

Lesson-Planning Routes

Route 1: Getting Started Experience (4 hours)

- The Getting Started Experience guides users through the creation of a basic chassis using TETRIX® and LEGO® MINDSTORMS® elements in Lesson 1. In Lesson 2, users add wheels and motors to the chassis to create the foundation for the Ranger Bot and make it move by deploying a program, by using sample code, or by using a keyboard (or optional joystick). In Lesson 3, users add sensors and deploy a program. Sample programs are provided to download for instant success. Video tutorials and printed guides have been provided to guide students through optional use of a keyboard or joystick, and program deployment using LabVIEW™ for LEGO MINDSTORMS and ROBOTC®.
- All students should complete this experience in approximately four hours. This experience also serves as the foundation for the remaining extended experiences.

Route 2: Introduction to Programming Experience (5.5 hours)

- The Introduction to Programming Experience uses the Ranger Bot completed in Lesson 3 to introduce students to programming. Divided into three parts, the Line Follower Programming Extension and support materials walk students step-by-step through the creation of a line-following program. The printed guides outline the creation of code in both LabVIEW for LEGO MINDSTORMS and ROBOTC. The video tutorials use the code created to highlight key concepts in programming.
- Students wishing to learn more about programming should complete this activity and watch the video tutorials.

Route 3: Program and Expand Experience (7 hours)

- The Program and Expand Experience uses the basic program created in the Line Follower Extension and adds to its functionality. Here students can choose from a variety of modular extension builds and their corresponding sample programs to create a Ranger Bot. This Bot will be able to reach out and grasp an object (Arm and Gripper); pick up, count, and move objects (Harvester and Transporter); deposit an object that has been collected (Dispenser); or propel an object through the air to a target (Launcher).
- Extensions can be added and programmed or combined to expand the capabilities of the Ranger Bot. Each Extension activity can be completed in approximately one and a half hours.
- Educators may wish to have students work in small groups with each group completing a different extension. This will allow students to share their success with each other and demonstrate what they have learned.

Route 4: Complete Classroom Experience (15.5+ hours)

- The Complete Classroom Experience provides a challenging path that culminates in an opportunity for students to experiment with a variety of extensions and then complete a final challenge. Students may complete a *FIRST* Tech Challenge-style Competition Challenge, an open-ended STEM Challenge with real world applications, or a Creative Challenge that uses robotics.
- While support resources, including sample Building Guides and Programming Guides, have been provided for the Competition and STEM Challenge, they should serve as a starting point. Students should be given time to experiment with and expand on the samples and create their own solutions to the tasks described in the Challenge overviews.
- Each Challenge activity may take four to six hours to complete, depending on the experience of students and the time allowed for experimentation, original builds, and programming.
- (Optional) The Add-On Extensions supplement the Complete Classroom Experience by providing additional activities designed for use with hardware that is not a part of the base set. Using the corresponding hardware listed in the materials needed, students can complete each of the extension activities. These extensions can be built and programmed using the Ranger Bot. Each extension activity can be completed in approximately one and a half hours.

Note: The Innovation and Inspiration suggestions, located at the end of the Reference Guide in each lesson, provide additional suggestions for variation, experimentation, and innovation.

Lesson-Planning Routes

Route 1: Getting Started Experience (4 hours)

- L1: Basic Chassis (1 hr)
- L2: Ranger Bot Movement (1.5 hrs)
- L3: Ranger Bot Sensors (1.5 hrs)

Route 2: Introduction to Programming Experience (5.5 hours)

- L1: Basic Chassis (1 hr)
- L2: Ranger Bot Movement (1.5 hrs)
- L3: Ranger Bot Sensors (1.5 hrs)
- Line Follower Program Extension (1.5 hrs)

Route 3: Program and Expand Experience (7 hours)

- L1: Basic Chassis (1 hr)
 - L2: Ranger Bot Movement (1.5 hrs)
 - L3: Ranger Bot Sensors (1.5 hrs)
 - Line Follower Program Extension (1.5 hrs)
 - Add One Extension (1.5 hrs each)
- Arm and Gripper (1.5 hrs)
Harvester and Transporter (1.5 hrs)
Dispenser (1.5 hrs)
Launcher (1.5 hrs)

Route 4: Complete Classroom Experience (15.5+ hours)

- L1: Basic Chassis (1 hr)
 - L2: Ranger Bot Movement (1.5 hrs)
 - L3: Ranger Bot Sensors (1.5 hrs)
 - Experimentation with Extensions (7.5 hrs)
 - Complete One Challenge (4+ hrs each)
- Competition Challenge (4+ hrs)
STEM Challenge (4+ hrs)
Creative Challenge (4+ hrs)
- One Add-On Extension (1.5+ hrs each)