SciTech Activities: PicoCrickets (Playful Invention Company)

Time: 4 hours (broken down into 4-1 hour classes)

Standards:
4th Grade Science Content Standards:

PS1a. Students know how to design and build simple series and parallel circuits by using components such as wires, batteries, and bulbs.
PS1d. Students know the role of electromagnets in the construction of electric motors, electric generators, and simple devices, such as doorbells and earphones.
PS1g. Students know electrical energy can be converted to heat, light and motion.

I&E6. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.

5th Grade Science Content Standards:

I&E6. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.

Topical Objectives:

- Students will investigate the various components of electricity and circuits.
- Students experiment on circuits and circuit design.
- Students design, program and construct a kinetic sculpture that includes movement, sound and light.

Safety Rules:
Students should be reminded to handle the computers and PicoCricket parts gently.
Students should be careful of loose materials and hair around the moving Pico parts.

Material:
(per group of 3-4 students):
Computer
1 Pico Cricket kit
Miscellaneous craft supplies:
Pom-poms
Tape
Google eyes
Pipe cleaners

Day 1
Introduction to PicoCrickets and Challenge I (Light)

Preparation:

1. Charge computers
2. Place PicoCricket Kits and computers on each group of student's desk.
3. Gather extra craft materials for Kinetic structures. This includes: Pom-poms, pipe cleaners, goggle eyes, etc…

Procedure:

1. Before starting this activity, instruct the students on the proper handling of the computers. Ask how many students have ever used a computer or have one at home. This will gauge the student's level of computer use. Remind the students that the PicoCricket activity will be the only program that they will use on the computers.
2. Review what the students' know about Electricity --Where does it come from? What are some things that use electricity? Briefly go over the connection and placement between the computer and the Pico parts.
3. First, hold up the PicoCricket and "Beamer" (sends programs from your computer to your PicoCricket). Instruct the students that the PicoCricket and beamer should be facing each other. When they turn on the switch to their PicoCricket, they will hear a "chirp". This will indicate that the PicoCricket is on and ready to start. If the light is orange, this indicates a low battery and will need to be replaced (AAA batteries).
4. Hold up and show the students what each sensors looks like and what cables hook into them. (Have the information placemats (Meet the PicoCricket) at each table so the students can correlate the pictures to the actual parts)
5. Next, have the students open up their computer and show them (Using a DocCam and projector) what each function will do when they press or click on a specific function. For example, show the students when they want to start their sequence of events, they need to use the "wand" and click on an item.

Challenge I: Let there be Light!

6. For the student's first PicoCricket challenge, have the students come up with a way to make the light sensor light up. (They will need a light sensor and cable to hook up to the PicoCricket)
7. Connect a light sensor to any of the four ports on the Cricket. Make sure the connection is correct and the silver sides of the plugs are facing up.
8. Drag out a **setlight color** block onto the "art pad". Use the slider to choose a color. Click with the **magic wand** to send it to the Cricket. Slide the arrow (under the color bar) to choose a different color and again click the magic wand.
9. To remove a command or stack of items the students do not want, they will drag the whole command into the box on the left side of the art pad. It will then

disappear. However, if the students want an item they just discarded back, the computer saves the last command and they can click on the wand to repeat the last command they had. (The computer automatically saves what you were just working on until you start another command).

10. Next, have the students program the light sensor (**Light** commands are in Blue, **Numbers** are in Purple and **Flow** is in Orange) to light up in at least 4 different colors with a period of time in between. Note: 10 ticks=1second, so a good example of a waiting time period would be 50ticks=5 seconds. This time period allows the students to see the changes that they have made.
11. To make the lights change at least four times, you will need several things. You already have your first color block out. You will need an **Orange Wait** display to go directly under the **setlight color** display. The correct pieces will fit together like a puzzle. To the **Wait display**, (it automatically sets the time for 10 clicks=1 second-this is not enough time to see the changes you will make) you will need a **Purple Numbers** display. The number display connects to the right of the wait display. You can set the amount of time by clicking on the numbers directly and put in 50ticks=5 seconds.
12. Repeat this sequence by stacking up the blocks. Setlight color/wait50/setlitght color/wait50/setlight color/ wait50 /setlight color.
13. Last, have the students tell the Cricket to keep running the stack **forever.** This is done by dragging the **Forever** (in orange) display and place it on top of the first setlight color display in the stack. The light sensor should change in a continuous cycle.
14. **NOTE:** Before the students leave, they will need to come up with a group name for their program. If time permits, have the students vote on possible group names. Help the students save their program under this name. Hint: You might want to write down on a separate sheet of paper, the student's group name and the computer they were working on to avoid any confusion.
15. Go over any question the students might have and review how the computer and PicoCricket interact with each other to create a program.

Science Notebook Ideas:

Students should draw and label the computer and different parts of the PicoCricket that they used in today's class. Students should also write any questions that arise during class or possible programs they want the PicoCricket to perform.

Day 2

PicoCricket Challenge II (Sound)

Preparation

1. Charge computers
2. Set up PicoCricket Kits and computers

Procedure:

** Don't forget to take pictures of the students in action!**

1. Review the PicoCricket parts, assist in opening the students program and remind students how to periodically save their work.
2. Review the procedures for creating light and tell the students that in today's activity they will be building upon what they learned in last class. Students will be performing the next PicoCricket Challenge-Sound! Note: You will find all sound commands in Light Blue.
3. Students will connect the Cricket to the **Sound Box** (Hold up for the students to see). They will first learn to make different sounds. Students will need to drag the **chirp block** onto the pad. Click with the magic wand to send to the Cricket. This command will "chirp". Next, have the students drag out the **playsound block** . It will automatically show a kitten label on the top. Have the student seen the command to the Cricket. The command will "meow". Let the students experiment with the various sounds--goose, dog, horse, etc… They will be able to choose different sounds by clicking on the arrows either on the left or the right.
4. Next, have the students choose the **melodies button** located at the bottom left corner of their screen. This will bring up a piano screen. Students can play a melody and choose which instrument they would like it to sound like (trombone, wood block or even Kitten). They will be able to control the volume, the tempo and musical notes. When they are finished with their completed melody, students can click "OK" for it to play and it will now be available on the main menu list.
5. If there is time, have the students include a touch sensor or a sound sensor to the Cricket. This command allows the sensor to start when a student speaks into or pushes or the button.
6. At this point, ask the students if they have any questions. Go around the room and observe how the students are doing. Make sure everyone gets a chance to program the computer.
7. Save all work!

Science Notebook Ideas:

Student's who are waiting for their turn to program the PicoCrickets, should come up with several ideas on which sounds they would like to produce. Students should also be thinking about their "Kinetic Sculpture" they would like to program and build. How will they incorporate different sounds, lights or motion? Will they build a spinning snowman? Or a birthday cake that plays "Happy Birthday"? Students will draw and label their groups Kinetic Sculpture.

Day 3:
PicoCricket Challenge III (Motion)

Preparation:

1. Charge computer
2. Place PicoCricket Kits and computers on each group of student's desk.
3. Gather extra craft materials for Kinetic structures. This includes: Pom-poms, pipe cleaners, goggle eyes, etc…

Procedure:
** Don't forget to take pictures of the students in action!**

1. Assist in opening the students program and remind students to periodically save their work.
2. Students will be performing the next PicoCricket Challenge-Motion. Note: You will find all motion commands are in **light green.**
3. Students will connect the Cricket to the **Motor Board and Motor** (Hold up for the students to see). They will first learn to turn the motor on (reminder: **10 ticks=1 second**) for approximately 5 seconds (50 ticks). Students can either drag the **motor onfor** or **motor on** to the board for the motor to start spinning. Use a spinning rod (black) and an object to observe the spinning motion.
4. Next, have the students use the reverse command and reverse directions to the motor for approximately 5 seconds. This is accomplished by "stacking" the motion commands. Students already have the **motor onfor** command on the board. They will have to build to make the motor spin and then reverse. To the students command, students will need to add a **motor off/reverse/motor onfor** (click for 50=5 seconds)
5. Finally, have the students include a touch sensor or a sound sensor to the Cricket. This command allows the sensor to start when a student speaks into or pushes or the button. Students will add a **waituntil** (orange) and to the right of this command a purple, oval **touch** button. This allows the students to control when they want to start their motors.
6. If time permits, have the students come up with a sculpture to spin. The students can use straws, pom-poms, paper for windmills etc… Have the students test their sculptures. This is a good gage to see if the students can program the PicoCricket to do what they commanded.
7. At this point, ask the students if they have any questions. Go around the room and check if the students are switching and are able to program their commands.
8. Save all work!

Science Notebook Ideas:

Students should start discussing their final design with their group members. For their final challenge, students must make a kinetic sculpture, invention, scene, game, or mover and shaker. Students discuss how to make their creation: light up, have sound and movement. Students should list possible materials needed (pipe cleaners, construction paper, pom-poms etc…) for their design. Students

should be able to give a class demonstration on their completed project by the end of Day 4.

Day 4: Kinetic Sculpture or Invention

Preparations:

1. Charge computers.
2. Place PicoCricket Kits and computers on each group of student's desk.
3. Gather extra craft materials for Kinetic structures. This includes: Pom-poms, pipe cleaners, goggle eyes, etc…
4. Provide extra tape and scissors.

Procedure:
** Don't forget to take pictures of the students in action!**

1. Discuss the guidelines for the student's kinetic sculptures, game or inventions.
2. Remember: They must incorporate light, sound and movement from the previous days.
3. As the students work on their projects, go around the room and help trouble shoot any problems, provide extra materials and observe how the students are interacting with each other.
4. Hint: As some students are programming their kinetic sculptures or inventions, have the other students begin designing and constructing parts they will add to their sculptures.

Science Notebook Ideas:

Have the students write down any suggestions or questions they have encountered during this activity. What other activities would they like to program and construct? What other components could they use for PicoCrickets—maybe a recording device or an alarm?

Extensions:

- PicoCrickets can be used in conjunction with circuits. Students will be able to test the different components of a circuit and the path that electricity flows. Battery (inside the Cricket and computer), conductors (cables), and load (lights, sounds etc…).

- Have the students come up with an invention that would help another student out. Maybe an alarm to wake someone up for school or a device to tell when the it's time to do your homework.
- Organizing PicoCricket Craft Exhibitions

Synthesis:

The PicoCricket program is designed for students ages 8 and up and developed by MIT Media Lab. PicoCrickets allow students to design, construct and invent creations using technology and art with a hands-on approach.

Research:

www.picocrickets.com