

Time for an Upgrade

Build motorized tools that can help solve competition tasks.

🕒 90–120 min. 📦 Advanced 🎓 Grades 6–8



Teacher Support

Key objectives

Students will:

- Create two tools for the Advanced Driving Base
- Explore how to program the Advanced Driving Base to use the tools to complete tasks

Things you will need

[LEGO® Education SPIKE™ Prime Set](#)

[LEGO® Education SPIKE Prime Expansion Set](#)

Additional resources

[Building instructions](#)

[Building instructions](#)

[Python Programs](#)

Educational standards

NGSS

MS-ETS1-4.

Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

CSTA

2-AP-17 6-8

Systematically test and refine programs using a range of test cases.

Common Core

CCSS.ELA-LITERACY.W.6.1

Write arguments to support claims with clear reasons and relevant evidence.

Lesson plan

1. Prepare

- Read through the student material in the LEGO® Education SPIKE™ App.
- To complete this lesson, your students will have to have built the Advanced Driving Base model.

2. Engage(10 Min.)

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- Use the ideas in the *Ignite a Discussion* section below to engage your students in a discussion related to this lesson.
- Use the video to explain the lesson.

3. Explore (30 Min.)

- Have your students work in pairs to build the Dozer Blade, Lift Arm, and Crates.
- When they have finished building, ask them to attach the Dozer Blade and Lift Arm to their Driving Base.
- Ask them to play the test program and to observe what happens (i.e., the Lift Arm will be raised).

4. Explain (10 Min.)

- Facilitate a discussion about the key features of the Dozer Blade and Lift Arm tools and how they could be useful in a competition.

5. Elaborate (40 Min.)

- Have your students create programming stacks that'll raise and lower both tools.
- Challenge them to make their Driving Base replicate the behavior shown in the video. Remind them that they are decomposing a problem.
- Don't forget to leave some time for cleanup.

6. Evaluate

- Give feedback on each student's performance.
- You can use the assessment rubrics provided to simplify the process.

Ignite a Discussion

Spend some time watching videos of competition robots in action. Use these questions to engage your students in a discussion about how successful teams use tools to help their robots collect and move objects around:

- Why are these tools useful in competitions?
- Why do teams change tools at different points during each competition run?
- Why is it important to reset the position of the motors when using tools?
- How would you describe the characteristics of your Driving Base tools in terms of precision, strength, and design?

Have your students watch this video to see what they're about to do.

Building Tips

The tools

In addition to the Advanced Driving Base, each team will need:

- a Dozer Blade
- a Lift Arm

Locking Tools into Place

Use the red connectors to lock the tools into place so the Advanced Driving Base looks like this:

Four Crates

Each team will need to build these 4 crates in order to complete this lesson.

Coding Tips

Main Program

Possible Solution

Other Programs

Differentiation

Simplify this lesson by:

- Having your students experiment with the Lift Arm until they're ready to move onto the Dozer Blade and challenge

Take this lesson to the next level by:

- Asking your students to modify the tools to pick up or move other objects or bricks
 - Having your students approach the crates from an angle and challenging them to write a program that uses the Gyro Sensor to position the Driving Base
 - Challenging your students to create their own Driving Base tools
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Assessment Opportunities

Teacher Observation Checklist

Create a scale that matches your needs, for example:

1. Partially accomplished
2. Fully accomplished
3. Overachieved

Use the following success criteria to evaluate your students' progress:

- Students can accurately describe the concept of an array.
- Students can create and correctly use an array in their programs.
- Students can use multiple arrays in their programs, comparing the value of each index.

Self-Assessment

Have each student choose the brick that they feel best represents their performance.

- Blue: I've used an array in my program.
- Yellow: I've created a second array in my program.
- Violet: I'm an array master! I can perform multiple operations on arrays. Give me any array challenge and I'll solve it!

Peer-Assessment

Encourage your students to provide feedback to others by:

- Having one student score the performance of another using the colored brick scale above.
 - Asking them to present constructive feedback to each other so that they can improve their group's performance during the next lesson.
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Language Arts Extension

To incorporate language arts skills development:

- Have your students prepare and deliver a presentation about how their Advanced Driving Base uses tools to complete tasks, highlighting the tools' strengths, components used, etc.

Note: This will make for a longer lesson.

Career Links

Students who enjoyed this lesson might be interested in exploring these careers pathways:

- Health Science (Allied Health)
- Health Science (Medical & Health Careers)
- Health Science (Medical Assistant)
- Information Technology (Computer Programming)
- Science, Technology, Engineering & Mathematics (Science and Maths)