

Western Engineering Outreach

Scratch Etch-A-Sketch

Grade 6-8

Meet Today's ENG HERO!



Miriam Capretz - Professor with Western Engineering

Miriam is the Associate Dean, Research in the Faculty of Engineering and a Professor of Software Engineering at Western University. She has been involved with software development, research, and teaching for over 30 years.

To learn more about Dr. Capretz visit:

https://www.eng.uwo.ca/electrical/faculty/capretz_m/index.html

Learning Goal:

- Students will get an introduction to coding and software engineering by creating a fun and interactive game which tests their logical thinking and creativity skills.
- They will learn how to use loops, if-statements and inputs.
- Curriculum Connections: Grade 6-8 - The Four Step Problem-Solving Model

Materials Needed:

- Computer with connection to the internet



Engineering and Science Connections:

Today, we will be explore coding and software engineering!

What is coding?

Code is a set of instructions that a programmer gives to a computer to tell the computer what they want it to accomplish.

Why do we need this set of instructions?

Computers cannot think for themselves, they can only read what they are being told. We must communicate with computers to be able to make them function.

Can we tell a computer what to do out loud?

No, computers only speak very specific languages, which must be given to them through text.

What are the names of some of the languages that computers understand?

- Drag and Drop
- Scratch
- Hour of Code
- Java
- C++
- C#
- Python
- HTML
- etc.

Today we will be using drag and drop (also known as block) coding. It is a great tool for beginners learning how to code, as it includes a lot of the same terminology used in other coding languages.

When real programmers are designing a code, before they write a single line of code, they come up with a master plan of how they are going to make their code work. This master plan is called a *Flow Chart*.

The reason flowcharts are so important in programming is because they help us see the entire picture of what we are trying to accomplish. Coding can include very small details that can sometimes be overlooked if you don't have a clear picture of what your code needs to include.

While these flowchart include the big ideas, it is only the main ideas of this process. When we write the flowchart for a computer program, we only include the main ideas of what we need our code to do, then more detailed individual lines of code will be added later when we actually begin to write the program.

There are many different ways to code a program with the same end goal. Often we will find that 2 codes can do entirely the same thing, but look nothing alike.

Coding Vocabulary

- **Variables:** used to store values such as numbers. It is used so that values can easily be changed rather than each value being changed manually one by one. Also can be used to store and change important values that can be used later on.
- **Loops:** used to repeat lines of code rather than writing out those lines of code over and over. The forever loop function repeats code an infinite amount of times.
- **If-statements:** used to execute specific lines of code only if a condition is true.
- **Inputs:** Something that you put into the computer which will most likely be transformed by the system in order to produce an output.
- **Pause:** used to delay code. Can be used in loops to prevent the code from executing too fast. Measured in milliseconds.

Video Recommendation: What is Coding?

<https://www.youtube.com/watch?v=cKhVupvyhKk>

Bob Ross on Etch-a-Sketch

<https://www.youtube.com/watch?v=q4CTyWwOrMo>

Activity:

Before beginning, think about the following questions:

- What is coding?
- What buttons on a keyboard might we use to simulate an etch-a-sketch?

Go to <https://scratch.mit.edu/>. Click the create button on the top left to begin a new project. You do not need to create an account, but if you would like to save your creation, create an account to do so.

Scratch uses block coding as a way to help you get familiar with coding concepts. Sprites are two-dimensional bitmap graphic objects that can be a static image or animation that is integrated into a larger scene, which are some of the characters you can find on Scratch.

Take some time to look at the different blocks of code on the left-hand side. The blue blocks are motion blocks and let you move sprites. The purple blocks are look blocks that let you change how your sprites look. The pink blocks are sound blocks. You can even record your own sounds to use in the program. Yellow blocks are event blocks that allow things to happen after certain events have happened. These can also be considered input blocks. Orange blocks are control blocks, which include wait blocks, loops, and if statements - the logic parts of coding. The light blue blocks are sensing blocks that sense when certain things have happened.

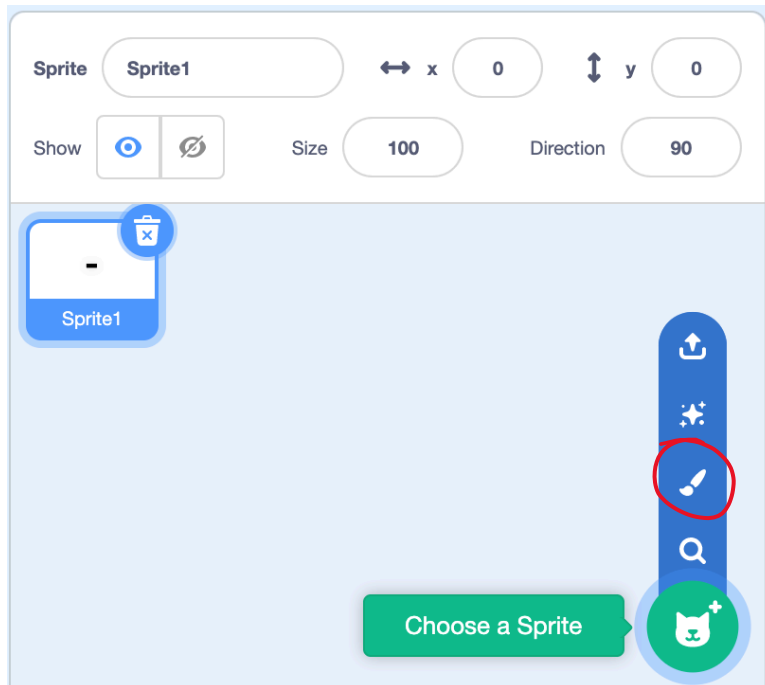
To use a block simply click and drag it into the coding area. To delete a block click and drag it back into the block tool bar. It will be deleted.

To practice, first let's move the cat sprite that is automatically there when you start a new project. Drag a yellow "when green flag clicked" block into the coding space. Drag a blue "move 10 steps block" and attach it to the yellow block. They will click together like puzzle pieces. Click the green flag above the scene on the right. The sprite will now move! Try to move it other ways as well.

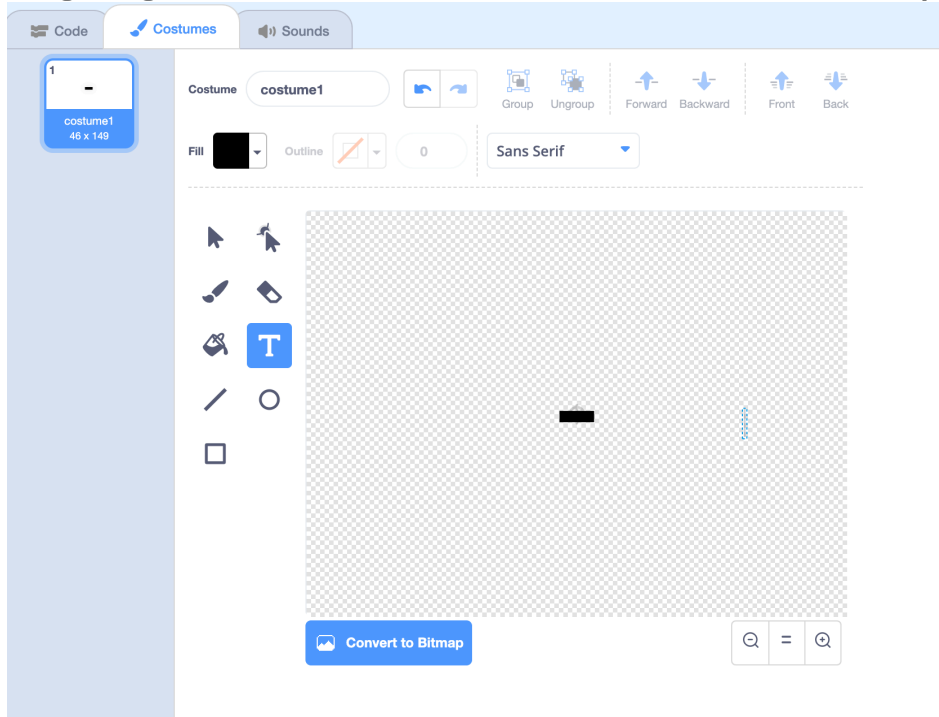
Let's get started. We will need to add a set of blocks. At the bottom of the block section, click the block plus sign. Choose the pen extension. It will be added to your blocks.

Make A Sprite

- We will need a sprite that acts as the line for the etch-a-sketch. We can delete the cat sprite that is automatically loaded.
- Underneath the scene, you can see all the sprites that you have. Hover over the cat head with the plus sign. Select the paintbrush



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- This will open a screen to make your own sprite. Use the text option. Type a dash (-) and resize it so that it is big enough to see. Place it in the middle of the box. Now you have your sprite.

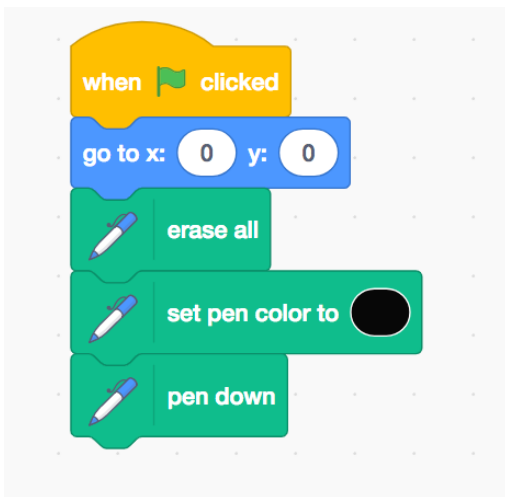


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- Click Code on the top left to get back to the coding screen. We will move on to coding the pencil.

Program the Pencil

- We will need a start button. Drag in a yellow "when green flag clicked" block.

- The first section of code describes where the pen will originate - you can decide what is best. This example code has chosen the middle of the grid. To change the location, change the x,y coordinates. This is found in the blue motion section.
- Then add a “erase all” pen block. As this is the start of the game, we are making sure no pen is on the screen yet.
- Then add a “set pen colour to” block. We chose black to make it look more like an etch-a-sketch.
- Then add a “pen down” block. This is like putting the pen down on a piece of paper. It will start the “drawing”
- Your code should look like this:

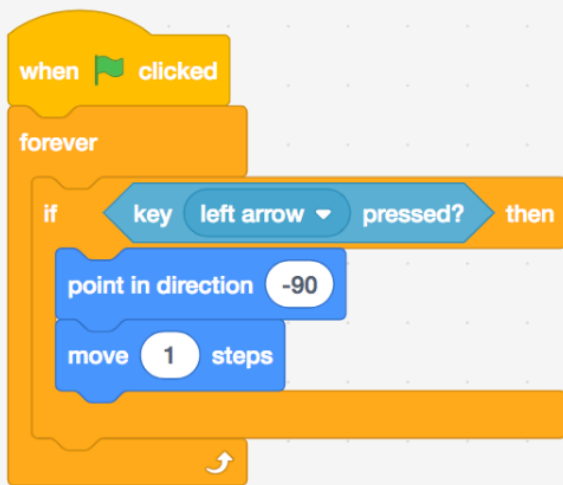


Program the Buttons

- The next step is to program the buttons that we will be using to move the pen. This will include the up, down, left, right arrow keys and the spacebar.
- We will be using a forever loop and an if statement to do this. A forever loop repeats the code inside of it over and over again. An if statement specifies a condition. If the condition is true, it does the code inside.
- Drag another yellow “when green flag clicked” block into the coding area.
- From the orange control section drag a forever block. Then add an “if then” block into the forever block.

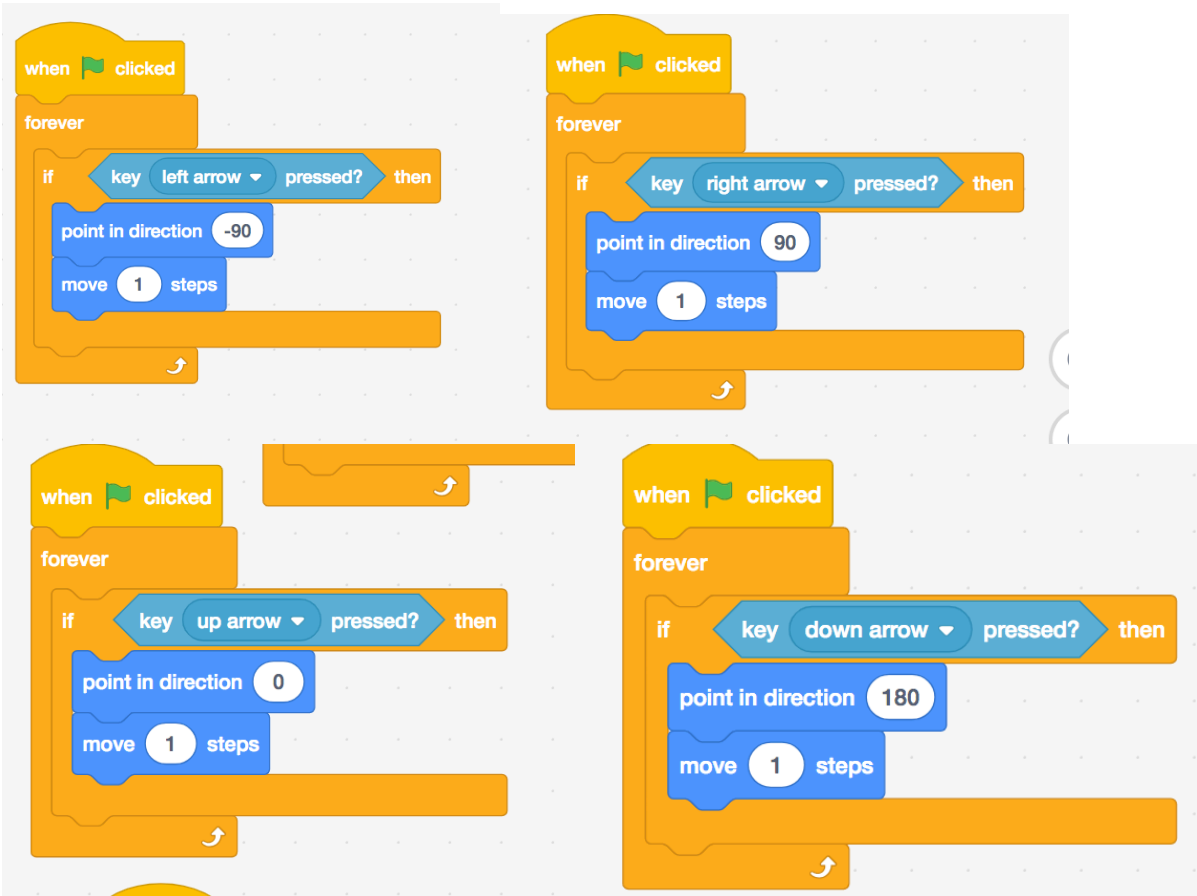


- The diamond shape in the if statement is where we will put our condition. In this case, the condition will be when we are pressing an arrow key. Add light blue sensing “key space pressed” block into the diamond. Use the drop down arrow to change “space” to “left arrow.” We will code the movement of our sprite to the left. As it moves, the pen we coded above will draw a line.
- Add a blue motion “point in direction 90” block. Change the number to -90. This will have the sprite face left.
- Add a blue “move 10 steps” block. Change the number to 1. It should look like this:

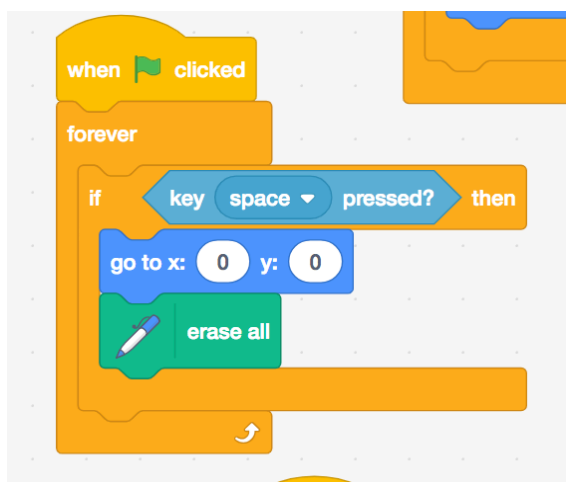


- This section of code works like this: the green flag is clicked. The forever loop will constantly check to see if the left arrow key is pressed. If it is not pressed, nothing will happen. If it is pressed, the sprite will face the left and move one step. The pen will draw a line. Now we need a piece of code like this for each of the 4 arrow keys. Right click on this section of code and select duplicate. This will copy the section! Now we just need to change some numbers. Choose right arrow key from the drop down. Change the direction number to 90. Duplicate the code again. Change the drop down to up arrow. Change the direction number to 0. Duplicate again. Change the drop down to down arrow. Change the direction number to 180. All four sections should look like this:

SCRATCH ETCH-A-SKETCH



- Now we will code the space button to delete the pen drawing and return the sprite to the centre of the screen. Drag a yellow “when green flag clicked” button into the coding space. Add an orange “forever” block. Add an orange if statement to the forever block. Add a light blue “key space pressed” block into the diamond space. Add a blue “go to x,y” block into the if statement. Change the numbers to 0 and 0. Add a pen “erase all block.” It should look like this:



- Test it out to make sure your code works! You may find your sprite looks too big for the pen line. You change the size of the sprite right underneath the scene where it says “size.” Adjust it until you think it looks good.

Etch-A-Sketch Pictionary

- Now that you have your game coded, grab someone to play Pictionary with! Take turns drawing an image using the etch-a-sketch and have the other person guess what you are drawing.

What Did You Learn?



- What is coding?
- How does an if statement work?
- How does a forever loop work?
- What is a sprite?

Future Learning



- If you enjoyed coding, you can continue to add to your etch-a-sketch game. Add a background to your game by finding an etch-a-sketch background image. You will have to add code to make sure your pen does not draw over your border. For that code you will need a forever block and if statements. You will also need the light blue “touching color” sensing block. Do some trial and error to see if you can figure out how to make the pen not draw on the red border. Good luck!

Share your creations!

We would love to see what you made. Email us at discover@uwo.ca or tag us on social media.

Instagram: @westernueng

Twitter: @westernueng

Facebook: @westernueng

Thanks for discovering with us!