LEGO Robotics Workshop

LEARNING GOALS: After the completion of this workshop, students will understand:

1. Students will understand the concepts of robotic and sensor programming
2. They will investigate the function that the NXT Brick plays in programming the robot
3. Students will also learn about the concepts of inputs (commands and sensors) and outputs (actions)

CONCEIVE – What do I wish to accomplish through this project?

This stage involves guiding students in defining the goals of the project, then helping them develop conceptual, technical and action plans to meet those goals while considering the technology, knowledge, and skills that apply. This guidance is provided in the form of Essential Questions that use student’s preconceptions, and misperceptions then move them toward a deeper and more realistic understanding of the process and skills needed to complete the project.

ESSENTIAL QUESTIONS:

1. How can we use the NXT software to program the robot to accomplish specific tasks?
2. How can we build an efficient basic robot platform using LEGO NXT parts?
3. What is an input? An output? How are the two related?

NOTES:

DESIGN - How will I accomplish the project?

The following resources are utilized in the methodology of this project.

2. NXT resources: http://www.nxtprograms.com/index1.html

Additionally an introductory lecture will provide the foundational understanding that allows for students to continue learning hands-on through the workshop.

NOTES:

IMPLEMENT - From an idea to a product!

Student Challenge: Students need to build and program a robot that can start in the middle of the field, navigate to each corner, and return to the center starting point.

Additional Challenges:
1. obstacles can be placed in the robots path for additional challenge
2. robots can be timed with the winning bot doing the challenge the fastest

Agenda:
1. (5 min) Introduction and Break students into groups of 4
2. (15 min) Robots today
3. (30 min) Students build the robot
4. (10 min) Overview of the programming software
5. (20 mins) Students test their robot on the field
6. (5 min) Debrief
7. (5 minutes) Clean up

Debrief:
- What gave you the most trouble: programming or building?
- What problem solving principles did you use to overcome issues?
- What are some applications that you could see being used?

NOTES:
OPERATE – Does it work the way I planned?

Students will want to start putting on all manner of sensors to their robot which quickly confuses things. Emphasize the number one rule of problem solving: only change one variable at a time. Have students start by using time to control their robot into the corners. Once students understand this concept, they will be able to use a sensor effectively. They should start with either the IR or touch sensor as these make the most conceptual sense. Evaluate whether students are ready to use sensors by seeing how well they can change the settings based on time. Once the team is comfortable with that, then they will be able to use sensors well.

Allow students to tinker and take risks, but with the reminder to only change one variable at a time.

RESOURCES NEEDED – What equipment and supplies do I need?

Supplies needed:
1. NXT Kits
2. Computers or laptops
3. A field. This could be a 4x8 piece of plywood on the floor or a taped area on a smooth floor. There need to be boundaries for the kids to test in.
4. Optional: some extra parts on the field for extra challenge

SET-UP
Kits, computers, and testing field should be in the same room/vicinity. For ease of use, it may be beneficial to go through the kits before the workshop and appropriate only the pieces that the students will be using in this particular activity.
### Massachusetts Technology Literacy Standards and Expectations: 6-8th Grade

<table>
<thead>
<tr>
<th>Standard 1. Demonstrate proficiency in the use of computers and applications, as well as an understanding of the concepts underlying hardware, software, and connectivity.</th>
<th><strong>Basic Operations</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.1</strong></td>
<td>Use features of a computer operating system (e.g., determine available space on local storage devices and remote storage resources, access the size and format of files, identify the version of an application).</td>
</tr>
<tr>
<td><strong>1.2</strong></td>
<td>Identify successful troubleshooting strategies for minor hardware and software issues/problems (e.g., “frozen screen”).</td>
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<tr>
<td><strong>1.3</strong></td>
<td>Independently operate peripheral equipment (e.g., scanner, digital camera, camcorder), if available.</td>
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<th>Standard 3. Demonstrate the ability to use technology for research, critical thinking, problem solving, decision making, communication, collaboration, creativity, and innovation.</th>
<th><strong>Problem Solving</strong></th>
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<tr>
<td><strong>3.4</strong></td>
<td>Independently use appropriate technology tools (e.g., graphic organizer) to define problems and propose hypotheses.</td>
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<tr>
<td><strong>3.5</strong></td>
<td>Use and modify databases and spreadsheets to analyze data and propose solutions.</td>
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### Massachusetts Technology Literacy Standards and Expectations: 9-12th Grade

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<tr>
<td><strong>1.1</strong></td>
<td>Identify the platform, version, properties, function, and interoperability of computing devices including a wide range of devices that compute and/or manage digital media.</td>
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<td><strong>1.5</strong></td>
<td>Explain criteria for evaluating hardware and software appropriate for a given task (e.g., features, versions, capacity).</td>
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<td><strong>3.5</strong></td>
<td>Explain and demonstrate how specialized technology tools can be used for problem solving, decision making, and creativity in all subject areas (e.g., simulation software, environmental probes, computer-aided design, geographic information systems, dynamic geometric software, graphing calculators, art and music composition software).</td>
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