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Mathematical Simulation of Rate of Growth

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Generic Lesson Plan Template

You should submit this form in addition to any computer generated files/documents/models to your group folder on Angel. Please create a .zip file and upload the group of files as a single archive.

Name: Lisa englert
Grade Level/Subject Taught: 8th grade General Science Living Environment
Objective: Students will: 1. Produce a scatter plot and best- fit model for existing data 2. To interpolate and extrapolate using a best-fit model 3. To explain how limiting factors control populations 4. To prove an understanding of carrying capacity

Please provide a rich **one-page, single-spaced**, description or a *vision* of your best thinking on a way or ways you might teach the planned lesson. (Approximately ½ page for the teacher role, ½ page for the student role). Also, construct a tentative rubric that you might use with your students (see example)

Items to include in your lesson plan: (Choose your discipline/concepts from your own area).

1. *Write* the Mathematical Concept or "key idea" that modeling will be used to teach: (e.g. Students use mathematical modeling/ multiple representation to provide a means of presenting, interpreting, communicating, and connecting mathematical information and relationships)

and/or…

1b. *Write* the Science Concept or "key idea" that modeling will be used to teach: (e.g. Organisms maintain a dynamic equilibrium that sustains life).

Exponential reproduction of bacterial organisms
Connection between math and science concepts of exponential growth
Environments have limiting factors for organisms that control the population
A carrying capacity exists for the populations in an environment

Materials:
M&M's in canisters or in bulk pack age
Graphing Calculator (view screen and overhead for teacher)
Small paper cup (if bulk package is used)
Paper towel (or clean piece of paper)

"…a rich **one-page, single-spaced**, description or a *vision* of your best thinking…"

Prompts:

1. How will you assess the prior knowledge of the student?
2. How will you begin the lesson?
3. What are the teacher and students doing every 5-10 minutes? (Teacher Actions and Student Actions
4. How will you assess the learning for the lesson?

Using ___TI-84 Graphing Calculator_ I plan on having my students

1. Spend ~5-10 min writing a brief description or KWL chart in reference to students' knowledge about bacteria (and its growth)
2. Discussion of their prior knowledge by randomly calling on three students to tell of their prior knowledge (~10 mins)
3. Together, read over the Mathematical Simulation of Rate of Growth (~15-20 mins)
4. Activity for the Mathematical Simulation of Rate of Growth to be completed in pairs of two
5. For the remaining 20 minutes students will work on completing the Student Worksheet by:

    a. Creating a scatter plot using the TI-84 calculator
    b. Finding the regression equation model to best support the data & sketch
    c. Answer the remaining questions 5-9
6. Remaining questions may be assigned as homework depending upon the level of success displayed in class.
7. My plan of assessment will be to compare how the answers to student questions on worksheet re: regression equation, etc compare with the graphing calculator results.

(software / modeling package(s)

Name: _____ Date: _____

Environmental Science

Directions for Mathematical Simulation of Rate of Growth Activity

Introduction: Of all of the organisms in the world, few could compete with bacteria for the title of "Fastest Reproducer". Bacteria are unicellular, like lots of organisms, but the unique characteristic that they possess is the absence of a true nucleus; they are prokayotes. An exponential growth function is one in which the values increase by a nonlinear, but still constant factor. In this activity let's see how we can use M&M's to model bacteria growth and a graphing calculator to simulate an exponential growth curve.

1. Each group of two students starts with only 4 M &M's in a cup (or canister) and paper towel.
2. Record the trial t=0 value as 4 in your chart as follows:

Trial #	Total # M&M's
0	4

(chart is located on your Student Answer Sheet)

3. Shake the cup and pour the M&M's out on the paper towel. Count the number of M&M's that have the M showing. Add an M&M for each one with an M showing. Record the total number of M&M's under t=1. Return all M&M's to the cup.

4. Shake the cup and pour out the M&M's out on the paper towel. Count the number of M&M's that have the M showing. Add an M&M for each one with an M showing. Record the total number of M&M's under t=2. Return all M&M's to the cup.

5. Repeat this process four more times.
6. When DONE, you may eat the M&M's and begin work on the Student Answer Sheet.

Name: _____ Date: _____

Environmental Science

Student Answer Sheet for Mathematical Simulation of Rate of Growth

Using the Graphing Calculator:

1. Enter the data from your chart below in lists L1 (trial #) and L2 (total # of M&M's)

Trial #	Total # of M&M's
0	4
1	_
2	_
3	_
4	_
5	_
6	_

2. Create a scatter plot with the trail # on the x-axis and Total # of M&M's on the y-axis. Use a separate sheet of graph paper.

3. Using the STAT→ CALC, find the best regression equation to model this data. Be sure to check the correlation coefficients to see that you have chosen the "best" model.
   Which regression model did you use?_____
   What is your equation? _____

4. Sketch your regression equation on the graph with your scatter plot.
5. What is the correlation coefficient for your model equation? _____
   Is this considered a "good fit"? _____ How do you know? _____
6. Using your equation, predict the number of M&M's on trial # 10. _____
7. Using your equation, predict the number of trails needed to produce a total of 400 M&M's. _____
8. Explain what the "a" and the "b" values in the equation represent _____
   _____
9. Why does the "b" value seem to equal approximately 1.5? _____
   _____

Example: "I was thinking about beginning the class on [modeling X] by using the overhead to ask students what they know about X. From this brainstorming session, I might ask them to get into groups and discuss one or more of the ideas they gave me. After about ten minutes, I would have the students give their ideas on X and write them down on a transparency so they would be able to see them for the entire hour. From here, I would provide a 10 to 15 minute demonstration of the basics of using _____modeling software. I would use an conceptual example that they would find familiar with such as getting a cold and how it is transmitted. From here, I would have students at the computer stations using a prepared guide or tutorial to get them started on basic software usage. I expect that is a short time a number of students would "catch on" rather quickly and be able to help others. …….. By the third lesson, I suspect that most would be well on their way to development of their own or small group models using the _____software. My plan of assessment would probably be a group model so they would gain more confidence in using the software in a meaningful way. After the second or third lesson, I would ask them to choose from a list of thematic or topic areas that fit the software nice and develop a model using the technology. As a product, I may have partners share their model and describe to other small groups how it works. The rubric I design would be general at first so that I might see what kinds of the products the student were capable of creating. From the prototypes, I would hone my rubric to make the modeling product as challenging as possible without making it too difficult." Etc…