A Beginner's Guide to FIRST LEGO League

Before you Begin:

Below is a sample schedule for a rookie team. Feel free to modify based on your team's background, how many times you can meet during a season, and when your first qualifier is scheduled. The recommended lessons and worksheets are resources we have created over the years for teams. You can substitute as needed if you prefer other sources. Also note that the lessons are based on installing the full version of the software. If you use Chromebooks or iPads, the equivalent programming lessons are all here.

At the end of the 13 weeks, all team members will have learnt basic programming (moving, turning, switches, loops, basic color sensor, and a basic line follower). The goal is for your rookie team to accomplish 2-3 missions reliably during this period. All students will have also contributed to the Innovation Project and have a strong understanding of the FIRST Core Values.

** Prior to the start of the season, be sure to build a FIRST LEGO League table and install the EV3 Education Software on a team laptop. Make sure that the software and the EV3 firmware have been updated on your team laptop.*

Useful Contacts

- ❏ Robot Game questions, Project questions, Judging questions, Team questions
- ❏ LEGO Education for order status or missing parts - 1-800-422-5346
- ❏ Facebook Group for getting support from other coaches - FLL: Share & Learn
- ❏ EV3 Programming Lessons from Beginner through Advanced: EV3Lessons.com
- ❏ FIRST LEGO League Tutorials: FLLTutorials.com
- ❏ Questions or suggestions for the author: team@flltutorials.com

You are welcome to modify and use any part of this guide or any worksheets. Please credit FLLTutorials for the original work (e.g. Modified from materials provided by FLLTutorials.com)

WEEK 1: Getting Started

Robot Game:

1) Build mission models using only the Build Instructions provided by FIRST. Divide into groups of two or three and build all the models. Have an adult double check all the models. Use the Field Set Up Guide (inside the Game Guide) to attach the models to the challenge mat. Budget about 2 hours for building mission models. Here are some tips.
2) Learn the missions - What are their names? What is the objective of each mission? (Worksheet: Learn the Missions)
3. Check for Robot Game Updates.

Innovation Project:

1) Read the Challenge Document to learn what the topic is and requirements are for the season. Identify some key words or requirements for this year's Innovation Project.
2) Check for Innovation Project Updates.

Core Values:

1) Develop a team Identity: Pick a team name. Come up with a logo. Design a team shirt.
2) Decide on Team Goals. Use the Rubrics as your guide.
3) Learn the FIRST Core Values (Worksheet: Learn Core Values)
4) Consider setting up a Kanban board for the team (See Week 4 in this document for an example). A team checklist may also be helpful.

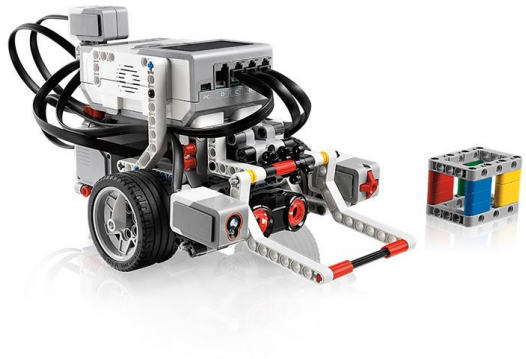
Homework:

1) Brainstorming: What sort of problems do you see in your community in a building or a public space? Bring your ideas to the next session.
2) Download and read all the rules in the Game Guide.

Useful References for the Coach: Coaching Core Values, Coaching Robot Game, Coaching Innovation Project, FIRST LEGO League Deliverables. * Check with your regional partner about what is required for judging in your region. Some regions may have variations in requirements as well as judging formats.

WEEK 2: Learning to Program

Check for Updates.



Robot Game:

1) If you are a rookie team, build a basic Educator Robot from the EV3 Education set. Instructions are available inside the EV3 Education Software.
2) Learn to move forward and turn
3) If you have some MINDSTORMS experience, you can skip ahead to learn more advanced coding (see EV3Lessons.com) or start to build your team robot.

Recommended Programming Lessons:
EV3Lessons.com: Introduction to Brick and Software, Port View, Moving Straight, Turning

Innovation Project:

1) Look at the mission models for inspiration. What problems do you think the models represent? Use the Project Sparks from the Engineering Notebook (pgs. 20-21).
2) Discuss the homework assignment. What problems did your team find interesting in your community?

Core Values: Do a teamwork activity to get to know each other. Decide how you will make decisions this season.

Sample activities can be found here: Core Value Activities
Recommended Lessons: Introduction to Core Values, Making Decisions

Homework: Take your brainstorming ideas and develop them into Innovation Project topics. You should do enough research on your topic so that you can explain it in detail to your team members the following session. (Worksheet: Research Notes Worksheet, Project Selection Worksheet)

WEEK 3: Developing a Team Strategy

Check for Updates.

Robot Game:

1) Discuss the rules and Challenge Updates that may change the rules.
2) Come up with a team strategy. If you are a rookie team, pick two or three missions to start with and divide them amongst your team. Missions near base or near lines are easier to navigate to. From the rubric: “Clearly defined and described the team's game strategy” (Worksheets: Mission Evaluation Worksheet, Robot Strategy Worksheet, Mission Brainstorming Worksheet).
3) Think about what what could solve the mission(s) and who will work on them. (Worksheet: Mission Brainstorming Worksheet).)
4) Learn to use the Color Sensor this week so you can make use of any lines. (Recommended Lesson: EV3Lessons.com: Introduction to the Color Sensor)

Innovation Project: Based on the homework, decide as a team what problem to work on and split the topic equally among the team members for homework. This time everyone is working only on one topic that the team picked.

Team Tip: “Always pick a project that is meaningful to the team members and something that interests them.”

Core Values: Learn what pseudocode is and the importance of giving accurate instructions. Pseudocode Peanut Butter Worksheet. (Recommended Lesson: Pseudocode)

Homework: Different kids should research different aspects of the chosen problem in order to divide the work among the group. Go into more detail this week using the same worksheet. Background information on the problem (where does this problem exist), Possible Field trips/Experts, Existing Solutions for this problem. Different students will be filling in different sections of the worksheets. Document all your research. (Worksheet: Project Selection Worksheet)

WEEK 4: What's our Problem?

Check for Updates.

Robot Game:

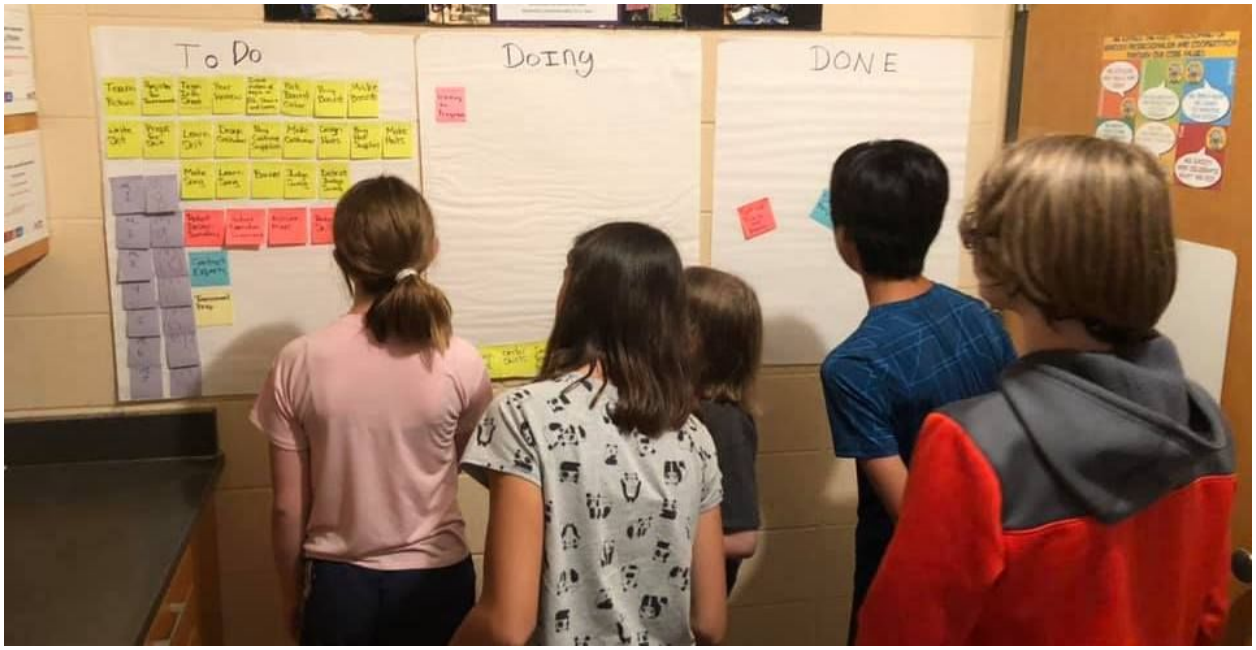
1) Learn to Line Follow. (Recommended Lessons: EV3Lessons.com Loop, Switches, Basic Line Follower).
2) Test your line follower out on the actual challenge mat

Team Tip: "Learning to use sensors can help your team be more reliable. It is worth the effort, even if you are a rookie team. Start with sensors such as Touch and Color."

Innovation Project:

1) Discuss findings from homework. Decide where to go on field trips and whom to talk to and contact people.
2) Start to think of possible solutions.
3) At the end of this week, team members should be able to clearly articulate the problem your team is studying. It should fit the innovation project criteria. You should have some idea of what a solution might be.

Core Values: Do a Core Value Activity that might require coordination among members.



Team using a Kanban board to keep track of work

WEEK 5: First Mission

Check for Updates.

Robot Game:
1) Finish the last programming lesson: Move an Object (Programming Lesson: EV3Lessons.com: Move an Object)
2) Look at the Crane Mission Lesson provided by FIRST – build the robot attachment provided. Note that the solution asks you to use an advanced proportional line follower. (Useful Reference to understand FIRST's Crane Mission Lesson: Crane Mission Tips (Full Software Version) or Chromebook/App Version) If you are a rookie team, we encourage you to use the basic line follower your learnt in Week 4 instead.

Team Tip: "Don't be afraid to change, adapt or improve a solution you see. Sometimes, you can come up with something better."

Innovation Project:

1) Develop questions for any interviews/field trips you may have scheduled. Experts like it when students are prepared.
2) It might be useful for you to develop a short presentation to be able to explain to your experts what you are working on and also include what FIRST LEGO League is and this year's challenge is about.

Core Values: If you have time this season, you can share your progress/work with the community. You might also be able to reach out to another team for help. (Recommended Lesson: Outreach in FIRST LEGO League)

WEEK 6: Let's Build a Robot

Check for Updates.

Robot Game:

1) Modify the Educator Robot for this season or develop a new team robot. What does the robot need based on the mission strategy and missions you picked? *Worksheets: Robot Design Worksheet)
2) Once a basic team robot is ready, test it out to make sure it is balanced and accomplishes what you want it to. Refer to the Robot Design Rubric to see what criteria is used in judging. (Worksheets: Robot Testing Worksheet)
3) Brainstorm how you might solve the missions you picked (Worksheet: Mission Brainstorming Worksheet)
3) Start to build attachments to solve missions. Write pseudocode for your programs. (Worksheet: Pseudocode Worksheet)

Alternative Robot Designs for inspiration: FLLTutorials Robot Designs. If you use any designs for inspiration, be sure to cite your sources and let your judges know.

Innovation Project: Go on a field trip and/or meet an expert this week.

Team Tip: "Experts can provide very valuable advice. Think outside-the-box for experts. They don't even need to be near you. You can contact them by phone, email or Google Hangouts."

Core Values: Do a Core Value Activity that teaches coming to a consensus.

WEEK 7: Developing Solutions

Check for Updates.

Robot Game:

1) If you didn't finish building a base robot last week, keep working on this.
2) Keep building attachments and keep working on programming missions.
2) Keep recording changes and testing ideas. (Worksheet: Attachment Evolution)
3) Save your program often and backup your code at the end of every meeting (onto a USB drive or Google Drive, email a copy to your coach/yourself, etc)

Innovation Project:

1) Go on any field trips and/or conduct expert interviews.
2) Develop your Innovative Solution for your problem. What makes it innovative? Refer to the rubric: "Degree to which the team's solution makes life better by improving existing options, developing a new application of existing ideas, or solving the problem in a completely new way" (Worksheet: Solution Selection)

Core Values:

1) Do any team building activity. How about building a City together?

Team Tip: "Remember to involve others in coming up with ideas. Be willing to listen to each other and help each other. Incorporate the Core Values into every practice."

WEEK 8: Testing, Testing, Testing

Check for Updates.

Robot Game:

1) Keep building attachments and keep working on missions. Keep recording changes and testing ideas. (Worksheet: Attachment Evolution)
2) Remember to backup your code
3) Always comment your code so that others can understand it or if another team member needs to work on the code the following week.

Innovation Project:

1) Develop a prototype or find a way to test or evaluate your solution. Refer to the rubric: “Systematic process used to select, develop, evaluate, test, and improve the solution (Implementation could include cost, ease of manufacturing, etc.)”
2) Compare your solution with existing solutions. (Worksheet: Innovation Worksheet)

Core Values:

1) Remember that it is important to incorporate core values into your team. Talk about how you used the Core Values today.
2) If possible, share what you have done with other classes or your community. Share with another team or help another team.

WEEK 9: Reliability is Key!

Check for Updates.

Robot Game:

1) Keep working on missions and making them more reliable. As you complete missions, run your robot 10 times and see how reliable your solutions are. If your solutions do not work well enough, think about how you can improve them. Take a look at the eight Robot Reliability Lessons for ideas.
2) Record how you tested your ideas and changes you made. From the rubric: "Developed and explained improvement cycles where alternatives were considered and narrowed, selections tested, designs improved (applies to programming as well as mechanical design)" (Worksheet: Attachment Evolution)
3) Track how many points you are able to score and how reliable your mission are. Use a tool like this scorer.

Team Tip: "It is more important that a few missions work well, rather than trying to do all the missions."

Innovation Project: Share your solution and get feedback on your ideas.

Core Values: Do a teamwork activity that helps you learn the value of working together. Activities can be found here: Core Value Activities

WEEK 10: Keep Improving!

Check for Updates.

Robot Game:

1) Keep working on missions improving missions or adding a new one if the first few are working well.
2) Remember to record your thought processes, tests and always back up your code. Well-commented code can help you in judging. From the rubric: “Programs are modular, streamlined, and understandable”

Innovation Project: Improve your project solution based on feedback received.
Team tip: “The biggest lesson from FIRST is to keep improving. Failure is part of the process. And there are always ways to improve.”

Core Values:

1) Do a Core Values Activity to describe your team identity.
2) Can each of your team members give examples of how the Core Values have impacted each of them? Review the Core Values if needed.

Homework: Brainstorming: How do you want to present your project to the judges? Game Show? Advertisement? You can watch some YouTube videos of specific project presentations for inspiration. There are several linked on the last page of this lesson.

WEEK 11: Starting to Wrap Things Up

Check for Updates.

Robot Game:

1) Keep improving missions.
2) Make sure missions you worked on before are still working reliably as you add more.

Innovation Project:

1) Finalize your Innovative Solution.
2) Decide on a presentation style and develop your presentation for your judges. (Recommended Lesson: Project Presentation)

Core Values: Do a Core Values Activity to learn the importance of giving good instructions. Start a Core Values poster if one is needed in your region.

WEEK 12: Finalizing

Check for Updates.

Robot Game:

1) Finalize your robot game
2) Start to practice robot runs. Who will run the robot? How will you switch in and out?
3) What features do you want to highlight in robot design judging?

Recommended Lesson: Robot Design Judging

Innovation Project:

1) Finalize the presentation script and any other materials (poster, props, handouts, etc).
2) Make sure that all students have a role and practice the presentation.

Core Values: Finalize any presentation/poster board. Do a Core Values activity that lets everyone know you appreciate their contribution. Compliments of We are a Team are great choices.

Image Credit: Girls of Steel FRC Team

Homework: Practice your presentation lines.

Useful References for Coaches: Tips from Robot Design Judges, Tips from Project Judges, Tips from Core Values Judges, Competition Day Tips, Dare to Prepare

Team Tip: "Remember that your time starts when you enter a judging room. It includes any setup time. So, set up quickly so that judges can hear your story."

WEEK 13: Practice, Practice, Practice

Check for Updates.

Robot Game: Practice Robot Runs. Practice presentations. Get all your worksheets together for an Engineering Notebook. Have your coaches/parents ask you questions about your robot design and code. There are sample questions in the Engineering Notebook provided by FIRST (pg. 33). Don't forget to take your M11 model that you built as a team.

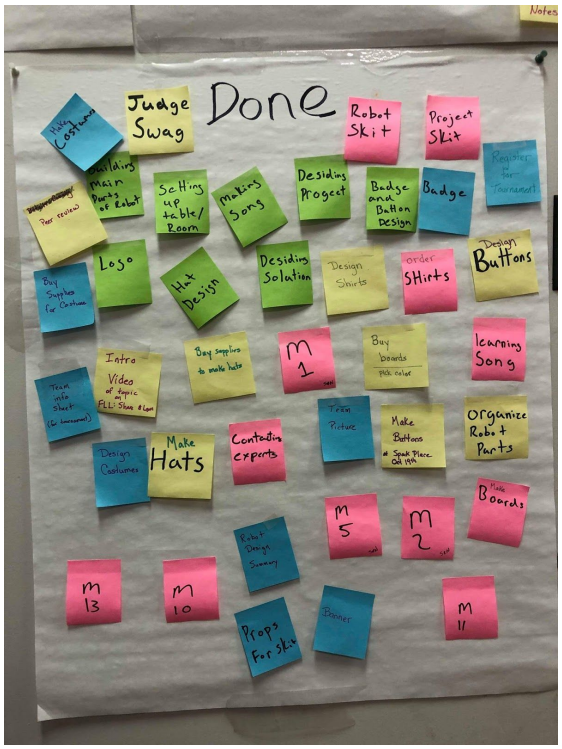
Innovation Project: Practice Presentations. Get all your worksheets/background research, etc together for a Research Notebook. Have your coaches/parents ask you questions about your project. There are sample questions in the Engineering Notebook provided by FIRST (pg. 33).

Core Values: Practice any presentations. Have your coaches/parents ask you questions about your season. There are sample questions in the Engineering Notebook provided by FIRST (pg. 33). (Recommended Lesson: Core Values Judging).

Homework: Pack for the tournament and practice your presentation lines.

Team Tip: "Judges are there to celebrate your season. You should not be intimidated by them. Share what you know and what you accomplished."

Useful Reference for Coaches: Tournament Tips



You are done. Celebrate your season!