



BOTANICAL SOCIETY OF AMERICA

BSA Sci- π Mathematics Tips for the Instructor

Introduction:

Since the research questions your students will develop may vary considerably, it is difficult to predict the mathematical applications that will emerge during various stages of the students' inquiry process. However, it is likely that many students will engage with the question of *rate of growth* (which relates to the mathematical concept of *rate of change*).

Rate of change is used extensively both in the natural and social sciences. Students commonly develop an insufficient understanding of rate of change and consequently struggle as they encounter ideas that build upon or relate to this essential notion. In light of this, the following information about student understanding of *rate of change* might be useful to you.

Graphing stem length versus time:

In this investigation, it is likely that many students will choose to graph sprout-stem length versus time. However, conceptual difficulties may arise if students choose to compare growth rates of different seed types.

To illustrate, let us suppose that a student is comparing the growth rates of seed-type A and seed-type B; and that seed-type A grows 2 centimeters in 4 days and seed-type B grows 2 cm in 4 days, each growing about the same increment each day. As a result, we can say that during the four days, both seed types grew at the same rate, which is $\frac{2}{4}$ or $\frac{1}{2}$ centimeters per day. However, this comparison can be misleading. Students may fail to realize that equal rates of growth do not necessarily imply that the two types of seed grew the same. This is because if seed-type A and B typically grow to lengths at maturity of 3 cm. and 10 cm. respectively. Then one can argue that seed-type A grew more than B, because it grew to $\frac{2}{3}$ (approximately 67%) of its length at maturity, while B only grew to $\frac{2}{10}$ (20%) in the same period of time. This is an example of additive versus multiplicative reasoning, a distinction which many students need help understanding. To this end, it may be useful to have students who are struggling to make sense of the difference try the following problem:

Additive versus Multiplicative Situations¹

Find and defend two different answers to the following problem:

Two weeks ago, two flowers were measured at 8 inches and 12 inches, respectively. Today they are 11 inches and 15 inches tall. Did the 8-inch or 12-inch flower grow more? (Hint: Suggest that the student draw the flowers at the start and after two weeks.)

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¹ Van de Walle, J.A. (2004). *Elementary and Middle School Mathematics: Teaching Developmentally*. Fifth edition. New York: Longman.