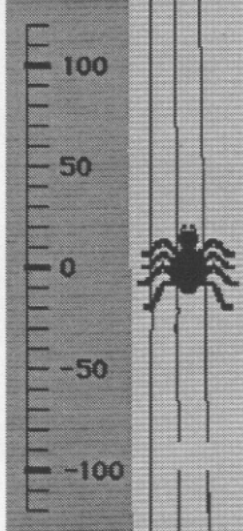# MODELING INTEGER OPERATIONS
by Kathryn A. Verzoni

Kudos to Robert Berkman for his excellent article, Modeling Positive and Negative Number Concepts with Microworlds, in the Special NCTM Conference Edition of Clime Connections (p. 8, 1995). In his article, Berkman discusses how he, while demonstrating MicroWorlds Math Links to a group of teachers, stumbled upon the idea of using MicroWorlds as an environment where one can model integer addition.

As I read, my 7th grade math students back at school were stumbling hopelessly with positive and negative integers. Despite my attempts to reach them with stories about owing money, owing money and finding money, having loans forgiven, losing bets to opposing bowling teams, and temperature or altitude changes, my students sat intent looking for rules to memorize. Multiplication and division were giving them less trouble than addition and subtraction. I'm convinced that this was not

for expressing mathematical relationships.

I built structure into the activity by presenting the example model and creating handouts to guide students in steps through the project. Encouraging students to work in pairs helped in that it halved the occurrence of syntax related problems. I had hoped that the project would take only two class periods, but it ended up taking three. In addition, several students required extra time after school to polish their projects. Class time is always a concern. Our textbook-problem-like final exam (and the many exams our students will take during the remainder of their K-12 journeys) worries me whenever we use mathematics class time for constructive projects. Somehow, I don't think I'm alone.

Two student projects are shown here. Joseph's Its Bitsy Spider models integer multiplication. Pam and Toni's Friday the Cat models integer subtraction with a multiplication twist-- MOUSEHUNGER times 2, "because the cat can get two mice if he favors a mouse feast, but only one bird if he favors a bird feast."

The Itsy Bitsy Spider

The Itsy Bitsy Spider can take steps of different lengths. Negative lengths are downwards and positive lengths are upwards. He can take different numbers of steps of whatever length.

Suppose Itsy Bitsy Spider starts at 0 and takes 6 steps of length −3. Where does he end up?

Suppose Itsy Bitsy Spider starts at 0 and takes 4 steps of length 12. Where does he end up?

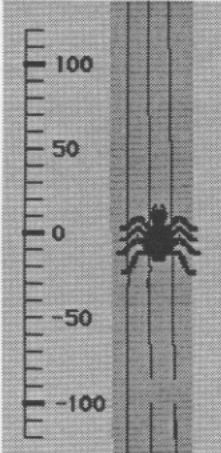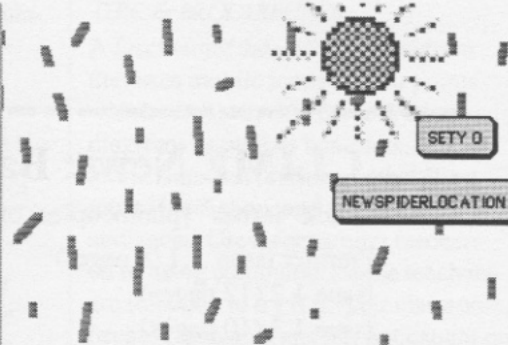Use the sliders and the NEWSPIDERLOCATION on the next page to answer questions like these.

BEGIN

Joseph Armstrong, April 95
G7, West Point School

The projects were fascinating in that many authors took on more than what they appeared to understand at first. Students were very creative with their applications of integer operations to real-life situations. Their creative ideas became their opponents when the time came to actually create the engines for their models. The more creative the idea, the more difficult it was to analyze and express the involved mathematical relationships. Students were obligated to actively connect their story situations with both visual representations (the animations) and abstract equations (the SET state-

because they understood multiplication and division any better than addition and subtraction, but because with multiplication and division, there's a neat set of textbook-supplied rules that can be memorized and applied. My 7th graders were quite distressed that no such rules like "a positive plus a negative equals a negative" exist.

Berkman's article sparked the solution to my problem. I schemed to put my students in charge of creating their own models. In their computer science and technology courses, our students learn how to program in MicroWorlds*. We reap the benefits of that investment in math class. We don't have to fuss with learning how to program and can concentrate on using Logo as a medium

number of steps
spider   4

length of one step
length   −1

end height of spider
climb   −4

*from Logo Computer Systems, Inc.