MODULE 3

NARROWING THE PROBLEM AND DESIGNING THE ROBOT

MODULE OVERVIEW

MODULE NUMBER: 3   DURATION: 1.5 hours

SUMMARY

In this module, the team will brainstorm a list of problems related to the Challenge theme they might want to explore for their Project. They will narrow this list and begin researching the problems. The team will also plan how they will solve the Robot Game missions and design any attachments or changes that need to be made to the robot.

Core Values to Focus on in This Module

- **Discovery:** *We explore new skills and ideas.*
- **Innovation:** *We use creativity and persistence to solve problems.*

OUTCOMES:

Educational standards alignments can be found at http://www.firstinspires.org/resource-library/fll/standard-alignment-map
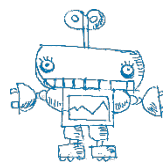
MATERIALS

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. Newspaper
6. Masking Tape
7. Book (can be anything)
8. Cardboard (approx. 8.5"x11")
9. Printed Field Research handouts

Note from An Experienced Coach:

By Module 3, you have brought your team together, introduced the Core Values to them, and started them on their way learning about the Project and the Robot. A lot of work lies ahead, but be sure to take some satisfaction from what you have accomplished so far. At this point the team's dynamics, both good and bad, are becoming clear. Congratulate the team on what is working in their interactions with each other, and strategize on what you might do to help the team adjust their behavior to reduce conflicts or increase performance. Use the Core Values where appropriate to encourage the team. If you see the team getting stuck on particular technical issues, consider seeking help from a parent or other source to resolve the problem Remember that FLL team coaches are supposed to have fun, too!

Capital Teens

Paper Table Challenge

The teamwork exercise for this week is an activity created by the PBS Design Squad. In the Paper Table Challenge, team members must use newspaper and masking tape to build a small table strong enough to hold a book. See the instructions here.

Discuss the Core Value

This week's Core Value is: We know our Coaches and Mentors don't have all the answers; we learn together.

Discuss this idea with your team. Ask them questions such as:

1. How did you see this week's Core Value in the activity?
2. How will this Core Value be relevant when building the robot?
3. How will this Core Value be relevant in the Project?
4. Is there only one right answer?
5. What do we do when we don't know the answers?
   - What did you do in the activity?
   - Did you try different approaches?

HINT:
There is NEVER only one right answer!

PROJECT

SUGGESTED TIME: 30 minutes

Identifying Problems

This week the team will brainstorm problems associated with the Challenge and then narrow the list to a handful of problems they might want to explore.

1. Before beginning the brainstorming session, remind the team of the brainstorming guidelines used previously:
    1. No idea is a bad idea.
    2. Throw out 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!).
    3. Keep a list of all the ideas.
2. Once the team has generated a list of problems, help them narrow the list down to the number of members on your team (if you have 5 kids, narrow the list to 5 problems).
3. Have each team member pick their favorite problem, or have everyone choose a problem out of a hat.
4. Each team member will perform research around their problem for this week's Field Research.

Professional Pre-Work

If possible, interviewing professionals can be very helpful for learning about the Challenge. It helps kids envision their future jobs by exposing them to professionals and allows them to gain real world knowledge of the Challenge. Help the kids identify people in their community who know something about the topic and create relevant questions to ask them.

1. Ask the students what kind of jobs are related to the problems they brainstormed.
2. Make a list of these professional jobs.
3. Then ask the students if they know any adults who work in these jobs.
    - Keep a list of the people.
    - If the students don't know anyone personally, ask them to think of local businesses they could contact.
4. Have the students create a list of 5 questions for the professionals. When creating their questions, have them think about:
    1. What do we currently know about this topic?
    2. What do we need to know about this topic?
    3. What are problems related to the topic?
    4. What is currently being done about these problems?

LEARNING RESOURCES

- *FIRST®* LEGO® League Challenge Guide
- *FIRST®* LEGO® League How-to: What is the Project? Video
  https://www.youtube.com/watch?v=r229WGU_zbA
- *FIRST®* LEGO® League How-to: How to Have a Successful Project Experience Video
  https://www.youtube.com/watch?v=pJae_UWamr8

1. Brainstorm ideas for how to accomplish each mission

In module one the team decided on the missions they are going to tackle. Now it's time to start building solutions! It's okay if the team doesn't have all the answers at first. However, the team can start to generate *ideas* about how the missions might be accomplished, which they will then use to guide their attempts to build and program the robot. It's best to keep things simple, and if your team only has time to build and program one mission, that is a success!

As a coach, you can facilitate the development of these ideas by asking questions like:

- Which missions are close to each other on the field?
- Are there any missions where an attachment might be useful?

> **HINT:**
> Attachments are extensions you build out of LEGO® elements and add to the robot to perform specific actions. For example, you might use a beam to push or pull a feature on a mission model. Attachments do not have to be motorized, but you may choose to use small motors to make them move.

> **HINT:**
> Your team will be able to add or remove attachment when the robot is in base during a match.

- Which missions require the same action, and therefore might be able to use the same attachment?
- Are there any clues the robot can use to help it find its way around?

> **HINT:**
> Later we will talk about using sensors and other strategies for accomplishing this.

2. Create a mission plan

After brainstorming ideas, the next step is to create a mission plan. Have your team use the Mission Planning Guide (attached at the bottom of the page) to create a step-by-step list of actions the robot must perform for the mission(s).

> 💡 **HINT:**
> Remember the blindfold activity! Robots can't think and will only do exactly what you tell them to do. So be specific!

> 💡 **HINT:**
> Many teams post videos of their robots on YouTube. Watching these videos may spark a few ideas!
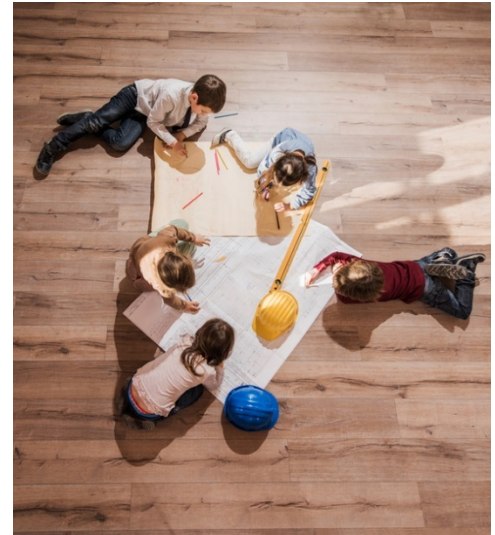
3. Decide on a robot design

When deciding what your final robot design will be, you can:

1. Use the basic robot you built in week 1.
2. Use a basic design that came with the LEGO EV3 Mindstorms Kit.
3. Search online for ideas.

> 💡 **HINT:**
> EV3Lessons.com provides instructions for building 3 different robots. These may spark ideas or provide a starting point for your team's robot.

Or create your own! You are going to make the robot your own by adding attachments and altering the robot for your needs as the season goes on.

LEARNING RESOURCES

- EV3Lessons Droid Bot Instructions
  http://ev3lessons.com/robots.html#en-us

DEBRIEF

SUGGESTED TIME: 10 mins

1. Check the Timeline
1. Have the team check the timeline they created last module.
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. The team:
1. Completed the Paper Table Challenge.
2. Brainstormed and identified problems related to the Challenge.
3. Decided on a robot strategy and design.

3. Reflect
Ask the team:
1. What interesting problems they identified related to the Challenge?
2. How did they work together and compromise as a team in the activities?
3. What did they do when they didn't know the answers?

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

FIELD RESEARCH

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

Project

Research the problem you have been assigned and write down:
1. Three interesting facts you learned about your problem.
2. Any solutions that currently exist for this problem and why they aren't working well enough.
3. Three possible ways to improve existing solutions or completely new solutions to the problem to share with the team.

Robot
1. Brainstorm ideas for attachments for a single mission. Draw a picture of what you think the attachment should look like.

Field Research

Module 3

Project

Research the problem you have been assigned and answer the following questions.
1. What are three interesting facts you learned about your problem?

2. Are there any solutions that currently exist for this problem and why they aren't working well enough?

3. What are three possible ways to improve the existing solutions or what ideas do you have for completely new solutions to the problem?

Robot

1. Brainstorm ideas for attachments for a single mission. Draw a picture below of what you think the attachment should look like.

OTHER TASKS & TIPS

TASKS

Set up interview
Arrange for an interview with one of the professionals identified by the team in the "Professional Pre-Work" section of the module. You may:

1. Ask a professional to come to practice
2. Arrange Skype or phone interview
3. Arrange for the team or a subset of the team to go meet with the professional
4. Arrange email "interview"

Check challenge updates
Challenge updates are continuously released throughout the season. Be sure to check at http://www.firstinspires.org/robotics/fll/challenge-and-season-info

Check roster in Team Registration System
Make sure all of the team members have signed up for the team in the Student Team Information Management System, and accept them to the team.

Consent and release forms
Make sure all of the parents have signed the Consent & Release Form for their student.

TIPS

Discussion Management
If the team talks over each other, try using one of the following approaches:

1. Round Robin Approach: Appoint one leader who goes around the circle listening to each idea one person at a time. The leader helps the group take turns talking.

2. Token Approach: There is one token - anything such as a paperclip or penny - and only the person with the token can talk. Then the token is passed around the team to let everyone share their ideas.

Do No Harm
Don't worry about score. Focus on having fun. Building complex robots like those you may see on YouTube are not for young or rookie teams. Start with a basic robot design and built out from there. You will be surprised by what a basic robot that goes straight can do.

Going Straight
A robot that does not go straight will not be consistent. Once you have a base robot, do a straight drive test. If the robot does not go straight, look at the robot's center of gravity and balance. Going straight is a big deal that is overlooked by young teams.

NEXT TIME

In the next module, the team will conduct a professional interview(s) and identify a single problem for their Project. They will also begin building attachments for their robot and programming the missions. Make sure that before you come to the next meeting you have reviewed *Module 4* thoroughly.