FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT

COMPUTER GAME DESIGN
f.k.a – Computer Animation and Game Design

Date: January 2014 **Course Length: 1 Year**
Revision: January 2015
Proposed Grade Level(s): 11-12 **Subject Area/Credits: CTE/5 per Semester**
Grading: A-F
Prerequisite: A pathway course such as: Media Productions 1, Digital Art 1, Exploring Computer Science, or Web Design

COURSE DESCRIPTION:

This is an intermediate level course that explores the design and building of animations & video games from conception, through development, programming, and production. Principles of computer animation will be studied as tool for creating motion graphics in developing video games. Previous digital media or computer science course work is required. This course will focus on the rigor and relevance of the STEM (Science Technology Engineering Math) pathway as well as aspects of the Media and Entertainment Arts pathway and is specifically designed as the intermediate course between advanced media or computer science courses. Students will learn the hierarchy of the game development process by participating in small group and individual activities such as conceiving story lines, developing the environments, animations, art work, and the underlying programming code that makes games function.

GENERAL GOALS/PURPOSES:

- Students will read about, write about, talk about, and reflect upon gaming design and animation art in order to gain fluency, skills and a deeper understanding of the history and future of animation and game development technology.
- Students will work collaboratively to create artistically, learning the importance of teamwork and collaboration.
- Students will analyze the roles, functions and development of animation and gaming through time and its connections to technology today and in the future.
- Students will develop creative skills in problem solving, communication and time management.
- Students will learn about career and post-secondary learning possibilities related to animation and game programming.
- Students will study the history of animation as it relates to game programming and compare and contrast styles and methods.
- Students will become proficient in aspects of Adobe Photoshop, Adobe AfterEffects, Adobe Flash, ToonBoom Studio, and Game Maker software.
- Students will become utilize the C# programming language used in the Game Maker software.
- Students will approach technology and computer software as a means of artistic expression.
- Students will expand their vocabulary of new media art and design, and how to apply design principles and elements of art to their projects.
- Students will focus on animation fundamentals and the principles of animation in order to create successful, professional projects for their Game Design Portfolio.
- Students will learn about copyright law and the ethics of digital imagery.
- Students will create portfolios and participate in classroom critiques.

CCSS READING COMPONENT:

Students will be required to read and understand technical manuals, internet-based learning activities, and online resources as they apply to this class. They will locate information from written and electronic sources and identify strategies for evaluating their reliability and validity. Students will edit all documents produced.

CCSS WRITING COMPONENT:

Students will demonstrate writing/editing skills by writing, proofreading, and editing all documents, using correct grammar, punctuation, capitalization, vocabulary and spelling. • Students will describe, analyze, critique and write about game design and animation and the characteristics of professional and student work in short essays (description, observation, and analysis). Students will reflect on the creative process and problem solving techniques used in animation & game programming (reflective). Students will compare and contrast, as well as analyze the methods of production and technology (informative). Students will keep an ongoing folder of design and programming documents and notes.

CCSS SPEAKING and LISTENING COMPONENTS:

Students will research, compose, and orally present information for a variety of topics utilizing appropriate technology. Demonstrate and teach others on various topics throughout the lessons. Take part in on-going small group and class discussions. Students will present oral reports and participate in class/small group discussions about their own work and the work of others. Students will present their projects to the class with an explanation of the process and an evaluation of the end result. Students will orally respond to and discuss their evaluation of peer and professional work using appropriate vocabulary and terms.

SEQUENCE OF INSTRUCTION

Title	Description	Duration
1. Art and Animation History	Lessons in this unit will cover the history of animation, from the first inventions to present day computer based techniques.	5 Hours
2. Review Animation Art Theory and Fundamentals	Lessons in this unit will review art theory in composition and animation, from the elements and principles of art to the philosophy of Aesthetics.	5 Hours
3. Animation Process	Lessons in this unit will allow students hands-on experience with the sequence and processes involved in developing basic computer animations and being on an animation development team.	20 Hours
4. Animation Principles	Lessons in this unit will include the seven principles of character animation.	30 Hours
5. Animation Production	Lessons in this unit will include techniques on how to plan, create and prepare for animation in pre-production, production and post production.	30 Hours
6. Game Building Principles	Lessons in these units will cover basics of programming, game mapping, game physics, design evaluation, peer review, and proof of concept testing.	20 Hours
7. Programming &	Lessons in this unit will teach more detailed	25 Hours

Title	Description	Duration
Production Principles	programming language, running simulations, peer review, and the recursive debugging cycle.	
8. Art & Animation in Application	Lessons in this unit will include a review of art and animation principles, modeling with Boolean operations, rendering lighting and backgrounds, and syncing audio to visual elements.	30 Hours
9. Documentation & Marketing	Lessons in this unit will include details of project management and documentation of concepts, construction, and completion.	10 Hours
10. Careers and opportunities	Lessons will include a short research project on available career paths in programming, game design and animation.	5 Hours

DETAILED UNITS OF INSTRUCTION AND COMMON CORE STANDARDS:

Units of instruction are based on a progressive set of assignments designed to ready students for further education and entry-level employment in the multimedia industry. Students work individually to learn specific technology integration skills and as group members to collaboratively apply these skills in the digital production process. Progressive projects will be accompanied by appropriate skill building exercises All equipment and supportive required resources will be available to all students.

1.Art and Animation History
This lesson series is meant to provide students with an overview of the major events, developments, and milestones of early animation (late 19th and early 20th century). It includes a short historical overview, timeline, and a series of videos that provide a good foundational knowledge of people, inventions, and institutions that helped shaped the medium as it exists. Students will research their favorite animations, write papers and create a slide show to share orally with the class detailing the origins of artistic and production style. The history of animation will continue to be explored and integrated throughout the course by watching and discussing other videos and clips on a weekly basis to show students a wide range of important artists and studios, principles, approaches, and story lines. Important films, individuals, and studios covered in this lesson:1. James Stuart Blackton's *The Enchanted Drawing, c.1900*2. Emile Cohl's *Fantasmagorie, c.1908*3. Winsor McCay premieres *Gertie the Dinosaur, c.1914*4. Willis O'Brien *The Dinosaur and the Missing Link. 1915*5. Winsor McCay's *The Sinking of the Lusitania, 1918*6. Max and Dave Fleischer's *The Tantalizing Fly, 1924*7. Lotte Reigniger *Adventures of Prince Achmed*, 19258. Disney Studios, *Steamboat Wille*, 1928. CCSS ELA-Literacy: CCRA R1, R2, W4, W6, W8, W10, SL1, SL2, SL4, L6

2.Review Animation Art Theory and Fundamentals
Students will design and create a phenakistoscope which means “Spindle Viewer” with 16 images, outlined and colored, that creates the illusion of continuous movement. They will demonstrate the understandings the basic animation concepts of cycle animation, which is when the first drawing of the animation cycle matches the last drawing of the animation creating an endless loop of motion. In addition students will be able to explain the scientific concept of persistence of vision. Students will then create a very basic frame animation through stop motion. The lessons will also reference three early animation techniques and artists; Muybridge, Winsor McCay, and the invention of the Zoetrope. Students will utilize basic Photoshop skills, Flash, and/or the animation software ToonBoom Studio to program movement and frame by frame animation of a self portrait. Students may add sound and create a final stand alone movie. CCSS ELA-Literacy CCRA R1, R2, W4, W6, W7, W10, SL1, SL2, SL4. CCSS Math Content HSF-BF A1a

3. Animation Process
Students will build on their animated self portrait figure and add design elements such as background to create a Walk Cycle. Principles taught include the understanding of motion using a frame-by-frame approach, tweening, timeline, and layers.
Students will review basic elements of good storytelling and learn how to create a storyboard before building a frame-by-frame animation. First they draw a prescribed setting; then develop their story in that setting; then create the storyboard that will guide their construction of the frame-by-frame animation.
Students will review the motion studies created by Edward Muybridge which are considered to be the bridge between photography and animation/film and will discuss Persistence of vision and how Muybridge exploited this phenomenon through his motion studies and in the process bridged the gap between still image and motion picture.
This lesson will introduce the students to 2D character development and the important role of shapes. They will be introduced to how professional animators utilize simple forms to create a multitude of characters. The students will create a basic cartoon character with simple shapes, be introduced to entry level character development, and create a final character of their own.
Using splines and NURBS for modeling students will learn how to create 3D models. Up to this point they have only looked at prebuilt geometric primitives or flat 2D pictures of themselves. With splines and NURBS they can create many more models. CCSS ELA-Literacy CCRA W4, W6, W8 CCSS Math Practice MP1

4. Animation Principles
Squash and Stretch-Rolling Ball-Stop Motion. In this lesson students will animate a ball rolling into the frame and squash against an object. This lesson is concerned primarily with exaggeration as it pertains to the principles of animation, squash and stretch. It also examines timing and easing out of a move. Students will also learn the principle of Secondary Action. Secondary Actions add to and enrich the main action of an animated sequence. Secondary actions add more dimension to the character animation, supplementing and/or re-enforcing the Primary Action. Students will create and add one or more secondary actions to the ball rolling sequence. Students will also study arc. Most natural movement, human and animal, takes place on an arc. From the flick of a finger, to the swing of a baseball bat or a moving tail, the majority natural movement occurs on wavelike arcs or in figure eight like movements. Understanding the importance of arcs in movement will help animators create more fluid and natural movements, from the smallest to the broadest of actions. CCSS ELA-Literacy CCRA W10, SL1, SL4. CCSS Math Practice MP1CCSS Math Content HSF-BF A1a, HSA-CED A3

5. Animation Production
Students will begin learning the basics of Object Oriented Programming and learn how and why an animator would instantiate an object using the properties inspector.
Students will learn to develop an algorithm to calculate the proper rotation for the hands on an animated clock face. They will then use event listeners to bring the hands to life and complete the animation.
Students will practice the basics of modeling with splines and object generators, creating and applying materials, setting lights, and basic key frame animation. Students will work through the four main processes of 3D animation to create their own production logo. Students will understand the purpose of a logo and work through a brainstorming activity to create their own unique signature.
Given a basic 3D scene, students will storyboard a sequence, and setup and render each shot of the sequence. The individual shots will then be brought into a video editing program to be finalized. Students learn to create videos in the popular Flash video format (FLV), for use on a website. This is the same format used by YouTube, Google Video, and almost all other "video" websites on the web.
Students will continue to learn how to action script buttons in order to move viewers through their animation or presentation, by clicking on buttons or using automatic triggers. This acts as a preview of button action scripting for game design, with room for creative personalization, as the "player" navigates a puzzle game through a Dungeon-type setting. CCSSELA-Literacy CCRA W10, SL1, SL2, SL3, SL4, SL5, L6.
CCSS Math Practice MP4, MP5. CCSS Math Content HSS-ID A1, IDA3, A13, CPA1, IC B4

6. Game Building Principles
Students will learn basic vocabulary for the Game Maker game design engine, as well as the function and use of the resource tree. Students will use Game Maker to develop a simple game and will program objects to react to the physics of game rules, including using relative and absolute referencing plot points on X and Y axis positions. Algebraic thinking will be used to explain and create path movements. Students will program animated sprites and moving targets as well as program "launch and destroy" sequences.
Students will create game interactions and sprites with random motions and introduce the concept of gravity. Working in small groups students will learn the recursive and iterative process of game development. Students will respond to peers feedback, modify game content based on comments, debug and fix errors. Students will also explore game rating systems and the role of the Entertainment Software Rating Board. CCSSELA-LiteracyCCRAW10, SL1, SL2, SL3, SL4, SL5, L6. CCSS Math Practice MP4, MP5
CCSS Math Content HSS-IDA1, IDA3, A13, CPA1, ICB4
7. Game Programming & Production Principles
In this section students will interpret the underlying programming code of an existing game and learn to apply Boolean logic to Game Maker programming. An original game object will be developed as well as a team generated original game concept according to required specifications. Students will critically evaluate their own and their peers work and ideas and be able to explain how and why their game rules work within the user interface. A heads-up display that will be dynamically updated during game play will be developed. Additionally students will learn variables in programming to affect the direction of launched objects. A research paper on the role of programmers in game design will be written and an original game will be designed. Students will also build a game to peer "customer" specifications. CCSSELA-LiteracyCCRAW10, SL1, SL2, SL3, SL4, SL5, L6. CCSS Math Practice MP4, MP5
CCSS Math Content HSS-IDA1, IDA3, A13, CPA1, ICB4

8. Art & Animation in Application
Students will evaluate their developed visuals using the elements of art and principles of design. They will be able to explain how visual perspective, lighting, and shadows help to create the illusion of 3D space. Students will create colors using the RGB (Red, Green, Blue) color model as well as the HSL (Hue, Saturation, and Luminosity) models, and describe the function of the alpha channel. Through this students will create 3D objects that move and rotate in 3D space, learning to program features along the X, Y, and Z axis. More work with Boolean modifiers will be done as students create 3D models that interact with user input, creating scenes. Students will learn how to set virtual lighting and camera positions and how to render those onto their 3D objects along with textures and back ground elements. Students will build basic features for backgrounds and models from primitive shapes and then further alter geometry by applying isosurfacing. Students will add sounds to created animations in response to user action. CCSSELA-LiteracyCCRAW10, SL1, SL2, SL3, SL4, SL5, L6. CCSS Math Practice MP4, MP5. CCSS Math Content HSS-IDA1, IDA3, A13, CPA1, ICB4.

9. Documentation & Marketing
Students will refine the definition of design team roles and indentify the three stages of development and iteration. They will understand the legal ramifications of copyright and the use of royalty free images and sounds and will develop a final game utilizing all the elements learned thus far. Each team will create supporting design documents detailing the development of the game and the roles embodied by each team member. Students will organize tasks using a Gantt chart or spreadsheet. Students will present the game design for peer review and play. CCS SELA-Literacy CCRAW10, SL1, SL2, SL3, SL4, SL5, L6. CCSS IC B4

10. Careers and opportunities
Students will research and present a thoughtful reflection on the opportunities available to those with programming backgrounds and skill. Research on current salaries, wages, royalties, and sales of current and

historical games of various platforms will be conducted and presented for peer review. CCS SELA-Literacy CCRAW10, SL1, SL2, SL3, SL4, SL5, L6. CCSS Math Content HSS-IDA1.

TEXTBOOKS: *Video Game Design Foundations*, Ploor, 2011, Goodheart- Wilcox Company, Inc. And *Introduction to Video Game Design,* Ploor, 2012, Goodheart- Wilcox Company, Inc.

COMMON CORE STANDARDS to be ADDRESSED:

- CCSS.ELA-Literacy.CCRA.R.1 Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
- CCSS.ELA-Literacy.CCRA.R.2 Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
- CCSS.ELA-Literacy.CCRA.W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- CCSS.ELA-Literacy.CCRA.W.6 Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
- CCSS.ELA-Literacy.CCRA.W.7 Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
- CCSS.ELA-Literacy.CCRA.W.8 Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
- CCSS.ELA-Literacy.CCRA.W.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.
- CCSS.ELA-Literacy.CCRA.SL.1 Prepare for and participate effectively in a range of conversations
- and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- CCSS.ELA-Literacy.CCRA.SL.2 Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
- CCSS.ELA-Literacy.CCRA.SL.3 Evaluate a [speaker's] point of view, reasoning, and use of evidence and rhetoric.
- CCSS.ELA-Literacy.CCRA.SL.4 Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
- CCSS.ELA-Literacy.CCRA.SL.5 Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.
- CCSS.ELA-Literacy.CCRA.L.6 Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.
- CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.
- CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.
- CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.
- CCSS.Math.Practice.MP4 Model with Mathematics.
- CCSS.Math.Practice.MP5 Use appropriate tools strategically.
- CCSS.Math.Content.HSF-BF.A.1a Building Functions - Write a function that describes a relationship between two quantities: Determine an explicit expression, a recursive process, or steps for calculation from a context.
- CCSS.Math.Content.HSS-ID.A.13 Interpreting Categorical and Quantitative Data - Summarize, represent, and interpret data on a single count or measurement variable: Represent data with plots on the real number line (dot plots, histograms, and box plots).

- CCSS.Math.Content.HSS-ID.A.3 Interpreting Categorical and Quantitative Data - Summarize, represent, and interpret data on a single count or measurement variable: Interpret differences in shape, center, and spread in the context of data sets, accounting for possible effects of extreme data points (outliers).
- CCSS.Math.Content.HSS-CP.A.1 Conditional Probability and the Rules of Probability - Understand independence and conditional probability and use them to interpret data: Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or" and "not").
- CCSS.Math.Content.HSS-IC.B.4 Making inferences and Justifying Conclusions - Make inferences and justify conclusions from sample surveys, experiments, and observational studies: Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.
- CCSS.Math.Content.HSA-CED.A.3 Creating Equations - Create Equations that describe numbers or relationships: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

DISTRICT ESLRs to be ADDRESSED:

• **Self-directed Learners:** Students will develop skills enabling them to work alone on project components. The nature of the production process will facilitate this skill.

• **Effective Communicators:** Students will develop communication skills by keeping conventional phone communication and email communication with prospective and active clients as necessary within the scope of work.

• **Quality Producers/Performers:** Students will strive to produce a marketable product that will be valuable to current and prospective clients. They will adhere to quality control guidelines and ethical concerns through the production process.

• **Constructive Thinkers**: Students will execute the tasks necessary for project success. Through this process, they will assume various production roles and will be responsible for reporting back for collaboration with other students, faculty, and clients.

• **Collaborative Workers**: Students will actively collaborate with clients, administrators, facilitators, and fellow classmates to work toward completion of common project goals.

• **Responsible Citizens:** Students will learn to act responsibly when representing the parent organization and will strive to advocate good citizenship exhibited by example. This will be facilitated by continuous community involvement and active retention of company image.

CTE/AME CONTENT STANDARDS TO BE ADDRESSED

Artistic Perception

1. To introduce students to the elements and principles of art as they apply to animation.
2. To build on student's experiences in using the elements and principles to create personal, technically proficient works.
3. To introduce students to the vocabulary and selected aspects of art and design through a variety of animation assignments.

Creative Expression

1. To solve problems by creatively applying the elements and principles of design to their animated and gaming work.

2. To provide instruction and practice in the safe and effective use of digital animation art methods and game production techniques.
3. To develop students' responsibility for organizing their own work, as well as maintaining shared tools, material and equipment in the classroom workspace.

Historical and Cultural Context
1. To familiarize students with significant historical developments of computerized art, animation and gaming through a variety of projects.
2. To familiarize students with the work of important twentieth century animators and game designers.

Aesthetic Valuing
1. To give students the vocabulary to evaluate and reflect on their works and those of their peers in writing or presentation.
2. To provide on-going opportunities for and instruction in analyzing and evaluating animation and game design according to aesthetic theories and conventions of criticism.

Connections, Relations, and Applications
1. To explore various career fields in the area of animation and gaming technology through research projects, studio exercises, and presentations.
2. In written reflection and discussion, students will speculate on the nature and function of animation and gaming due to changing technology and culture.

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