Teachers Teaching with Technology™
Professional Development from Texas Instruments

Getting Started with TI-Nspire™ Technology in Connecting Science and Mathematics

Materials for Workshop Instructor*

Lab Equipment	Quantity (per 5 people)
Beakers (100 mL)	5
Beakers (1 L)	5
Hot plate	1
Tape measures (or meter sticks and string)	3
Hair dryer (optional)	1

Consumable	Quantity (per 5 people)
Styrofoam cups (8-16 oz.)	10
Various box labels w/ weight identified in both g and oz. • Rice, pasta, cereal, etc. • At least 5 different sizes	10 labels or more
Paper towels/ Kleenex®/Kimwipes®	1 roll/ box
Balls (for bouncing) - basketball, racquetball, four square, etc. • At least 3 different types	5
Latex balloons	3

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Conversion – Direct or Inverse Variation?

PD Objectives

- Participants will learn to use all of the built-in TI-Nspire™ applications at an introductory level.
- Participants will use common measurements to do conversion in the Calculator, Lists & Spreadsheet, Data & Statistics, and Notes pages.
- Participants will get an introduction the Vernier® DataQuest™ app where they will gather Celsius and Fahrenheit data.
- Participants will save their work on the handheld for access later.

Materials Needed/Set Up Requirements

- TI-Nspire™ Lab Cradle, two EasyTemp™ temperature probes.
- 5 labels with ounces and grams on them for each participant.
- 1 cup (Styrofoam) per participant, ice, hot plate, and 1 liter beaker or tea pot.
- *Conversion_Solution.tns* (Instructor use only).

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- Have the participants work in groups of two or three for this activity.
- Discuss the importance of having students make predictions about the relationships between the ounces and grams.
- Discuss the idea of students building conversions as opposed to being given conversions.
- When participants are graphing a line in Data & Statistics, focus in on the slope, and explain how this value is a conversion factor.

Technology Tips

- You will need to discuss with them how to add an application and discuss each application as you add one.
- You will not use Menu until you get to the Data & Statistics page. This allows them to focus in on the Home button and the applications first and not get bogged down on all of the possibilities in the first application.
- On the spreadsheet, point out that the column names become variables that will maintain their values on all other pages within the problem.
- You might want to point out how to start the data collection by clicking the **Start Collection**  arrow in the lower left corner of the screen.

How Does It Stack?

PD Objectives

- Learn to open and use a pre-made document.
- Move from page to page and use the touchpad.
- Discuss how estimation can be used to approximate the densities.
- Show participants how to use the Scratchpad to make calculations and return to the document.

Materials Needed/Set Up Requirements

- *How_Does_It_Stack.tns*

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- We want to **"**wow**"** the participants and show them that they can move through an activity without knowing how to do everything on the handheld.
- Be sure to take it slowly. Demonstrate and talk about what you are doing**.** Then encourage the participants to explore on their own.
- Be sure to point out how each student receives different values for the masses and volumes**,** and how they change if the student makes an error.
- Encourage questions and sharing of "tech tip" discoveries**.**

Technology Tips

Summary Reflection Questions

- *Density* is a big idea throughout science and *ratio* is a big idea in mathematics. How does this activity improve student understanding in both?
- How can the dynamic nature of TI-Nspire**™** technology be useful?
- Can students and teachers use the TI-Nspire™ handheld as a tool without learning to use every feature?

Introduction To Data Collection

PD Objectives

- This investigation will introduce data collection with TI-Nspire™ technology by exploring rates of heating and cooling with the Vernier® DataQuest™ application. Participants will design experiments to cause the probe to heat and cool, collecting data at least two times.
- Participants will create a new document, automatically add a DataQuest app by plugging in the EZ-Link, identify variables, change the Time and Unit settings, and save the document.
- In the Notes application, participants will use text format options to discuss experiment parameters and to interact with the text. (Optional as they answer questions.)

Materials Needed/Set Up Requirements

- Vernier EasyLink® USB interface and TI Stainless Steel Temperature probe for each participant. (Option of EZ-Temp if needed.)
- Optional: collection of ice and cups, fan, alcohols, liver, and other mechanisms and materials to facilitate cooling and heating.

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- Have the participants become aware of the data collection aspects of TI-Nspire™ technology.
- Show the power of TI-Nspire technology as a science tool, using the Notes application in conjunction with the Vernier DataQuest application.
- Note that the rate of heating and cooling is not constant and that it is related to the materials used to heat or cool the probe.
- Participants will need to list the variables in the experiment and then design an experiment to cool the probe. In both cases key words should be formatted with **Bold**, Underline, *Italics* and Color fonts (fill or text).

Technology Tips

- Follow the instructions. Start a new document! If participants just plug in the probe, it will launch the app in the current document, or pick up with the setting in the current app.
- Use the TI-Nspire™ Teacher Software, not the TI-Nspire™ Navigator™ Teacher Software for presentation. Do not use the TI-Nspire Navigator system to send documents to participants.

Summary Reflection Questions

- Is this a good introduction to the Vernier DataQuest application?
- Would you/could you do this with students?
- What other probe might be used? How?

Cool It

PD Objectives

- Participants will learn to use the Vernier DataQuest™ application to collect temperature data.
- Participants will collect temperature data for a cooling temperature sensor. They will collect the data using the default setting which collects readings for 180 seconds.

Materials Needed/Set Up Requirements

- Vernier EasyTemp® USB temperature sensor or Vernier Go! ® Temp USB temperature sensor with interface (Vernier EasyLink® USB sensor interface or TI-Nspire™ Lab Cradle)
- Cup of hot water with a temperature of 45º–55ºC or a hair drier to heat the temperature sensor.
- Insulated cups for the water and a source to heat it such as a hot plate with a large beaker or microwave oven. A hair drier can also be used to heat several sensors at once.
- Show teachers what these adapters look like:
  - Using the EasyTemp with a computer requires the use the mini-standard USB adaptor to plug the temperature sensor into a computer.
  - Using the TI-Nspire Lab Cradle with the standard temperature sensor requires a USB cable to connect to the teacher's computer.
- If you do not have the adapter, consider collecting data with the student handheld and transfer to the computer using TI-Nspire™ Navigator™ System or the TI-Nspire™ Teacher Software.

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- Have the participants work in groups of two or three for this activity.
- Discuss the importance of having students make predictions prior to collecting data. Research shows that this practice improves student understanding. One such article about interactive lecture demonstrations and making predictions as well as keeping the class interactive is at http://www.aapt.org/conferences/upload/Thorton-2003-Calc-Conf-Presentation.pdf.
- Discuss the horizontal asymptote and how it must be lower than any of the temperature values to perform an exponential regression. An exponential regression can only be performed if all temperature values are positive since an exponential equation is the form $y = a \bullet b^x$ is always positive.
- Consider using the graphs of both the original data and the transformed data to show that the parameter *a* is the same for both. Many students (and some teachers) might not understand why the initial temperature is not the value for *a*.

Technology Tips

- Point out how to start the data collection by clicking the **Start Collection** arrow in the lower left corner of the screen
- The Vernier DataQuest app can be opened in the same way that any other TI-Nspire application is opened if it does not start automatically.

Match Me

PD Objectives

- Participants will use the Vernier DataQuest™ application and a Calculator-Based Ranger 2™ (CBR 2™) to match a position-versus-time graph that is randomly generated in the Vernier DataQuest app.
- Participants will experience first-hand the value of this type of activity in helping students interpret slope and *y*-intercept in a real context.

Materials Needed/Set Up Requirements

- One CBR 2 and one USB CBR 2-to-calculator cable for each group of two participants.

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- Have participants work in groups of two for this activity. If there is an odd number of participants, you can be a partner or have a group of three. Encourage all participants to experience both roles in the activity—the walker who matches a graph and the TI-Nspire handheld operator.
- Participants do not need much preparation for this activity. The Vernier DataQuest should start when the CBR 2 is connected to the handheld. This activity is designed to be participant-led.
- Refer participants to the last section in the Teacher Notes where there are directions for creating position or velocity matches. They can create a graph to be matched and try it out.

Technology Tips

- You may wish to point out how to start the data collection by clicking the **Start Collection** arrow in the lower-left corner of the screen
- The Vernier DataQuest app can be opened in the same way that any other TI-Nspire app is opened if it does not start automatically.

Summary Reflection Questions

- Could this activity be used as a performance assessment?
- What concepts do students need to understand in order to match a position versus time graph?
- Some students create graphs where the slopes match but the first part of the graph is shifted above or below the given graph. What information does this give about the starting position?
- How might an activity of this type help students learn to better attend to properties of a graph, e.g., the scale used on an axis?

How Does it Bounce?

PD Objectives

- Enter data into the Lists & Spreadsheet application and graph it in the Data & Statistics application.
- Plot a function to add a model in the Data & Statistics application.
- Examine relationships that are not linear or quadratic.
- Develop an understanding of exponential functions

Materials Needed/Set Up Requirements

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- Students are asked to make a graph prediction and compare it with the relationship. Stress the importance of making predictions at the beginning of the activity.
- Participants should be able to do this activity in their groups while the instructor moves about the class.
- Encourage questions and sharing of discoveries.

Technology Tips

- Use the TI-Nspire™ Navigator™ System as a teaching tool to monitor progress and share with the entire group.

Summary Reflection Questions

- How does this activity help students to develop an understanding of what an exponential function is?
- How can this activity be used to assist students in making connections in both science and mathematics?
- How would the equation change if the relationship showed exponential growth rather than decay?
- What does it mean in terms of energy if the ratio is always nearly the same?

Summary Reflection Questions

- Could this activity be used as a performance assessment?
- What concepts do students need to understand in order to match a position versus time graph?
- Some students create graphs where the slopes match but the first part of the graph is shifted above or below the given graph. What information does this give about the starting position?
- How might an activity of this type help students learn to better attend to properties of a graph, e.g., the scale used on an axis?

Introduction to the TI-Nspire™ Navigator™ System

PD Objectives

- Introduce the TI-Nspire Navigator System to participants.
- Make participants aware of Quick Polls, sending documents, and the Live Presenter feature.

Materials Needed/Set Up Requirements

- *Navigator_Introduction.tnsp*
- *Navigator_Introduction.tns*
- *Nav_Quick_Polls.tns*
- *Nav_Data_Collection.tns*
- TI-Nspire™ Lab Cradle
- Temperature probe

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- Open the PublishView™ document and use it to guide the activity.
- Send out each question in the *Nav_Quick_Polls.tns* as Quick Polls. Discuss how this could be used in their class to gather feedback.
- Ask teachers about how they get students' feedback on lessons that they have done on prior days.
- How do you assess students on a daily basis?
- How can you guide the class through an activity without touching the technology?
- Send the participants the *Nav_Data_Collection.tns* and make a participant the Live Presenter. Talk them through how to setup the handheld to collect the temperature data.

Technology Tips

Summary Reflection Questions

- How would you modify this activity for your students?
- How do you see yourself using the TI-Nspire Navigator System at this time?
- How could using the TI-Nspire Navigator System strengthen your teaching?

Why Bigger is Not Necessarily Better

PD Objectives

- Learn to open and use a pre-made document from Science Nspired.
- Use the Lists & Spreadsheet and Data & Statistics applications.
- Plot a function and perform a regression in the Data & Statistics app.
- Examine relationships that are not linear.

Materials Needed/Set Up Requirements

- *Why_Bigger_is_Not_Necessarily_Better_Simulation.tns*
- *Why_Bigger_is_Not_Necessarily_Better_Data_Collection.tns*

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- This is a Science Nspired activity that focuses on surface area and volume, which are often difficult concepts for students in mathematics.
- Students are asked to make a graph prediction and compare it with the relationship.
- Participants should be able to do this activity in their groups with the instructor floating around.
- Encourage questions and sharing of discoveries.

Technology Tips

Summary Reflection Questions

- Surface area and volume are big ideas in mathematics and their ratio is important in characteristics of how organism adapt to their environments.
- How can this activity be used to assist students in making connections in both biology and mathematics?
- How do the various graphs show characteristics that are important for animals?