



Connecting Middle Grades Science and Mathematics with TI-Nspire™ and TI-Nspire™ Navigator™ – Day 1

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Materials for Workshop Participant*

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T³ Professional Development Categories and Learning Objectives

There are three categories of T³ Professional Development, each with a unique set of learning objectives. This workshop is focused on technology integration, and its objectives are as follows:

Technology Integration

- Emphasis on learning to use TI technology, with broad “how-to” coverage highlighting a wide range of features
 - Subject/content-focused training on appropriate usage of TI technology in the classroom
 - I am comfortable with essential technology skills for exploring math and science content.
 - I can design opportunities for students to use technology as a tool to deepen their understanding of mathematics and science.
 - I can locate and download TI activities that align to my standards.
 - I can describe the role technology should play in the successful implementation of my standards, and I can implement a vision of a classroom where students routinely use technology to engage in the practice and content standards.
-

Workshops focused on instructional practices and content knowledge have the following objectives:

Instructional Practices

- Emphasis on classroom practices with technology as a tool to enhance student learning
- Models CCSS, TEKS, and STEM tasks using in-depth discussions, reflective practices, and essential technology skills
 - I can demonstrate the importance of teacher actions for students’ engagement in the Practices, and I can take actions that will enable students to become mathematical and scientific practitioners.
 - I can describe the role that technology should play in the successful implementation of my standards, and I can implement a vision of a classroom where students routinely use technology to engage in practice and content standards.
 - I can design tasks for students to employ the Practices, using technology as a tool to deepen their understanding of mathematics and science.
 - I can ask questions designed to make student thinking visible – to push them to think about connections, make comparisons, or probe their understanding.

Content Knowledge

- Emphasis on content with technology as support
- Addresses critical, tough-to-teach topics and new content standards for CCSS or TEKS
 - I have a deeper understanding of the mathematics and science in my content area, and I am aware of the shifts in content that affect what I teach.
 - I can design opportunities for students to use technology as a tool to deepen their understanding of mathematics and science.
 - I can locate and download TI activities that align to my standards.
 - I can describe the role technology should play in the successful implementation of my standards, and I can implement a vision of a classroom where students routinely use technology to engage in the practice and content standards.



Connecting Middle Grades Science and Mathematics with TI-Nspire™ and TI-Nspire™ Navigator™ – Day 1

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I can...
Login to class.
Open a transferred TI-Nspire™ document.
Grab and drag an object.
Locate specific keys on the TI-Nspire™ keypad.
Open a new document.
Add an application to a new document.
Open the TI-Nspire™ CX Navigator™ Teacher Software.
Use the Documents Workspace.
Create a TI-Nspire™ Navigator™ class.
Create and start a TI-Nspire™ Navigator™ class.
Use the built-in Vernier DataQuest™ application.



Objective

- Participants will learn how students log in to a TI-Nspire™ CX Navigator™ class.

TI-Nspire™ Technology Skills:

- Logging in as a student

TI-Nspire™ CX Navigator™ Features

- Logging in to the TI-Nspire™ CX Navigator™ System from a handheld

Tech Tips:

- Make sure the font size on your TI-Nspire™ handheld is set to Medium.

The TI-Nspire™ CX Navigator™ System uses both your computer and your students' handhelds. Your computer and your students' handhelds communicate through the TI-Nspire™ CX Navigator™ access point.

You do not have to begin a class and have students log into the TI-Nspire™ CX Navigator™ network to communicate with your students' handhelds. Without beginning a class, you can use the Transfer Tool to send or delete documents and/or operating systems on the students' handhelds. However, if you plan to use Quick Poll, Class Capture, Live Presenter, or place documents in the Portfolio during the TI-Nspire™ CX Navigator™ class session, then you must log in student handhelds to the TI-Nspire™ CX Navigator™ network.

- On the teacher computer, within the TI-Nspire™ CX Navigator™ Teacher Software, press Begin Class.
- Turn on the handheld that is connected to a wireless network adapter (or locked in the cradle). You will notice the following icons on the handheld in the upper right hand corner.

Icon	Status	Meaning
	Blinking	The handheld is searching for an access point.
	Solid with ✓	The handheld has found an access point.
	Solid with a warning sign	The handheld is not communicating with the wireless network adapter. Detach the handheld from the wireless adapter, wait for the icon to disappear, and then reattach the handheld to the adapter.
	Blinking	The handheld is connected to the network and is ready to log in.
	Solid	The handheld is logged in to the network and is fully charged.



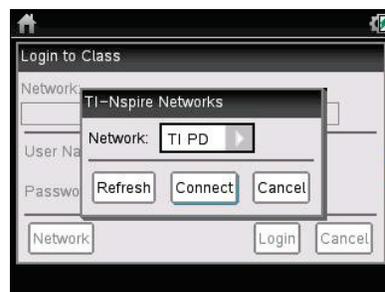
Student Login

TI PROFESSIONAL DEVELOPMENT

3. When the  icon appears in the upper right-hand corner of the handheld, a “Login to Class” dialog box will appear.
- If the dialog box does not appear, have students press  > **Settings > Login...**

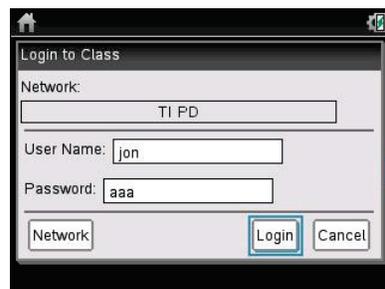
4. When logging in for the first time, a network must be selected. Click the **Network** button, select the appropriate network from the Network drop-down field, and click **Connect**.

- A network only needs to be selected once, not every time a handheld is logged in.



5. Students will first enter their User Name, press , and then enter their Password.

- Passwords must be at least 3 characters. The teacher might have chosen the student password when setting up the class.



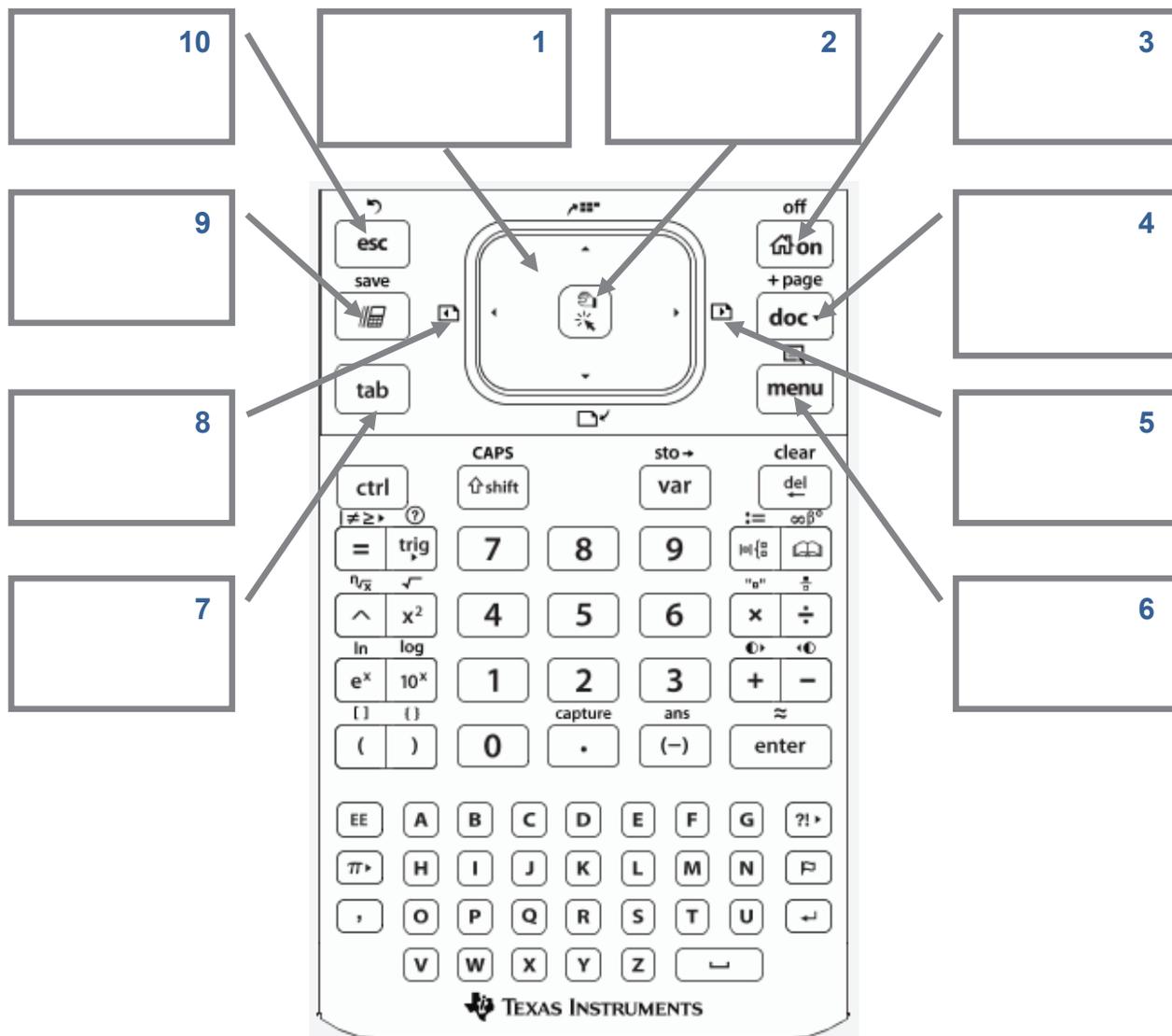
6. Press , and the “Login Successful” dialog box will appear on the handheld.



TI-Nspire™ CX Family Overview
TI PROFESSIONAL DEVELOPMENT

Activity Overview

In this activity you will become familiar with the most commonly used keys on the TI-Nspire™ CX family of handhelds.



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TI-Nspire™ CX Scavenger Hunt – The Calculator Application

TI PROFESSIONAL DEVELOPMENT

Activity Overview

In this activity, you will learn how to perform basic calculations in the Calculator application. You will also be introduced to various features and commands.

- Press $\boxed{\text{on}}$ twice. There are three sections on the screen. In the bottom section, there are seven icons which represent seven different applications. Predict what these applications are:

- What happens to the screen when you press and hold $\boxed{\text{ctrl}}$ and then tap $\boxed{-}$ several times? What happens when you tap $\boxed{+}$ instead?

- Open a New Document by using the Touchpad to move your cursor to New Document. Click by pressing $\boxed{\text{on}}$. If the handheld asks you, “Do you want to save?” answer ‘no.’
How did you answer “no”? _____
- Select ‘Add Calculator’ by pressing $\boxed{\text{enter}}$. How else could you select it?

- Press $\boxed{6} \boxed{\wedge} \boxed{5}$ and $\boxed{\text{enter}}$. How does the problem appear on your screen? _____
What is the answer? _____ Press $\boxed{2} \boxed{8} \boxed{\wedge}$ and explain what happens when you press $\boxed{\wedge}$.

Where is the cursor located? _____ Find 28^3 _____.
- Find 36^2 _____. There is a quicker way to type 36^2 without using $\boxed{\wedge}$. Instead we can use the $\boxed{x^2}$. Where is it located, and why is it faster this way? _____
- Type $\boxed{3} \boxed{\div} \boxed{8}$ and $\boxed{\text{enter}}$. What is the answer? _____
Try $\boxed{3} \boxed{\div} \boxed{8}$ again, only this time press $\boxed{\text{ctrl}}$ and $\boxed{\text{enter}}$. What is the answer? _____
One more time, type in $\boxed{3} \boxed{\div} \boxed{8}$, but this time include a decimal point at the end and then press $\boxed{\text{enter}}$. What is the answer? _____
- Press $\boxed{\text{ctrl}} \boxed{\div}$. What appears on your screen? _____ Where is the cursor? _____
Type in $\boxed{1} \boxed{2}$, press $\boxed{\text{tab}}$, type in $\boxed{9} \boxed{8}$, and press $\boxed{\text{enter}}$.
What is the answer? _____ What did pressing $\boxed{\text{tab}}$ do? _____
- Press \blacktriangle once so the last answer is highlighted, and then press $\boxed{\text{enter}}$. What happens?

Press \blacktriangleleft once. Where is the cursor? _____



TI-Nspire™ CX Scavenger Hunt – The Calculator Application

TI PROFESSIONAL DEVELOPMENT

Delete the current number by pressing $\boxed{\text{del}}$. Type in $\boxed{2}\boxed{8}$, and press $\boxed{\text{enter}}$. What is the answer?

10. Press \blacktriangle several times, and then press $\boxed{\text{enter}}$. Try this a few times. What happens?

11. Press \blacktriangle twice (to highlight the last problem you entered) and press $\boxed{\text{del}}$. What happens?

Press $\boxed{\text{del}}$ several more times. What is happening each time you press $\boxed{\text{del}}$?

12. Press $\boxed{\text{ctrl}}$ and \blacktriangle . What do you see? _____

Press $\boxed{\text{del}}\boxed{\text{enter}}$. What does the screen say? _____

13. Press $\boxed{\text{ctrl}}\boxed{0}$. This is a calculator screen, but what looks different about it? _____

Now type in $\boxed{3}\boxed{(}\boxed{5}\boxed{-}\boxed{8}$ and $\boxed{\text{enter}}$. What is the answer? _____

You typed in 3(5-8, but what does the problem look like on the handheld? _____

14. Press $\boxed{\text{ctrl}}\boxed{x^2}$ to get a square root. Then type $\boxed{2}\boxed{3}\boxed{-}\boxed{7}$, move one space to the right, and type

$\boxed{+}\boxed{2}\boxed{\text{enter}}$. What is the answer? _____

What does the problem look like on the screen? _____

What happened to the square root bar? _____

Where did the cursor move when you moved one space to the right? _____

15. Press $\boxed{(}\boxed{(-)}\boxed{1}\boxed{7}\boxed{)}\boxed{x^2}\boxed{\text{enter}}$. What is the answer? _____

What makes the $\boxed{(-)}$ button different from the $\boxed{-}$ button? _____

16. Press $\boxed{\text{ctrl on}}$, and open a New Document. Select 'No' when it asks if you want to save the document.

Press $\boxed{\text{ctrl}}\boxed{\text{ctrl on}}$ to turn off the handheld. **These are the last things you should do on your handheld before you put it away each day!**

17. How can you clear your screen entirely? _____

18. How can you recall the last answer? _____

19. How do you know where you are typing on the Calculator screen? _____

20. How can you make sure your answer is in the form of a decimal and not a fraction? _____



Introduction to the TI-Nspire™ CX Family

TI PROFESSIONAL DEVELOPMENT

<p>1. What keys on the handheld remind you of computer keyboard keys?</p>	<p>2. What keys on the handheld remind you of cell phone keys?</p>	<p>3. How can you access the secondary commands printed in blue lettering? [For “School Property” handhelds, the lettering is yellow.]</p>
<p>4. Turn the TI-Nspire™ CX on. If necessary, answer the questions as to language and font size. (Medium font size is recommended.)</p>	<p>5. Find the left/right/up/down arrows on the keypad. Where are they located?</p>	<p>6. Press  on. Describe what happens.</p>
<p>7. Move to this icon.  What message appears?</p>	<p>8. Move to this icon.  What message appears?</p>	<p>9. Move to this icon.  What message appears?</p>
<p>10. Move to this icon.  What message appears?</p>	<p>11. Move to this icon.  What message appears?</p>	<p>12. Move to this icon.  What message appears?</p>
<p>13. Move to this icon.  What message appears?</p>	<p>14. Press . Describe what happens. Press  again. What happens?</p>	<p>15. How much battery life is available? Explain how to determine this.</p>

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Demonstration – Formative Assessment

TI PROFESSIONAL DEVELOPMENT

Objective

- Demonstrate sending, collecting, and saving a TI-Nspire™ document with questions.

TI-Nspire™ CX Navigator™ Features

- Sending a document
- Auto-Refresh of Class Capture
- Collecting a document
- Viewing class results
- Saving to Portfolio

TI-Nspire™ Technology Skills:

- Logging into the TI-Nspire™ CX Navigator™ System
- Opening and navigating a TI-Nspire™ document
- Answering questions in a TI-Nspire™ document

Assessment Activity

Participants will be students in a classroom with a TI-Nspire™ CX Navigator™ System. ‘Students’ are asked a series of questions in a TI-Nspire™ document. The ‘teacher,’ your instructor, will use the Class Capture feature to monitor students’ progress through the assessment.

When all students have completed the assessment, the teacher will collect the questions and immediately review the results with the class. After class, the teacher can compare the results to previous questions asked on an earlier day to monitor learning over a period of time.

This is a demonstration activity. You will have the opportunity to perform all the TI-Nspire™ CX Navigator™ tasks in subsequent activities in the workshop.

Notes for Today’s Activity

These notes provide an overview of the activity, but they are not intended to describe all of the steps performed by the ‘teacher’ and ‘students.’

1. The teacher will start class and open a pre-made TI-Nspire™ assessment document (Demo_FA...tns).
2. Students log in to the class. One participant will wait and play the role of a student who comes to class late.
3. The teacher sends the document to the class.
4. The teacher monitors the documents being sent to the class.
5. The teacher uses Class Capture of the entire class to assist students in opening the document.
6. The teacher might use Live Presenter to review navigation of a document and answering questions.
7. The teacher will ask the “late student” to log in to the class. Note: The “late student” still receives the document and can begin working.



Demonstration – Formative Assessment

TI PROFESSIONAL DEVELOPMENT

8. The teacher uses the Auto-Refresh feature of Class Capture to monitor the progress of the class.
9. Ask students to press ctrl ^ when they are finished. This makes it easy for the teacher to know when students have completed their assessment because all of the screens will be the same.

Discussion Questions/Points:

- Why did the teacher Class Capture the entire class? Class Capture will ensure that late students will be part of the Class Capture when they log in to the class, assuming that Auto-Refresh is used.
- Why is Auto-Refresh useful? Students work at different rates. Class Capture with Auto-Refresh allows the teacher to monitor students as the class progresses.
- Once a student finishes an assignment, what types of additional tasks can be assigned to keep the student engaged? One reason that students sometimes become discipline problems is that they have finished their work. If the teacher knows which students are finished with their work, they can be given another task while waiting for the rest of the class.

10. When all students are finished, the teacher will discuss the types of questions that were included in the assessment and which ones can be graded automatically by the system.
11. The teacher will collect the document using one of two methods: Click the **Collect from Class** icon, or right-click on the document name in the Class Record.
 - The “Collect from Class” method has the option to delete the file after collection.
 - Using the right-click method does not include the option to delete the file, but it can be deleted later by selecting the **Delete from Class** icon.
12. The teacher can show the results in the Review workspace by right-clicking on the collection of the document in the Class Record.
 - The Page Sorter view in the Documents Toolbox allows navigation of the document and class results.
 - Correct answers appear in GREEN. If an answer is marked incorrectly, it can be adjusted.
 - Questions that aren’t auto-graded can be graded when viewing the results with the class.
13. Save the collected results to the Portfolio by right-clicking on the document in the Class Record.

Discussion Question:

- Why would you want to save the document to the Portfolio? Saving to the Portfolio allows the teacher to compare student results with previous work by the student to monitor improvement in student understanding.



Circuit Construction Kit

Middle Grades Student Activity

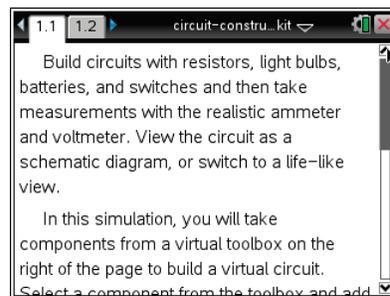


Name: _____

Class: _____

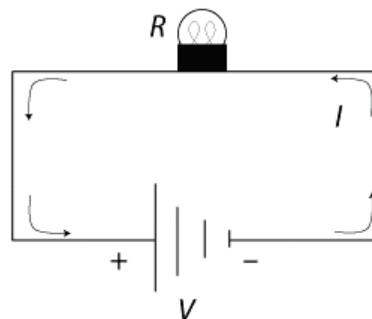
Open the TI-Nspire document *Circuit Construction Kit.tns*.

In this simulation you will learn about electrical circuits and you will construct simple circuits.



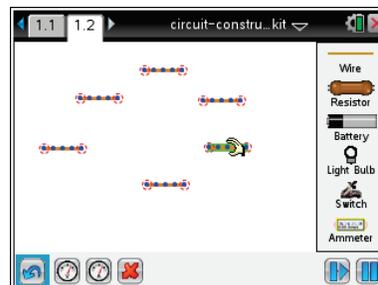
Read the information on page 1.1.

An **electric circuit** is a continuous loop of wire that carries **electric current** through it. There is a source of electricity and an **electrical device** that uses that electricity. In this diagram, a **battery** is the source of electricity. Wires connected to both ends of the battery allow current to flow through the wires. The electric current is used to power an electrical device, in this case a light bulb.

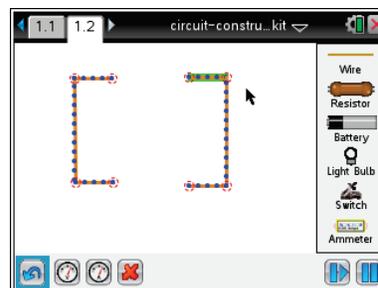


Move to page 1.2. Construct a circuit.

Step 1: Place six wire segments as shown. Select Wire  and then move the wire to the desired location. Select the wire again to drop it.



Step 2: Arrange the wires as shown, connecting the four corners. Select the middle of the wire to move the whole piece. Select either end and drag it to make the wire longer.

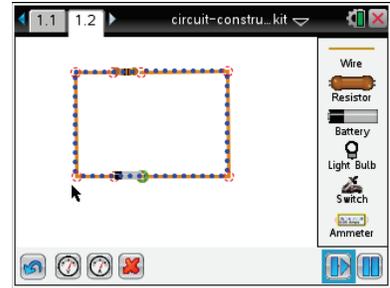


Tech Tip: To place a wire on the screen, select Wire . Then, place your finger on the wire and drag it to the desired location.



Tech Tip: If you accidentally connect two wires, you can undo the connection. Select the red circle connecting the wires and select . To delete a wire segment, select the middle of a segment and the wire is highlighted in green. Then select .

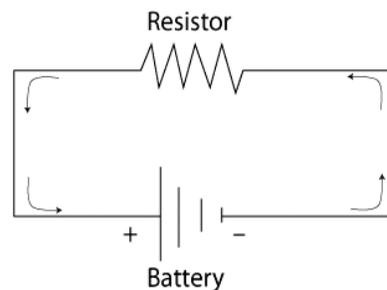
Step 3: Now place a resistor  in the top opening and a battery  in the bottom opening, as shown. Make sure the resistor and battery snap into wires.



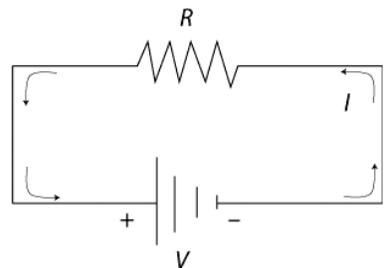
Q1. Describe what happens.

Part 1: Exploring Electric Circuits

This **circuit diagram** shows three key components of a circuit: (1) a closed loop of wire, **where electric current** flows, (2) a battery, which is the source of the electric current, and (3) a **resistor**, which affects the amount of current in the circuit.



The amount of current flowing through the circuit is denoted by I ; the amount of **resistance** R ; and the amount of force pushing current through the circuit is denoted by V , the **voltage**.





Circuit Construction Kit

Middle Grades Student Activity

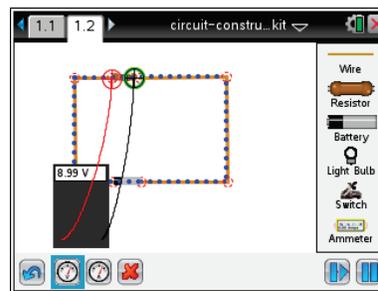


Name: _____

Class: _____

1. Measure the current and voltage in this circuit by selecting one of these buttons on the bottom toolbar:  . The one on the left is for voltage and the one on the right is for current.

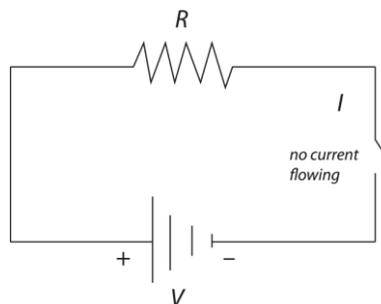
To measure voltage, place the two leads,  and , for voltage across the connections to the resistor. To measure current, place the single lead  over the circuit. Voltage is measured in volts and current is measured in **amperes**.



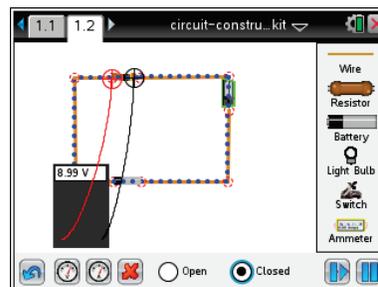
- Q2. What are the measurements for voltage and current?

Current will continue flowing through the circuit, unless the connection between any of the wires is interrupted.

In fact, you don't always want current flowing through a circuit. For that reason, a **switch** is another important component of a circuit. When the switch is closed, the current flows; when the switch is open, the current stops flowing.



2. Add a switch to the circuit. Highlight one of the points connecting two pieces of wire and select Delete  to disconnect the wires. Be careful that only one segment is highlighted, not the whole item. Bring a switch onscreen and connect it to the circuit. By default the switch is open. Select the circle next to "Closed" to close the circuit.



(Open Circuit Icon)



(Closed Circuit Icon)



Tech Tip: To disconnect two wires, select the red circle connecting the wires and select . After the switch is inserted into the circuit, select the switch to bring up the buttons to open or close it.



Q3. How can you tell that the circuit is open or closed other than the change in the icon?

The units of measurement for R are **Ohms**, and recall that the units for V are volts and I are amperes.

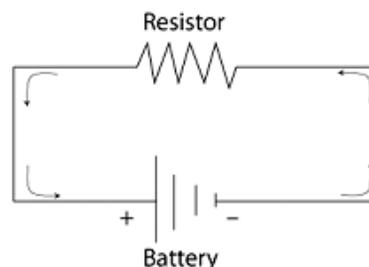
In fact, the relationship among the three variables is summarized in this formula:

$$V = I \cdot R$$

Q4. To calculate the resistance in the circuit, first solve the formula for R .

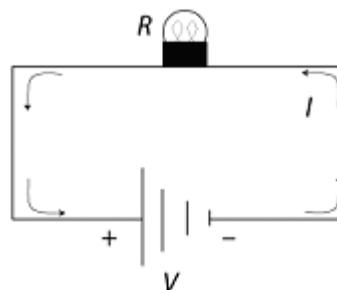
Q5. What are the values of V and I ?

Q6. Substitute the values of V and I into the formula from Question 4. What is the resistance in the circuit?



Part 2: Creating a Circuit with a Light Bulb

One of the most common uses for an electric circuit is to power an electrical device. And one of the most common electrical devices is a light. In this circuit a light is connected. This light has its own resistance (R) and its own voltage (V) and has current (I) flowing through it.





Circuit Construction Kit

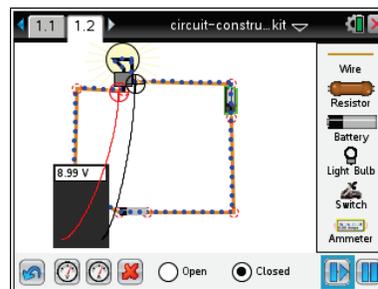
Middle Grades Student Activity



Name: _____

Class: _____

3. Replace the resistor with a light bulb. Select the resistor and select  to remove it. Select the light bulb button and place it in the open space. Grab and drag the wires from either side and connect them to each end of the light bulb. You may need to move the leads of the voltmeter in order to attach the wires to the light bulb terminals. Then select the switch. Select the open circle next to “Open” or “Closed” to turn the switch on and off.

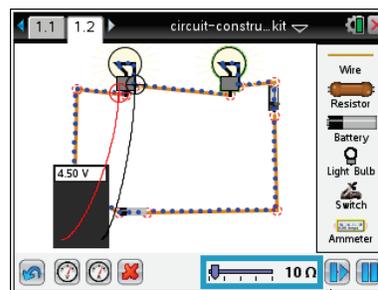


Tech Tip: To replace the resistor with the light bulb, select the resistor and select  to remove it.

- Q7. Describe what happens when you turn the switch on and off.
- Q8. How much current, or amps, is flowing through the bulb? What is the voltage?
- Q9. What are the values of V and I ?
- Q10. What is the amount of resistance, or value of R ? Substitute the values of V and I into the formula from Question 4 and simplify.

Part 3: Creating a Circuit with Several Light Bulbs

4. Now connect a second bulb next to the first one. You'll need to add another piece of wire. Try to get your screen to look like this.

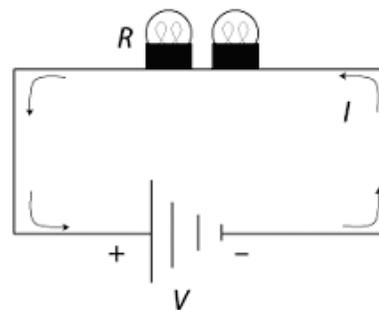




Adding two of the same kind of bulbs doubles the resistance. However, the voltage across the two resistors is the same. This is summarized in this formula.

$$V = I(R_1 + R_2)$$

$$I = \frac{V}{R_1 + R_2}$$



Q11. Calculate the current, I , using the formula in Step 4. Use the previous values for voltage, V , and the calculated value for resistance, R .

Q12. Run the simulation to check the calculated value for the current.

Q13. Suppose the circuit now had 10 bulbs. What would be the current?

Q14. What happens to the current as more electrical devices, such as light bulbs, are added to a circuit?



Science Objectives

- Students will describe electric current, voltage, and resistance and the units of measurements for these physical quantities.
- Student will construct a simple circuit with an on/off switch.
- Students will construct a simple circuit with multiple bulbs.

Vocabulary

- | | |
|--------------------|--------------|
| • ampere | • resistance |
| • battery | • resistor |
| • circuit diagram | • switch |
| • electric circuit | • volt |
| • electric current | • voltage |
| • ohm | • voltmeter |
| • ammeter | • schematic |

About the Lesson

- This lesson uses a simulation environment for constructing electric circuits. Students construct simple series circuits and measure voltage and current. They also work with equations relating voltage, current, and resistance.
- As a result, students will:
 - Describe an electric circuit.
 - Use formulas to calculate resistance, voltage and current.
 - Construct series circuits.

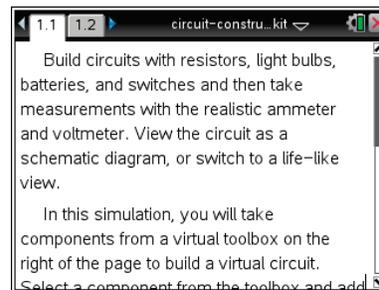


TI-Nspire™ Navigator™

- Send out the *Circuit Construction Kit.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to allow students to show the class how to build circuits and use the meters.

Activity Materials

- Compatible TI Technologies:  TI-Nspire™ CX Handhelds,  TI-Nspire™ Apps for iPad®,  TI-Nspire™ Software



Tech Tips:

- This activity includes screen captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at <http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials>

Lesson Files:

Student Activity

- Circuit_Construction_Kit_Student_MG.doc
- Circuit_Construction_Kit_Student_MG.pdf
- Circuit_Construction_Kit.tns

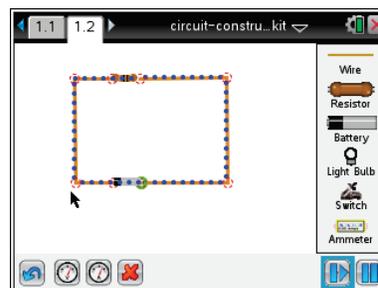


Discussion Points and Possible Answers

Allow students to read page 1.1 and the information on the activity sheet.

Move to page 1.2.

Students are to place six pieces of wire on the screen and arrange them as a rectangle with two horizontal gaps. These gaps are for the resistor and the battery. The current will begin to flow when the circuit is connected. Students can select the Pause button to pause the current flow.



Tech Tip: If students accidentally connect two wires, they can undo the connection. Select the red circle connecting the wires and select . To delete a wire segment, select the middle of a segment and the wire is highlighted in green. Then select .

Q1. Describe what happens.

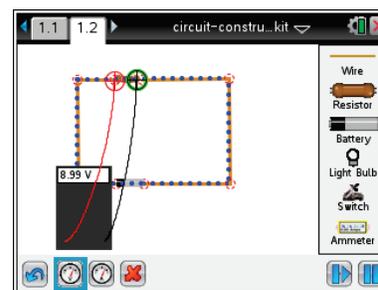
Answer: Current starts flowing.

Part 1: Exploring Electric Circuits

In this part of the lesson students construct a simple electric circuit with a resistor. They also measure current and voltage and add a switch to the circuit.

1. Measuring the voltage and current means placing the probes on the circuit itself. In particular, the two leads for the volt meter should be placed on either side of the resistor, in such a way that the readout is positive.

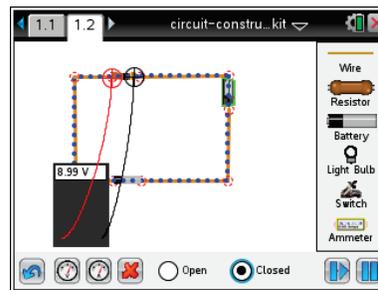
Q2. What are the measurements for voltage and current?



Answer: Voltage = 9.00 V; current = 0.9 Amps



2. Adding a switch to the circuit involves disconnecting one of the wires. To do so, select a wire. It will be highlighted green. Select Delete to disconnect the wire. Then place the switch between these wires.



Tech Tip: To disconnect two wires, students will select the red circle connecting the wires and select . After the switch is inserted into the circuit, select the switch to bring up the buttons to open or close it.

- Q3. How can you tell that the circuit is open or closed other than the change in the icon?

Answer: Current stops when the switch is off and the circuit is open. Current flows when the switch is on and the circuit is closed.

- Q4. To calculate the resistance in the circuit, first solve the formula for R .

Answer: $R = \frac{V}{I}$

- Q5. What are the values of V and I ?

Answer: $V = 9.00$ volts, $I = 0.90$ Amps

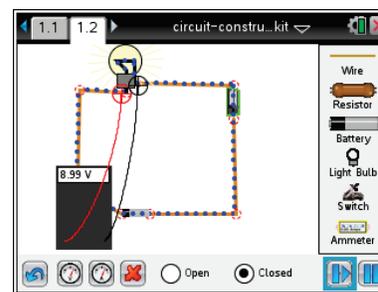
- Q6. Substitute the values of V and I into the formula from Question 4. What is the resistance in the circuit?

Answer: 10 ohms

Part 2: Creating a Circuit with a Light Bulb

Having seen how a basic circuit works, students can now build a circuit with a single light bulb.

3. Have students replace the resistor with a light bulb. This involves highlighting the entire resistor (so that the whole thing is green) and selecting Delete to remove it. Then select the light bulb button and connect the bulb to the circuit. Remind students that a light bulb is itself a source of resistance. Share with the kids the





difference between a joint/connection being selected and the complete item (light, battery, etc.).



Tech Tip: Students may need to move the leads of the voltmeter away from the circuit in order to connect the light bulb to the wires.

Q7. Describe what happens when you turn the switch on and off.

Answer: When the switch is on, the current flows. When the switch is off, the current is no longer flowing.

Q8. How much current is flowing through the bulb? What is the voltage?

Answer: Voltage = 9.00 V; current = 0.9 amperes

Q9. What are the values of V and I ?

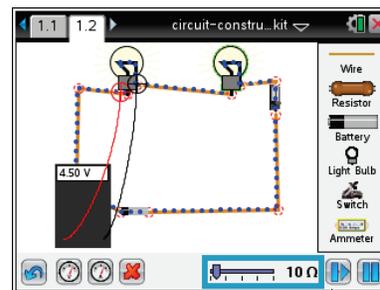
Answer: $V = 9.00$ volts; $I = 0.9$ Amps

Q10. What is the amount of resistance, or value of R ? Substitute the values of V and I into the formula from Question 4 and simplify.

Answer: 10 ohms

Part 3: Creating a Circuit with Several Light Bulbs

Adding a second bulb allows you to explore the impact on the current when a second source of resistance (a second light bulb) is added.



Q11. Calculate the current, I , using the formula in Step 4. Use the previous values for voltage, V , and the calculated value for resistance, R .

Answer: 0.45 amperes



Q12. Run the simulation to check the calculated value for the current.

Answer: Check students' work.

Q13. Suppose the circuit now had 10 bulbs. What would be the current?

Answer: 0.09 amperes

Q14. What happens to the current as more electrical devices, such as light bulbs, are added to a circuit?

Answer: The more devices are added, the more the current decreases.

**TI-Nspire Navigator Opportunities**

Allow students to volunteer to be the Live Presenter and demonstrate how to adjust/add and remove the components of the circuit. Use Quick Poll to check for understanding during the course of the activity.

Wrap Up

When students are finished with activity, collect students' worksheets.

Assessment

- Formative assessment will consist of questions embedded in the student worksheet. Analyze questions in the student worksheet with the students.
- Summative assessment will consist of questions/problems on the chapter test.

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Objective

- Perform various TI-Nspire™ CX Navigator™ skills demonstrated in previous activities.

About the Lesson

- Participants will role-play in this activity as a teacher and/or a student.
- The participant playing the role of the teacher will conduct a directed lesson using the features of the TI-Nspire™ CX Navigator™ System.
- The participant playing the role of the student will perform the tasks of a student for the lesson.
- Participants should then switch roles and repeat the process for another lesson.

TI-Nspire™ Navigator™ Features

- Setting Up a Class
- Sending a Document
- Class Capture
- Live Presenter
- Quick Poll
- Portfolio Workspace
- Student Data

Roles

Working in pairs, assign one role as the teacher and one role as the student. The “teacher” will operate the computer, and the “student” will operate two TI-Nspire™ handhelds. Participants will have an opportunity to switch and experience both roles.

Instructions

If a step below has **Teacher** in front of it, the participant operating the computer will perform the task. If the instruction has **Student** in front of it, the participant operating the TI-Nspire handhelds will perform the task.

TI-Nspire™ Technology Skills:

- Opening and navigating a TI-Nspire™ document

Lesson Materials:

Equipment

- Computer with TI-Nspire™ CX Navigator™ Teacher Software (for a pair of participants) with two USB ports
- Two TI-Nspire™ CX learning handhelds per participant
- Standard A to Mini-B USB Cables

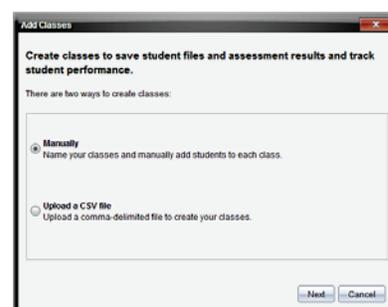
Adding a Class

- Teacher:** Open the Teacher Software on the computer by double-clicking the Teacher Software icon on the desktop.
 - If necessary, close the Welcome Screen.
- Teacher:** If necessary, open the Class workspace by clicking on the **Class** tab.
- Teacher:** Select the **Add Classes** icon from the tool bar, or select **Add Classes** from the **Class** menu.
- Teacher:** Click on **NEXT** to enter the class and students manually.
 - The process for uploading a CSV file to create classes is located in a tip sheet. It can be discussed at a later time.
- Teacher:** Enter “Practice Class” as the class name and “3rd Period” as the section.
 - It is not necessary to complete the Section field. But it allows teachers to name classes by subject only (e.g. Algebra) and use the section field to distinguish between classes of the same subject (e.g. 3rd Period).

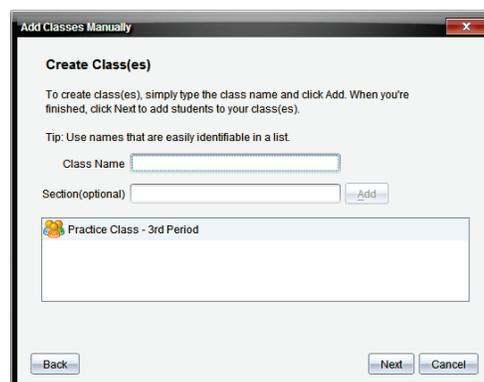
Version	TI-Nspire	CAS
v4.x		
v3.9		



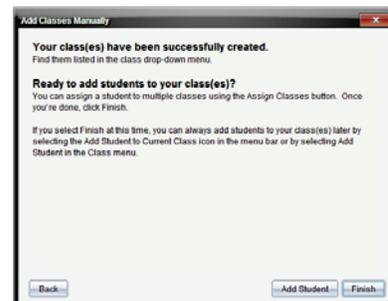
 Add Classes...



- Teacher:** Click on the **Add** button.



- Teacher:** Click **Next**.





Adding Students

1. **Teacher:** To immediately add students to the class, click the **Add Student** button.

- If the teacher closes the Class Wizard by clicking **Finish**, select the **Add Student** icon or select **Add Student** from the **Class** menu.



2. **Teacher:** For each student below, enter the first name, last name, and user name into the Add Students window. Select **Add Next Student** to add another student.

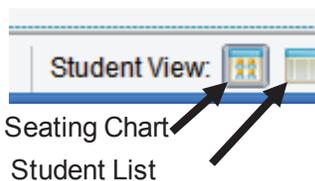
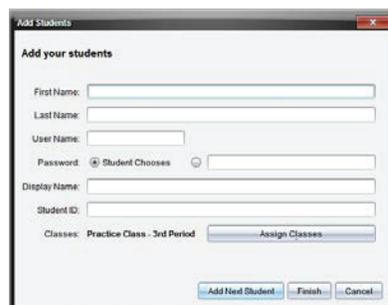
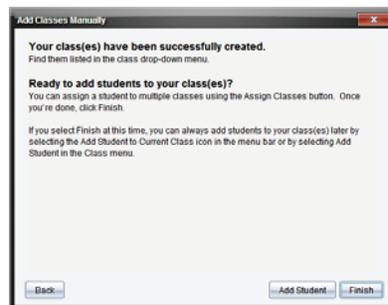
- Jon, Smith, Jon
- Deb, Jones, Deb
- Marco, Polo, Marco
- Sonja, Perez, Sonja
- Raymone, Tyson, Raymone

3. **Teacher:** You can choose a password for each student, or each student can choose his or her own password when they log in to the class for the first time.

- This will then be the student's password unless the teacher chooses to reset it.
- By default, the Display Name is the student's first name. The Display Name can be edited as desired.
- The Student ID is optional but sometimes important if you want to import grades into grade book software.

4. **Teacher:** After the last student's name is entered, click **Finish**.

5. **Teacher:** To switch the student view between **Seating Chart** and **Student List**, use the Student View icons in the lower right corner of the software.



Log in Students

1. **Teacher:** Begin the class by clicking **Begin Class**.
 - Each student's icon should change from light gray to light blue/yellow.
2. **Teacher:** Connect both of the TI-Nspire™ handhelds to your computer using USB cables. One end goes into your computer's USB port and the other into the TI-Nspire™ handheld.





Note: In your classroom, each student's handheld will not be connected to your computer in this way. They will each have their own wireless module that will communicate with your computer.

3. **Student:** Turn on each handheld.
4. **Student:** Log in a student on one of the handhelds.
 - The login window should pop up on the handheld's screen.
 - If it does not, press  to access the Home screen, select  for Settings and  for Login.



5. **Student:** Type **jon** as the username of one handheld, press  on the Touchpad/Clickpad, type **abc** as the password, and press .
 - You will see a message pop up on the handheld stating: "You are logged in as user: jon"

6. **Student:** Press  to select the OK button.



Note: The passwords used can be the same for all students or unique to each individual. Some teachers assign everyone the same password so that they do not have to reset any passwords. Some teachers allow students to pick their own passwords.

7. **Student:** Log in as **deb** on the other handheld.
 - If necessary, press  to access the Home screen, select  for Settings & Status and  for Login.
 - **Student:** Type **deb** as the username of another handheld, press  on the Touchpad/Clickpad, type **abc** as her password, and press .
 - You will see a message pop up on the handheld stating: "You are logged in as user: deb"
8. **Student:** Press  to select the OK button.

Send a Document

1. **Teacher:** Click **Send to Class**.
2. **Teacher:** Browse for the TI-Nspire™ document titled *Density_of_Metals.tns* provided for this activity in the location specified by your instructor. Click on the TI-Nspire™ document name so that it is highlighted.
 - Each person, when in the Teacher role, should use *Density_of_Metals.tns*.

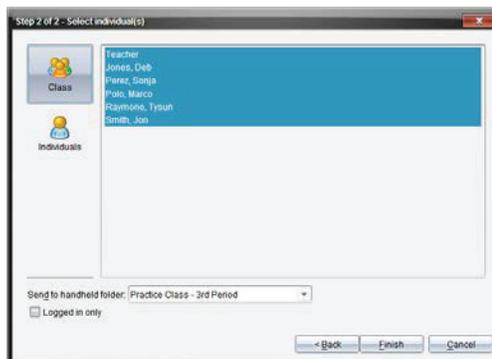




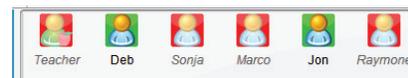
3. **Teacher:** Click **Finish** to send the document to the handhelds.
 - You are able to send a document to specific individuals. However, the default is to send to the entire class. This is advisable because late students automatically get the document after they log in with minimal disruption.
 - You do not have to wait until the students log in before sending a TI-Nspire™ document. Documents can be sent any time after a class has been started.
 - On the handheld, all documents will be sent to a folder with the same name as the class (in this case, the Practice Class – 3rd Period folder).

4. **Teacher:** Click on the 1st row in the Class Record. The row will turn blue, and you will see red and green student icons in the Classroom View.
 - A green icon indicates that the student has received the document; a red icon indicates that that student has not received the document.
 - Students with a red icon might be absent, or communication has been disrupted.
 - It is good practice to monitor the transfer of the documents sent to ensure that your students receive them.

5. **Student:** Students know they have received a document based on the “Transfers Complete” pop-up window.



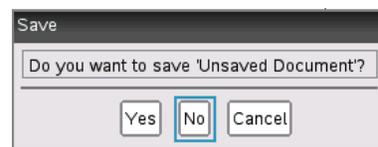
Class Record		
Action	File Name	Status
	NavLinTransformati...	2 of 6



Open the Document

Remember: The participant in the **teacher** role should be looking at the computer screen and not the handhelds. The participant in the **student** role should be looking at the screen of their handheld and not the computer screen. This is to model the classroom experience.

1. **Student:** Pick **one** of the two handhelds and follow the Teacher’s instructions in step 2.
2. **Teacher:** Say: “Open the document that was just sent to your handheld. To do this, Press **enter** or **del**”
 - If the handheld had a document open prior to opening this one, you would be asked to choose whether to save the prior document. Select No by pressing .



Class Capture and Live Presenter

1. **Teacher:** Without looking at the student handhelds, press the **Take Screen Capture** icon and select **Class Capture**.

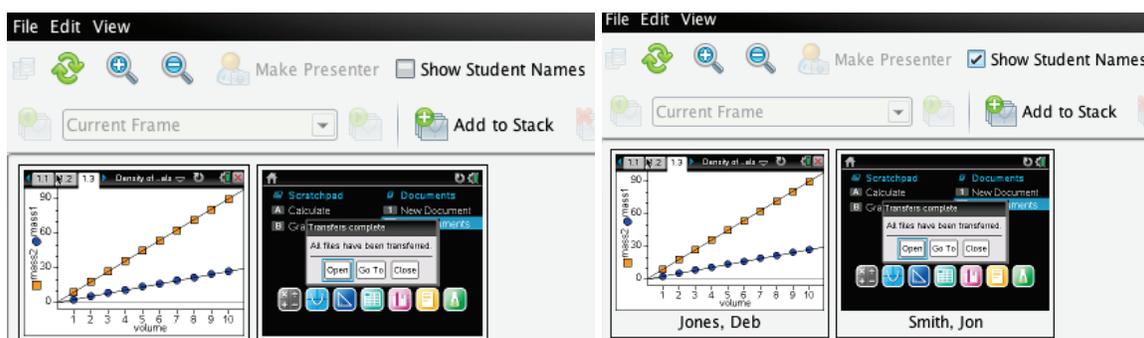


2. **Teacher:** Click on the check box next to “Logged in only” to place a check mark inside. This will show screen captures for only those students that have logged in. Click **OK** to display the screens.



3. **Teacher:** If the student only opened the document on one handheld as requested, the participant playing the role of teacher will notice that one student in the class has not opened the document.

4. **Teacher:** Click on the check box beside Show Student Names, and observe the names appearing under the screenshots.



Pause and Think About:

- Are there scenarios where you want to see the name with the screenshot of each handheld?
- Can you think of a scenario where you would not want the names displayed?
- If you notice that a student has not yet followed your instructions, how could you get the student back on track?

5. **Teacher:** Click on the one screen capture that does not have the first page of the document. It might be Jon’s or Deb’s handheld.

- You want all students to properly process your verbal instructions. Class Capture can help you in this regard.

How do you get this student back on track?

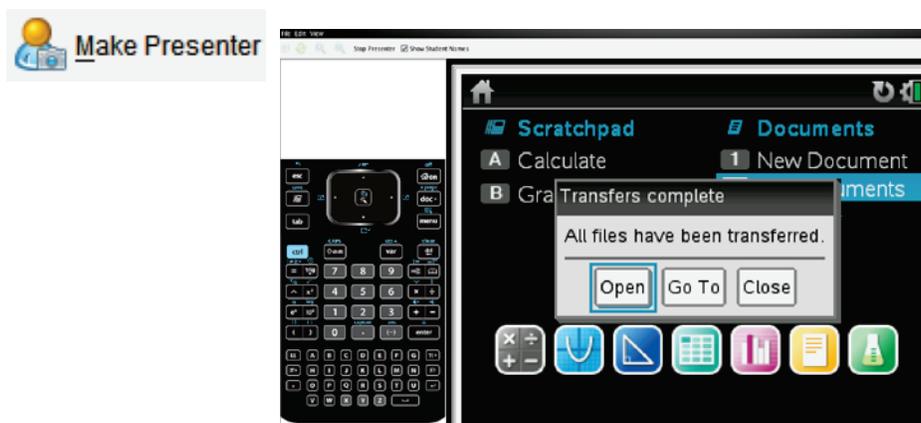
- One strategy makes use of the Show Student Names feature within Class Capture to identify students that are having difficulty. Students close to them can help them get back on track.
- Another strategy to get a student back on track is to make the student the Live Presenter and coach the student back. This is the strategy described below.

The TI-Nspire™ CX Navigator™ Science Classroom

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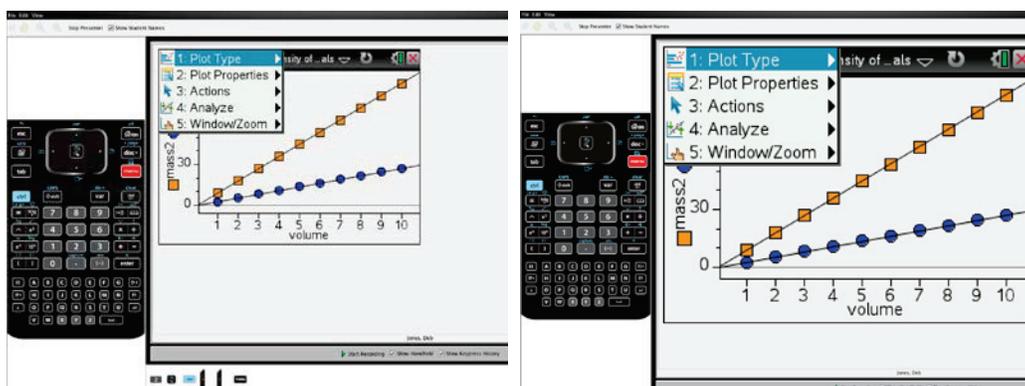


6. **Teacher:** Click on the Screen Capture of the student who is not on the appropriate screen, and click the **Make Presenter** button. You can now view a live feed of the handheld belonging to that student.
- You will see the student's handheld on your computer screen.
 - The Live Presenter is a tool inside Class Capture that will show what the student is doing in real time. See Below. Note that you will see the handheld type used by the student according to the keypad they are using. This student is using TI-Nspire™ with Touchpad.

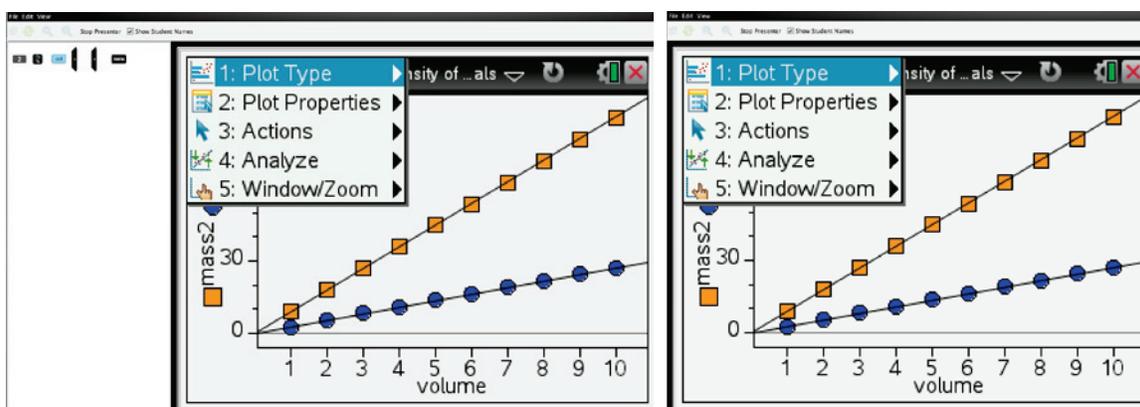


7. **Student:** Pick up the second handheld that has Deb logged into it, and follow the teacher's directions.
8. **Teacher:** Direct the student to press **enter** or  on the handheld to open the document that was sent to the class.

Note: The teacher can customize the layout of the presenter. Currently, the default is to show the Handheld and Key Press History. You can turn off either or both of these views to customize the Live Presenter. You will see the key press history and the screen changing in real time. Notice on your computer software that you will see the specific buttons the student pushes identified by red outlines.



Show Handheld and Key Press History Show Handheld Only



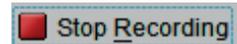
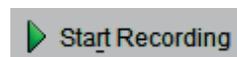
Show Key Press View Only Neither Handheld Nor Key Press History

Note: One other important feature of Live Presenter is the ability to record keystrokes. Pressing **Start Recording** initiates the recording of an .avi video file. When you press **Stop Recording**, you will be prompted to save the .avi file in the Practice Class folder that exists on your computer.

9. **Teacher:** Once this student has opened the document, click on the **Stop Presenter** button.
10. **Teacher:** Direct the student to interact with the document using the accompanying Student Activity handout (if applicable).
11. **Student:** Interact as directed with the TI-Nspire document.
12. **Teacher:** While students are working, monitor their progress with the Class Capture. Refresh manually or set up Auto-Refresh as desired

Pause and Think About:

How could the use of Class Capture and Live Presenter change the way you can teach?



Stop Presenter



Auto-Refresh: 30 seconds

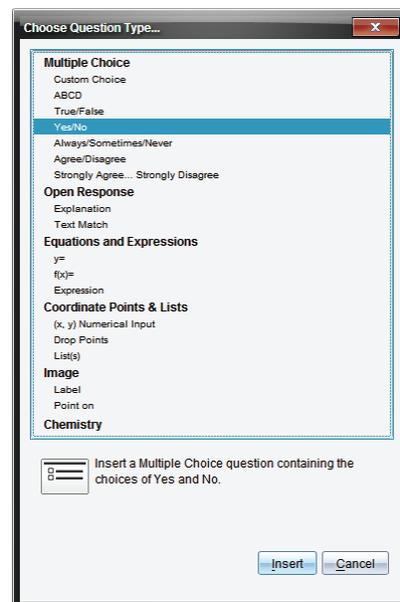
Quick Poll

1. **Teacher:** Close the Class Capture feature of the software on your computer.

2. **Teacher:** Now, click the **Quick Poll** icon.



- The Choose Question Type dialog box appears.
- There are a variety of question types available:
 - Multiple Choice: Custom Choice, ABCD, True/False, Yes/No, Always/Sometimes/Never, Agree/Disagree, Strongly Agree... Strongly Disagree
 - Open Response: Explanation, Text Match
 - Equations and Expressions: $y=$, $f(x)=$, Expression
 - Coordinate Points & Lists: (x,y) Numerical Input, Drop Points, and List(s)
 - Image: Label, Point on
 - Chemistry



3. **Teacher:** Select the Multiple Choice - Yes/No question type and press **Insert**.

- A document titled “Practice Class – 3rd Period, QP Set 1, DATE” opens in the Document workspace with a question page.
- If desired, the question can be entered into the question field or it can be left blank and the question can be asked orally.

Question Field

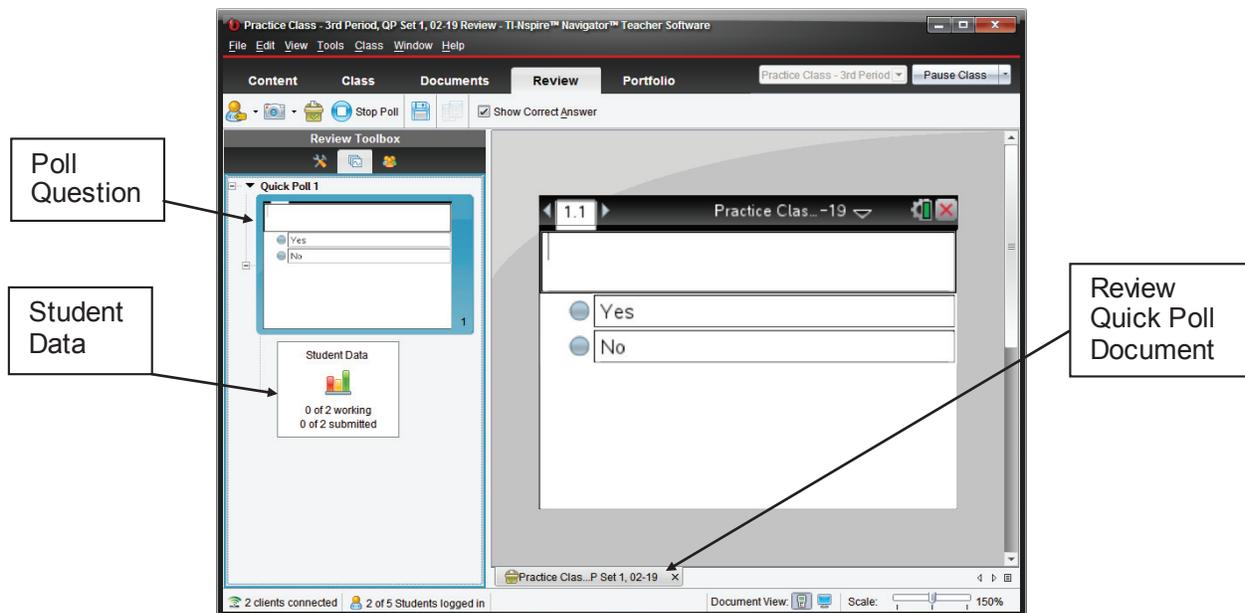
Poll Document

4. **Teacher:** Press the **Start Poll** button.

- Assume that you are going to ask the following question orally to your class without the need for the question text.
- Ask the student a yes/no question orally about the activity.

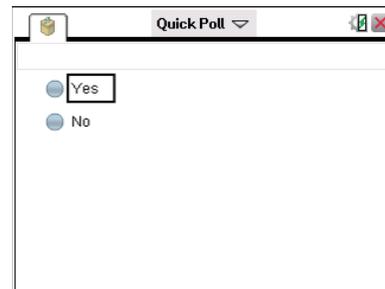


Note: Immediately after pressing the **Start Poll** button, the software opens to the Review workspace and creates a Review Poll document containing the Poll Question and Student Data.



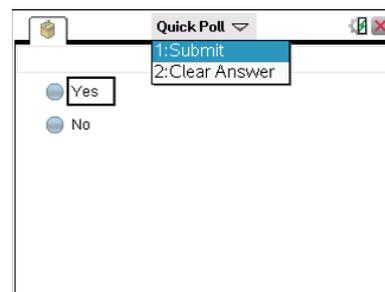
5. **Teacher:** Monitor the number of incoming responses by watching the Student Data.

- As the students begin to answer the poll, the numbers will change in real-time according to the number of students working on the question and the number of students who have submitted their answer.
- Shown to the right is what a student sees on his or her handheld. All students have been sent the poll.



6. **Teacher:** If this is the first time a student has been asked to respond to a poll, you might have to give instructions for answering a poll and submitting an answer. Tell the student:

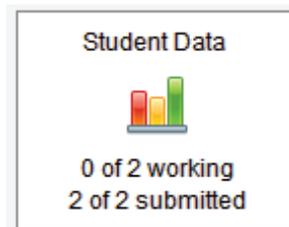
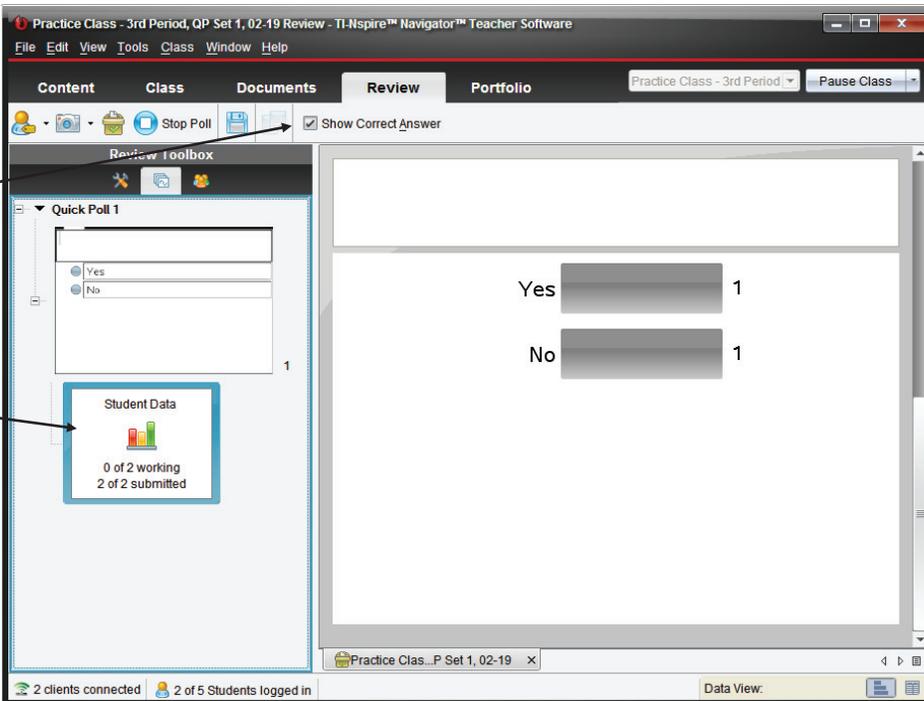
- “To answer the question, use the arrow keys to move to the Yes or No answer. Press the click key to “color” in the answer bubble of your choice.”
- “To submit your answer, press the DOC button and select **1:Submit**.



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- Alternatively, click on the down arrow to the right of the words **Quick Poll** at the top of the screen. Select **1:Submit**.
 - On a Clickpad handheld, press   to open the Quick Poll pull-down menu.
- Student:** Follow the teacher's instructions to send student responses from each handheld to the teacher's computer. On one of the handhelds, send Yes as the answer to the poll. On the other handheld, send No as the answer to the poll.
 - Teacher:** Monitor the Student Data, and click the **Stop Poll** button once you have received an answer from each handheld.
 - As the students begin to answer the poll, the numbers will change in real-time according to the number of students working on the question and the number of students who have submitted their answer.
 - Teacher:** Click the **Student Data** icon, and note that the incoming answers have been collected and organized for you.

Practice Class - 3rd Period, QP Set 1, 02-19 Review - TI-Nspire™ Navigator™ Teacher Software

File Edit View Tools Class Window Help

Content Class Documents Review Portfolio Practice Class - 3rd Period Pause Class

Stop Poll Show Correct Answer

Reviewer toolbox

Quick Poll 1

Yes No

Student Data

0 of 2 working
2 of 2 submitted

Yes 1

No 1

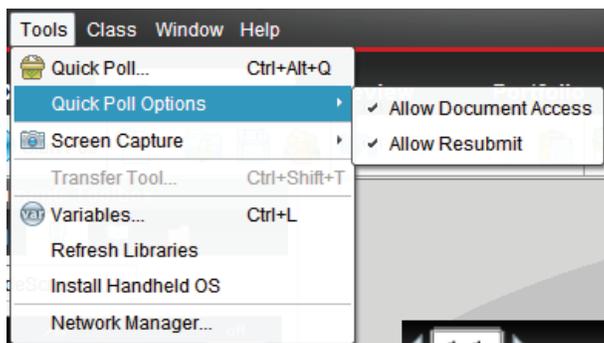
Practice Clas...P Set 1, 02-19

2 clients connected 2 of 5 Students logged in Data View

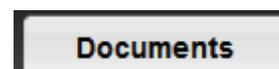
Show Correct Answer

Student Data icon

Note: By default, the “Allow Resubmit” option is turned off. This option allows students to resubmit their answers until the poll is stopped. When the “Allow Resubmit” option is turned off, then the student has only one chance to respond to the question and the poll will disappear as soon as the student submits an answer.



10. **Teacher:** The “Allow Resubmit” option is located in the Documents workspace under the **Tools > Quick Poll Options** menu. Return to the Documents workspace, and select **Allow Resubmit**.

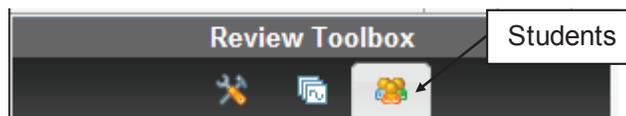


Pause and Think About:

When would you want students to Resubmit answers to a poll?

When would you not want students to Resubmit answers to a poll?

11. **Teacher:** Type the text of another appropriate yes/no question for the activity in the Quick Poll Question page that is already open.
12. **Teacher:** Press the **Start Poll** button.
13. **Student:** Select a response, and submit it for both handhelds.
 - The Quick Poll window remains open on the handhelds since the teacher selected the Allow Resubmit option.
14. **Student:** Change an answer on one handheld and resubmit.
15. **Teacher:** Monitor the Class Results, and click **Stop Poll** once you have received answers from all of your “students.”
16. **Teacher:** Click on the **Student Data** icon for Quick Poll 2 to see the student responses.
17. **Teacher:** Click on the **Students** icon under the Review Toolbox to see each student’s response. The students’ names that are in red have not answered the poll.



18. **Teacher:** Click on the check box beside **Display Student Responses**, and observe what happens. Notice all the responses are hidden, but the teacher knows who has responded.

Review Toolbox	
Student ▲	Response
<input checked="" type="checkbox"/> Deb	No
<input checked="" type="checkbox"/> Jon	Yes
<input checked="" type="checkbox"/> Marco	
<input checked="" type="checkbox"/> Raymone	
<input checked="" type="checkbox"/> Sonja	

Review Toolbox	
Student ▲	Response
<input checked="" type="checkbox"/> Deb	<Responded>
<input checked="" type="checkbox"/> Jon	<Responded>
<input checked="" type="checkbox"/> Marco	<No Response>
<input checked="" type="checkbox"/> Raymone	<No Response>
<input checked="" type="checkbox"/> Sonja	<No Response>

Pause and Think About:

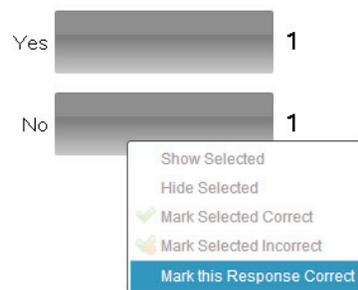
- How could you use this feature in your classroom?
- Are there times when you want or don't want your students to see the responses?
- Is there pedagogical value in the information provided?

19. **Teacher:** In the Class Results display area, right-click on the bar representing the answer No, and select **Mark this Response Correct**.

- The bar next to the word No will change to green to signify that it has been recorded as the correct answer if **Show Correct Answer** is selected.

Show Correct Answer

- This will allow the teacher to record and track the correctness of each student's answer to the question posed.
- If the correct answer to a question is never marked, the teacher can still gauge class understanding from the results, but the question will not be included in any scoring when the results are saved into the Student Portfolio.

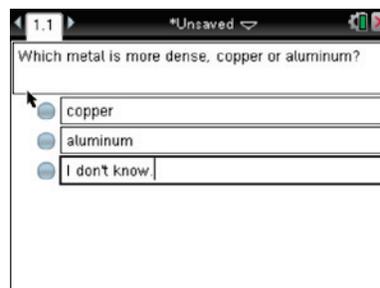


20. **Teacher:** Return to the Document workspace.
21. Turn off the “Allow Resubmit” option by pressing **Tools > Quick Poll Options**.
22. **Teacher:** Click the Quick Poll icon.

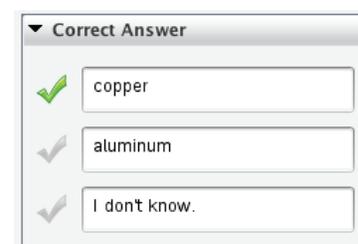
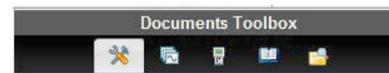


23. **Teacher:** Select the Multiple Choice - Custom Choice type of question, and press **Insert**.
24. **Teacher:** Click in the question field, and type an appropriate question for the activity.
25. **Teacher:** Click in the first answer field, and type the first answer choice.

26. **Teacher:** Using **Tab** or the down arrow, navigate to the second answer field. Type the second answer choice.
27. **Teacher:** Press **Enter** to open an additional answer field, and type in a third answer choice.
- To remove an empty answer field, click in that field, and press **Backspace**.



- Note:** If this process is not being completed in front of students, the teacher could mark the correct answer when writing the question. Open the **Document Tools** in the Documents Toolbox and click on the checkmark in front of the correct answer.

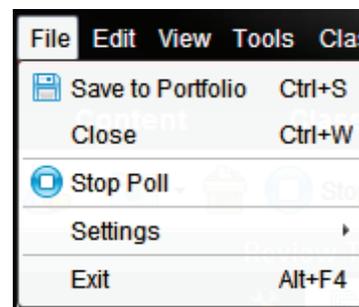
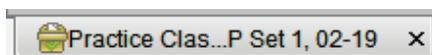


28. **Teacher:** Send the Quick Poll to the class by pressing **Start Poll**.
29. **Student:** Answer the Quick Poll question on both handhelds, and submit the responses.
30. **Teacher:** Monitor the incoming responses. If necessary, repeat instructions on how students submit a Quick Poll response.
31. **Teacher:** Click on the **Stop Poll** button after students have responded to the question.

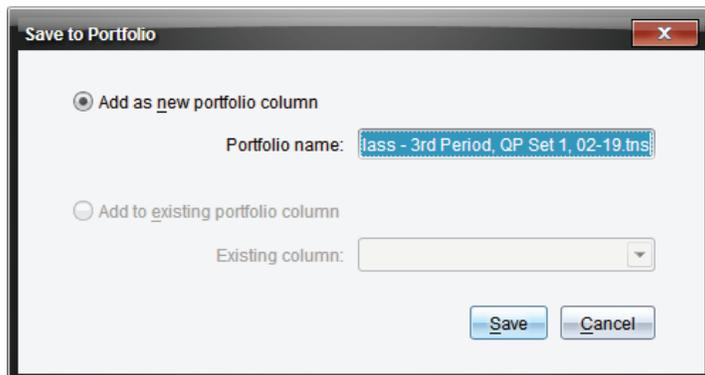
Saving to the Portfolio

The Quick Poll questions and class results for a class session are compiled into one Review Document for up to 15 Quick Poll questions. If more than 15 Quick Poll questions are sent during a class session, another Review Document will open and compile the next 15 Quick Poll questions and results. These results can be saved into the Portfolio at any time during the class session. Saving the results will help the teacher monitor student progress over time and make diagnostic decisions regarding student performance.

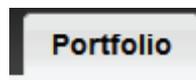
1. **Teacher:** Click on the X to close the Review Document containing the Quick Poll questions and class results, and click **Save**. Alternatively, select **File > Save to Portfolio**.



2. **Teacher:** If desired, change the name of the portfolio column, and click **Save**.

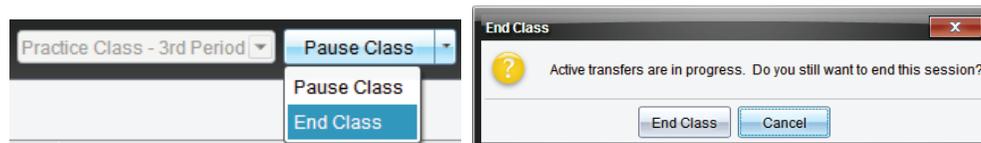


3. **Teacher:** To view the portfolio, go to the Portfolio workspace. The Assignment Summary displays the results in a gradebook type display.
- The portfolio will be discussed in depth in a later activity in the workshop.



Assignment Sum... ▲	Practice Class Po...	
	Average	
Column Actions		
Class Average	50%	50%
Date	08-07	
Deb	0%	0%
Jon	100%	100%
Marco		
Raymone		
Sonja		

4. **Teacher:** To end the class, select **End Class** from the pull-down menu next to the Class Name.
- If a pop-up window indicates ‘Active transfers are in progress,’ press **End Class**. The alert indicates that the TI-Nspire document sent to the class is still available for those who have not yet logged in to the class session.



Switch Roles

Now switch roles and repeat the activity. When creating a new class, be sure to use a different class name and select that class name before starting the class.

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Introduction to Data Collection

TI PROFESSIONAL DEVELOPMENT

Activity Overview

In this activity, you will see how easy and efficient it is to collect and analyze data using TI-Nspire™ technology and the built-in Vernier® DataQuest™ application.

Materials

- Vernier® EasyLink™ adapter
- Stainless Steel Temperature probe

Step 1:

Turn on the TI-Nspire™ CX handheld, and create a new document by selecting **New Document**.

- If asked to save the current document, select “Yes” or “No.”

A new document will appear. Though you have the opportunity to add one of the seven built-in TI-Nspire applications, do not select an application at this time.

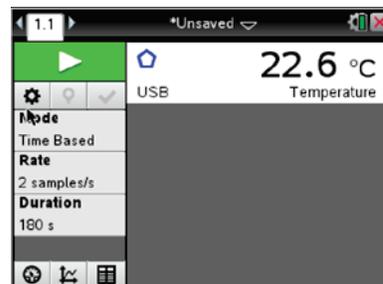


Step 2:

Obtain a TI Stainless Steel Temperature probe and the Vernier EasyLink adapter.

Plug the TI Stainless Steel Temperature probe into the EasyLink adapter, and then connect the Vernier EasyLink adapter to the mini-USB port on top of the handheld.

This should launch the Vernier DataQuest application on Page 1.1.



Step 3:

Discuss the following questions with your partner:

- What is the temperature? What are the units?
- How often does the temperature reading update?
- What are the default settings for the mode, rate, and duration?
- What happens as **tab** is pressed?
- What do you think each of these icons represent?



**Step 4:**

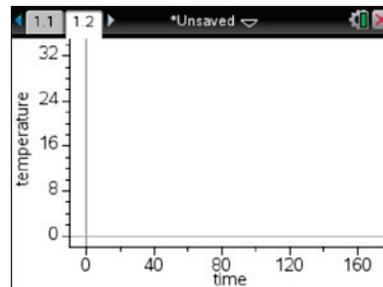
Let the temperature probe reach room temperature. Note your measure of the temperature of the room and compare it with others around you.

- Are the values the same?
- If not, how could one account for the differences?

Step 5:

Now we want to heat the temperature probe. Discuss with your partner how you might go about this, and share your plan with others in the room.

Predict what a plot of temperature vs. time would look like if you implemented your plan.

**Step 6:**

The best way to perform most temperature change experiments is to start the temperature change event and then start the data collection.

Prepare to start collecting the data by pressing until the **Start Collection** button at the top of the screen is highlighted. Start heating the probe. Then press . Alternately, you can hover the cursor over the Start Collection button and use the click button on the Touchpad.

Note: The and buttons perform slightly different commands. The click is like a left-click on a computer mouse and will activate the part of the screen that the cursor or pointer  is over.

Step 7:

During the data collection, a scaled graph will appear and the Start button will change to a Stop button. After a brief period of time, end the experiment by clicking the Stop button.

When the experiment ends, the check appears. Clicking this will store the latest data set.

Introduction to Data Collection

TI PROFESSIONAL DEVELOPMENT

Step 8:

Examine your results and compare with your prediction. Discuss the following questions:

- Did you need the full time for the experiment, or did you end it early?
- We are interested in the rate at which the temperature increased. How would you describe this rate? At the start? Toward the end?
- What material did you use to warm the probe? Do you think that the material used to heat the probe matters? Why?
- Check with others in the room, and see their results. How do they compare with your results? What material did they use to warm the probe? Would that account for the differences?

Step 9:

To look at the table of data from the experiment, use the Touchpad to position the pointer over the TableView icon  and press .

Explore your rate of warming by looking at the change in temperature over equal increments of time.

- How could you quantify this change in rate of warming?
- How does this compare with your earlier analysis?

Step 10:

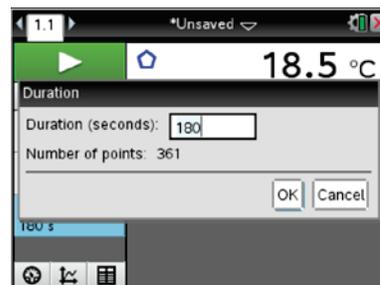
To save the results from the first experiment, use the Touchpad to position the pointer over the Store latest Data icon  and press .

- What changes do you notice on the screen?

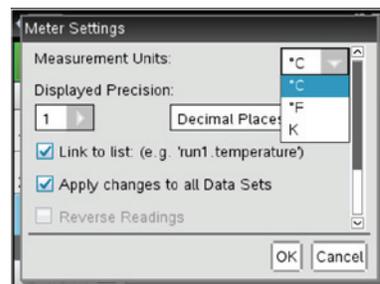
Step 11:

Now design an experiment that will cool the temperature probe.

Consider changing some of the options by clicking an area of interest (Mode, Rate, Duration, Settings). For example, change the default settings of three minutes by clicking on Duration and entering a new value (in seconds).



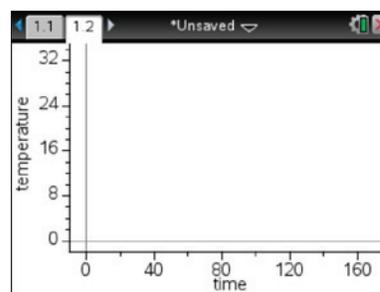
Note that these options are also under the **menu**. Based on what you learned in the heating experiment, adjust the settings as needed for your cooling experiment.



Step 12:

As you prepare for the cooling experiment, consider the following questions:

- What will you use to cool the probe?
- How long will it take to cool?
- What units will you use?
- What will the plot of temperature vs. time look like this time?



Step 13:

Collect the data using your design for cooling. Once the cooling begins, start the data collection as soon as possible. Highlight the Start button , and press **enter** to start.

Step 14:

Explore your rate of cooling as before, and look at the table of data. Discuss the following questions:

- Were the rates of cooling or heating the same in both experiments? Explain.
- To compare the heating and cooling experiments, what variables should you control?

Step 15:

We might use this data again, so the experiment should be saved. To save the experiment as a document, press **ctrl** **S**, name the document, and select a folder to place it in. If necessary, create a new folder.

