

Lesson #1:

First LEGO League Missions



Overview:

Students will work to solve First LEGO League “Into Orbit” space challenges. Students should have a solid understanding of programming and building the lego mindstorm robots prior to completing this unit. The students will choose a specific space mission where they will have to select appropriate sensors, motors, and lego pieces in order to successfully engineer their robot to autonomously solve a mission. The purpose of this project is for students to use coding to ask questions and solve problems in the real-world that would occur in space. Through programming in robotics, students will learn and develop many computational thinking and problem solving skills.



Student Agency:

This unit is centered around student agency. Students have the opportunity to not only select which space missions interest them but to also solve the mission in their own creative way. There is no right or wrong answer and very few rules when solving the missions. This unit allows for students’ creativity to be the focus while also teaching them programming and engineering skills.



Pathway: Computational Thinking & Engineering



Duration: 12 Classes (40 minutes each)



Teacher Tip: This is an approximate amount of time. The great part about this unit is it can be longer or shorter depending on the amount of time you can devote to it. I find it best to do it for at least 8 days so most groups are able to solve a mission. However, I would have liked to do it more than 12 because groups get really into it and want to keep solving missions after they successfully complete one mission. There are 15 total missions of varying difficulty levels.

- **Days 1-4:** Choosing a mission, understanding it, and developing a plan to solve it
- **Days 5-8:** Solving and debugging missions
- **Days 9-12:** Solving and debugging a second mission



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Essential Question: How we design robots to accomplish space missions automatically?



Objectives:

- Students will learn how to use their knowledge of the robot and strategically pick a mission that is realistic to accomplish but also earns them points.
- Students will learn how to use the knowledge from the robot license in order to make decisions when designing their robot.
- Students will learn how to identify tasks in their space mission and build their robot to assist with those tasks.
- Students will learn how to test and debug their robot by changing one variable in their program and seeing the effect it has on the robot.

 <u>Competencies & Practices</u>	 <u>Student Artifacts/ Evidence</u>
Collaboration	Missions
Problem Decomposition	Missions
Test & Debug	Missions
Simulation	Missions



Teacher Preparation:

In order to prepare for this lesson, print out all of the mission guides. I find it best to laminate them and have each class reuse the instructions. Also, make sure that the table is setup and the missions are assembled correctly in order to be able to complete the mission. You can try them by hand just to make sure the students will be able to program their robot to solve them.



Materials for Students:



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- Lego Mindstorm Robots
 -  **Teacher Tip:** Best if you have one robot per partner group but this activity can also work in groups of 3-4
- FLL Tables
- Mission models setup
- Challenge Guides



Students Prior Knowledge:

Students should have completed Intro to Steering Robots and the Autonomous Driver's License before completing this unit. Students should feel very comfortable programming the robots at this point.



Concepts:

- Engineering & Design
- Problem Solving
- Thinking Logically & Sequentially



Habits of Mind:

- Thinking Interdependently
- Thinking Flexibly
- Persisting
- Creating, Imagining, and Innovating
- Responding with Wonderment and Awe
- Striving for Accuracy



Lesson Sequence:

Day 1:

1. Anticipatory Set:

- Introduce Space Challenges
 - Play Introduction Video on Missions:



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1. Explain that the robot needs to automatically make all these things happen
 2. (start at 1:27)
<https://www.youtube.com/watch?v=2x1xSvvJVhg>
- ii. Missions
1. Explain rules of robot game (i.e. no touching robot out of base, careful with mission models etc.)
- iii. Space Mission Competition
1. Describe posters, class cards, points, and penalties



Teacher Tip: I have found students like to compete against the other classes for the most points. Each mission is worth so many points so when they complete one I add it to their class scoreboard. As they come in each day, they will be excited to see where their class is in comparison to other classes. I also gave the winning class extra recess. I also find that having a class score instead of groups allows for cross-collaboration between groups in the class because everyone wants each group to be successful because it helps our overall class score.

2. Engaging Activity:

- a. **Finish Car Challenges:** Any students needing to earn Robot License must do that first before selecting their Space Challenge
- b. **Choose Space Challenge:** Students will decide as a challenge which space mission they want to solve. When deciding on missions, encourage students to consider the following:
 - i. Complexity
 - ii. Level of difficulty
 - iii. Location on the table
 - iv. Points Awarded
 - v. Robot Design
 - vi. Sensors Needed
 - vii. Motors Needed
- c. **Understanding Space Challenge:** Once the students decide on a challenge, they should complete the following tasks to learn about the rules and requirements
 - i. Review the challenge poster



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- ii. Watch the challenge in the video
- iii. Visit the challenge on the table
- iv. Understand the rules and points for your challenge
- v. Plan out what steps they need to take in order to solve the challenge (including sensors, motors etc.)
- vi. Begin to build a robot to solve the challenge

Day 2:

1. **Anticipatory Set:** Review Space Challenges and vocabulary:

- a. Robot
- b. Field
- c. Field Setup
- d. Launch
- e. Mission Model
- f. Base
- g. Controller

2. **Engaging Activity:**

- a. **Design Robot:** Students will work to plan out and design their robot to solve their chosen challenge. Students will use knowledge of robot from robot license challenges to help them decide how to design the robot.

Day 3:

1. **Anticipatory Set:** Review space challenges and points so far

2. **Engaging Activity:**

- a. **Design Robot:** Students will finish designing their robots to complete the space challenges
- b. **Build Robot:** Once students know their design, they will begin building their robot to fit the needs of the challenge. Students should consider building an attachment that can be easily added and removed from their robot for other classes.

Day 4:

1. **Anticipatory Set:** Review Space challenges

- a. Discuss testing and debugging strategies when programming our robots

2. **Engaging Activity:**

- a. **Build Robot:** Students will finish building any attachments to their robots to help them solve the challenges.
- b. **Test & Debug:** Students should test and debug their robots to make sure they are able to solve the challenges on the table. Students will identify variables to change in their code and see the effect that the change has on the performance of their robots.



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Days 5-12:

1. Anticipatory Set: Review

a. Vocabulary:

- i. Robot
- ii. Field
- iii. Field Setup
- iv. Launch
- v. Mission Model
- vi. Base
- vii. Controller

b. Strategies

c. **Rules:** Describe posters, class cards, points, and penalties

d. **Observations made in previous class**

e. **Scoreboard:** Points, penalties, class cards etc.

2. Engaging Activity: Students will work through the following cycle each time they choose a new space activity:

a. **Choose Space Mission:** Students will decide as a group which space mission they want to solve. When deciding on missions, encourage students to consider the following:

- i. Complexity
- ii. Level of difficulty
- iii. Location on the table
- iv. Points Awarded
- v. Robot Design
- vi. Sensors Needed
- vii. Motors Needed

b. **Understanding Space Mission:** Once the students decide on a mission, they should complete the following tasks to learn about the rules and requirements

- i. Review the mission poster
- ii. Watch the mission in the video
- iii. Visit the mission on the table
- iv. Understand the rules and points for your mission
- v. Plan out what steps they need to take in order to solve the mission (including sensors, motors etc.)
- vi. Begin to build a robot to solve the mission

c. **Design Robot:** Students will work to plan out and design their robot to solve their chosen mission. Students will use knowledge of robot from



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- robot license challenges to help them decide how to design the robot.
- Build Robot:** Once students know their design, they will begin building their robot to fit the needs of the mission. Students should consider building an attachment that can be easily added and removed from their robot for other classes.
 - Program Robot:** Students will use their knowledge from the robot license to program their robot to solve the Space mission using the different attachments.
 - Test & Debug:** Students should test and debug their robots to make sure they are able to solve the missions on the table. Students will identify variables to change in their code and see the effect that the change has on the performance of their robots.

 Assessment Questions	Yes	No
Are students using knowledge of robot to help solve the challenge?		
Are students engineering solutions using extra lego pieces?		
Are students redesigning when their design is not successful?		
Are students assessing the problem as a coding or design problem?		
Are students working with their group as well as other groups in their class to reach a common goal?		

Activities for Relearning:

Students can be partnered with a peer who seems to be understanding programming the robots. Also, students that are ahead can assist other groups. Students may also use their Autonomous Driver's License paperwork as a resource to help them.

Activities for Enrichment:

Students can walk around and help other groups who need assistance with the mission. Additionally, students can work ahead and complete the next mission.



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Resources for Teachers:

- <http://www.firstlegoleague.org/past-challenges>
- <http://www.firstlegoleague.org/missionmodelbuildinginstructions>



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