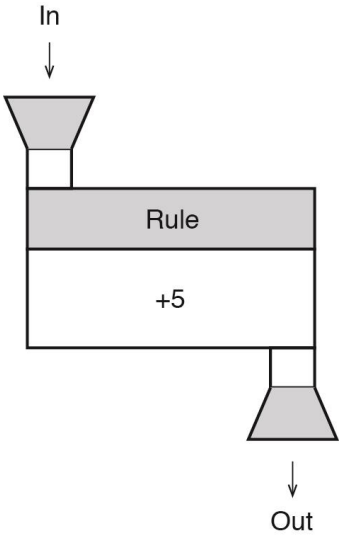
Scaffolding Adult Numeracy Lessons

Background Essay

Some adult numeracy teachers who introduce functions unfortunately begin with an overly formal definition (e.g., “a function is a relation where each input is associated with exactly one output”), and they may also introduce multiple challenging representations in the first class session (e.g., the “vertical line test”). More, they may simultaneously introduce formal function notation (e.g., f(x) = 4x + 1) that itself leads to many student misconceptions. Steve argues that a better approach is to begin by focusing on the concept of a function, use more “student-friendly” notation, and only gradually increase the complexity of function rules and the number of representations of functions.

Steve argues that functions should be introduced using a student-friendly “machine” analogy, and the early functions in Steve’s lessons show the function machine in a visual way. [*See the machine image Steve uses at right.*] After using it for the first few activities, the image is removed and replaced with a more traditional table of values.



Steve emphasizes one-operation function rules first (e.g., “+5”) so that students develop a strong concept of a function, and so that they are familiar with the meaning of a table of inputs/outputs. This includes the more interesting instances when an output is given, and the input is needs to be determined.

Two-operation rules are introduced after one-operation rules (e.g., “x4 then +1”), which creates very interesting problems when it is the input value that needs to be determined. Steve also laces decimal numbers (but no negative numbers) in the rules and tables of values to increase the challenge. While students are still working with function rules in this format, they begin to use and interpret functions that model a range of realistic situations.

Steve believes that teachers must be very careful when first writing function rules as equations. Instead of jumping all the way to x/y notation, Steve will continue to use the familiar In/Out language as rules are written as equations for the first time (e.g., “Out = In x 4 + 1”). There is a lot going even in this transition. Variables are being used for the first time, and it can confuse students that we customarily begin the rule with the “Out”.

According to Steve, all of the work described above (about 12 classroom hours) should be done before students transition to function rules written as “y = 4x + 1.” The video focuses on exactly how to transition students from the In/Out equation format to x/y format.

When functions instruction is carefully scaffolded in the ways described above and in the video, Steve argues that students will have a robust understanding of functions and will be capable of using and interpreting functions in many mathematical and realistic problems.

Questions for Discussion

Do you generally present functions for the first time using x/y notation, or with the very formal definition given at the outset of the background essay? If so, what can make this challenging for your students?

What can we do to find the classroom time that is needed in our programs so that carefully scaffolded work can be done in all of our math teaching?