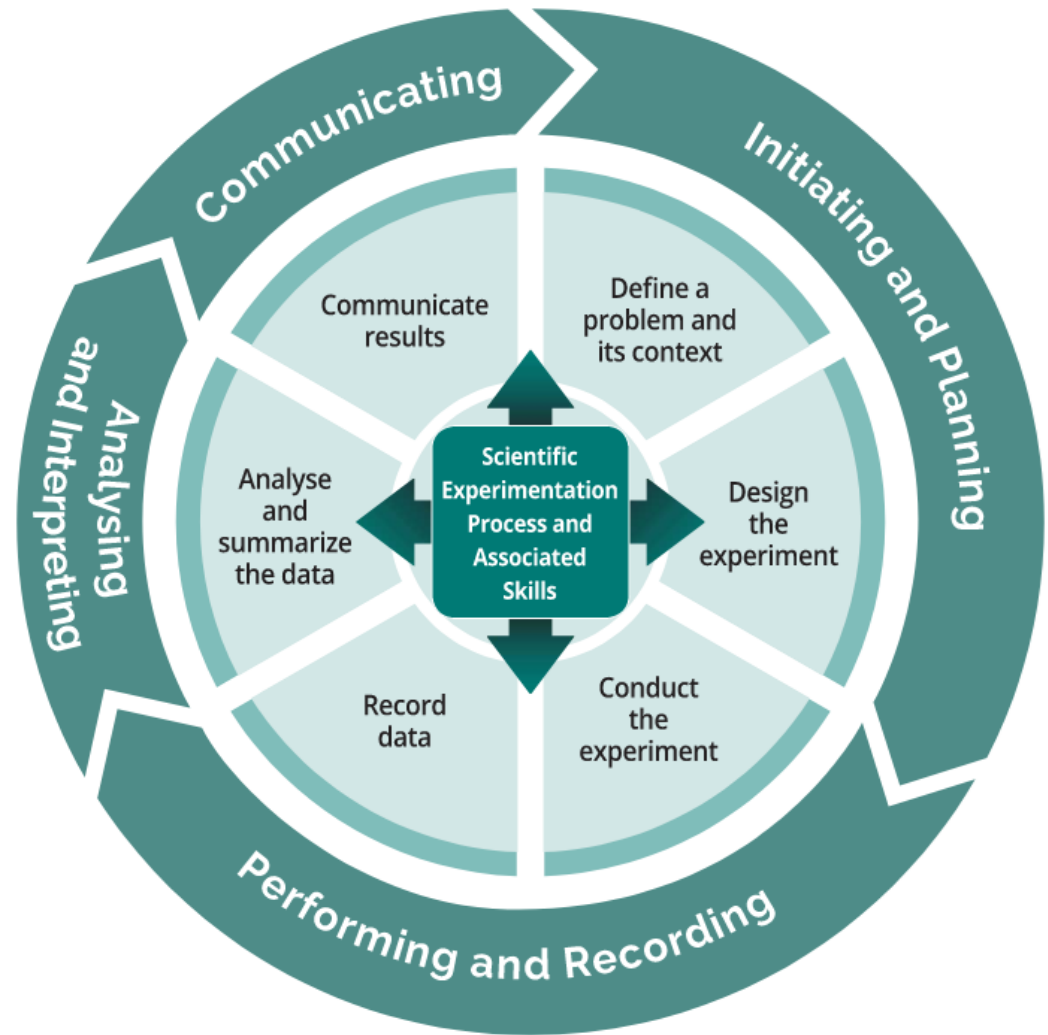


Python and Scientific Experimentation

Scientific Experimentation with Grass Seeds

What is the Scientific Experimentation Process?

Experimentation involves performing various steps to answer a question, test and validate or reject a hypothesis, as well as manipulating different variables in order to observe the results.



Scientific Experimentation Process: Initiating & Planning

Let's define the problem:

1. Identify our resources

We have 3 different types of grass seed!

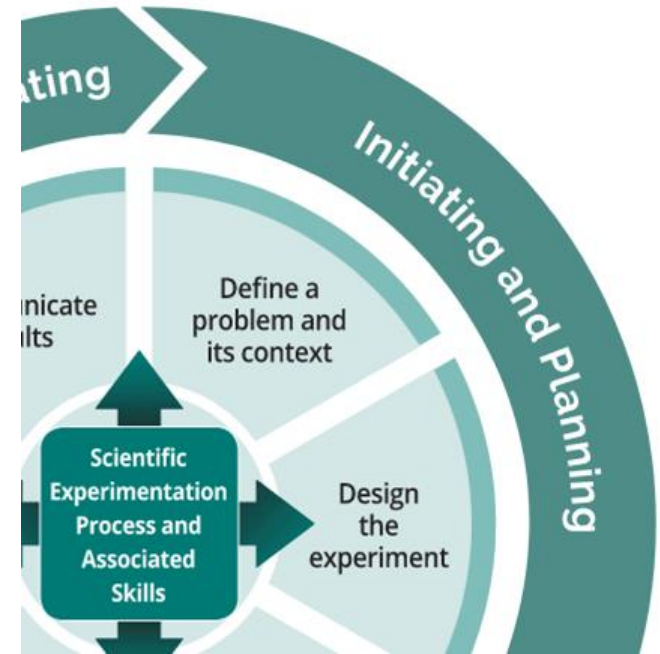
2. Consider questions related to the area of investigation:

Which grass seed will have the widest blade?

Which grass seed will grow the tallest?

Which grass seed will grow fastest?

We will focus on this question!



Scientific Experimentation Process: Initiating & Planning

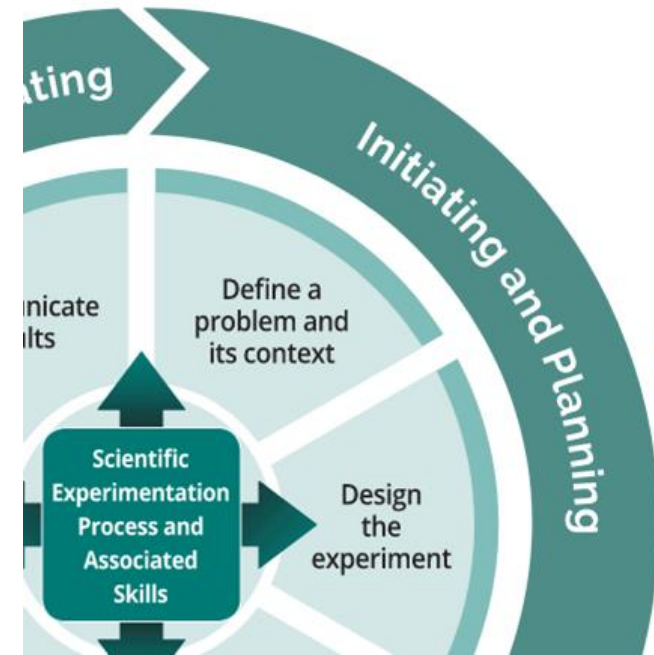
3. Define a specific problem and identify what is to be investigated

We need to grow grass very quickly, but we only have so much water. Which grass seed will grow the fastest with the same amount of water?

4. Formulate a hypothesis. (if... then... because statement)

Ex. If you increase the number of hours spent practicing, then you will increase the number of free throw shots you will make.

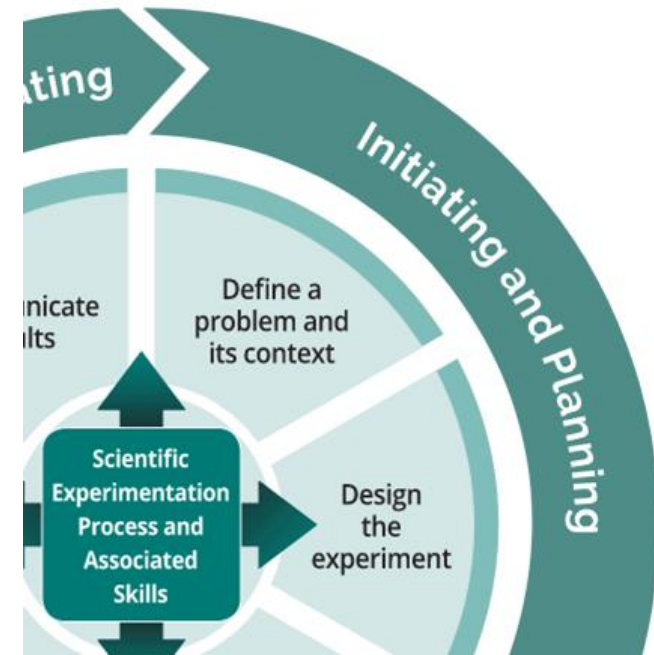
With your group, create a hypothesis for our question! Use the internet to research the “because” portion of the statement



Scientific Experimentation Process: Initiating & Planning

4. Formulate a hypothesis. (if... then... because statement)

Ex. If you increase the number of hours spent practicing, then you will increase the number of free throw shots you will make.



If the amount nutrients in the grass seed is increased, then the grass seed will grow faster because the seedling relies upon the nutrients stored within to grow.

Scientific Experimentation Process: Initiating & Planning

Let's design the experiment:

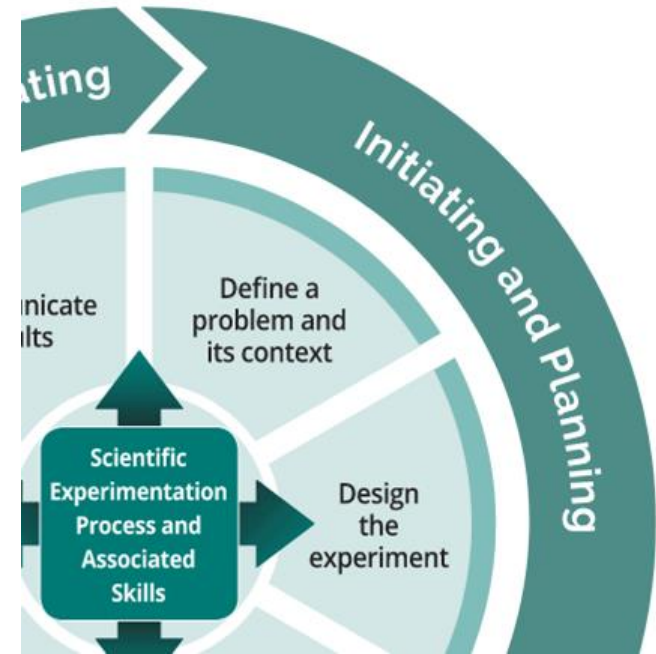
1. Consider the variables that will remain constant and that will change

Variable that will change (ONLY ONE):

- Grass seed type

Constant Variables:

- Amount of grass seed
- Amount of water
- Amount of light
- Amount of soil
- Type of water
- Type of soil
- Type of light



2. What data is to be collected?
The average height of the grass blades for each grass seed type.

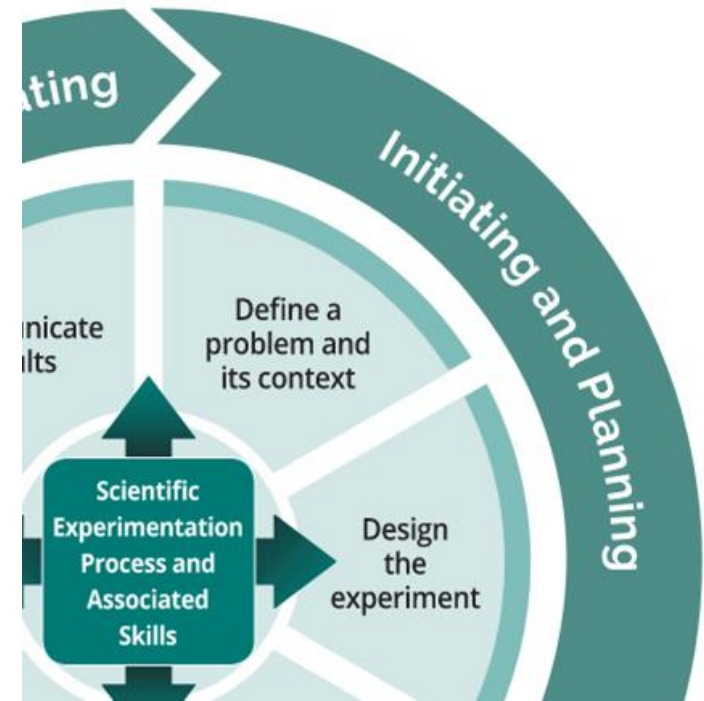
Scientific Experimentation Process: Initiating & Planning

Let's design the experiment:

3. Identify materials, equipment, and health and safety precautions

Materials:

- 3 different types of grass seed
- Potting Soil
- Water
- UV Lights/Sun Lamps/Grow Lights
- 3 shallow containers
- Gravel/Stones (optional)
- Measuring Cups
- Ruler
- Magnifying glass



Safety:

- Do not taste any of the materials

Scientific Experimentation Process: Initiating & Planning

4. In your group, create a list of the steps to complete the experiment... show it to your teacher for feedback!
 1. Label each of the containers with the grass seed type of you will be planting.
 2. If the 3 shallow containers do not have drainage holes, place the same amount of gravel or stones to fill the bottom on each of the containers.
 3. Measure, using the measuring cups, the same amount of potting soil for each of the 3 containers.
 4. Fill the remainder of each container with the same amount of dampened potting soil. Amount of soil placed in each container: _____
 5. Determine how many grass seeds you wish to plant for each container and count #_____ (ex. 50) for each grass seed type.

Scientific Experimentation Process: Initiating & Planning

4. In your group, create a list of the steps to complete the experiment... show it to your teacher for feedback!
6. Place each of the required number of grass seeds in the designated grass seed type container.
7. Place and leave the 3 containers underneath the Sun Lamps.
8. Determine the amount of water provided for each container, each day. (Ex. Each container will received 250 ml or $\frac{1}{2}$ cup of water each morning at the same time). Amount of water: _____
9. Provide _____ of water to each container.
10. Observe the grass and record the length of 10 blades of grass for each container, then calculate the average length for each container.
11. Repeat Steps 9-10 for 10 school days.

Scientific Experimentation Process: Recording and Organizing Data

Now that we have set up our experiment, we will set up a table of values to record the data each day as we measure the average length for each type of seed.

In your notes you will need one table for every different type of seed.

Ex. Type of grass: _____

Day	Grass Blade Length (10 blades)	Average of 10 Blades of Grass

Coding with Python: Scatterplot

For this investigation, we are using two variables. The number of days (x) and the average height (y). We will use the Python coding language to create a visual representation of our data tables to make it easier to interpret.

1. Navigate to → <https://trinket.io/embed/python3>

1. Upload Python Scatter plot.txt by clicking



1. Copy and paste the entire code from `Python Scatter Plot.txt` into `main.py`



Coding with Python: Scatterplot

4. Your screen should look like this

```
trinket Python3 Run Share
main.py Python Scatter Plot.txt
1 #
2 # Paste the data you wish to graph in tab spaced rows in the format:
3 #
4 #     xdata <tab> ydata
5 #
6 # In this example the xdata is time (d) and y data is y position (cm)
7 #
8
9
10 data = """
11 1 2
12 2 4
13 3 6
14 4 7
15 5 8
16 6 7
17 """.split('\n') # split this string on the "newline" character.
18
19
20
21
22
23 # The data is stored in a single string. Now, split the data and store
24 # each column in a list. Convert the data from a string to a float.
25
26
27 tlist = []
28 ylist = []
29 for s in data:
30     if s:
31         t,y = s.split() # split the string in two
32         t=int(t) # convert time to int
33         y=float(y) # convert y-position (cm) to float in meters
34         tlist.append(t) # append to the list for time data
35         ylist.append(y) # append to the list for y-position data
36
37 #print "tlist=",tlist
38 #print "ylist=",ylist
39
40 import matplotlib.pyplot as plt
41 plt.title('Grass Type - height vs. time of growth')
42 plt.xlabel('t (d)')
43 plt.ylabel('y (cm)')
44 plt.plot(tlist,ylist,'m.')
45 plt.show()
```

This is where we will insert our data. Here, the 1 2 is interpreted as (1,2) by our program. 1 is the day, x variable and 2 is the height, y variable.

- When you insert your values, use “tab” to create the space between the numbers.

Coding with Python: Scatterplot

5. Once you have completely input your data, you will have to adjust

```

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```

Here we can change the titles, and the axis labels.

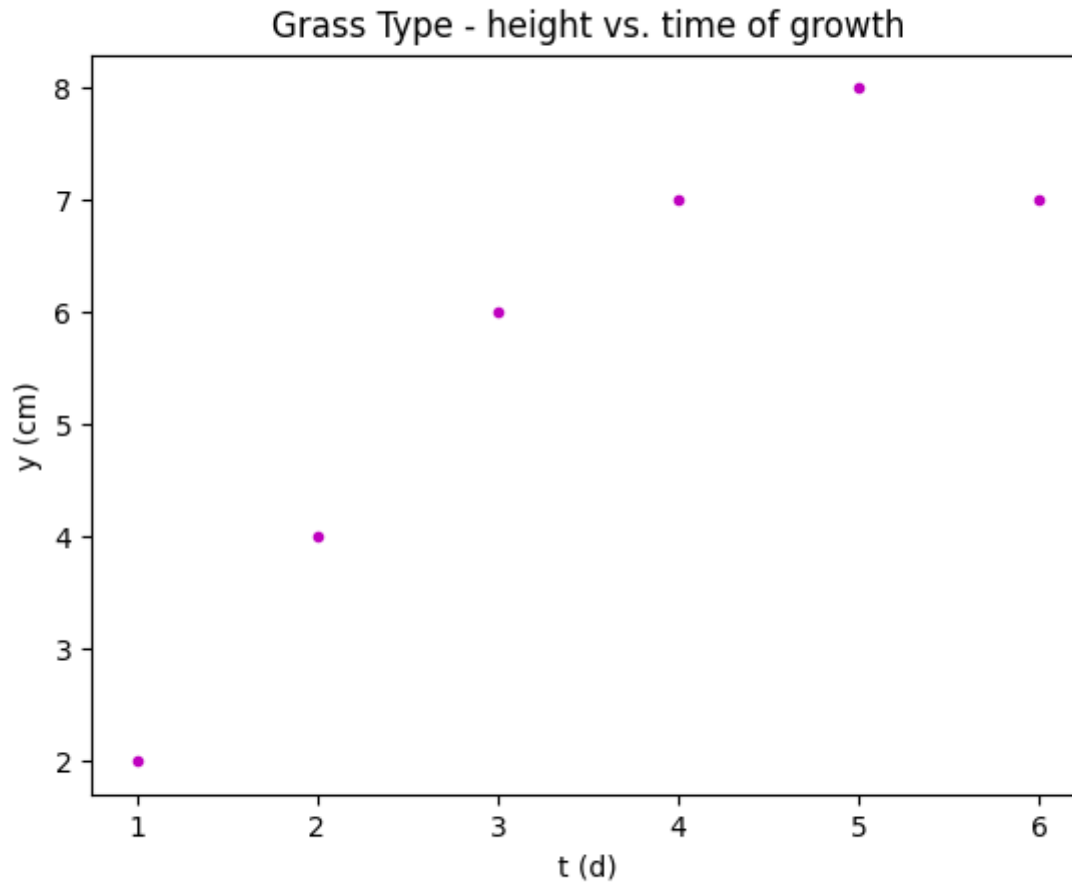
Coding with Python: Scatterplot

6. Run the program and you will see your plot created.

```

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```



[trinket_plot.png](#) 

You may click the trinket_plot.png to download and save your graph locally.