



# MODULE 5

## SELECTING A PROBLEM AND PROGRAMMING MISSIONS

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### MODULE OVERVIEW

MODULE NUMBER: 5

DURATION: 2 hours

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### SUMMARY

In this module, the team will select a specific solution related to their chosen problem. They will also continue to program the robot missions.

#### Core Values to Focus on in This Module

- **Innovation:** *We use creativity and persistence to solve problems.*



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## OUTCOMES:

Educational standards alignments can be found at

<http://www.firstinspires.org/resource-library/fll/standard-alignment-map>

## MATERIALS

1. *FIRST*® LEGO® League Challenge Set
2. Whiteboard or other writing surface
3. Pencil/Pens/whiteboard markers
4. Computer or tablet to program the robot
5. An envelope
6. 3 inches of tape
7. 5 rubber bands
8. Printed Field Research handouts



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## Note from An Experienced Coach:

The beginning of an FLL season can be overwhelming: you'll have to learn the rules to a new game, coordinate the team's building efforts and reinforce effective teamwork skills through the CORE values. In the end though, it is best to break things down into chunks, take a breath and realize that the processes is intended to be fun and it's all about the kids. These days I jump right into the building and programming LEGO robots with my class. The reason I do this because I've realized that the first stages of an FLL season are crucial towards building enthusiasm and excitement around the field of robotics. If you have a group with a wide range of abilities, because you have some returning students, create some pre-season activities which can be scaled up and down depending on programming ability. Once all students have a taste of what it is like to program in the EV3 language and have some experience building a robot (individually if resources allow) your group will be primed to brainstorm ideas for the robot game especially in relation to what can and cannot be achieved with their abilities thus far.

Kit Fuderich



# INSPIRATION

SUGGESTED TIME: 15 minutes

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## Bridge Challenge

### Materials:

1. An envelope
2. 3" of tape
3. 5 rubber bands

**Goal:** Create the longest bridge possible with the given supplies between two chairs or tables in five minutes.

Present the team with the supplies above, tell them the goal of the challenge, and say "Your time begins now!" Then sit back and let the team figure out how to build a bridge.



### Discussion

Ask the team members the following questions to help them focus on the process of the activity as opposed to the end result.

1. How did you decide where to start?
2. How did you decide what to do with the materials?
3. Did you plan beforehand or did you just start building?
4. Did everyone feel like their ideas were heard and considered?
5. What did you learn by doing this activity?
6. What would you do differently if you did it again?



### HINT:

If you have time and the team has ideas about what they would do differently, give them five more minutes to redo the activity.

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# PROJECT

SUGGESTED TIME: 45 minutes

## 1. Review the team's Field Research about the problem

In the Field Research for the last module, team members researched the problem the team identified. Have each team member share the references they found about the problem. They should tell:

1. Where they found the reference.
2. What they learned from the reference.

## 2. Brainstorm solutions to the problem

- Now brainstorm solutions to the problem. Before beginning the brainstorming session, remind the students of the brainstorming guidelines:
  - No idea is a bad idea.
  - Say any and every idea that pops into your head. Even a crazy idea might lead to something else (or it might not be as crazy as you thought!).
  - Keep a list of all the ideas.
  - Once you have a thorough list, then go back and narrow it down, but not before.
- Have the team keep a list of all the ideas.
- Ideas may be completely original or modifications of existing solutions.



## 3. Decide on a specific solution

- Now use your team's decision making process to decide on a single solution idea the team will build out and present.
- The following questions may help the team think through the options:
  - Which solution best satisfies our problem?
  - Which solution are the most people interested in?
  - Which solution would have the biggest impact on our community or world?
  - Which solution can we state very clearly?
  - Consider if the solution is something you or others could realistically implement. Your team does not have to implement your solution, but it might be something you want to consider when deciding on your solution.



### HINT:

Have your team read the Innovative Solution section of the Project Judging Rubric when evaluating their solutions.



### HINT:

If your team is having trouble agreeing upon a single solution, you may have them:

1. Take a vote.
2. Try multiple ideas to see which one works better.
3. Combine ideas, or take the best parts from each idea.



**HINT:**

Later in the year, your team might be selected for the *FIRST*<sup>®</sup> LEGO<sup>®</sup> League Global Innovation Award and get further help developing your innovative solution to your problem.

<http://flinnovation.firstlegoleague.org/>

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## LEARNING RESOURCES

- *FIRST*<sup>®</sup> LEGO<sup>®</sup> League Challenge Guide

# ROBOT

SUGGESTED TIME: 40 minutes

## Continue programming and testing the robot missions

1. As a team, create a list of everything that needs to be done to complete the robot programming.
2. Decide which team members will do which tasks and set specific deadlines if the team hasn't already.
3. Continue to program the robot, test it, and make changes repeatedly.

## ROBOT TIPS

### Batteries

Your EV3 robot probably came with the EV3 Rechargeable DC Battery and DC charger. With this battery, you can build your robot and not worry about having access to the battery compartment to change the battery. You simply plug in the robot between practices to charge it. (Be sure to leave access to the charging port.) You can also use AA batteries, but they will have to be changed frequently, so you will need to leave access to do that, or be able to remove the brick from your robot easily. While the EV3 Rechargeable DC Battery takes up slightly more room than the AA batteries, the difference is small, and the DC battery is a good option.



#### HINT:

Some teams will purchase an additional DC battery and keep one battery fully charged, for longer programming sessions. If you do this, you will still need to either leave access to the battery compartment or be able to remove the brick so that you can change the battery without taking apart your robot. Additional batteries may be found at:  
<http://shop.lego.com/en-US/EV3-Rechargeable-DC-Battery-45501>

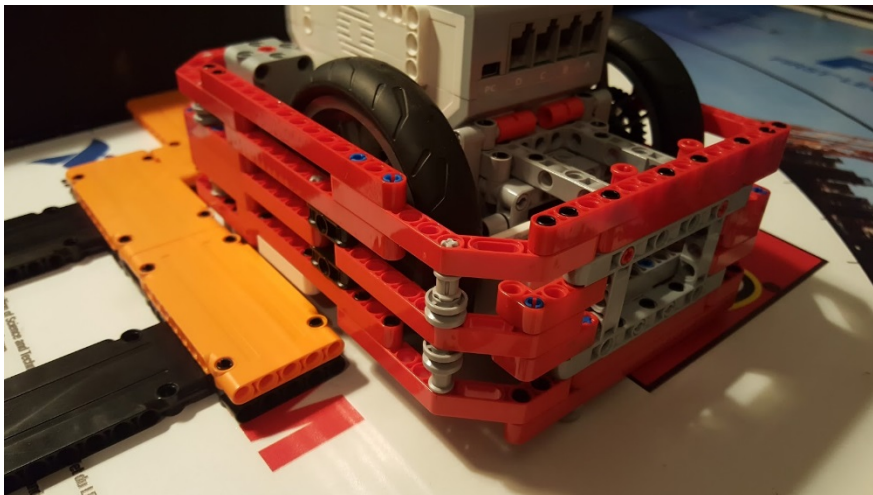


#### HINT:

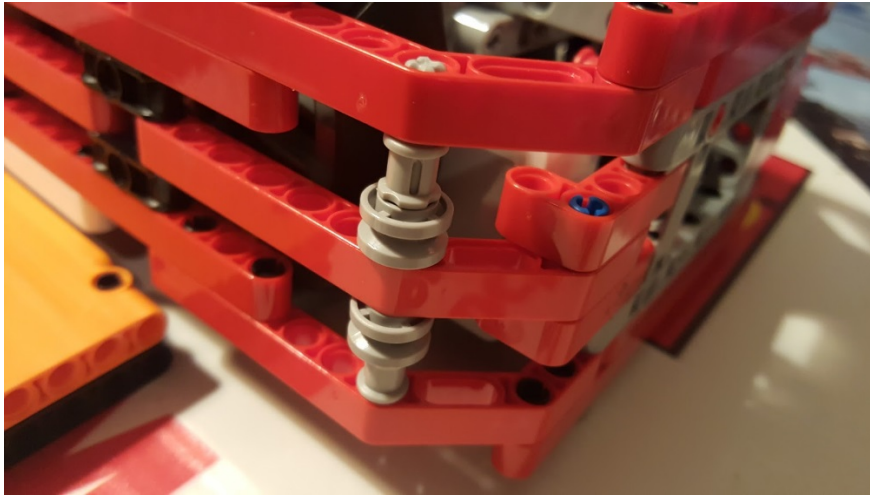
When changing the battery, always wait until the brick has completely shut down before removing it. If you don't, it could delete the most recent version of your program that you have downloaded. Then you'd be running a previous version and you might not realize it.

### Robot Features

1. Having a smooth border or bumper on your robot can help you align against a wall or other features on the table and can help prevent getting caught on table elements.



2. Adding smooth wheels or rollers to the side of the robot can help the robot roll smoothly along a wall and is a good way to travel long distances.



3. When designing attachments, try to keep it simple. Make sure the attachment affixes securely to the robot, but can also be easily changed between runs, if necessary.
4. A good attachment shouldn't require absolute precision every time, like threading a needle. Try to design the attachment so that there is some room for error.
5. Be sure all team members know how to secure the attachments to the robot so they are attached the same way every time. Try to design the attachment so it is clear and easy to see how to affix the attachment correctly.
6. Remember that making any significant physical changes to your robot, such as adding a heavy attachment could cause the robot to act differently. Think about this if you add something that increases friction or adds a load to the robot on one side.


### Programming Tips

1. Be sure to take advantage of the resources provided with the LEGO® Mindstorms EV3 software. From the home page, click on the Robot Educator on the left of the screen. There you will find various tutorials. The "Basics" and the first four tutorials of "Beyond Basics" will walk you through the steps you need to be successful. These tutorials will give you vital skills to increase accuracy on the field, such as following a line, detecting when a touch sensor has been pressed, detecting colors, and using the ultrasonic sensor.
2. **Save your programs often!** Save them every few minutes during a practice, not just at the end of each practice. Make dated back-ups of your programs and store them somewhere other than the computer you use for programming, like a flash drive or cloud storage. If something happens to the computer, you will have access to them.
3. Don't try to program too many steps at once. Check for accuracy as you go.
4. Use the comments feature to document each section of your program. If you need to go back later to make changes, you can easily identify where you are in the program.
5. How to make your robot go straight video:  
<https://www.youtube.com/watch?v=OIAO9Ho-N58>

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## LEARNING RESOURCES

- LEGO.com has links to the EV3 Mindstorm user community, apps for learning programming, and a variety of videos, galleries and games that can provide inspiration.
- The LEGO MINDSTORMS Education EV3 Software (that you use to program the robot) also has many programming tutorials that will be useful to the team.

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- A comprehensive approach to robot design and programming with lessons categorized as Beginner, Intermediate and Advanced is available at [EV3Lessons.com](http://EV3Lessons.com).
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# DEBRIEF

SUGGESTED TIME: 10 mins

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## 1. Check the Timeline

1. Have the team check the timeline they created last practice.
2. If they are on schedule, congratulate them!
3. If they are a little behind, ask them what they can do to catch up.

## 2. Recap

Review what the team accomplished in this module. The team:

1. Identified a specific solution to pursue for the Project.
2. Continued to program the robot missions.



## 3. Reflect

Ask the team:

1. What do you find interesting about the chosen solution?
2. How do you feel about your progress in programming the robot?

## 4. Give the students the Field Research for this week.

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# FIELD RESEARCH

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Before the next module, team members should use the attached handout to do the following activities:

## Project

- Write down two ideas of how you can present your solution to the judges.



### **HINT:**

To understand the presentation requirements, see the Project Presentation section of the Challenge Guide and the Project Rubric.

## Robot

- Programming is a process. Things never go as planned on the first try. Choose one issue your team ran into while programming the robot and write down one way the team can fix it.
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# Field Research

## Module 5

### Project

1. Write down two ideas of how you can present your solution to the judges.  
*Hint: The project rubric tells how the judges will judge your presentation. See the rubric at <http://www.firstinspires.org/resource-library/fll/judging-rubrics>*

1.

2.

### Robot

1. Programming is a process. Things never as planned on the first try. Choose one issue your team ran into while programming the robot and write down one way the team can fix it.



# OTHER TASKS & TIPS

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## TASKS

## TIPS

1. Make sure your team is registered for your regional tournament. Registration happens through your regional partner's website. You can find local events at <http://www.firstinspires.org/team-event-search#type=teams&sort=name&programs=FLL&year=2018>.
  2. Think about any ways that parents might be able to help with the upcoming presentation.
  3. By the end of the 5th week, the team's first tournament may be looming large, and they may not be as far along as you (or they) would like in the process. Take stock of what is working for the team, and where they may be having problems. Congratulate them on what they are getting right. Ask them what they think they can do to solve problems they are having. Remember, the team "does the work", but coaches and parents are there to help them through the difficult times. Resist the temptation to give the team answers, but do help them develop/improve the processes they use for finding answers.
  4. If necessary, remind the team of the core value for this week- if they are learning and having fun, then they are "doing it right" even if they feel they aren't succeeding.
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# NEXT TIME

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In the next module, the team will create their Project presentation and reduce the amount of errors they have in the robot missions.



Make sure that before you come to the next meeting you have reviewed *Module 6* thoroughly.

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