

CODING - Grade 7

Scientific Inquiry and Gathering Data

Scientific Inquiry

Inquiry starts with curious people asking questions.



Questions can be simple, such as, “What are the results of flipping this coin?” or more complex, like, “Which environmental factors impact plant growth the most?”.

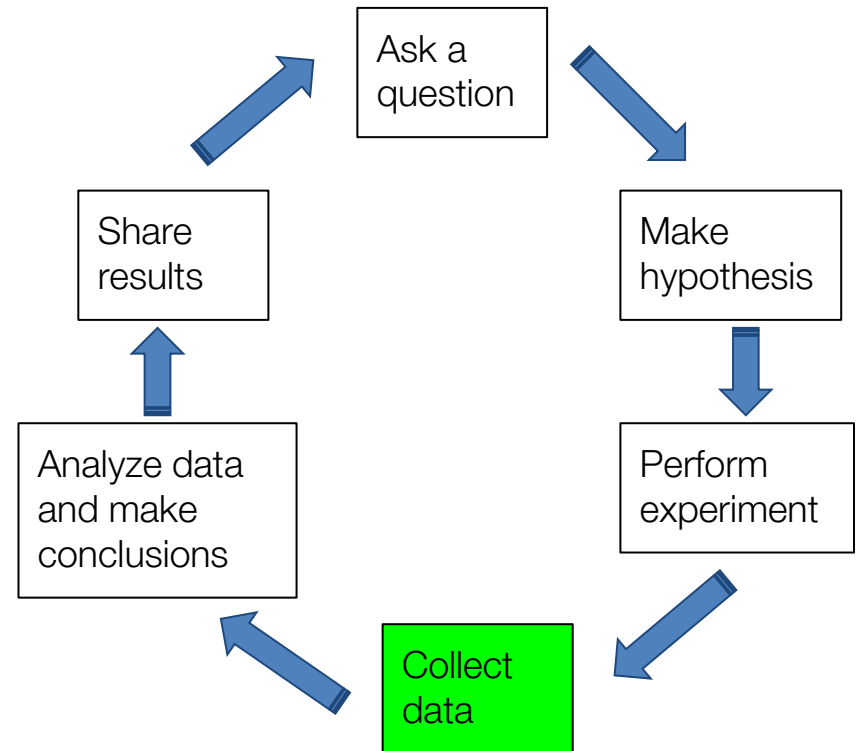


To answer questions like these, you can do research and create experiments to make observations and gather **data**.

The Scientific Method

The scientific method is a model for inquiry that works in a cycle. It can be started at any point; maybe you are inspired by hearing about the results of others at a science fair, or you make a hypothesis about how to make a certain program and then decide to create it.

Here, we are focusing on how to collect data.



Types of Data

Primary Data

This is information directly observed by the researcher using their senses or asking other people questions.

- surveying a population
- measuring length, volume, weight, temperature, etc.
- recording change over time

Secondary Data

This is information learned by doing research from other sources, such as books or the internet.

- using reputable large databases such as [Statistics Canada](#)
- using reliable sources (texts, encyclopedias, .edu and .gov websites)
- information from other peoples' work

Ways to Record Data

Qualitative Data

Information that uses **descriptions or comparisons** (“qualities”) to communicate meaning.

- colours, textures, shapes, types

Quantitative Data

Any information that uses **numbers** and **quantities** to communicate meaning.

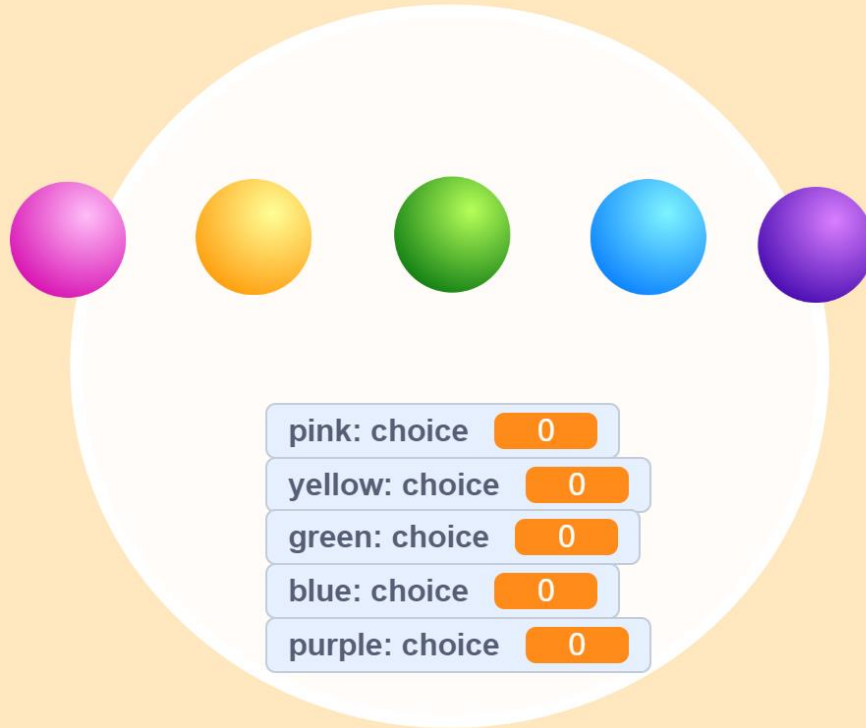
- tally charts
- measurements of time, volume, length, population

Collecting Data - Activity 1

In this Scratch-based activity, your teacher will run the Scratch program on a single device, in the style of polling station.

Each person in the room gets one choice, which can be recorded by them clicking directly, or by one person collecting results.

Which colour do you prefer?



Try it!

<https://scratch.mit.edu/projects/874349655/>

What is Bias?

Bias is an emphasis on characteristics that are not typical of an entire population and that may result in misleading conclusions¹.

When you survey your class, do you ask the whole population or only your friends? Are grade 7 students going to answer your questions the same way as grade 2 students? It is important to state which variables are being measured in your observations to minimize bias; “I only surveyed grade 6 and 7 students in our school, so these results only apply to them.”

What bias do you see here?

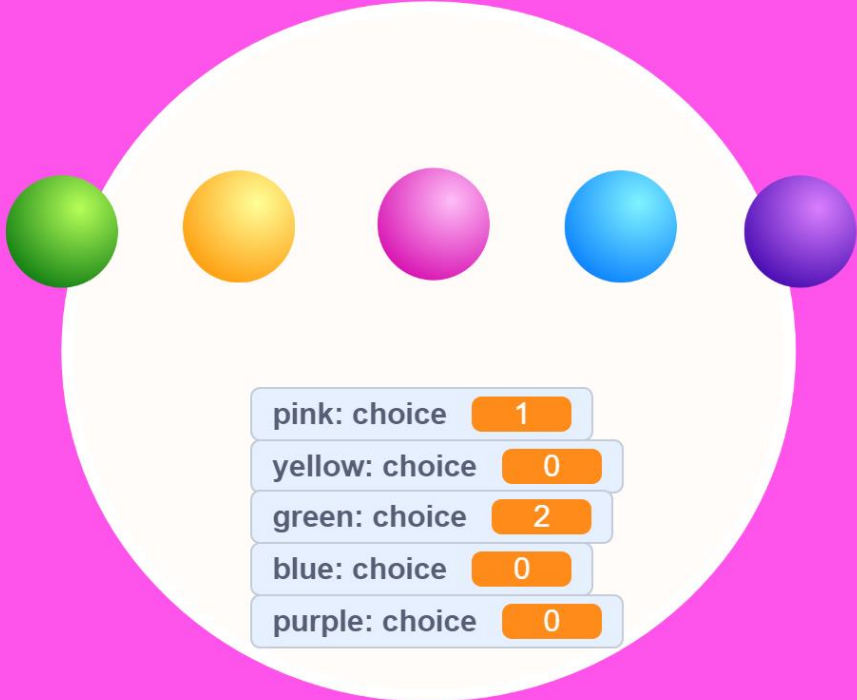
Which colour do you prefer?

A poll interface with a white circular background on a light orange gradient. Five colored spheres are arranged horizontally: pink, yellow, green, blue, and purple. The purple sphere is significantly larger than the others. Below the spheres is a list of five choice counts, each in a light blue box with an orange button showing the count '0'.

pink: choice	0
yellow: choice	0
green: choice	0
blue: choice	0
purple: choice	0

What bias do you see here?

Which colour do you prefer?



A poll interface with a white circular background on a pink gradient. Five colored spheres are arranged horizontally: green, yellow, pink, blue, and purple. Below them is a list of choices with counts in orange buttons.

pink: choice	1
yellow: choice	0
green: choice	2
blue: choice	0
purple: choice	0

What bias do you see here?



Bias in Data

Bias 1 - size of object

Bias 2 - background colour

Bias 3 - wording of question and only displaying the results for one colour

Are there any other biases you can identify?

Bias in Data

There are many ways that data collection can create bias. These can be intentional or unintentional.

- the need to better control variables
- wording of questions
- tone of voice
- order of question choices
- size and location of question choices
- use of colour
- limited options for responses

Bias in Data

Example: “I really like pizza. Which food do you like the best? Falafel, pizza, tacos, pizza, fruit, or pizza?”

The experimenter is showing an obvious bias by sharing their own opinion and then repeating their favourite option. This will potentially influence the results.

Bias in Data

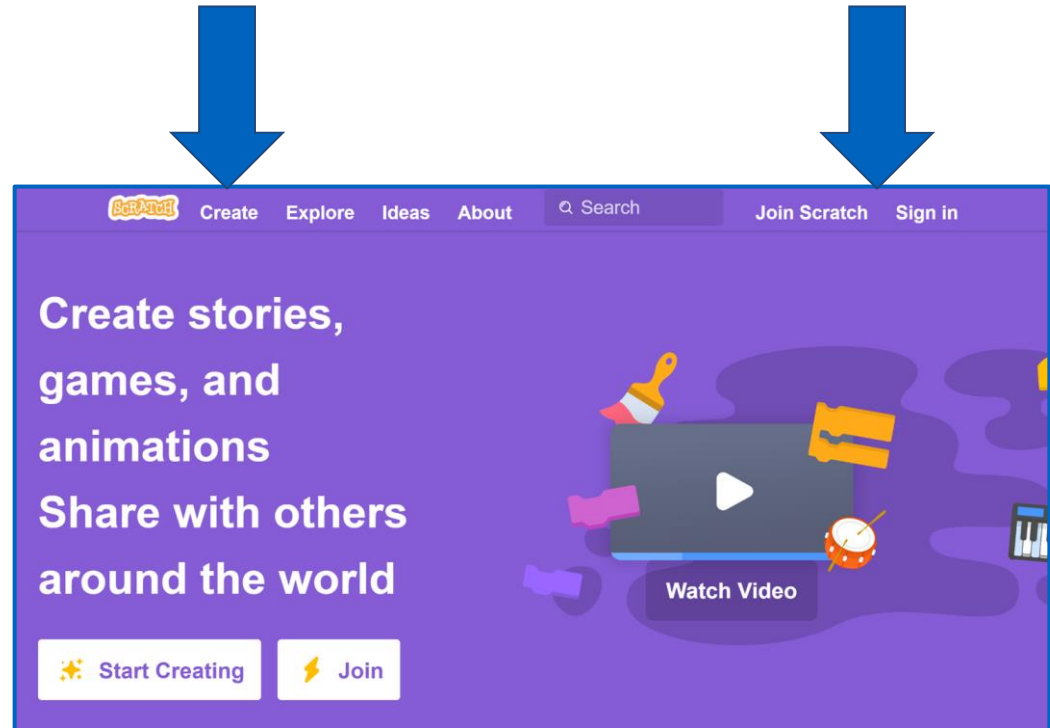
When creating a question or setting up for an experiment where you will be collecting data from others, try to:

- be aware of your own personal bias
- keep your language neutral
- present each option in an equal way
- consider randomizing or shuffling the question order so you are not presenting the same option first each time

Using Code to Collect Data

Create a new Scratch project by going to <https://scratch.mit.edu/> and clicking “Create” at the top left.

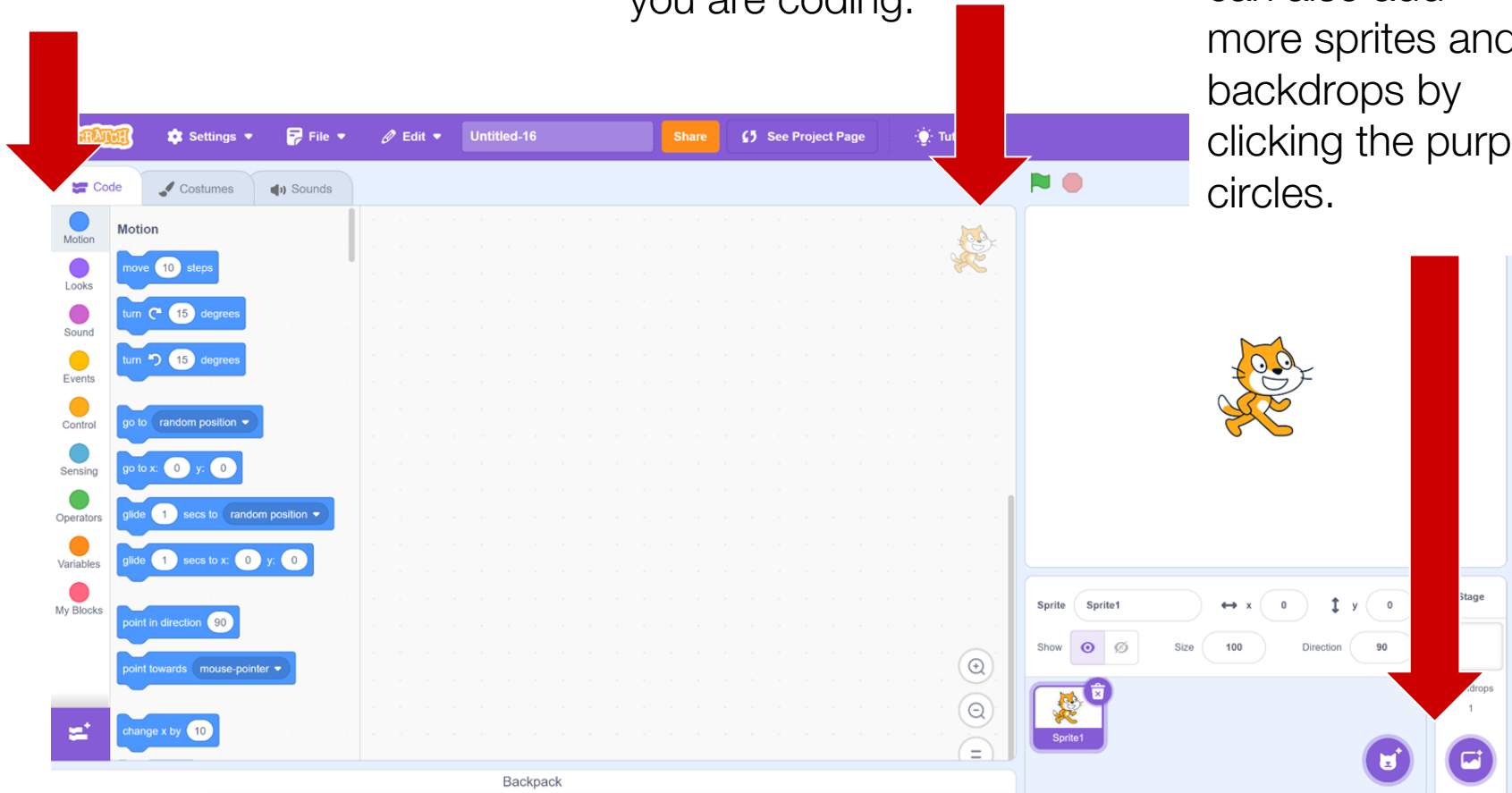
It is suggested that you make an account to save your work. You are able to code with or without an account.



A new Scratch page looks like this. Use the circles on the left to find and select commands.

Drag and drop commands into the middle space. The watermark at the top shows which sprite you are coding.

You can select which sprite or backdrop you are coding for at the lower right. You can also add more sprites and backdrops by clicking the purple circles.

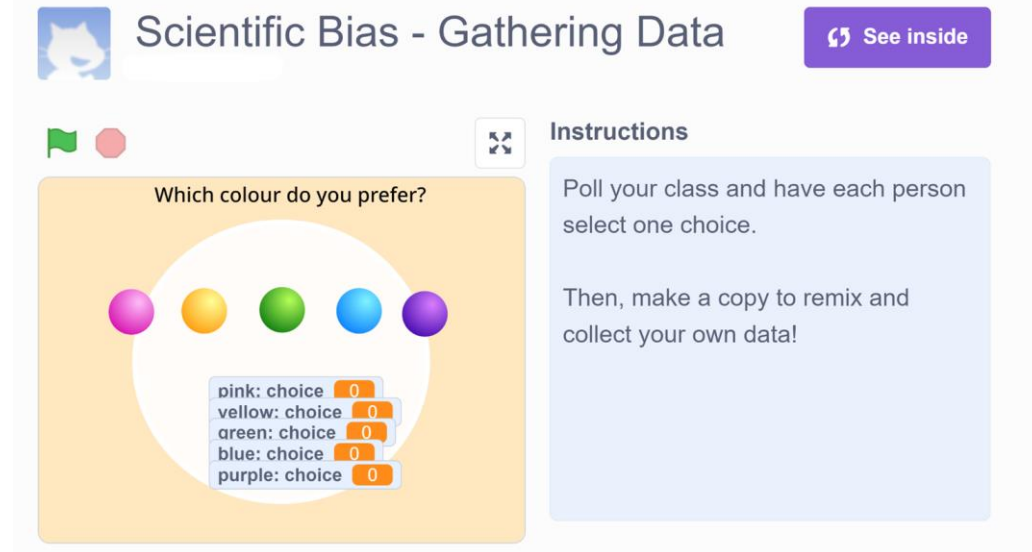


New to Coding?

Instead of starting a brand-new project, try remixing this code.

<https://scratch.mit.edu/projects/874349655/>

Click the purple “See inside” button, then you can change the code. Go to file -> Save a copy to make your own version.



The screenshot shows a Scratch project titled "Scientific Bias - Gathering Data". The project window displays a poll interface with the question "Which colour do you prefer?". Below the question are five colored circles: pink, yellow, green, blue, and purple. Underneath the circles is a list of choices with corresponding counters:

pink: choice	0
yellow: choice	0
green: choice	0
blue: choice	0
purple: choice	0

To the right of the project window, there is an "Instructions" panel with the following text:

Poll your class and have each person select one choice.

Then, make a copy to remix and collect your own data!

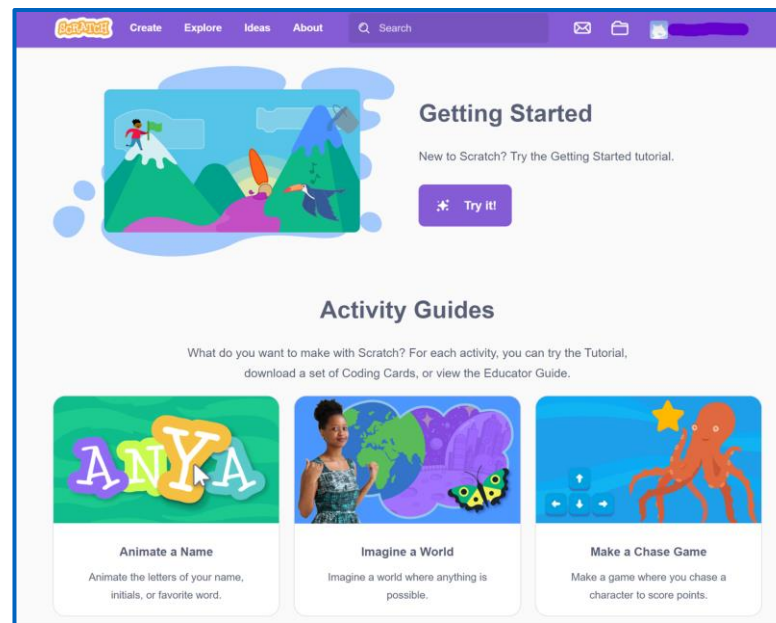
A purple button labeled "See inside" is visible in the top right corner of the project window.

Scratch Instructions

Tutorials on how to use Scratch can be found here

<https://scratch.mit.edu/ideas> and here are printable step by step cards for each activity

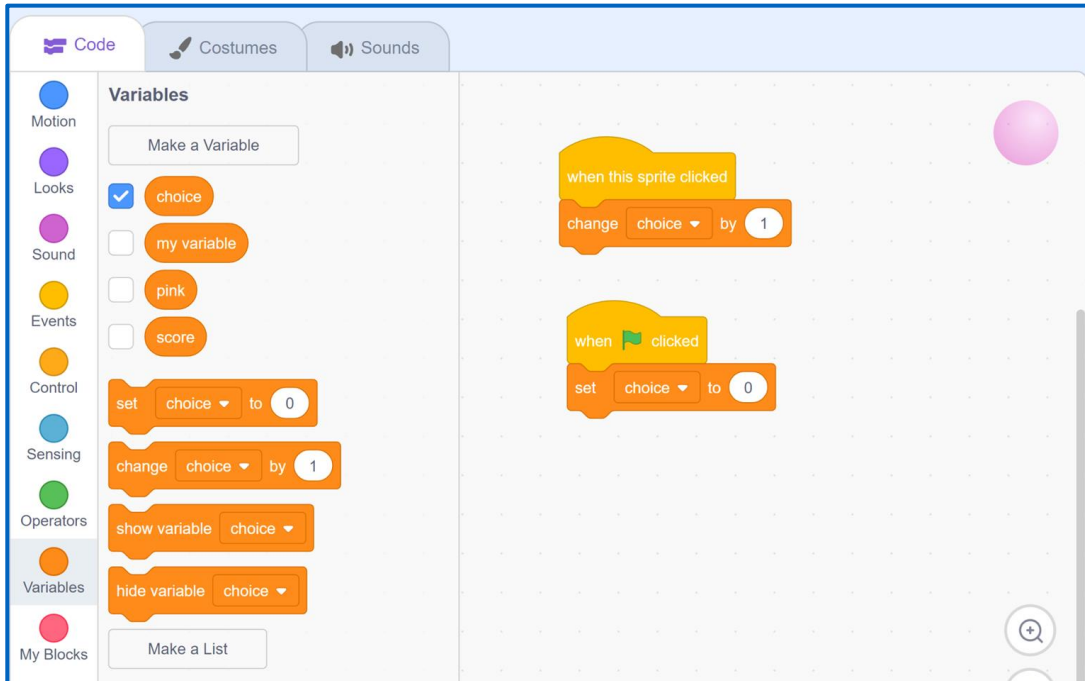
<https://resources.scratch.mit.edu/www/cards/en/scratch-cards-all.pdf>



Create a score

The blocks shown here will add a score of 1 each time you click the pink circle.

When you click the flag, the score will reset to 0.



- To start, click on the orange variables circle on the left.
- Select “Make a Variable” and give it a name.
- Click “for this sprite only” then “ok”.

Coding Challenges

- Create a Scratch survey to see which animal your class prefers. You can use 3, 4, or 5 sprites as choices.
- Use the “Costumes” tab to add text instructions to your backdrop or change the way your sprites look.
- Add sound to your code. How could this add or reduce bias?
- Hack your own code! Can you make one choice worth more points than another choice? Where would this be useful? Is it ethical?

Important Learning

- Science experiments collect data to help answer questions.
- Experimenters need to carefully identify and work to eliminate bias when conducting research and experiments.
- Coding is an effective way to create tools to collect data.

Happy Coding!

	Level 4 Extending	Level 3 Proficient	Level 1-2 Approaching
Programming with Scratch	All parts of the code are functional with no missing parts or error messages.	Most parts of the code are functional, with only 1 or 2 dead ends or miscoded parts.	Code needs work to become playable. Time to troubleshoot!
Data Collection: Creativity and Skill	Code is original, going beyond what is provided in the examples. All parts function as intended by the coder. Performs data collection in a way that is clear to the end user.	Code shares some original ideas, building on the examples. Most parts of the code function as intended. Performs data collection with a few questions from the end user.	Code uses the examples from class, changing some elements. Some parts of the code need work to make them functional or clear to the end user.