impact has animation had upon the entertainment industry?
• How has animation affected other aspects of society?
• How have other cultures influenced animation?
• What aspects of social history have been represented in animation?

ITEEA National Standards
The Cultural, Social, Economic, and Political Effects of Technology

The Role of Society in the Development and Use of Technology

TSA Competitive Events

Computer-Aided Design (CAD), Architecture

Digital Video Production

Scientific Visualization (SciVis)

Video Game Design

Webmaster

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Task Number 52

Analyze fundamental principles of animation.

Definition

Analysis should include the following:

- Solid drawing
- Character movement (e.g., squash and stretch, anticipation, arcs, secondary action, exaggeration)
- Staging
- Straight-ahead action and pose-to-pose
- Follow-through and overlapping action
- Timing
- Slow out and slow in
- Appeal

Process/Skill Questions

- How can you stage an animation to keep the focus on what is important?
- How can visualizing movement improve an animation?
- How is timing critical to establishing aspects of a character?
- Why must an animator be skilled in basic modeling?

ITEEA National Standards
Task Number 53

Explore careers related to computer animation.

Definition

Exploration should result in a list of relevant job titles in a variety of fields (e.g., science, medicine, law enforcement, architecture, advertising, entertainment, engineering) and should include for each field

- uses of animation
- preparation required for entering
- opportunities for advancement
- employment trends.

Students should use job databanks and match their abilities, aptitudes, and job expectations with industry standards.

Process/Skill Questions

- What are some ways to prepare for a career in computer animation?
- How is animation used in forensics?
- How are computer games created, using 3D animation?
- How can animation be used in advertising?

ITEEA National Standards

Information and Communication Technologies
Relationships Among Technologies and the Connections Between Technology and Other Fields

The Cultural, Social, Economic, and Political Effects of Technology

TSA Competitive Events

Computer-Aided Design (CAD), Architecture

Digital Video Production

Scientific Visualization (SciVis)

Video Game Design

Webmaster

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Exploring Storyboards

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Task Number 54

Explain the storyboard.

Definition

Explanation should include

- defining the term storyboard (i.e., a preliminary graphic outline of the animation sequence)
- stating the purpose of a storyboard
- stating the reason that a storyboard should be the initial step in the animation process
- listing the components of a storyboard (e.g., frame, script, setting, camera movement, audio, timing) and their functions.

Process/Skill Questions
• What aspects of an animation project should be included in the storyboard process?
• What role does visualization play in creating a storyboard?
• What might be the consequences of skipping the storyboard step?
• In what other fields are storyboards used?

ITEEA National Standards

Information and Communication Technologies

TSA Competitive Events

Digital Video Production

Scientific Visualization (SciVis)

Video Game Design

Task Number 55

Analyze an existing storyboard.

Definition

Analysis should include a summary of the ways the storyboard meets the criteria of storyboard components.

Process/Skill Questions

• How are transitions used?
• How are audio and script elements revealed in the storyboard?
• Does each frame fit together to reveal the whole animation process?
• Why should a storyboard be a work in progress?
• What factors may result in changing the storyboard?

ITEEA National Standards

Information and Communication Technologies

The Attributes of Design

TSA Competitive Events
Task Number 56

Create a storyboard.

Definition

Creation should include

- applying the elements and principles of design
- applying storyboard components.

Process/Skill Questions

- How would you describe the process of creating a storyboard?
- How is the storyboard used as a tool when working through the animation process?
- Why should you apply the principles of design in creating a storyboard?
- How can you determine whether you used the elements of design effectively in your storyboard?

ITEEA National Standards

Apply Design Processes

The Attributes of Design

TSA Competitive Events

Digital Video Production

Scientific Visualization (SciVis)

Video Game Design
Exploring Computer Modeling

Task Number 57

Describe the computer-modeling process.

Definition

Description should include

- the planning process, including sketching and scanning
- development of basic geometric shapes and forms
- identification of the Cartesian coordinates and $x$, $y$, $z$ axes
- modification of 3D forms.

Process/Skill Questions

- When would computer modeling be used in the design/planning process?
- In what situations are the Cartesian coordinates applicable in the computer-modeling process?
- How does the current software compare to similar software you have used previously?
- What are the purposes of modifying 3D forms?
- What might be the consequences of not following the plan you have made?

ITEEA National Standards

Information and Communication Technologies

TSA Competitive Events

Animatronics

Computer-Aided Design (CAD), Architecture

Computer-Aided Design (CAD), Engineering

Digital Video Production

Dragster Design
Task Number 58

Create computer models of basic 3D forms.

Definition

Creation should include the following forms:

- Cube
- Cylinder
- Sphere
- Torus
- Pyramid
- Cone

Process/Skill Questions

- Why is creating models of basic 3D forms important?
- How do geometrical forms represent 3D space?
- How does perspective enable visualization of 3D space?
- How are mathematical calculations related to creation of basic 3D forms?

ITEEA National Standards

Information and Communication Technologies

Use and Maintain Technological Products and Systems

TSA Competitive Events

Computer-Aided Design (CAD), Architecture

Computer-Aided Design (CAD), Engineering

Digital Video Production
Task Number 59

Modify basic computer-generated 3D forms.

Definition

Modification should include

- joining different forms to create objects
- using additive and subtractive techniques
- free-form sculpting
- adding a skin or effect
- adding materials and textures.

Process/Skill Questions

- What are possible outcomes of using different modification techniques (e.g., extrude, bevel, smooth, cut)?
- How would you describe the process of modifying forms?
- How is adding a skin different from using an additive technique?
- What is the benefit of adding materials and textures to a 3D form?

ITEEA National Standards

Information and Communication Technologies

Use and Maintain Technological Products and Systems

TSA Competitive Events

Computer-Aided Design (CAD), Architecture

Computer-Aided Design (CAD), Engineering
Task Number 60

Analyze an existing animation.

Definition

Analysis should include

- identification of purpose (i.e., inform, instruct, persuade, entertain)
- use of principles and elements of design
- representation of characters
- use of shadow effects
- use of backgrounds
- presentation of plot
- overall continuity and success.

Process/Skill Questions

- How can freeze framing be used for analysis?
- How does lighting enhance or detract from this animation?
- What criteria would you use to evaluate overall continuity and success of an animation?
- What is the intent of this animation?

ITEEA National Standards
The Attributes of Design

TSA Competitive Events

Computer-Aided Design (CAD), Architecture

Digital Video Production

Dragster Design

Scientific Visualization (SciVis)

Video Game Design

Task Number 61

Create an animation of a graphic image.

Definition

Creation should include

- identifying typical uses of animations of graphic images (e.g., logos, commercial images, icons, and interactive graphics)
- selecting an image for animation
- stating a purpose of the animation
- creating the animation, using the design process
- explaining how the final animation fulfills its purpose.

Process/Skill Questions

- What steps are used to animate a graphic image?
- What criteria are used to select an image for animation?
- How should an animated graphic be formatted for web page use?
- How have animated graphics changed television (e.g., weather reports, sports broadcasts, children’s programs)?
- How can you decide whether animating a graphic is appropriate within a specified context?

ITEEA National Standards

Information and Communication Technologies
Task Number 62

Create an animated product for the purpose of informing.

Definition

Creation should include

- the informative content to be communicated (e.g., science concepts, public service announcements, historical facts)
- planning (e.g., researching, script writing, audio recording, sketching, storyboarding)
- modeling
- texturing/mapping
- animating
- rendering.

Process/Skill Questions

- What research must be done during the planning stage to create an animation for the purpose of informing?
- What areas of learning could benefit from animated products?
- How can you evaluate whether animation is enhancing the process of informing?

ITEEA National Standards

Apply Design Processes
Assess the Impact of Products and Systems

Information and Communication Technologies

The Attributes of Design

TSA Competitive Events

Digital Video Production

Scientific Visualization (SciVis)

Video Game Design

Task Number 63

Create an animated product for the purpose of instructing.

Definition

Creation should include

- the instructive content to be communicated (e.g., tutorials, step-by-step instructions, map directions)
- planning (e.g., researching, script writing, audio recording, sketching, storyboarding)
- modeling
- texturing/mapping
- animating
- rendering.

Process/Skill Questions

- What is the difference between informing and instructing?
- How can animation address various learning styles when instructing?
- What factors should be considered when creating an animation for the purpose of instructing?
- How can you evaluate whether animation is enhancing the process of instructing?

ITEEA National Standards

Apply Design Processes
Assess the Impact of Products and Systems

Information and Communication Technologies

The Attributes of Design

TSA Competitive Events

Digital Video Production

Scientific Visualization (SciVis)

Video Game Design

Task Number 64

Create an animated product for the purpose of persuading.

Definition

Creation should include

- the persuasive content to be communicated (e.g., advertisements, political campaign literature, promotional information)
- planning (e.g., researching, script writing, audio recording, sketching, storyboarding)
- modeling
- texturing/mapping
- animating
- rendering.

Process/Skill Questions

- What are the basic methods of persuasion?
- What ethical considerations should be included when creating an animation for the purpose of persuading?
- What elements and principles of design can help to make an animation persuasive?
- What other factors should be considered when creating an animation for the purpose of persuading?
- How can you evaluate whether animation is enhancing the process of persuading?

ITEEA National Standards
Task Number 65

Create an animated product for the purpose of entertaining.

Definition

Creation should include

- the entertaining content to be communicated (e.g., cartoons, movies, music videos)
- planning (e.g., researching, script writing, audio recording, sketching, storyboarding)
- modeling
- texturing/mapping
- animating
- rendering.

Process/Skill Questions

- How can you create an animation specific to a target audience for the purpose of entertaining?
- How has the availability of social media affected the quantity and quality of animation?
- How does the quality of the texturing/mapping of an animation affect its entertainment value?
- What ethical considerations should be included when creating an animation for the purpose of entertaining?
- How can you evaluate whether animation is enhancing the process of entertaining?
ITEEA National Standards

Apply Design Processes

Assess the Impact of Products and Systems

Information and Communication Technologies

The Attributes of Design

TSA Competitive Events

Digital Video Production

Scientific Visualization (SciVis)

Video Game Design

Exploring Interactive Animation

Task Number 66

Explain interactive animation.

Definition

Explanation should include

- virtual reality
- gaming
- virtual tour/walk-through
- scene animation
- the basics of programming logic.

Process/Skill Questions

- How is a user interface related to interactive animation?
• What are the different types of user interfaces?
• How does a computer interpret actions from a user into actions on a screen?
• How can you explain modality in terms of input and output?
• What are the six major steps in interactive design?
• What is artificial intelligence (AI)?
• What are some important real-world applications of interactive animation?

ITEEA National Standards

Information and Communication Technologies

TSA Competitive Events

Computer-Aided Design (CAD), Architecture

Digital Video Production

Dragster Design

Scientific Visualization (SciVis)

Video Game Design

Webmaster

Task Number 67

Create an interactive animation.

Definition

Creation should include

• planning (e.g., using a design document, storyboard)
• developing interaction between user and animation
• following the concepts of animation and modeling.

Process/Skill Questions

• What are the components of a virtual environment?
• How is programming logic used in creating interactive animations?
• What is a computer algorithm?
• How do computer algorithms relate to flow charts?
• Why are most games designed by a team rather than an individual?
• What could happen if a design team did not use a planning guide such as a game design document (GDD)?
• Why is debugging necessary?

ITEEA National Standards

Apply Design Processes

Information and Communication Technologies

The Attributes of Design

Use and Maintain Technological Products and Systems

TSA Competitive Events

Computer-Aided Design (CAD), Architecture

Dragster Design

Scientific Visualization (SciVis)

Video Game Design

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SOL Correlation by Task

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
<th>English</th>
<th>History and Social Science</th>
<th>Mathematics</th>
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</thead>
<tbody>
<tr>
<td>39</td>
<td>Explain digital visualization.</td>
<td>9.3, 9.5, 10.3, 10.5, 11.3, 11.5</td>
<td>VUS.14</td>
<td>G.13, COM.12</td>
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<td>40</td>
<td>Create a multimedia portfolio of examples of student’s digital visualization work.</td>
<td>9.1, 9.5, 9.6, 10.1, 10.5, 10.6, 11.1, 11.5, 11.6</td>
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<td>G.3, COM.12</td>
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<td>41</td>
<td>Analyze legal and ethical considerations related to digital visualization.</td>
<td>9.5, 10.5, 11.5</td>
<td>GOVT.1, GOVT.9, GOVT.15</td>
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<td></td>
<td>Task Description</td>
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<td>42</td>
<td>Compare raster and vector images.</td>
<td>English: 9.5, 10.5, 11.5</td>
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<td>Mathematics: MA.7</td>
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<td>43</td>
<td>Explain standard file-naming conventions.</td>
<td>English: 9.5, 10.5, 11.5</td>
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<td>Mathematics: COM.2</td>
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<td>44</td>
<td>Create an image.</td>
<td>Mathematics: COM.1, COM.10, COM.12</td>
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<td>45</td>
<td>Edit an image, using image-editing software.</td>
<td>Mathematics: COM.12</td>
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<td>46</td>
<td>Describe the design process.</td>
<td>English: 9.5, 10.5, 11.5</td>
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<td>Mathematics: COM.3, COM.4</td>
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<td>47</td>
<td>Explain the elements of design.</td>
<td>English: 9.5, 10.5, 11.5</td>
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<td>Mathematics: G.3, COM.12</td>
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<td>48</td>
<td>Analyze the principles of design.</td>
<td>English: 9.5, 10.5, 11.5</td>
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<td>Mathematics: COM.10</td>
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<td>50</td>
<td>Outline the evolution of animation technology.</td>
<td>English: 9.6, 9.7, 10.6, 10.7, 11.6, 11.7</td>
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<td>History and Social Science: VUS.13, VUS.14, WHII.13, WHII.14</td>
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<td>Mathematics: COM.12</td>
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<td>Examine the mutual influence between animation and society.</td>
<td>English: 9.5, 10.5, 11.5</td>
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<td>52</td>
<td>Analyze fundamental principles of animation.</td>
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<td>53</td>
<td>Explore careers related to computer animation.</td>
<td>English: 9.5, 9.8, 10.5, 10.8, 11.5, 11.8</td>
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<td>Explain the storyboard.</td>
<td>English: 9.3, 9.5, 10.3, 10.5, 11.3, 11.5</td>
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<td>Mathematics: COM.12</td>
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<td>Analyze an existing storyboard.</td>
<td>English: 9.6, 10.6, 11.6</td>
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<td>56</td>
<td>Create a storyboard.</td>
<td>Mathematics: G.13, COM.12</td>
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<td></td>
<td>Describe the computer-modeling process.</td>
<td>English: 9.5, 10.5, 11.5</td>
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<td>Mathematics: G.13</td>
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<td>Create computer models of basic 3D forms.</td>
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<td>Modify basic computer-generated 3D forms.</td>
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<td>60</td>
<td>Analyze an existing animation.</td>
<td>History and Social Science: VUS.5</td>
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<td>61</td>
<td>Create an animation of a graphic image.</td>
<td>English: 9.5, 10.5, 11.5</td>
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<td>62</td>
<td>Create an animated product for the purpose of informing.</td>
<td>English: 9.1, 9.2, 10.1, 10.2, 11.1, 11.2</td>
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<td>Mathematics: G.3, COM.12</td>
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<td>63</td>
<td>Create an animated product for the purpose of instructing.</td>
<td>English: 9.1, 9.2, 10.1, 10.2, 11.1, 11.2</td>
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<td>Mathematics: G.3, COM.12</td>
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<td>64</td>
<td>Create an animated product for the purpose of persuading.</td>
<td>English: 9.2, 10.2, 11.2</td>
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<td>Mathematics: G.3, COM.12</td>
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<td>65</td>
<td>Create an animated product for the purpose of entertaining.</td>
<td>English: 9.1, 9.2, 10.1, 10.2, 11.1, 11.2</td>
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<td>History and Social Science: GOVT.1</td>
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<td>Mathematics: G.3, COM.12</td>
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<td>66</td>
<td>Explain interactive animation.</td>
<td>English: 9.5, 10.5, 11.5</td>
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<td>Mathematics: G.3, COM.12</td>
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**Entrepreneurship Infusion Units**

Entrepreneurship Infusion Units may be used to help students achieve additional, focused competencies and enhance the validated tasks/competencies related to identifying and starting a new business venture. Because the unit is a complement to certain designated courses and is not mandatory, all tasks/competencies are marked “optional.”
Appendix: Credentials, Course Sequences, and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- Adobe Certified Associate (ACA) Examinations
- Autodesk Certified Professional Examinations
- Autodesk Certified User Examinations
- College and Work Readiness Assessment (CWRA+)
- National Career Readiness Certificate Assessment
- Unity Certified User Examination
- Workplace Readiness Skills for the Commonwealth Examination

Concentration sequences: A combination of this course and those below, equivalent to two 36-week courses, is a concentration sequence. Students wishing to complete a specialization may take additional courses based on their career pathways. A program completer is a student who has met the requirements for a CTE concentration sequence and all other requirements for high school graduation or an approved alternative education program.

- Advanced Drawing and Design (8438/36 weeks)
- Architectural Drawing and Design (8437/36 weeks)
- Architectural Drawing and Design (8492/18 weeks)
- Communication Systems (8415/36 weeks)
- Communication Systems (8418/18 weeks)
- Engineering Drawing and Design (8436/36 weeks)
- Engineering Drawing and Design (8493/18 weeks)
- Graphic Communications Systems (8458/36 weeks)
- Imaging Technology (8455/36 weeks)
- Introduction to Engineering Design (PLTW) (8439/36 weeks)
- Modeling and Simulation Technology (8460/36 weeks)
- Technical Drawing and Design (8434/18 weeks)
- Technical Drawing and Design (8435/36 weeks)
- Video and Media Technology (8497/36 weeks)

Career Cluster: Arts, Audio/Video Technology and Communications

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<tr>
<th>Pathway</th>
<th>Occupations</th>
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<tbody>
<tr>
<td>Audio and Video Technology and Film</td>
<td>Audio and Video Equipment Technician</td>
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<td>Audio-Video Designer, Engineer</td>
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<td>Editor</td>
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<td>Graphic Designer</td>
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<td>Multimedia Artist, Animator</td>
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<td>Producer</td>
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<td>Sound Engineering Technician</td>
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<td>Videographer</td>
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<tr>
<td>Visual Arts</td>
<td>Graphic Designer</td>
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<th>Pathway</th>
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<tr>
<td></td>
<td>Illustrator</td>
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<tr>
<td></td>
<td>Media Planner, Buyer</td>
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<tr>
<td></td>
<td>Multimedia Artist, Animator</td>
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