

Learning Experience: PicoBoard and Scratch Game Design

Domain: CM4: Motion / Human Computer Interface / Game Design / Robotics:

CS Principles Covered:

- Learning Objective 5: The student can use programming as a creative tool.[P2]
- Learning Objective 16: The student can analyze the considerations involved in the computational manipulation of information. [P4]
- Learning Objective 17: The student can develop an algorithm.[P2]
- Learning Objective 18: The student can express an algorithm in a language.[P5]
- Learning Objective 21: The student can explain how programs implement algorithms.[P3]
- Learning Objective 24: The student can develop a correct program.[P2]
- Learning Objective 26: The student can employ appropriate mathematical and logical concepts in programming.[P1]

Concepts and Vocabulary: (What students will discuss verbally or in writing at the end of the unit)

Resistance Sensors

- Electrons are negatively charged particles that orbit around the nucleus of an atom.
- Conductors are materials whose electron shell structure allows for the exchange of electrons.
- An electrical charge happens when there is an excess or lack of electrons.
- A circuit provides a “path” for electrons to travel from a negatively charged point to a positively charged point.
- A resistor “restricts” the flow of electrons through a circuit.
- Resistance is measured in Ohms.
- Variable resistors allow for physical movement to change the resistance in a circuit.
- Resistance can be measured and displayed or stored as numerical values.
- By measuring the resistance in a variable resistor, one can use the values to control events and properties within a computer system.
- The PicoBoard uses variable resistors (Slider, light, sound, pushbutton, and A,B,C,D inputs) and encodes these measurements to a stream of data that the Scratch program reads and stores in variables.
- The Scratch reads the range of numbers in the PicoBoard Sensors as values from 0 to 100.
- Object (Sprite) properties and actions can be connected to the Sensor Values from the PicoBoard – allowing for the programmer to have objects controlled by the Sensor events.
- Sensors exist in computing devices such as cellphones (gyroscope, GPS, accelerometers, proximity, touchscreens). The application of sensors in consumer electronics has changed how humans interact with devices. Sensors allow human movement to control devices. (Wii Controllers, Xbox Kinect, tablet and phone devices.)
- The study of Human/Computer Interaction is a growing field in computer science.
- The slope (pace of change of the elements) of sensor input can be manipulated via the use of constant and multiplication. This is analogous to the “slope” in a linear equation. (m in the ‘y=mx + b’) format.
- The “Range” (min and max) values of sensor input can be manipulated by the addition or subtraction of a constant. This is analogous to the ‘b’ in the ‘y=mx+b’ linear equation.

Computer Science

- A computer program is a collection of sequential sets of directions and data models of objects.

- A computer program has objects that use stored data to represent and model objects.
- Objects in a computer program have sequential sets of directions that are called functions or methods. (In Scratch they are called Scripts)
- A computer program can have 'threads' that execute at the same time. (In reality, these threads execute in sequence 'taking turns' at a rapid pace.)
- Variables allow for the storing, manipulation, and reuse of numerical and string values.
- Programmers use variables to model real world data. (Such as speed, direction, score, size . . .)
- Objects, Variables, and Methods are named by the programmer and names help the human reader of the program understand the intent and action
- The programmer uses comments to inform human readers as to the algorithms and intent of the program components.
- Properties describe how variables store discrete values representing real world objects.
 - Size, Color, Location, Sounds, Costumes, Direction, Visibility
- In an animation system, the x and y position variables indicate the location of the object along a two dimensional space.
- Conditional Statements compare two values or state and return a 'true' or 'false'. On the return of 'true' the statement can direct the program to execute a specific sequence of commands.
- Iteration or 'Loops' allow for repeated sequences of commands.
- In robotic systems and game environments – 'Forever' loops allow for the system to 'stay alive' and wait for user event input.

Skills and Product: (What students will create or demonstrate in their portfolio of Artifacts)

Students will design and program a Video Game or Interactive Art project in Scratch using the PicoBoard Sensors to control properties and Actions of the Sprites.

The Scratch Game or Art project will have at least 3 Sprites with descriptive names.

The project will use at least two PicoBoard Sensors.

The project will use at least three variables.

Students will use comments to describe the actions of the scripts within their program.

The student will share the project via the Scratch website.

The student will create a Screencast or Jing demonstrating their game and describing how the PicoSensors manipulate the events in the program.

<Insert reference to rubric>

Software Tools for Learning Experience:

Scratch

PicoBoard: <https://www.sparkfun.com/products/10311>

Jing or other Screen Casting Software

Resources:

<http://nebomusic.net/picoboardlessons/index.html>

<http://nebomusic.net/scratch.html>

<http://scratch.mit.edu>