

NXT 001



An Introduction to Robotics

Instructor's Manual

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General description of the instructional products

This instructional package combines weekly lesson handouts with assignments and quizzes. It enables the student to have a hands-on experience with LEGO MINDSTORMS NXT, and it challenges them to understand the basics of the robotic set and its included programming software.

Overview of the materials

Included are four lesson handouts for both the instructor and the students. These lessons are essentially this course's mini-textbook. Each lesson will take about one and a half hours to fully teach from start to finish.

There are also four weekly assignments for the students to complete as they progress through the lessons.

Finally, there are four quizzes, one for each lesson. These are no longer than ten questions each, and they cover the majority of the material covered in the lessons.

Instructional goals

The goal of this course is to teach the students the basics of LEGO MINDSTORMS NXT. This ranges from building a simple robot to understanding how to program that robot using the NXT-G software environment.

Performance Objectives

- Given the different hardware components of the NXT kit, the student will be able to identify its hardware components with 100% accuracy.
- Given an NXT Brick, the student will be able to successfully power it on in less than 10 seconds.
- Given an NXT Brick, proper USB cable, and easy access to computer and its ports, the student will be able to correctly connect the NXT Brick to the computer in less than 1 minute.
- Given an NXT Brick, the student will be able to navigate its menu options and perform a list of actions, each within 1 minute.

- Given the NXT-G software, the student will be able to create a new programming file as well as open and close existing files within 1 minute.
- Given the NXT-G software, the student will be able to identify, describe, and switch between the different programming block palettes with 100% accuracy.
- Given the NXT-G software, the student will be able to describe and use the different programming blocks from all of the programming block categories with 90% accuracy.
- Given the NXT-G software, the student will be able to create, save, and re-open a custom “My Block” programming block with 100% accuracy.
- Given the NXT-G software, a pre-built robot, and a task for it to perform, the student will be able to successfully create a new program by dragging programming blocks onto the program sequence beam, configuring the blocks’ settings, and connecting the blocks together with input and output data wires (if needed) within 30 minutes in such a way that, when downloaded to the robot, the robot performs the desired task.
- Given the NXT-G software with an open program and an NXT Brick connected to the computer, the student will be able to download the program onto the NXT Brick within 30 seconds.
- Given the NXT-G software and an NXT Brick connected to the computer, the student will be able to logically and efficiently manage the NXT Brick memory resources with 100% accuracy.
- Given the NXT-G software, the student will be able to access the provided NXT Help guide and navigate to specific help sections with 100% accuracy.

Media, materials, and equipment

This instruction uses PDF handouts as the direct instructional material. It provides a PowerPoint slideshow for the first lesson, and the lessons thereafter are to be conducted with the instructor using the NXT-G software as both a teaching tool and a means for providing demonstration.

Assessment is carried out by the students completing quiz handouts at the end of each lesson. There is one quiz for each lesson, and they are about ten questions a piece.

The students should be encouraged to use additional resources such as a provided NXT Tutorial that consists of screen casts walking the student through the different aspects of the software. Also, the students will be encouraged to watch two instructional videos explaining the basics of LEGO MINDSTORMS NXT.

The students will each have access to an NXT set and a computer during the course of the instruction, and each computer will be equipped with the NXT-G software. A computer lab will be available so the students may work their assignments outside of class.

Topics/skills/terminology covered in the instruction

The topics at hand in this course are predominately robotics and programming. The course will introduce many technology oriented references and require the students to be proficient in not only building a robot, but also with a computer and the NXT-G software.

Below is a list of the Lesson layout and the topics within each:

Lesson 01

- Discuss an overview and history of LEGO MINDSTORMS
- Discuss LEGO TECHNIC pieces
- Discuss NXT electronics
 - NXT Brick
 - Input sensors
 - Interactive output motors

Lesson 02

- Discuss LEGO MINDSTORMS NXT Software (NXT-G)
 - Creating a new or opening an existing program
 - Using the Robo Center
 - Overview of programming block palettes
 - Overview of the block configuration panel
 - Overview of the NXT controller buttons

- Using NXT-G help option
- Discuss miscellaneous items

Lesson 03

- Discuss essential NXT-G programming blocks
 - Move block
 - Wait block
 - Loop block
 - Switch block
 - Nested Loop and Switch blocks
 - Display block

Lesson 04

- Discuss advanced NXT-G programming blocks and functions
 - Data hubs and wires
 - Data blocks
 - Logic block
 - Math block
 - Compare block
 - Range block
 - Random block
 - Advanced blocks
 - Text block
 - Number To Text block
 - My Blocks
 - Variable block

Classroom activities

The classroom activities within this course will consist of building a robot a piece at a time and programming it with the NXT-G software. The students will be able to test their robots on a provided test mat, and after class is over they will have time to work on their homework assignments in a computer lab outside of class. Upon returning to class, they will take a quiz over the previous class's lesson before moving on to the next lesson.