# TECHNOLOGY tips

Welcome to a new year of "Technology Tips." I, Hollylynne Stohl, will edit the column for the 2004–2005 year. If you have a tip that can help other teachers learn how to use a technology application in the classroom, please send your ideas to me.

I thank Karen Hollebrands for her excellent leadership as editor of the column last year and for providing a solid apprenticeship so that I can assume the editorial duties. I am pleased to introduce this year's coeditor, Suzanne Harper. Suzanne teaches undergraduate and graduate mathematics content courses at Miami University in Oxford, Ohio. Her main interests include the appropriate use of technology in teaching K–12 mathematics, the content knowledge of prospective mathematics teachers, and the teaching and learning of geometry.

This month's tip is contributed by Robin Rider, East Carolina University, Greenville, SC 27858. Rider contributed a "Technology Tip" in the February 2004 issue, in which she introduced TI-Interactive! (Texas Instruments 2002). Version 1.2 is now available. You can download a free upgrade or demo version (thirty-day trial), or you can purchase a license at education.ti.com/us/product/software/tii/features/features.html. Please see Rider's February 2004 tip if you need a brief overview of the software's capabilities.

In this month's tip, Rider shares two ideas for using TI-Interactive! She first demonstrates collecting data by using a CBL or CBR with TI-Interactive! without using a graphing calculator. Her second tip shows how to create a number line by using the coordinate graphing features.

The "Surfing Note" this month includes a link to a tutorial on the basics of using TI-Interactive! as well as several data-collection lessons that can be used with TI-Interactive! or with graphing calculators.

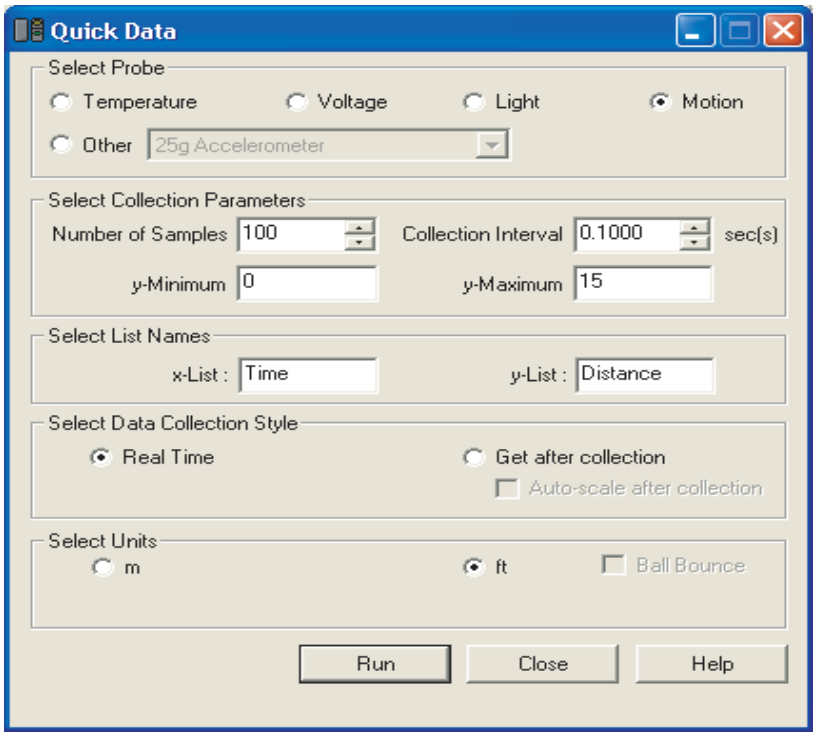


**Fig. 1** Using Quick Data to set the parameters of a data-collection experiment

This department offers a forum where teachers can share innovative classroom activities and ideas related to teaching and learning mathematics using technology. Ideas using all types of classroom technology are welcome. Send tips to "Technology Tips," *Mathematics Teacher,* 1906 Association Drive, Reston, VA 20191; or send electronic submissions to mt@nctm.org.

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**TIP 1:**

*Data collection with a CBL/CBR*

Calculator-Based Laboratory (CBL) and Calculator-Based Ranger (CBR) activities have become commonplace in some mathematics classrooms. However, few teachers have used this technology without some frustration. Maybe the problem was that the correct program was not installed on the calculator, the program did not do exactly what the teacher wanted, or that the teacher wanted to use the data later but did not remember the list to which each variable was assigned. Ease of use of the CBL/CBR technology has been a factor in whether teachers have embraced it. TI-Interactive! has made data collection simple and useful for those who have access to a PC, a graph link, and a CBL or CBR. The following example uses a CBR connected with a silver USB cable to a PC and uses TI-Interactive! Ver. 1.2.

First, you must have a new TI-Interactive! document open, and the CBR (or CBL) must be connected to the computer with a link (silver USB or black serial). Once connected, click on the Quick Data button on the toolbar. The Quick Data window, shown in **figure 1,** will appear. The Data Editor window will also appear in the background, since it is where the data will be stored in List format. The Quick Data feature takes the guesswork out of setting up an experiment and requires no additional programs. In the pop-up menu, the user chooses the probe that he or she is using, the parameters of the sample (for example, the number of data points to collect and the time interval), and then runs the experiment. For the example in **figure 1,** I am conducting a motion experiment with the CBR that involves collecting 100 samples, 1 per 0.1 second, for a total of 10 seconds. I have chosen maximum $y$-value (distance) of 15, and I am collecting the data in real time. The unit of measure is feet. Data can also be collected in the "get after collection" mode and then graphed.

In real-time mode, the graph will appear as the data are collected. The final graph for the data that I collected is shown in **figure 2.** The graph image can be saved in the TI-Interactive! document and saved as a picture file (JPEG, GIF, BMP, or EPS) for use in other documents.

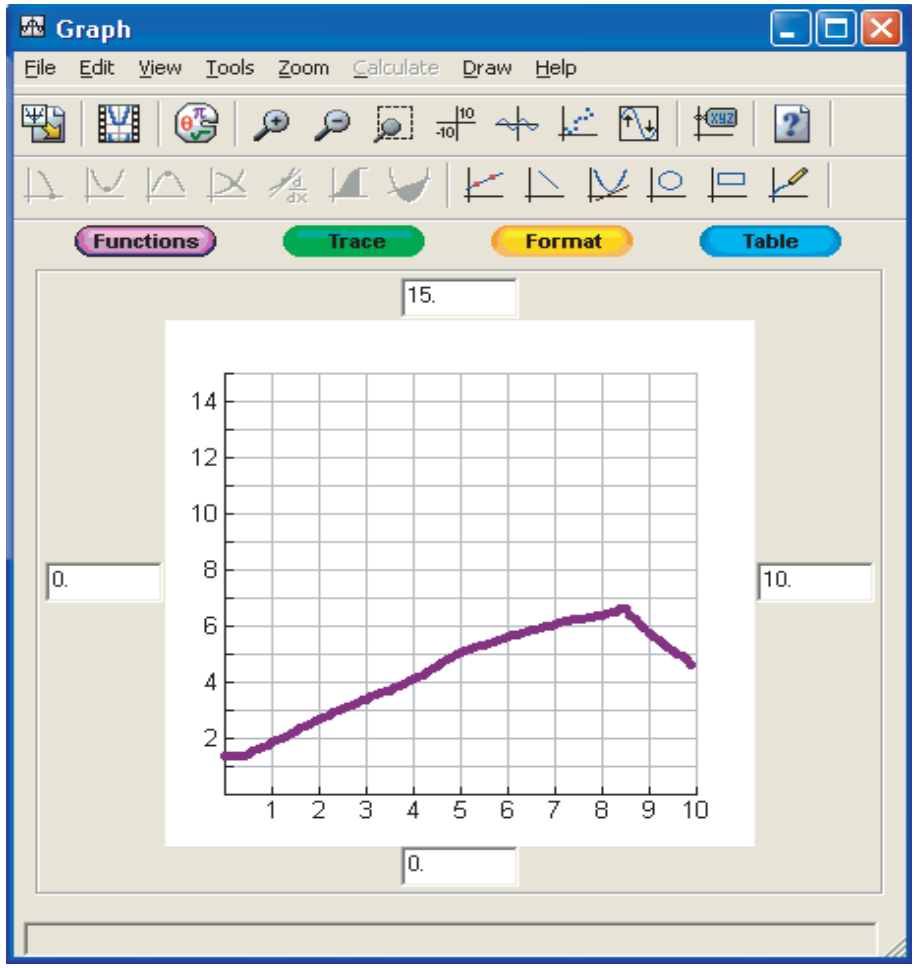


**Fig. 2** Scatterplot of data collected with CBR

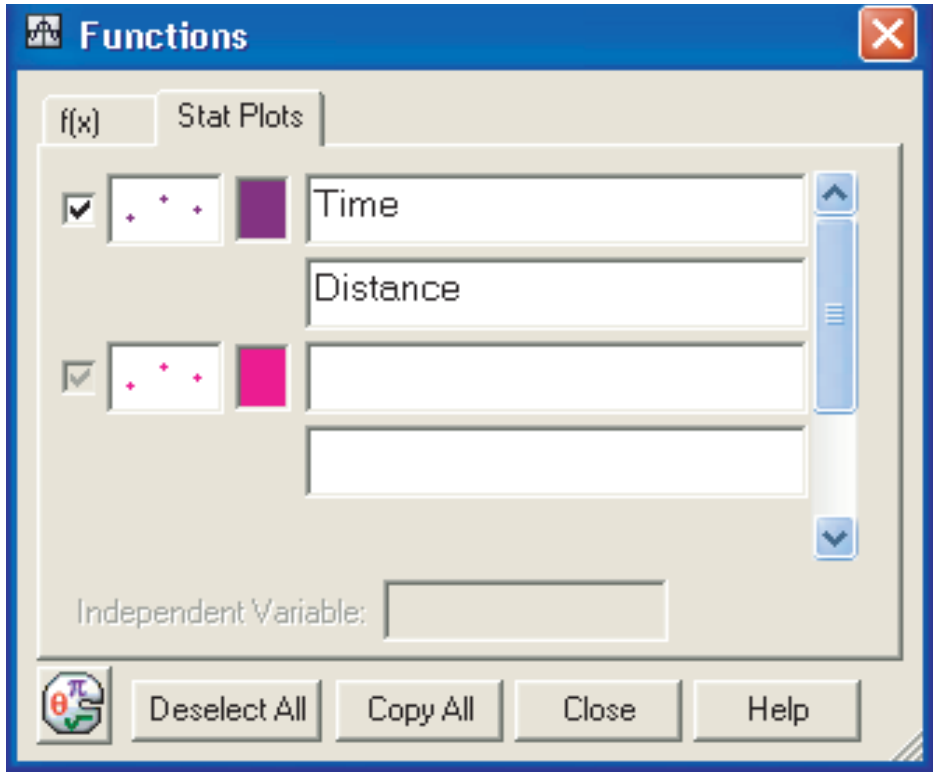


**Fig. 3** Stat Plot window indicating variable names

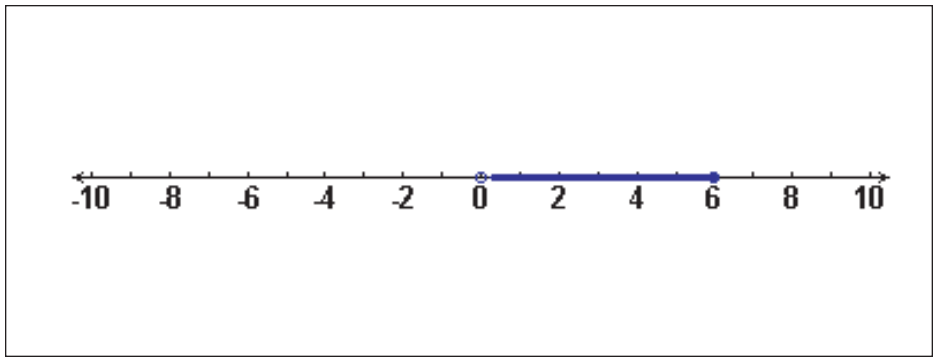


**Fig. 4** Number line created in TI-Interactive!

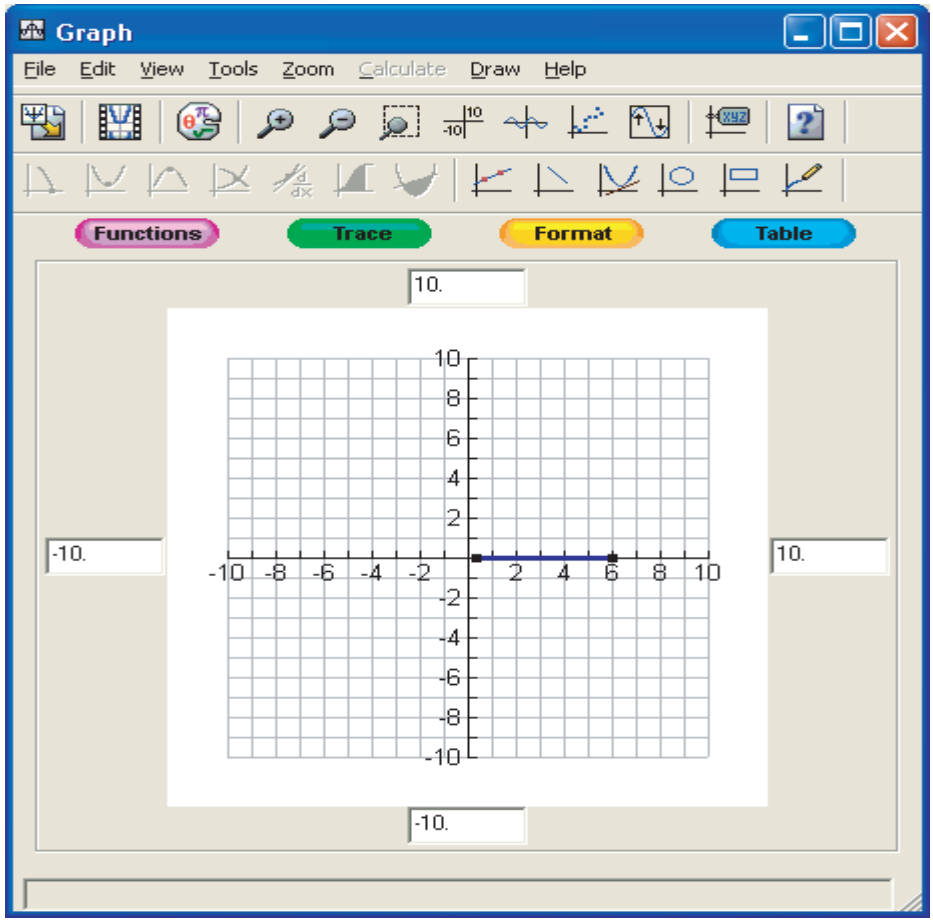


**Fig. 5** Segment drawn on x-axis from 0 to 6

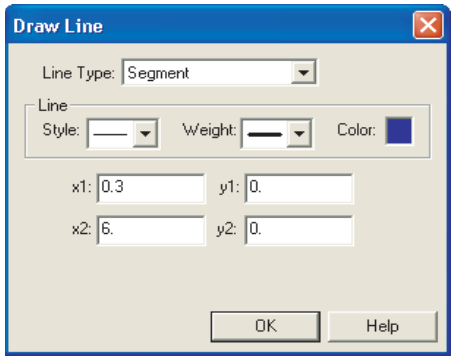


**Fig. 6** Setting the endpoints of the segment

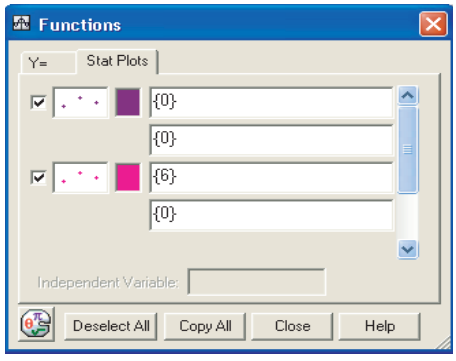


**Fig. 7** Endpoint information entered as two data sets

The numerical values of the experiment are stored in the Data Editor menu in the Time and Distance list columns. These data can be analyzed with statistical tests and then graphed. The data can be easily explored further with the TI-Interactive! spreadsheet; transferred, by simple copy and paste, to Excel; or transferred to a graphing calculator by using the "Export to Graphing Calculator" button in the Data Editor. One of the most useful features of collecting data with TI-Interactive! is that the program names the lists where it is storing the data and displays those names in the Data Editor and Stat Plot window, as shown in **figure 3,** thereby making it easier to remember the units measured for the independent and dependent variables.

For those who like to design their own experiments and who do not like to write calculator programs, a PC with TI-Interactive! gives users freedom to design the experiment with the features that they want and collect the data in a spreadsheet, without using a graphing calculator. Because sampling can be set up to incorporate as many data points as desired or to set a specific time interval, data can be collected over a period of minutes, hours, or days, rather than seconds, as with the graphing calculator. The software also lets the user choose the units (for example, Celsius or Fahrenheit, meters or feet), change the list names to accurately describe the variables, and decide whether to view the data during or after the experiment.

## TIP 2:
### *Creating number lines*

Instead of asking students to draw the graph of $0 < x \leq 6$, suppose that a teacher wants to give the students the graph and have them write the inequality represented by the graph, as shown in **figure 4.** Although TI-Interactive! is an easy tool to use when drawing two-dimensional graphs, number lines are a little trickier.

First, the user needs to draw the segment. With a TI-Interactive! document open, click on the Graph button in the toolbar, as if you were going to graph a function. In the Graph window, use the Segment tool, which is one of the draw buttons, to draw a segment

on the *x*-axis from 0 to 6, as illustrated in **figure 5.** The default segment that appears can be moved by dragging the endpoints.

The Draw Line dialog box, shown in **figure 6,** can also be used to type in the points where you want the segment to start and stop. Since the left-hand endpoint for the example will be an open circle, do not start the segment at x1=0, since it runs into the middle of the open circle. The other endpoint is closed, so x2 can be 6. Start the segment on (0.3, 0), and end on (6, 0). You can also change the weight of the line so that it is a little thicker.

There are several ways to put the open and closed circles on the endpoints of a segment. Click on the Functions button Functions, choose the Stat Plots tab, and enter the coordinates for the left endpoint (0, 0) on the first two lines and the right endpoint (6, 0) on the next two lines. If the numbers are not enclosed in { }, an error message will be displayed. The braces signify the beginning and end of the data set. In this example, each data set has only one element. Be sure that both data sets are selected with the check box, as shown in **figure 7.**

To make the dots open and closed, click on the first white box with the three data-point markers in it to open the Stat Plot Styles window, shown in **figure 8,** in which you can change the data-point markers. Change the symbol to an open circle for the (0, 0) and the size to be 3 or 4. Repeat this procedure, and use a closed circle for (6, 0).

You next need to turn off the grid and *y*-axis and put arrows on the end of the number line. Press the Format button to open the Format window. Click on the Grid tab, and deselect the option to Display Grid. Then click on the Axes tab, and choose the Vertical Axis tab. Deselect the Show Vertical Axis option, and select the last Arrows option to display arrows on each end of the *x*-axis. See **figure 9.** The finished product will look like the number line in **figure 4.** As always, the graph can be saved in the TI-Interactive! document or saved as a picture document, for example, in JPEG or GIF format.

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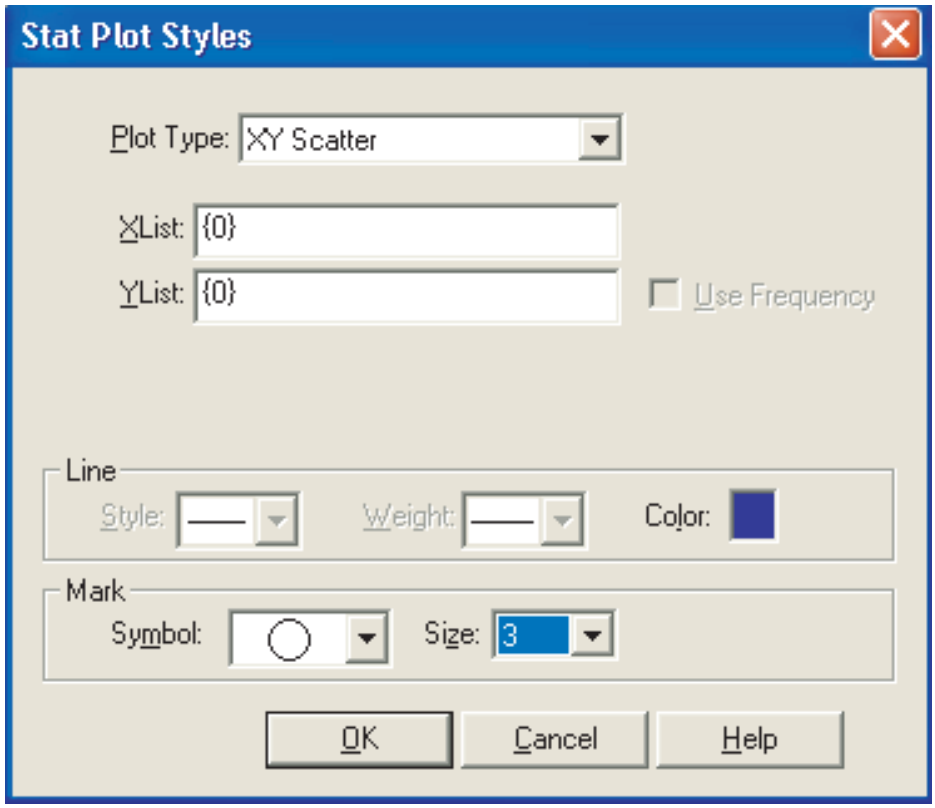


**Fig. 8** Setting the style of the markers as closed or open circles

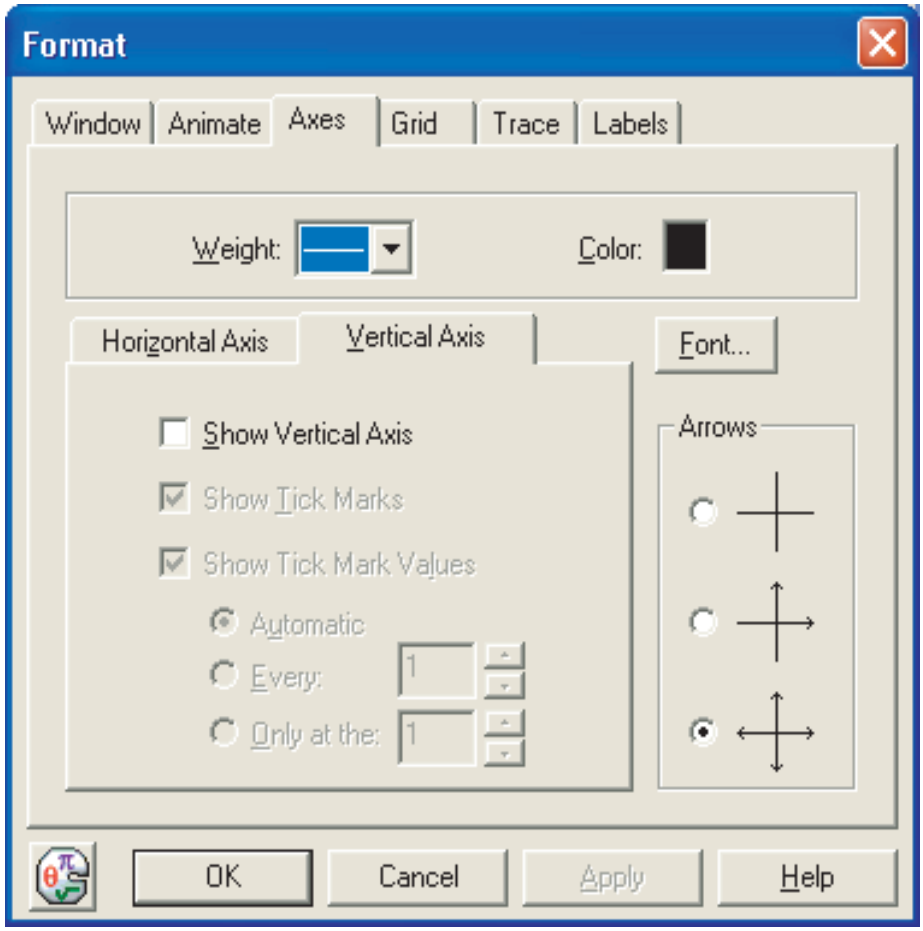


**Fig. 9** Formatting the graph to appear as a number line

## Surfing Note

Richard Stockton College has created an online tutorial showing how to use the basic features of TI-Interactive! This site is helpful for the beginning user, teacher or student:

www.ettc.net/njssi/tiproject/ti/page1.html

The Kiski School Mathematics Department has a Web site that shares many activities that use graphing calculators and TI-Interactive!:

www.kiski.org/imt/index.html

Most of these lessons include some sort of data collection from Internet sources, CBL/CBR's, or physical experiments. The activities using TI-Interactive! include student handouts, as well as TI-Interactive! documents that can be downloaded. ∞