Outreach-in-a-Box: Discovering IT

Program Guide

Dear Presenter:

The Outreach-in-a-Box: Discovering IT program guide supplies you with everything you need to prepare and present a fifty-minute or extended program about computing for middle-school students. Most program elements are completed for you, but you will need time to acquire materials (a robotic car, provided by NCWIT) and to customize features of the program to include:

- Your history, specialty and passions
- Information about your institution/organization/workplace
- Opportunities for youth in your community (optional)

Please take time to become familiar with the program, discuss it with your host educator, and customize the presentation.

Contents of the Program Guide

A. Using Advance Materials

Below are resources and steps that will help you prepare for your presentation. Once you have set up your school visit, review items b) and c) with your host. Each of these advance materials is a separate document on the Web site.

1. Acquiring a LineChaserz Car NCWIT purchased robotic cars for presenters to use during their Outreach-in-a-Box session. The instructions for acquiring the car are in this document. Please plan ahead; it will take several days for the car to arrive and you will want time to practice using it for the class activity.

2. Sample letter This letter announces the IT-in-a-Box opportunity, describes the purpose and contents of the program, and describes logistics such as material needs, preferred setting, and time frame. Customize this letter and send it to school personnel (administrator, teacher, or school counselor), or if you prefer, call the school directly to discuss the opportunity with this letter as your guide.

3. Set-the-Stage Activities Your program will have a greater impact if students are prepared. Your host educator has a choice of two Set-the-Stage activities he or she can use in advance which will reveal prior understanding and beliefs about IT, and get students thinking about the learning ahead. Share these activities with the hosting educator and learn whether he or she will be using one or both of them. Prior to your presentation, review the Set-the-Stage experience with the teacher and discuss how the students' experience can serve as the "stepping off" point for your visit.

B) Preparation Steps

1. Order your LineChaserz car now. See the Acquiring LineChaserz Car page.

2. In advance of your presentation, if possible, meet with the hosting educator.

- Discuss program goals and seek advice about managing activities so they are inclusive (getting to the less technical kids).
- Ask your host to arrange for a computer (or bring your laptop), projector, and screen for the slide presentation. Discuss the room arrangement – Students at desks for presentation, in chairs in semi-circle for activity.
- Share Set-the-Stage class activities he or she can use to prepare students for the program ahead. (This is a separate document.)
- Discuss the brochure. Together, customize it by adding an insert with local opportunities such as high school courses, clubs, and events.
- Prior to your presentation, talk with the hosting educator again to discuss Set-the-Stage activities he or she may have conducted with the class. Discuss ways to respond to these during your presentation.

3. Read the lesson plan and prepare for the presentation and activities as advised.

4. Materials necessary for each activity are described in the activity.

a. Prepare the slide presentation.

- The slide set is on a light background. Customize the set by adding your institution's slide background or choose another light background.
- Review the slides and read the slide notes (see "normal" view in PowerPoint) for prompts and more information.
- Several slides start with the word TEMPLATE. These are yours to customize, following the prompts on each slide and adding slides as you wish. Please leave the last "credits" slide.
- Review the entire slide presentation. You will return to the slides during the robot car activity t o show details of the car otherwise too hard to see.

b. Prepare and copy the brochure, one for each student. The hosting teacher may be able to help you with this.

C) Tips for relating to your audience

The intent of Outreach-in-a-Box is to cast IT in an appealing light and inform young people about myriad opportunities in computing. Like it or not, as a guest in the school your very presence puts you in the position of "role model". And, like it or not, as an IT professional you wear the mantle of young people's previous perceptions about people who work in the field. We encourage you, through your appearance, demeanor, and language, to put forth the most appealing and professional presence you can. This means:

Appearance: Appear approachable but professional. Wear "casual Friday" apparel – not so dressy you seem alien, yet not "weekend sloppy" either.

Demeanor: Being well prepared will help you appear polished and credible. Strike a professional but friendly demeanor. Kids like adults who obviously like them. Chat with students before you begin your presentation and show interest in what is going on in the school. Give students an opportunity to see you as a person first and as a computing professional second.

Language: Don't oversimplify the presentation in an effort to make it work. Use the vocabulary of the discipline, but define key terms and write important words on the chalkboard. Avoid acronyms and unnecessary jargon.
Check for understanding, Individual differences: The intent of this program is to encourage all students – and especially girls and other underrepresented populations – to get excited about computing. Here are tips for being inclusive of everyone:

- When you ask a question, the more technically inclined students may have their hands raised before your words are out of your mouth. Give the class time to think before you call on anyone. Ask open-ended questions that have many right answers so everyone can participate with confidence.

- If activities involve sharing technology, make sure all kids have turns to use devices. Assertive students may tend to dominate, so ask the hosting teacher for advice on class management and strategic grouping to assure equal access and equal opportunity to learn.

- Demonstrate that everyone can be "good at" technology. If an activity requires a volunteer, choose students who do NOT raise their hands and let them bask in the light of their successes.

D) Activity Plan

This lesson plan has four parts: 1) Introduction 2) Presentation 3) Activity 4) Extensions and Wrap-up

1. Introduction – 5 minutes

Briefly introduce yourself, your work, and your organization. (More of this comes in the slideshow presentation, so be brief.) Ask students if they know others who work where you do, or anyone who works in computer science or IT.

In advance of your arrival, did the hosting educator engage students in preparation activities? (see Set the Stage Activities) If so, ask students to describe what the class did. Review pictures on the wall or lists they made, and relate their activity to what you will do during the period. Tell them by the time the session ends they will have learned more about computing and be inspired to consider computing opportunities as they move beyond middle school.

2. Slide Presentation – 7 to 10 minutes

Description: This presentation starts with slides that help you tell your story and that of your institution. The next few slides connect students' experiences and interests to the range of computing topics. The last slide sets up and illustrates the activity you will do with the class.

Objective: Students become familiar with computing and relate their knowledge and interests to opportunities ahead.

Materials needed: Slide presentation: (file name: Outreach-in-a-Box_Presentation.ppt), a computer, projector, and screen. A remote device for advancing slides is helpful so you can move around the room.

Room set: Students are seated at desks.

Directions: Deliver the slide presentation, following the suggestions in the notes associated with each slide. (You may wish to print the presentation with the notes showing to use as a guide as you deliver the presentation.)

3. Robot Car Activity – 35 minutes

Description: This inquiry activity will get students thinking about how computers work. Discuss the activity with the hosting teacher. He or she will have ideas for overall management of the activity.

Objective: Students learn that a robotic car is a mechanical computing device that employs sensors. Students recognize how sensors are used in a variety of applications in their everyday world.

- Materials needed:

- LineChaserz car (at least one)
- Blank white paper
- 8.5" x 11" scratch paper for planning
- 2'x3' butcher paper or chart pack paper, one for each pair (half the number of students in class)
- Black markers – thicker chisel point similar to that in the kit - one for each pair (half the number of students in class).

- Room set: Situate students in chairs in a semi-circle around open floor space so they can see the car in action.

- *Directions*:

a) Show. Demonstrate how the car follows a black line on a 2'x3' piece of paper. Keep the line fairly simple and run the car several times. Ask students how they think it operates. Don't go into great explanation here. Just encourage many possibilities and then say, "Let's find out."

b) Involve Students. Follow these steps:

i) Invite student pairs to draw their own line with a thick-tipped black pen on a 2' x 3' sheet of paper. (You may want students to pencil sketch their idea on small paper before drawing their path on the large sheet.)

ii) Collect the large sheets and randomly select eight sheets, keeping them face down.

iii) Pull a sheet, find the pair who drew it, and let this pair run the trial. Before each pair runs the car on their sheet, ask the class to predict how the car will respond to the design.

iv) After trying all eight, ask and discuss: What seems to give the car trouble? Success? Which drawings worked? Which ones didn't?

c) Inquire. Ask students how they think the car might be working. You can pass the car around for students to look at, if you'd like. Tell them not to take it apart, but guess "what's under the hood?" Ask them to describe what they see on the car.

d) Discuss what's going on. Show the slides with photos of car details. Talk about how the car follows the line.

i) On the bottom of the car are two red LEDs (light emitting diodes) and two pairs of IR (infrared) emitter/detector pairs. Explain: When the car is turned on, the red LEDs are illuminated and cast light under the car, changing the color on the paper. Notice the LEDs are on the outside of the IR pairs.

ii) The IR emitter sends out a beam of infrared light (which you can't see), which detects the reflected light sent out by the LEDs. The color of the reflected light tells the sensor if it's over a black line or not. (More detailed description: When the LED casts a beam on black (the line) it is absorbed and shows nothing for the IR pair to sense. When it casts a beam on white (plain paper) it is reflected, and it is this reflected light that the IR pairs sense. So LED beam over black is like "off", LED beam over white is like "on".)

iii) Ask: Why are there two pairs? (Get students to think about this.) What would happen with only one set? Could we still follow a line? Would it work as well? Why or why not?

iv) Pop the cover off the chassis and expose the circuitry. (Run any additional trials with the cover off.) Explain that this is circuitry like in any computing device. It responds to electric signal based on programmed computer code. Give more detail if students show interest.

v) Write pseudocode for line-following on the board or show the slide with this "code" on it. Explain that the circuitry "reads" the code and relays instructions to the car. Read the code aloud.

if left-ir sees black, steer to left, otherwise steer to right

if right-ir sees black, steer to right, otherwise steer to left

Ask: What's happening in this code? What happens when neither line sees black? (Car should go straight – verify this with your car.) The students can also experiment with the car held in the air, using paper to block one or the other pairs of sensors

Ask: Why not the following? Are we really using both sides to follow the line with the code below?

Ask: What happens if a line forks? Does the car tend to take one branch rather than the other? Test.

Ask: What does this tell us about the car's programming?

Discuss precision in instrumentation, that a toy car doesn't require the fine-tuned precision of a surgical instrument for instance.

e) Discuss Sensors. Explain that the IR pairs are sensors that read information about the environment; the car acts on the information from these sensors to change its behavior, based upon the program (above).

Explain that not all sensors are light sensors. There are motion sensors, tilt sensors, touch sensors, and more. All sensors give feedback to circuits that instruct a machine to do work, like steering the robot car. Ask: Where else do you see sensors? Have the students brainstorm, and write examples on the board. Here are ideas:

- Faucets in bathrooms that turn on automatically (use a distance sensor)
- Automatic doors at stores (might use a distance sensor or a motion sensor)
- Alarm systems (might have motion sensors, contact sensors on windows and doors, or audio sensors)
- Toys (Furby and Sony Wii have a tilt sensor and touch sensor; Mindstorms has sensors in the kit)
- Roomba vacuum cleaner (touch sensors in bump skirt, IR emitter/detector pairs to prevent going off stairs)
- Television (IR detector to read signal from IR emitter in remote control)
- Thermostat (temperature detector to turn on heat or air conditioning)
- Rain gauge in a sprinkler system (contact sensor)
- Cars (speed readings, thermometer for engine heat, sensing problems with engine)
- Automatic lights that come on when it gets dark (if not on timer, otherwise controlled by a light sensor)
- Bar code scanner at stores (light sensor)

f) Ask: Why do we use sensors so much? This gets at the heart of robotics – computers + mechanics produce automated work. A machine is, by definition, a labor-saving device; the computer sensors make machines even more independent and labor-saving. Encourage kids to brainstorm: How might more sensors be put to work in the world? If time allows, encourage student pairs to draw diagrams of their ideas to share now or continue with later.

g) If time allows and students show interest in coding, explore: How could this car run differently? One example: A car could be programmed to stay between two parallel lines instead of following a single line. The "programming" would look like:

if left-ir sees black, steer to right, otherwise steer to left

if right-ir sees black, steer to left, otherwise steer to right

Ask: How might it respond to different colored lines?

E. Extensions and Wrap-up

If time allows or if you can meet with students a second time, consider using the Extension Activities (see: Set-the-Stage and Extension Activities).

Otherwise, at the end of your session, be sure to pass out the brochures. Encourage kids to give them a look now. Ask: What looks good to you? What might you try this week? This summer? Later? Which one will you show your parents or a friend? What more do you want to know about or do?

Before you leave, challenge students to find places in the designed world where there are NOT computing devices. (They are likely to notice them everywhere after today.) Encourage students to explore their interests. If your organization makes visitors welcome, invite them to come by.

If you can retrieve it later, leave the car with the class so they can perform more investigations.