WAMC Lab Plan - M&Ms Exponential Growth Lab

Math Concept(s): Exponential Patterns
Source / Text: Me   **Developed by:** Ryan Chute
        E-Mail: chute.ryan@gmail.com, rchute@sheltonschools.org   **Date:** June 23, 2021

Attach the following documents:
- Lab Instructions
- Student Handout(s)
- Rubric and/or Assessment Tool

Short Description (Be sure to include where in your instruction this lab takes place):
Students will use the counting of M&Ms to model exponential growth.

Lab Plan
Lab Title: M&Ms Exponential Growth Lab

Prerequisite skills: tabulating data, plotting points

Lab objective: Students will record data representing the # of M&M's (and Skittles) that when "rolled" out of a cup have their M or S facing up, and will use plot this data on a graph. Students will then start to consider terms to describe this pattern and connect this pattern to what they have experienced in their lives.

Standards: *(Note SPECIFIC relationship to Science, Technology, and/or Engineering)*
Mathematics K–12 Learning Standards:
- A.CED.1: Create equations and inequalities in one variable and use them to solve problems.
- A.FIF.4: For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
- A.F.LE.1: Distinguish between situations that can be modeled with linear functions and with exponential functions.

Standards for Mathematical Practice:
- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Model with mathematics.
- Look for and make use of structure.

K-12 Learning Standards-ELA (Reading, Writing, Speaking & Listening):
- RST.9-10.3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- RST.9-10.4: Determine meaning of symbols, key terms, or other domain specific words and phrases as they are used in specific technical context

- RST.9-10.7: Translate quantitative or technical information expressed in words in a text into visual form and translate information expressed verbally or mathematically into words.

K-12 Science Standards
- HS-LS2-1: Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales
- HS-LS2-2: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales

Technology:
- 1.2.1: Communicate and collaborate to learn with others.
- 1.3.2: Locate and organize information from a variety of sources and media.
- 2.2.1: Develop skills to use technology effectively.
- 2.4.1: Formulate and synthesize new knowledge.

Engineering:
- HS-ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)
☐ Global Awareness   ☐ Financial/Economic/Business/Entrepreneurial Literacy   ☐ Civic Literacy
☐ Health/Safety Literacy   ✓ Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION	INFORMATION, MEDIA & TECHNOLOGY SKILLS	LIFE & CAREER SKILLS	Productivity and Accountability
Creativity and Innovation	Information Literacy	Flexibility and Adaptability	☐ Manage Projects
☐ Think Creatively	✓ Access and Evaluate Information	☐ Adapt to Change	✓ Produce Results
☐ Work Creatively with Others	☐ Use and manage Information	☐ Be Flexible	Leadership and Responsibility
☐ Implement Innovations	Media Literacy	Initiative and Self-Direction	☐ Guide and Lead Others
Critical Thinking and Problem Solving	☐ Analyze Media	☐ Manage Goals and Time	✓ Be Responsible to Others
☐ Reason Effectively	☐ Create Media Products	☐ Work Independently	
✓ Use Systems Thinking	Information, Communications and Technology (ICT Literacy)	✓ Be Self-Directed Learners	
✓ Make Judgments and Decisions	☐ Apply Technology Effectively	Social and Cross-Cultural	
☐ Solve Problems		✓ Interact Effectively with Others	
Communication and Collaboration		✓ Work Effectively in Diverse Teams	
☐ Communicate Clearly			
☐ Collaborate with Others			

Teacher Preparation: (What materials and set-up are required for this lab?)
Materials:
- M&Ms and Skittles
- Paper towels
- Cups
- Whiteboard + marker

Set-Up Required:
    None needed.

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected): By working in small groups of 3, each student will have a role within their group so that they are relevant and necessary to the completion of their group's goal. Once students have tabulated their results, they will also have follow-up questions for their group to answer collectively, which offers another opportunity for students to step up and lead the conversation about the follow-up questions.

Cooperative Learning: This lab is intended to be completed as a group, where students need one another in order to complete the lab. The same goes for the lab follow-up questions, where each group discusses their answers together and will eventually share their answers with the class.

Expectations: Students are expected to work with their groups and contribute in a meaningful way, whether it be in managing the materials, recording the results, leading the post-lab discussion, or verbally chipping in with insights about population dynamics during the lab and discussion.

Timeline:
Intro Activity + Predictions: 5-10 minutes
Introducing the Lab: 5 minutes
Running the Lab: 20-30 minutes
In-Group Discussion: 5-10 minutes
Full Class Discussion + Wrap-Up: 5-10 minutes (as needed)

**adjust time as needed so that there is discussion at the end

Post Lab Follow-Up/Conclusions:
Discuss real world application of learning from lab using previous 'deep thinking' questions

Career Applications: ask students about which careers would need to think about population dynamics.

https://wa-appliedmath.org/

Population Growth Lab

In groups of 3, you will explore the nature of population growth with the help of M&M's (or even Skittles).

Instructions

1. Put 2 M&M's or Skittles in the plastic cup.
2. One of your group members will "roll" the candy onto the paper plate.
3. Count the number of M&M's or Skittles that are face up showing an M or an S and note them in your data table
4. Put that number of candies into the plastic cup with the other two (it will be either one more or two more candies)
5. Repeat until all of the candies are gone, even if you go over the amount you have
6. Note the number of rounds it took you to run out
7. Input the data points on your graph
8. Let me know when you are done so I can check your work
9. Prop up your whiteboard somewhere in the room when you are finished so the other groups can compare their data with yours 😊
10. Answer the analysis questions on the back of this sheet on your notes page.

Turn #	0	1	2	3	4	5	6	7	8	9
# of M&M's	2									

Analysis Questions

Write your answers down to the following questions in your notebook. When you finish, discuss your answers with your group.

1. Describe your graph. What does it show about how your population grew over time?

2. What possible factors could have caused this kind of growth to happen?

3. Does this seem like a realistic way in which a population would grow? Why or why not?