



# MODULE 4

## IDENTIFYING A PROBLEM AND BUILDING ATTACHMENTS

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### MODULE OVERVIEW

MODULE NUMBER: 4

DURATION: 2 hours

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### SUMMARY



In this module, the team will narrow down the problems they have explored to a single problem they will research further and design a solution to. They will also conduct an interview with a professional about the Challenge. For the robot, the team will design and build attachments to help the robot complete the game missions.

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

- **Inclusion:** *We respect each other and embrace our differences.*



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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. 2 Tokens per team member (pennies or any small item will do)
6. Printed Field Research handouts



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## Note from An Experienced Coach:

A rookie and a veteran player are making suggestions for an attachment to the robot that will manipulate a model on the challenge field but neither is persuading the other. The coach suggests they each build a quick prototype of their idea and share it with the team. They each build their idea and bring it to the table for demonstration. The rookie is not yet familiar with the hundreds of different LEGO pieces so her prototype is not very strong, but it's good enough to get the concept across. The veteran's is robustly built and looks cool, but his doesn't accomplish the task very well.

After the demonstration the veteran builder tells the team he thinks the rookie's idea is better and offers to help her find the right pieces and use good building technique to improve her prototype. In the competition of ideas Coopertition® between teammates is as important as with other teams at a tournament.

Over the past five seasons the Amazing Knights have designed and built a wide variety of attachments from passive to active making use of motors, magnets, cannons, rubber bands and pneumatics to create innovative, high performing robots.



# INSPIRATION

SUGGESTED TIME: 15 minutes



## Trivia Challenge

If the team has already had good research time/met with an interviewee, they might be able to play a trivia game to test their knowledge. This will help the students review the project and encourage teamwork.

1. Divide the team into two groups.
2. The teams will compete to see who can answer the most questions.
3. You will ask them questions about:
  1. The problem they have researched.
  2. The interview with the professional.
4. Here are the rules:
  1. Groups will alternate being asked questions.
  2. One representative is chosen to answer each question. Every group member must attempt a question before another member has a second turn.
  3. Each question is worth 2 points.
  4. If the representative can't answer they may ask for help from the rest of their group for 1 point.
  5. If the group does not answer in 30 seconds, the other group may attempt to answer the question.
  6. Ask between 10-15 questions.



### **HINT:**

The point system is to encourage kids to act independently rather than always fall back to their group. This could be beneficial for quiet, reserved kids.

# PROJECT

SUGGESTED TIME: 45 minutes

## 1. Identify a problem for the Challenge



Prepare the team to identify a problem to research by confirming the team members understand the Challenge Theme (exploration of the theme was conducted in Week 3). Be prepared to take notes on something everyone can view such as a whiteboard or flip chart.

1. Have the team sit in a circle. Remind them that you want to hear from everyone. Consider going around the circle asking each child for a contribution.
2. Ask team members to share what they found in their Field Research from the last module.
  - What are three interesting facts you learned about the problem?
  - Are there any solutions that currently exist for this problem and why aren't they working well enough?
  - What are three possible ways to improve the existing solutions? What ideas do you have for completely new solutions to the problem?



### **HINT:**

Sometimes kids start answering spontaneously. You can take advantage of this enthusiasm but remember that inclusiveness is important. After the initial burst of ideas you can transition to going around the circle child by child to prompt responses.



### **HINT:**

Tell the students that the team might not choose their favorite problem, but they will choose something that everyone can support.

3. Help the team decide on a specific problem
  - On a whiteboard or piece of paper, write down each problem the team has researched.
  - Ask questions like:
    - Which problem best satisfies the Challenge requirements?
    - Which problem are the most people interested in?

- Which would have the biggest impact on our community or world?
- Which problem can we state very clearly?



**HINT:**

A good way to end questioning sessions is to ask "Does anybody have anything else to add?" If you believe a team member has not contributed, gently direct a question their way.

- Choose a final problem by following the decision making process the team decided upon at the beginning of the season.

## 2. Conduct Interview(s)

Have your team interview one of the professionals they identified in module 3.

- If the team is conducting the interview in person, over the internet, or via phone, have team members decide:
  - Who will ask the questions?
  - Who will record the answers?
  - How will they record the answers?
- If conducting the interview via email, email the professional the questions the team created in the last module.



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## LEARNING RESOURCES

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

SUGGESTED TIME: 40 minutes

## 1. Finalize and build attachment designs

- In the Field Research from the last module, the team members each came up with an idea for an attachment. Have each team member build their attachment. Have kids work together or individually. Make a note of which missions each attachment can attempt.
- Go around and have each team member demonstrate by hand how their attachment can do the mission they are attempting.
- Don't throw out any ideas at this point. Later, you will have the opportunity to refine and revise your attachments.



### HINT:

Remember the Technic beam exercise. The team may be surprised to see how a simple attachment can be used to earn points.

- Attachment tips:
  - Attachments can be connected to motors on the robot. EV3 robots have four ports available to plug in motors.
  - Motorized arms that raise and lower can be used to solve missions, however, not all attachments need to be motorized.
  - Attachments may be passive or active. A passive attachment such as a plow may be used to control a mission model while pushing it. An active attachment may require a motor to raise or lower an arm containing an object or perhaps to rotate an arm.

## 2. Program Missions

In module 3, your team created a mission and programming plan. Now that you have your basic robot design and some attachments to try, you can begin programming!



### HINT:

After completing the EV3 basic Robot Educator units in Module 2, team members should be able to move the robot forward, backward, left and right. They should also understand how to use sensors to provide feedback to the EV3 controller so it knows where it is on the playing field. Use these skills to program the mission solutions.



### HINT:

Where the robot starts strongly influences where it ends. Keep good notes about where the robot is placed in base prior to leaving to attempt a mission. Consistency in starting position is very important.



### HINT:

It's allowable to bring paper notes to the competition table at a tournament for referencing. However, you cannot physically use the paper to align the robot since only LEGO® elements are allowed on the table.



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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.
  - 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 problem.
2. Interviewed a professional.
3. Built robot attachments.
4. Began programming robot missions.

## 3. Reflect

Ask the team:

1. What do you find interesting about the chosen problem?
2. How do you feel about 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

- Research what is currently being done about the team's chosen problem and bring back two references containing information about the problem.

**HINT:**

Encourage the team members to use a variety of resources such as journal articles, books, periodicals, and the internet.

**HINT:**

Be sure the team members collect the references in a shared location, either online or on paper.

## Robot

- Reflect on how programming the robot went in this module. Write down the next three steps the team needs to do to continue programming the robot.
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# Field Research

## Module 4

### Project

1. What is the team's chosen problem?
  
2. Research what is currently being done about the team's chosen problem and bring back two references containing information about the problem. Use references such as journal articles, books, periodicals, and the internet.

### Robot

1. Think about how programming the robot went in this module. Write down the next three steps the team needs to do to continue programming the robot.
  - 1.
  
  - 2.
  
  - 3.



# OTHER TASKS & TIPS

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## TASKS

1. Registration should have been completed for team members, coaches and mentors during Modules 1 and 2. If not, make time to accomplish the mandatory tasks. *FIRST*® LEGO® League tournament registration and participation will be difficult if not impossible until registration is completed.
2. The Student Team Information Management System (STIMS) is used for parents to register their youth as a *FIRST* LEGO League team member and complete the consent and release form online. Parents should go to the registration link indicated on the email invitation, or <https://my.usfirst.org/stims/Login.aspx>.

## TIPS

1. Coaches need to delegate in order to avoid burnout. Consider having a parent attend each meeting to help maintain order and focus.
  2. If there are *FIRST* LEGO League events nearby that are prior to your team's competition, consider a field trip to familiarize yourself and the team members with the atmosphere of a *FIRST* LEGO League event. They can also benefit from touring the pit area and asking questions about each team's Project idea.
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# NEXT TIME

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In the next module, the team will decide on a specific solution to their chosen problem and continue programming the Robot Game Missions.



Make sure that before you come to the next meeting you have reviewed *Module 5* thoroughly.

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