**Instructional Days:** 6-7

**Topic Description:** Introduce the features of the NXT Brick—the “brain” of the robot.

**Objectives:**

Students will be able to

* Distinguish between the parts of the NXT brick.
* Hook up input and output devices correctly.
* Use built-in NXT Brick programs.

**Outline of the Lesson:**

* Observation of the NXT brick (20 minutes)
* Plug in sensors, motors, and light, and run “View” programs (30 minutes)
* Try Me” built in programs (40 minutes)
* NXT Brick programs (20 minutes)

**Student Activities:**

* Articulate what they observe about the the NXT brick while the teacher explains each part.
* Test sensor data using the ‘View’ programs and report observations.
* Run ‘try me’ programs and describe what the programs do.

**Teaching/Learning Strategies:**

* Have students get out their robot base, sensors, lights, motors, and three wheels. Explain that the NXT is the brain of the robot. Have students describe the parts they see and make sure the following parts get identified. (The NXT User Guide pp. 9-12 can be used as support.)
* Ports number 1-4: these are input ports. You use wires to plug sensors into the NXT brick. There are four kinds of sensors: touch sensors (detect touch/obstacles), sound sensor (detect the sound levels), light sensor (detects light level), ultrasonic sensor (detects movement and distance to an object). Reminder: input means sensing something in the robot’s environment.
* Ports A-C: these are output ports. You use wires to connect devices for output. The devices are lamps and motors. Also, note that the speaker is an output port. The output is that the light can go on or off and that the motor can turn or stop turning. Reminder: output means effecting change in the robot’s environment.
* Buttons:  
  Orange button: On/Enter

Light grey arrows: Navigation, left and right

Dark Grey button: Clear/Go back. Keep pressing this to turn off until prompt, and then hit orange

* Lines in the right side: speaker. This is where noise comes out of the robot. o If the rechargeable battery is in, there will be a power plug and LCD lights.
* Tell students to turn on the robot by pressing the orange button. What happens? (It makes a happy little song. LOUD.) What do they see now?
* NXT at the top—name of the brick. This can be changed in the software
* Battery level top right.
* Running icon—next to the battery icon. As long as it is spinning, the NXT is turned on and working correctly. If it freezes, the NXT has frozen and must be reset.
* There are three icons on the screen. The one that is highlighted by default looks like two floppy disks and has the label above “My Files”. If they start hitting buttons, they can scroll through several menu options by using the arrow keys or go into My Files by hitting the orange button. The menu options are:
* My Files—where programs will be stored.
* NXT Program—allows you to build small programs using only the NXT without the need for a computer.
* View—you can do a quick test of your sensors and motors and see the current data for each. You have to select the test you want to do and which port the sensor or motor is on. Only one test can be run at a time. The data will display on the screen.
* Bluetooth—you can set a wireless connection between the NXT and other Bluetooth devices including other NXTs, phones, and computers.
* Settings—you can change settings such as the speaker volume and the sleep time.
* Try Me—built-in programs.
* Explain that in order for the robot to really do anything, you have to hook up input and output devices. Ask students to try to identify the devices in the kit. Make sure they can identify the touch sensor, sound sensor, light sensor, ultrasonic sensor, servo motor and lamps. Reinforce that the sensors are all input devices and the motors and lamps are output devices.
* Demonstrate and have students carefully plug the devices into the NXT. Sensors can be plugged into any input port numbered 1-4 but these default settings are used for the test and sample programs. See pp. 5-6 and 9 of the NXT User Guide for more information. Make sure students know to support the weight of the devices and the NXT brick without pulling on the wires.
* Port 1: Touch sensor
* Port 2: Sound Sensor
* Port 3: Light Sensor
* Port 4: Ultrasonic Sensor
* Port A: Light
* Port B & C: Servo motor
* Have students navigate to the View menu. They should test each of the sensors and see what the displays do. Make sure they also use the motor rotations and motor degrees program. See NXT User Guide pp. 23-33 for more information. After a few minutes with students experimenting, ask what they noticed. What kind of data does each of the sensors provide? How could a robot use this in a program? Remind them that what they are doing is testing and debugging.
* Have students navigate to the Try Me menu by using the dark gray button to move up the menus and using the light gray arrows and orange button to enter the Try Me menu.
* Select one of the programs and have all the students try it. Once they have tested it, ask them what it did. See if they can flowchart what the program does.
* Try sound—moves the motors faster as more sound is detected.
* Try touch—changes display and makes noise when button is touched.
* Try light—makes noise based on how much light is detected.
* Try ultrasonic—changes noise based on distance detected.
* Try motor—changes sound based on motion of motor on port A.
* Finally, have students navigate to the Program menu and follow the directions in the LEGO Mindstorms manual on pp. 22-45, trying the programs indicated. They should then test the programs and make sure each one works as expected. (Also see the NXT User guide pp. 15-16 for more information.)

**Resources:**

* NXT User Guide