THE GROW BEAST

Introduction

This simple activity allows your students to get a motivating and relatively intuitive introduction to scientific investigation and data representation in the form of a growth chart. They are asked to construct the chart from data they collect and to use it to make inferences about the growth of the "grow beast".

The grow beast is a toy that expands when placed in water. It starts out as a very small dinosaur shaped object and, when placed in a pan of water, expands to many times its original volume and mass. This process takes two or three days. You will see growth, however, in an hour or two. When it is removed from water, it will gradually dry out and return to something like its original size. The Grow Beast is sold in many toy stores, novelty shops etc. They usually cost less than a dollar and can be "grown" and shrunk several times although they begin to deteriorate after too many repetitions.

Description

I ask a student who has experience with these toys to explain the general idea of the grow beast to the class. Sometimes the package the grow beast is sold in contains claims about the amazing growth characteristics of the toy (e.g., "*Expands to 6 times its original size.....!*". I read these to the class, let them look at the packaging, and ask them just how big they think the grow beast will get. After they have had a moment to talk about the grow beast, I ask them whether they believe the claims about the growth of the toy. What do the manufacturers mean when they say it will expand to "6 times its original size"? Some believe that this means that it will be 6 times as tall. Others believe that it will weigh 6 times as much. Some may refer to a six-fold change in volume. I ask students to tell us how tall?, how heavy?, how massive would it be at that rate? What would it be like? This leads them to ask how big it is now. They suggest that we weigh it, measure its height, and some may ask that we determine its volume (by dunking it in a container of water and measuring the over flow or rise in the water level). You can choose to examine one or more of these variables. For younger children, its shape might simply want to keep track of its shape and how that changes over the course of the investigation. A good variable for 7th graders would be mass and so, for our purposes, I will assume that we are going to look at mass. (Length and /or height also make excellent variables to track and they are easier to measure than mass.) You may find it necessary to conduct a quick, informal review of the metric system of mass. I pass around a set of metric weights (masses) so that students can feel a gram, 100 grams, a kilogram. We weigh (mass) some common objects (a pen, a comb, a quarter, a golf ball, a spoon, a pattern block, a student, etc.) and set them in the front of the room with their masses written beneath them.

We then determine the mass of the grow beast, place it in a large container of water (a cup generally will not do!), and note the time. With this done, I ask the students write down their guess about the mass the grow beast will have in exactly 72 (or 96) hours. I provide a sheet for the students to use in recording their predictions.

Grow Beast Prediction Sheet Name:_____

Date of: 1st prediction 2nd prediction 3rd prediction etc.

_____ _____ _____ _____

Predicted
Mass: _____ _____ _____ _____

Please justify your
first prediction:_____

Please justify your
new prediction:_____

etc.

With this, they can refine their predictions periodically based on the developing growth chart. The growth chart, usually drawn on a large piece of tag board, may be created by some of your willing and artistic students. The horizontal x-axis - time - should allow for at least 5 days. The reason for this will be made clear below. The vertical y-axis - mass - will vary depending on the size of your grow beast. The students will benefit from a discussion of which should be the independent and which should be the dependent variable.

Students make an initial prediction. You might want to determine a class average prediction and post this for future reference. I like to let all of my classes in on this and make it a contest. The class whose prediction comes closest to the correct mass at the end of the three-day period is the winner. With all of the classes involved, it is easy to get a very complete data record, at least during the school day. Students can weigh (mass) the grow beast at any time and record the new mass on the growth chart. At least once a day, I ask the students to examine the chart and make a new prediction. Sometimes I will also ask the students to come up with a single prediction for each of their cooperative groups. Whenever they revise their predictions, they are asked to write a sentence or two about what lead them to make this change. This works better if they are working together in small groups.

[Note: When students measure the mass of the grow beast, they should be encouraged to see whether the number they get fits the rest of the data. Sometimes, even during the growth phase, when students measure, one right after another the mass will seem to decrease. Why? You can use this as an opportunity to talk about controlling variables, establishing uniform testing and measurement procedures, and so forth.]

After the final mass (at the end of 72 hours or whatever time limit you have selected) is determined, and the winners (individual or group, and class, initial and final predictions) have been congratulated, you can start the reverse process by removing the grow beast from the water and letting it shrink as the water evaporates. In this case students will predict not the eventual mass, since it will return nearly to its original state, but the length of time that will be needed to return to a predetermined mass. For reasons unknown, this interval is generally shorter than the length of time needed to complete the original expansion. (Perhaps in a climate even more moist than ours, should one exist, this process would slow down.) However, your students will not necessarily know this and their initial predictions will probably center around the 72 hour mark. As usual, ask them to explain their reasoning when they make their predictions. Let them discuss these predictions, briefly, as a class. As the data are recorded and the growth chart takes shape, students will generally revise their predictions to accommodate them.

In this investigation, the idea of *slope* is implicit in making an estimate of the eventual mass as the grow beast expands, or the interval needed to return to the original mass as the water evaporates. I think that this is a good way for students to find out or reinforce what slope is all about and why it is a useful and important concept in mathematics. Of course many student will simply look at the chart and "get a feel " for where they think it is going. If, however, you ask them to write about the reasons for the predictions they make and if you have modeled the use of quantitative evidence and mathematical reasoning, they will be more likely to make formal or informal use of the slope concept to solve this "problem".

Extension: It is interesting to have students complete this investigation by comparing their growth charts with growth charts made for tracking the development of human infants. (These are available where ever fine babies are born.) They will see that the same sort of curve is apparent (minus the evaporation period).