

FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT

Exploring Computer Science

Date: January 2014

Subject Area: CTE

Proposed Grade Level(s): 9-12

Course Length: 1 Year

Grading: A-F

Credits: 5 per semester

Prerequisites: None

COURSE DESCRIPTION:

Exploring Computer Science focuses on the creative, collaborative, interdisciplinary, and problem-solving nature of computing featuring an inquiry-based approach to learning and teaching. As part of this curriculum, students will delve into real world computing problems that are culturally relevant and address social and ethical issues while delivering foundational computer science knowledge to students. Students will engage in several in-depth projects to demonstrate the real-world application of computing.

GENERAL GOALS/ESSENTIAL QUESTIONS:

- Help students understand why certain tools or languages are used to solve particular problems.
- Develop computational practices of algorithm development, problem solving, and programming.
- Introduce topics such as interface design, limits of computers, and societal and ethical issues.
- Prepare students for careers related to computer science that involve the design, development, implementation, maintenance, and management of systems that rely on software programs to satisfy the operational needs of modern business organizations.

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.

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.

DETAILED UNITS OF INSTRUCTIONS:

Unit I: Human Computer Interaction (Weeks 1-4)

The topics in this unit are designed to allow all students to gain familiarity with computers and computing in the context of activities that give students an opportunity to work at their own pace, collaborate in groups where they can learn from each other and generally gain an overview of the many and varied ways in which computers and computing are used.

- A. Computers and computing concepts

- B. Hardware terminology and components
- C. The World Wide Web
- D. Search engines
- E. Internet resources
- F. Website evaluation

CCSS.ELA-Literacy: CCRA.R.1, R.2, W.4, W.6, W.8, W.10, SL.1, SL.2, SL.4, L.6.

CCSS.Math.Practice: MP1, MP4, MP5.

Unit II: Problem Solving (Weeks 5-9)

In order for students to become “computational thinkers” they need experience solving a wide range of problems and the opportunity to experiment with a variety of solution strategies. This unit begins with an introduction to the problem solving process. Students are asked to solve new problems by planning a strategy, designing and producing solutions, and then reflecting on their solutions and strategies.

- A. Data collection and problem solving
- B. Problem solving process
- C. Binary number system
- D. Linear and binary search algorithms
- E. Sorted and unsorted lists
- F. Minimal spanning trees
- G. Graphs
- H. Projects and presentations

CCSS.ELA-Literacy.CCRA.R.1 R.2, W.4, W.6, W.7, W.10, SL.1, SL.2, SL.4.

CCSS.Math.Practice.MP1, MP2, MP3, MP4.

CCSS.Math.Content.HSF-BF.A.1a.

Unit III: Web Design (Weeks 10-15)

The Web Design unit builds on the concepts presented in the previous units by having students apply problem solving strategies to web design; thus, it also serves as a bridge to the Introduction to Programming unit as students move from user to creator. The unit also provides an opportunity to expand upon the issues of ethics and privacy related to the internet that were introduced in the first unit. The basics of html and css are introduced as a method for describing features of web pages that students can use to design and develop web pages based on their own culture, interests and unique experiences.

- A. Social responsibility in web use: effects on society, personal lives, and education.
- B. Basic HTML
- C. Image editing
- D. Basic CSS
- E. Hyperlinks
- F. Page layout styles
- G. Practice the use of design elements
- H. Website that includes: JavaScript, HTML, CSS, Photoshop, Accordion menus, Lightbox, and Sliding Images.
- I. Gallery Walk of Projects

CCSS.ELA-Literacy.CCRA.W.4, W.6, W.8.

CCSS.Math.Practice.MP1.

Unit IV: Introduction to Programming (Weeks 16-22)

Programming is one of the creative processes that can transform ideas into reality. The intention of this unit is to highlight what can be created by using programming as a tool. As with the previous unit, students will create projects that reflect the diversity of interests in the classroom and that are personal to individual students.

- A. Scratch programming language
- B. Dialogue between two sprites and moving sprites
- C. Event driven programming
- D. Broadcasting

- E. Story telling
- F. Variable
- G. Conditionals
- H. And, Or and Randomness
- I. Program game, timer, timing game
- J. Create original project

CCSS.ELA-Literacy.CCRA.W.10, SL.1, SL.4.

CCSS.Math.Practice.MP1.

CCSS.Math.Content.HSF-BF.A.1a, HSA-CED.A.3.

Unit V: Computing and Data Analysis (Weeks 23-29)

Managing and interpreting large amounts of data is part of the foundation of our information society and the economy. Computing has enabled researchers to use data to explore questions related to large global issues such as climate change, animal habitats, and human behavior. The ability to analyze, visualize and draw conclusions from large data sets is critical to computing. This unit has been designed to allow students the opportunity to experience the process of data collection and analysis in real-world contexts. The focus will be on conceptual understanding of data analysis--making appropriate inferences, using data to make a case or inform a discovery, and being able to justify conclusions.

- A. Using Data
- B. Data and Photo Ethics
- C. Group Dynamics/Teamwork
- D. Presenting Data: bar plots, categorical and continuous data, mosaic plots
- E. Trends
- F. Subsetting Data: mean, median, minimum, maximum, box plots, histograms, filters and queries, analyze text, and data analysis.

CCSS.ELA-Literacy.CCRA.W.10, SL.1, SL.2, SL.3, SL.4, SL.5, L.6.

CCSS.Math.Practice.MP4, MP5.

CCSS.Math.Content.HSS-ID.A.1, ID.A.3, A.13, CP.A.1, IC.B.4.

Unit VI: Robotics (Weeks 30-37)

Robotics provides a physical application of the programming and problem solving skills acquired in the previous units. The LEGO® Mindstorms NXT software and the NAO Robotics software uses drag and drop programming which will provide a natural transition from Scratch. Robots are shared by several students which will emphasize the collaborative nature of computing. In order to design, build and improve their robots, students will apply effective team practices and understand the different roles that are important for success.

- A. What is a robot?
- B. Robot body design
- C. Algorithms to control robot behavior
- D. LEGO Mindstorms or NAO Robot
- E. Build Robot Base
- F. NXT Brick-the “brain”

- G. Program Robot
- H. RoboCup Competition
- I. Robo Tic-Tax-Toe Tournament
- J. Dancing Robot
- K. Rescue Robot

CCSS.ELA-Literacy.CCRA.R.2, W.4, W.10, SL.1, L.6.

CCSS.Math.Practice.MP1, MP5.

CCSS.Math.Content.HSA-CED.A.3

TEXTBOOKS and RESOURCE MATERIALS:

Exploring Computer Science materials are provided by the ECS Team from UCLA in .pdf format. In addition, the robotics unit may be replaced with the NAO Robot unit provided by Aldebaran Robotics Company.

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 independently monitor their progress in a variety of projects and determine the next steps needed to complete the assignment. Students will work independently to use technology to find information, research subjects and complete class assignments.
- **Effective Communicators:** Written and oral projects will help develop the necessary skills to enhance the students' abilities to communicate effectively and regularly practice those skills, both independently and in a group setting.
- **Quality Producers/Performers:** Students will select and use the appropriate technology and edit all work to ensure all work is to the best of their abilities.
- **Constructive Thinkers:** Students will be required to research information from the Internet and various sources and analyze and synthesize that information into a usable format.
- **Collaborative Workers:** Through the study of group dynamics, students will learn how to implement those dynamics in a functional group, and during group projects, will become better collaborative workers.
- **Responsible Citizens:** Through the course work and units of study, students will develop a better understanding of themselves, the world around them, and the impact they have on their environment. They will also have a better understanding of the ethical and societal issues related to technology and practice responsible use of technology systems, information, and software.

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