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
Pipets or graduated cylinders (10 mL)	5
Pipet bulbs	5
Test tube rack w/five 20x150 mm test tubes	3
Cuvettes	5
Stirring rods	3
Wash bottles	3
Hot plate	1
Heat lamp	1
Tape measures	3
Meter sticks	3
Pendulum bobs or ball on string	3
Masses up to 0.5 kg • Mass set or sand/rice with plastic bags	3
Stopwatches (or a clock w/a second hand)	3
Safety goggles	5
Hair dryer (optional)	1

Consumable	Quantity
Styrofoam cups (8-16 oz.)	10
Paper cups (8-16 oz.)	10
Ice	1-5 lb. bag

Consumable	Quantity
Distilled water	1 gal.
Various box labels w/ weight identified in both g and oz. • Rice, pasta, cereal, etc. • At least 5 different sizes	10 labels or more
Coffee filters or pieces of filter paper (2.5 cm^2)	10
Paper towels/ Kleenex®/Kimwipes®	1 roll/ box
Masking tape	1 roll
Small rubber bands	50
Balls (for bouncing) - basketball, racquetball, four square, etc. • At least 3 different types	5
Latex balloons	3
String	1 roll
Vinegar	1 gal. bottle
Ammonia	64 oz. bottle
Methanol (methyl alcohol)	10 mL
Ethanol (ethyl alcohol)	10mL
1-propanol (C_3H_7OH)	10 mL
1-butanol (C_4H_9OH)	10 mL
n-pentane (C_5H_{12})	10 mL
n-hexane (C_6H_{14})	10 mL
Green food coloring (substitute for nickel(II) sulfate)	1 bottle

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?

TI-Nspire™ Scavenger Hunt – The Calculator Application
PD Objectives • The primary goal of the activity is give participants practice using the Calculator application.
Materials Needed/Set Up Requirements • If needed, explain the difference between the Calculator application and the Scratchpad. • Do not introduce participants to the Scratchpad until later to avoid confusion.
Main Focus • Participants will become familiar with the Calculator application. • The instructor role for this activity is to walk around and observe.

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?

Who's Got a Better Coffee Cup?

PD Objectives

- Participants will use the Vernier® DataQuest™ application and a temperature probe.
- Participants will experience an open-ended problem in thermodynamics where they have to create the criteria for determining the best coffee cup.
- Participants will gather supporting evidence to prove they have the best coffee cup.

Materials Needed/Set Up Requirements

- Styrofoam and paper cups as well as any coffee mug of their choice
- 3 Vernier® EasyTemp™ USB temperature sensors per lab
- Hot plate or hot pot to warm water
- Ice

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- Ask the participants to create a strategy with what they have learned to this point to determine which coffee cup is the best.
- If they struggle, suggest that they can use hot water to help them. Try not to give them strategies but have them struggle like a student would in class.
- Help them set up time settings on the TI-Nspire handhelds.
- Each group might come up with a different strategy. Some might look at the slope of cooling of hot water in the cup and determine that the cup with the least slope is the best cup because it holds heat the best. A chemistry or physics teacher might calculate the heat loss over time using $q=mC\Delta T$.
- Be prepared to assist in analysis either selecting a section of a plot and getting the linear curve fit or doing 1-var statistics to get min and max temperature to get a ΔT.

Technology Tips

- 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
- 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.
- Time settings can be changed by selecting **Menu > Experiment > Collection Setup**.

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?

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?

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?

Falling Objects and More

PD Objectives

- In this simulation, participants will explore two objects falling to Earth, either with air resistance or in a vacuum.
- Air, mass, and height of the object will be varied, and participants will examine the velocity and acceleration of the object as a function of time.

Materials Needed/Set Up Requirements

- *Falling_Objects_and_More.tns*

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- Upon identifying the variables involved in this simulation, discuss why it is critical for students to understand the meaning of each variable.
- To examine the impact of altering a specific variable, consider asking students (or groups) to perform the simulation with all variable the same except one. For example, all students keep the "vacuum" variable deselected, while some drop the feather and others drop the basketball (both from approximately the same height).

Technology Tips

- Use Class Capture, Live Presenter, and Quick Poll as appropriate.

Summary Reflection Questions

- How does selecting/deselecting the "vacuum" variable provide an opportunity to correct students' misconceptions about gravity and air resistance?
- What other types of lessons could effectively supplement this simulation?

Boyle's Law

PD Objectives

- Participants will become familiar with TI-Nspire™ technology and the Vernier DataQuest™ application.
- Participants will use a Vernier gas pressure sensor to make pressure measurements.
- Using the data and graph, the type of mathematical relationship between pressure and volume of the confined gas can be determined.

Materials Needed/Set Up Requirements

- TI-Nspire™ CAS handheld, Vernier EasyLink® USB sensor interface or TI-Nspire™ Lab Cradle, Vernier gas pressure sensor, and a plastic syringe.
- *Boyles_Law.tns* or *Boyles_Law_MG.tns*

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- You might want to do this activity in two parts.
    - Initially the activity could be done without the *Boyles_Law.tns* document as an introduction to Events with Entry data collection with all participants doing the activity together.
    - The second part, as a Boyle's Law extension, would be to do the activity individually or in pairs using the *Boyles_Law.tns* document.

Technology Tips

- Progress can be monitored using the Class Capture feature of TI-Nspire™ Navigator™ System.

Summary Reflection Questions

- Discuss how the animation in the TI-Nspire document helps students understand at the molecular level the pressure of gases. This is a good pre-lab activity.
- Did you have issues with:
    - the technology?
    - the directions in the TI-Nspire document?
    - the calculations?
- What did you like about this activity?
- What did you not like that you would want to improve?
- Where would this activity fit into your curriculum?

Body Mass Index

PD Objectives

- Explore the body mass index (BMI) calculator.
- Students will model data with a moveable line to determine the relationship between weight and percent body fat.
- Teachers will add a Lists & Spreadsheet page, assigning variables to columns and entering data.
- Teachers will add a Data & Statistics page plotting two sets of data.
- Teachers will answer different question types.

Materials Needed/Set Up Requirements

- *Body_Mass_Index.tns*

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- Talk to teachers about their predications of what affect weight has on percent body fat. “Is it a linear or non-linear relationship?”
- Discuss defining appropriate variables. As examples, column A could be defined as **Weight**, column B as **My_BF**, and column C as **Your_BF**.
- Plot both data sets of percent body fat.
- Have participants color or define the difference in color between the two graphs.
- Which graph represents the taller person? The graph with the lesser *y*-intercept is the taller person.
- Focus on the slope of the graph and how it relates to percent body fat divided by weight in pounds.
- Discuss the *y*-intercept and that a person that has a mass of zero doesn’t exist.

Technology Tips

Summary Reflection Questions

- How would you present this activity to your students?
- What other questions would you like them to focus on?
- What are discussion questions that you would hope this leads to?

NASA – Lunar Surface Instrumentation

PD Objectives

- Teach participants the use of geometry tools to solve vector problems.
- Teach the use of the Calculator application to solve vector problems.
- Demonstrate the use of variables with assigned values.
- Demonstrate measurement tools on Graphs and Geometry pages.

Materials Needed/Set Up Requirements

- *Lunar_Surface_Instrumentation.tns*
- *Lunar_Surface_Instrumentation_Solutions.tns*
- *Instrumentation2.tns*
- *Instrumentation2_Solutions.tns*

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- Discuss the following questions with participants:
  - How do you typically discuss vectors in your classes?
  - How can you explore component vectors on the handheld?

Technology Tips

- Use ctrl menu to show Context menus.

Summary Reflection Questions

- How can this make the concept easier than how you teach it now?
- Would this save you time in your class?

Getting Started with the TI-Nspire™ Family of Teacher Software

PD Objectives

- Participants will explore basic features of the TI-Nspire Teacher Software, such as adding applications, exploring menus and submenus, and viewing settings.

Materials Needed/Set Up Requirements

- Computer with TI-Nspire Teacher Software

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- As participants explore the Welcome Screen, encourage them to move their cursors over each icon to see a description of the given feature. This is a universally helpful skill when exploring the TI-Nspire Teacher Software.
- As participants move from the Calculator application to the Graphs application, ask them what happens to the menus in the Documents Toolbox under the Document Tools tab. Participants should recognize that each application has its own unique menu.
- Encourage participants to explore the various menus and submenus in the Document Tools tab. Also, encourage participants to explore the Utilities, Page Sorter, TI-SmartView™ emulator for TI-Nspire, and Content Explorer tabs.
- As participants explore the various Document Views and TI-SmartView emulator views, discuss how each view might be helpful in the classroom.
- Though participants will not collect any data during this activity, they are asked to insert a page with the Vernier DataQuest™ application. The purpose is to expose participants briefly to the data collection features of the Teacher Software.
- When exploring the Document Settings, discuss the options available in each field. Make sure participants are comfortable tabbing through fields and changing the settings.

Technology Tips

- Sometimes participants do not immediately see the five icons in the Documents Toolbox. Consider emphasizing the location of these icons.

Summary Reflection Questions

- What types of features are available in the Documents Toolbox?
- How does the Documents Toolbox change when working with different applications?
- How might the various Document Views and the TI-SmartView emulator options be helpful in the classroom?

Energy Loss of a Ball

PD Objectives

- Participants will learn to use the Vernier® DataQuest™ application to collect CBR 2™ data.
- Participants will strategize on methods to measure energy loss of a ball.
- They will collect ball bounce data and spend time analyzing data to determine energy loss either by the height of the ball on each bounce or by the velocity of the ball as it hits the floor.
- Participants will summarize their results and explain why a ball might or might not lose energy.

Materials Needed/Set Up Requirements

- CBR 2™ motion sensor
- 3 different types of balls

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 different forms of energy, potential and kinetic: $E_p = mhg$ and $E_k = ½\ mv^2$.
- Have participants focus on what variables they need to measure and what variables are constant in this experiment.
- Participants need to determine the method of measuring and what data needs to be analyzed.
- Discuss the importance of not only defining variables in a problem but how to measure these variables and the constraints that must be considered to get results to support a hypothesis.

Technology Tips

- 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
- The Vernier DataQuest app for TI-Nspire can be opened in the same way that any other TI-Nspire application is opened if it does not start automatically.
- Show the participants how to add a tangent line and point out that on the left side of the screen they will see the time, the height, and the slope of the tangent line.
- Explain how to save their data if they would like to come back to it tomorrow and do more analysis.

Vernier – Evaporation and Intermolecular Attractions

PD Objectives

- This experiment investigates temperature changes caused by the evaporation of several liquids, and relates the temperature changes to molecular sizes for similar liquids (e.g. alcohols vs. alcohols) and to the strength of intermolecular forces of attraction for dissimilar liquids (e.g. alcohols vs. alkanes).

Materials Needed/Set Up Requirements

- *20_Exaporation_and_Intermolecular_Attractions.tns*
- methanol (CH_3OH) and isopropanol [$(CH_3)_2CHOH$]

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- This activity showcases the TI-Nspire™ Lab Cradle. You will use two temperature sensors simultaneously.
- The experiment can be performed with two commonly available liquids—methanol (CH_3OH) and isopropanol [$(CH_3)_2CHOH$].
- **Fuel line antifreezes** usually are pure isopropanol or pure methanol. Look at the ingredients of the bottle to find out which is which. You can usually find these in gas stations, convenience stores, or auto parts stores. A popular brand is HEET; the red bottle is isopropanol and the yellow bottle is methanol.
- As a wrap-up, make sure to discuss the activity with the participants. Emphasize the relationship between molecular size and the graphs of temperature vs. time.

Technology Tips

Summary Reflection Questions

- Discuss the roles of molecular size and molecular interactions on the rate of evaporation.
- Did you have any issues with the technology? The directions in the TI-Nspire document? The calculations?
- What did you like about this activity?
- What did you not like that you would want to improve?
- Where would this activity fit into your curriculum?

Vernier – Tic Toc: Pendulum Motion

PD Objectives

- This activity has the student measure the amplitude, period, and offset distance for a pendulum using a meter stick and a stopwatch. Although these values could be obtained from the Motion Detector graph, independent measurements show the student that the Motion Detector is using the same distance and time standards as conventional instruments.
- Avoid using a soft or felt-covered ball for the pendulum bob, as the ultrasonic waves from the motion detector tend to be absorbed by these surfaces. A ball with a hole drilled through its center works well, as do a large fishing bobber or an empty soft drink can.

Materials Needed/Set Up Requirements

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- Have participants open a new document. Instruct them how to name and save this new document.
- Progress can be monitored using the Class Capture feature of the TI-Nspire™ Navigator™ System. The TI-Nspire™ Navigator™ Teacher Software should be used to model for the participants and to help those who are struggling. Consider using the Live Presenter feature.
- At the end of the activity, the document can be collected and saved to the Portfolio.
- As a wrap up, discuss the activity and emphasize how the mathematics enhances the understanding of the science concepts.

Technology Tips

Summary Reflection Questions

- Why is it important to ask students to measure period, amplitude and equilibrium position as opposed to finding them from a graph of the data?
- What is the relationship between period and frequency? Did all groups have the same period if they used the same mass? This relates to the science extension and what the period depends upon for a pendulum.
- Did you have any issues with the technology?
- What did you like about this activity?
- What did you not like that you would want to improve?
- Where would this activity fit into your curriculum?

Vernier – Lights Out! Periodic Phenomena

PD Objectives

- Use the TI-Nspire™ Lab Cradle to collect data at a fast rate.
- Use the light sensor.
- Examine periodic relationships including period and frequency.
- Discuss alternating current.

Materials Needed/Set Up Requirements

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- Use the data already collected during the activity *Vernier –That's the Way the Ball Bounces*. Have participants add pages to the ball bounce TI-Nspire document.
- This activity has two parts. In the first part, the data is collected slowly by participants' moving their thumbs on and off of the light sensors. In the second part, the sensor is pointed toward a fluorescent light and the sensor detects the alternating current turning the light on and off very quickly. If you are pressed for time, you may want to do only the second part.
- Stress that the TI-Nspire Lab Cradle is required for data collection at rates greater than 200 samples per second, because that is the maximum collection rate for the Vernier EasyLink® USB sensor interface.
- Encourage questions and sharing of "discoveries."

Technology Tips

- Discuss how to slide the handheld into the TI-Nspire Lab Cradle, and how to determine which port to use for analog versus digital data collection.

Summary Reflection Questions

- How does this activity help students to develop an understanding of the relationship between period and frequency?
- How can this activity be used to assist students in making connections in both science and mathematics?
- How does the combination of the two parts of this activity help a student understand what is happening with alternating current?
- What does *period* mean in a physical sense?

The Carousel – Exploring TI-Nspire™ Activities

PD Objectives

- Participants will choose one or two activities to explore, discuss, and report back to the group.

Materials Needed/Set Up Requirements

- Any activities from the participant binder not yet tried
- Content resources on the TI-Nspire™ Teacher Software
- Any activities participants have found or you suggest in response to questions

Main Focus – Suggested Questions/Strategies for Accomplishing Objectives

- One basic principle of adult education is to provide the learners with opportunities for self-directed learning. The Carousel gives participants the chance to choose their own activities and work through them in a manner that fits their needs. An introduction during the computer lab session would be helpful so participants have a chance to look for ideas beforehand.
- Plan for about 3 hours at the end of the workshop. Participants should have 1.5 to 2 hours to work on one or two self-selected activities, and each activity group should give a presentation of about 10 minutes to the whole group.
- Encourage participants to collaborate in groups and focus on pedagogical implications, their own TI-Nspire skills and comfort, and critical evaluations of the activity for their classroom. Keep in touch with their work and help them see how to adapt an activity for their needs.
- Use of laptops, handhelds, and/or the computer lab is acceptable.
- When reporting back, have participants give a brief overview of the activity, the outcomes of the activity, and a summary of their critical discussions. Ask deeper questions to get at the ideas of pedagogical implications, appropriate use of technology, and their TI-Nspire skills to adapt or extend their activity. Leave time for a final wrap-up at the end.

Technology Tips

Summary Reflection Questions

- Ask participants why they chose the activity and encourage them to discuss issues around the effective use or adaptation of the activity for student learning
- Ask participants to discuss their own skill development with the TI-Nspire family of products.
- Encourage participants to share successes and challenges with the activity.
- Encourage them to provide key commentary on: “This activity is good for me to use in_(course)_ because ____.” Or, “This activity was not suitable for me to use in ____, but it could be used or adapted for ____.”