

Leapfrog Program **Course Title: LEGO Robotics**

Course Description

Using LEGO blocks, sensors, motors, and wheel gears, students build their own robots. While gaining hands-on experience in engineering and computer programming principles, students work independently and in teams, applying their problem-solving skills to program robotic systems that respond to feedback from the environment. This course encourages young engineers to apply their math and science skills in a fun, practical environment.

Essential Questions

- What makes robots move and follow commands?
- Is the number of movements and functions a robotic structure is able to perform finite or infinite?
- What are the best strategies for designing and creating robots that solve problems?

Outcomes

Upon successful completion of this course, students will have:

- a. Demonstrated, using NXT robots, an understanding of the interaction between structure and function
- b. Programmed NXT robots to perform basic functions successfully
- c. Collaborated with other students to analyze tasks and solve problems effectively
- d. Designed and implemented functional robots with specific purposes
- e. Evaluated designs and identified the characteristics of successful designs

Instructional Strategies

Students will engage with materials using a wide variety of strategies. Throughout the course, students will experience hands-on guided inquiry explorations to build and program robots. They will engage in tiered assignments and flexible groupings. Additionally, students will have self-paced robotic challenges to complete. Finally, students will engage in interpersonal and problem solving learning experiences to complete building and challenge projects to promote the development of critical thinking skills.

Resources and Materials

Books

- a. Lego Mindstorms NXT Idea Book By Martijn Boogaarts, ISBN: 9781593271503
- b. Lego Mindstorms NXT-G Programming Guide by James Floyd Kelly, ISBN: 9781590598719
- c. The Lego Mindstorms NXT 2.0 Discovery Book by Laurens Valk, ISBN: 1593272111
- d. The Lego Mindstorms NXT Zoo! By Fay Rhodes, ISBN: 9781593271701

Web sites

- a. Everything you need to know about Lego Mindstorms: <http://mindstorms.lego.com>
- b. How Robots Work: <http://science.howstuffworks.com/robot.htm> -A basic description of how robots work with links to other information
- c. Robot Magazine: www.botmag.com/articles/lego_mindstorms_robot_news_1.shtml -The magazine for hobby, science, and consumer robotics
- d. Learn and Think About Robots: www.learnaboutrobots.com- Fun information to learn about robots and robotics engineering

Student Assessment

- **Pre-Assessment**

As a class, students will complete an activity to help define the question “What is a Robot?” Next, students will complete a brief questionnaire about their experience with robotics and Legos. Students will also work in small groups to construct a preliminary building challenge: The Inch Worm Robot.

- **Documentation of Learning**

1. In their notebooks, students will keep a list of challenges, robotic structures, and planning for projects they have completed.

2. Students will set three goals they wish to accomplish during challenge work time each day. At the end of each day, they will reflect on how they did or did not achieve these goals and why.

3. Students will present different robotic challenges they have completed to their peers at least twice during the course.

- **Post-Assessment**

Students will present a self-designed or complex project of choice to their families. Also, students will guide their parents to program a robot to complete a simple movement challenge. Finally, a video of students’ robots throughout the course will be compiled and presented. At the end of the course students will receive a written evaluation based on general class performance, discussion, participation (whole group and small group) evaluations, and written work. Final Student evaluations are written are mailed out by September 15. Please refer to the Leapfrog Family handbook for more information.

Schedule

Date	Topic(s)	In-class Activities	How will you document learning for assessment?
7/25	Structure and Function	What is a Robot?	Students will be assessed on participation in small and large groups
7/25	Basic Programming for Robots	Guide the Teacher, Exploration in Move, Wait, Display, and Sound Blocks	Students will be assessed on participation in small and large groups, and their ability to logically sequence planning a program
7/25	Solving Programming Challenges	Introduction to Debugging, Pseudo Code and Flow Charting	Students will be assessed on their group participation and ability to plan a computer program
7/25	Robots and Sensors 1	Explorations Using: Touch and Sound Sensors	Students will be assessed on their group participation and problem solving skills
7/26	Using Gears for Action	Exploration of Gear Types and How to Effectively use Gears	Students will be assessed on their group participation and problem solving skills
7/26	Designing for Action	Challenge: Design a driving robot without using instructions	Students will be assessed on their ability to plan, revise, and refine a structure
7/26	Robots and Sensors 2	Explorations Using: Light and Ultrasonic Sensors	Students will be assessed on their group participation and problem solving skills
7/26	Beginning/Intermediate Programming	Introduction to the Loop, Switch, Record/Playback, and Random Blocks	Students will be assessed on their small and large group participation and ability to logically sequence a complex program
7/27	Robots Working Together	Challenge: Create a robot that is designed to complete one step of a task	Students will be assessed on their ability to plan, revise, and refine a structure

Date	Topic(s)	In-class Activities	How will you document learning for assessment?
7/27	Robots Working Together	Refining structures and program for challenge	Students will be assessed on their ability to problem solve
7/27	Solving Structural Challenges	Introduction to the Engineering Problem Solving Cycle	Students will be assessed on their ability to participate in small and large groups and problem solving skills
7/28	Designing with Limitations	Class Discussion: How to build with minimal parts	Students will be assessed on their group participation
7/28	Designing with Limitations	Challenge: Build a robot with minimal parts	Students will be assessed on their ability to create a robotic design and overcome challenges
7/28	Advanced Programming for Robots	Introduction to parallel programming lines, data wires/hubs, and the rotation sensor	Students will be assessed on their ability to problem solve, and group participation
7/29	Research and Design	Students will research and design self-proposed projects	Students will be assessed on their ability to analyze tasks and create a robot based their findings
7/29	Research and Design	Build and program work time	Students will be assessed on their group participation and problem solving skills
7/29	Final Projects	Expo!	Students will be assessed on their ability to present their projects

CTD Statement on Third-Party Web Sites

Instructors are required to thoroughly review any third-party web sites they intend to use in their courses for inappropriate content. However, because web content continuously changes, CTD disclaims any responsibility for any of the content contained on third-party web sites used in course materials. If you become aware of anything that may be inappropriate, please notify CTD staff immediately.