FIRST® Robotics Engineering Explorations

Teacher Guide — The Ball Game

Unit 6

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Activity 1: Preparing for the Game

Driving Questions

- How can we involve the team during competition?
- How do we plan our competition day?
- How do we know if we are prepared for the game?

Objectives

- Teams will learn about their robot through a practice competition.
- Teams will learn about different roles team roles members might fill during the competition.
- Teams will find ways to use the *FIRST*® Core Values and philosophies of *Coopertition*® and *Gracious Professionalism*® while they compete in practice matches.

Materials

Each team will need:

- Engineering Notebooks
- Robot
- Game manual
- Internet access
- You will also need score sheets and the game field set up.

Getting Started

BEFORE THE START OF CLASS:

- Ensure team members have the game rules and guidelines they created for your ball game competition.
- Gather the supplies needed for the ball game challenge and field setup.
- Set a date for a community event where teams can invite parents, friends, and community members who could become team mentors or sponsors.
- Review the material on team roles.
- Build a match schedule. Samples are outlined later.

DURING CLASS:

- The Career Connections section in the student guide describes the professional roles that work together to create a game: game designers, developers, web and graphic designers, marketing analysts, and game testers. Teams will later expand upon this by identifying the roles that they might want to develop their own skills for. Encourage students to choose an area where they feel their skills will be best utilized.

Student Tasks

TASK 1: EVENT ROLES

Design and Prototype:

- Students identify the role they will play during their ball game challenge event. The following are suggested roles students might specialize in:
  - Marketing Specialist
    - Creates flyers, promotes the event, and takes pictures of your robot during the event
    - Describes your robot design and game strategy to other team members
  - Logistics Specialist
    - Organizes game supplies by setting up and resetting the field
    - Takes notes of your robot's performance and any issues that arise during the match
  - Mathematician Specialist
    - Keeps score for the team during the competition
  - Drive and Engineering Team

- Is responsible for running the robot and making any changes needed (mechanical and programming)

Test and Improve:

- Guide students to choose the role they feel will help them further develop their natural skills and talents.

TASK 2: PLANNING YOUR COMPETITION EVENT

Design and Prototype:

- The goal of the community event is to authenticate student learning by making an impact on people outside of their class. The event can be small or big, and it can be modified depending on restrictions and expectations of your school. It can be an end-of-the-year event, or you can customize it to fit your needs.
- Use the following questions to conduct a whole-class brainstorming session to involve students in planning the event:
  - How can you plan the event to have the most impact, capitalizing on other school events?
  - How can you involve members of your local business and industry to become supporters of your event?
  - How can you involve school decision-makers to see the impact of your learning (for example, school administrators or district committee members)?
  - How can you engage and inspire younger students to participate in this program?
  - If a community event is not possible, how might you share your learning and skills with others digitally?
- As you set up the schedule for the competition and interviews, consider the following:
  - How much time do you have?
    - How long can you have students?
    - How long can you have the judges?
  - What facilities will you be using?
- Use the following sample checklist to help you and the teams plan the competition event. Adapt this to whatever works best for you to meet your course and school guidelines.

CHECKLIST FOR EVENT DAY	
Event Date	
Facilities/Location	
Student Task List	
Invitations	
Schedule	

Provide teams with 15 minutes for their judging session presentation. Provide additional time per session for judges to review Engineering Notebooks and complete the rubrics.

Schedule time for the judges to review each team's Engineering Notebook before doing the interview. It can help them ask helpful questions. If students submitted their Engineering Notebook electronically, you could send notebooks to the judges ahead of time. If you choose not to send the judging manual and notebooks electronically, schedule time before sessions for judges to go through the materials. It should take only one hour for judges to review the Engineering Notebooks.

Example Schedules

Hour 2
Team 1 – 10:00-10:15
Team 2 – 10:20-10:35
Team 3 – 10:40-10:45

Hour 3
Team 4 – 10:00-10:15
Team 5 – 10:20-10:35
Team 6 – 10:40-10:45

After teams have completed judging, they should conduct a self-reflection.

Hour 4: Feedback and Awards Celebration
This is a time for feedback sessions and the award presentation. Feedback sessions could be in a formal face-to-face setting with the judges, or students could get feedback by watching a recording of their interview. Students should at least receive feedback via the judging manual.

Hour 5: Students should reflect on the judges' feedback and what they would like to improve in the next semester.

TASK 3: DRIVE TEAM COMPETITION!

Design and Prototype:

- Students plan a driving competition to determine who on their team will drive the robot during the competition. Many students will often want to drive until they must do it under pressure.
- Creating a mini driving competition can ensure each team has a driver with the best skills. It also gives others an idea of what they can work on to become a better driver.
- Teams use matches to test team members' robot-driving skills. Match tasks should be completed in less than 2 minutes and should use a scoring system to track who earns the most points.

Test and Improve:

- Students write down the details of their matches and discuss them as a class. After this, you should have all the details you need to finalize roles to practice for your community event.

TASK 4: PRACTICE ROUNDS

Test and Improve:

- The following match schedule can be used for eight teams in four alliances. You will likely need to customize it according to the number of teams you have.

	BLUE ALLIANCE	RED ALLIANCE
Match 1	Teams 1 & 2	Teams 7 & 6
Match 2	Teams 3 & 8	Teams 5 & 4
Match 3	Teams 8 & 5	Teams 6 & 2
Match 4	Teams 1 & 7	Teams 4 & 3
Match 5	Teams 5 & 6	Teams 7 & 4
Match 6	Teams 3 & 1	Teams 2 & 8
Match 7	Teams 3 & 7	Teams 8 & 6
Match 8	Teams 2 & 5	Teams 4 & 1

- Encourage students to ensure that they are practicing their competition roles. Getting practice will help them refine their skills as they go.
- The marketing specialists could work on flyers to distribute for your final event, or they could practice taking pictures. These pictures could also be used in their event flyers.

Test and Improve:

- After the practice competition, students reflect on the following questions:
  - Identify five things that went well with your team performance and robot performance.
  - Identify five things you would like to improve on.
- Students use their project management tools to determine the next steps for what needs to be completed before your community event.

Guiding Questions

- What are your next steps for the community event?
- What needs to be done on the robot for the ball game challenge?
- What needs to be done to market your community event?
- How will you present your robot and design in our community event?

Suggested Extensions/Modifications

- Extension – Ask students to design more mini competitions to choose team roles.
- Modification – If students have trouble choosing team roles, give them options to choose from.

Teacher Reflection Questions

- Did my students find the Getting Started activity engaging?
- Do my students understand their team role in the grand scheme of the competition?
- Did my students participate in planning the competition?

Student Artifacts

In their Engineering Notebook, students should have recorded:

- Responses to the questions from the Getting Started activity.
- Responses to questions in Task 1. Create and upload sketches if needed.
- Their team number.
- Responses to questions in Task 2. Create and upload sketches if needed.
- Responses to questions in Task 3. Create and upload sketches if needed.
- Responses to questions in Task 4. Create and upload sketches if needed.

Checkpoint

- Are teams familiar with the competition game field layout?
- Have teams planned scoring strategies and step-by-step instructions for all three game periods?
- Have teams evaluated their robot design to make it suitable for the game?
- Have teams assigned roles to each team member?
- Do teams have a team number?

Activity 2: More than Robots!

Driving Questions

- What are our next steps for the community event?
- What needs to be done to our robot for the ball game challenge?
- How will we market the community event?
- How will we present our robot and our design in our community?

Objectives

- Teams will develop a brand for their team and presentation for our community event.
- Teams will use project management to improve the robot and event planning for the community event.

Materials

Each team will need:

- Engineering Notebooks
- Robot
- Gamepad
- Internet access
- Game manual
- Marketing supplies (craft materials)

Getting Started

BEFORE THE START OF CLASS:

- Gather supplies for teams to create custom aesthetics for their robot.

DURING CLASS:

- Teams develop an identity and brand to market their team.
- They develop a presentation to demonstrate their Engineering Design Process and teamwork in the community event.
- They use project management to do a final push for their community event.

Student Tasks

TASK 1: TEAM IDENTITY AND MARKETING!

Brainstorm and Explore:

- Students develop a plan to market their team to stand out and represent them well at the event.
- Ask students how popular brands represent a product, tell a story, and promotes itself.
- Students discuss and answer the following questions:
  - Does your robot have a way for others to recognize that it represents you?
  - Can your team develop a way to be unified and appear as a brand?
  - What does your brand and identity represent? How can you make it fun?

Design and Prototype:

- Students develop aesthetics that help their robot represent them. They can consider team costumes or attire. Their marketing personnel should develop materials to promote the team brand.

TASK 2: PRESENTATION

Brainstorm and Explore:

- Students discover the power of storytelling, which is used as a marketing technique to engage an audience. They develop a five-minute presentation, or story, to help them promote their robot, journey, and team.
- Resources you might share with students for developing their story:
  - "Story Marketing: Why it Matters and a Step-by-Step Guide" article by the American Marketing Association
  - *FIRST* Fundraising Toolkit
    - "What NOT to Do in a Sponsor Presentation" video by Official *FIRST*
    - "What TO Do in a Sponsor Presentation" video by Official *FIRST*
- Encourage students by asking the following questions:
  - How did you determine your robot design?
  - What was the most challenging part of building a robot?
  - What challenges did you overcome as a team to compete in the game?
  - What was your biggest accomplishment in the designing and building process?

Test and Improve:

- Students practice presenting their story.
- Pair groups of students together so that they can take turns presenting to each other.
- Encourage them to provide feedback to each other.

TASK 3: IMPROVE YOUR ROBOT

Test and Improve:

- Students use their knowledge from their practice rounds and project management skills to develop a last push for improvements to make to their robot before the final event.
- Students should continue to test and improve their robot. They should include all results in their Engineering Notebook.

Guiding Questions

- What feedback did you receive on your presentation and story? How can you improve?
- What are your next steps for your robot?

Suggested Extensions/Modifications

- Extension – Ask students to practice their presentation with others outside of their class.
- Modification – If students have trouble providing feedback on other teams' presentations, provide them with some standard questions to think about or ask.

Teacher Reflection Questions

- Are my students excited about the ball game?
- Are students proud of their identity and their robot?
- Do my students know how to talk about their story and journey?

Student Artifacts

In their Engineering Notebook, students should have recorded:

- Their team identity and brand.
- Presentation practice notes.
- Tasks to do to improve their robot.

Checkpoint

- Were students able to develop their five-minute presentation?
- Are students ready for the community event?
- Do teams need more time to iterate and improve?

Activity 3: Welcome to the Game

Driving Questions

- Are we ready to have fun competing?
- Are we ready to share our knowledge and what we have learned?
- How does *Coopertition* impact our approach to competing?

Objectives

- Teams will play practice matches to prepare for their community event.
- Teams will play matches for their community event.
- Teams will present their team and their Engineering Design Process to their community.

Materials

Each team will need:

- Engineering Notebooks
- Robot
- Driver Station
- Game rules
- Game field

Getting Started

BEFORE THE START OF CLASS:

- Make sure the game field is set up.
- Schedule the matches that teams will compete in. You can use the following chart and earlier sample schedule for help.
  - Ensure that each team will compete in at least three matches.
  - Alliances should change with each match.
  - The Getting Started section of the student activity goes over each period of the game. Before teams compete, ask them to review the game rules. Teams should pay particular attention to major and minor penalties and methods for scoring points.

MATCH	RED ALLIANCE		BLUE ALLIANCE	
1	Team 1	Team 2	Team 3	Team 4
2				
3				
4				
5				
6				
7				
8				

- Allow each team to practice in the game field before they start competing in alliances. Two teams can practice on the game field at a time, one team per side.
- Post the match schedule for all teams to see so they can prepare between matches.
- During each match, ask students to assist with scoring while they are not competing.
- Use a stopwatch or clock to keep track of the time during each match. After the autonomous period, give alliances five seconds prior to a "3, 2, 1, go!" countdown.

- While you record scores after a match, ask alliances to reset the game field and prepare for the next match.
- After you finish scoring a match, present the results to the alliances that competed.
- After all teams have completed three matches each, ask all students to assist in the breakdown of the game field.

Student Tasks

TASK 1: PRACTICE, PRACTICE, PRACTICE

Identify the Problem:

- As part of the community event, you will want to have an open invitation for the parents and community members.
- Have a group of students present the rules of the ball game to the community.
- The Marketing teams can be inviting and talking to parents as the other team members are going through their practice rounds.
- Before teams are put into *Alliances* and begin competing in the game, they will each get a practice round.
- The practice round that each team gets will be their last opportunity to make changes to their programs.

Test and Improve:

- After teams complete their practice round, they should reflect on the performance of their robot and program.

TASK 2: MATCH ONE, START!

Test and Improve:

- After all teams have had a chance to practice with their robots inside the game field, they should be prepared to play in their first competitive match with their first alliance.
- In their alliance, teams should take some time to discuss their strategies for winning the game.
- If possible, give students time to reflect in between matches with a five-minute break.
- Students should discuss the following questions:
  - Were you able to score points in each of the ball game periods?
    - How many points did you score in the autonomous period?
    - How many points did you score in the driver-controlled period?
    - How many points did you score in the end game period?
  - Did your team get any penalties during the ball game?
  - Did your alliance win?
  - What did your team do well during the ball game?
  - What can your team do better in the next match?

TASK 3: MATCH TWO, START!

Identify the Problem:

- Teams have now completed their first competitive match and should understand what is expected of them before, during, and after each round.
- The process for running all the second matches is the same as for the first match.
- Ensure that teams work in the alliances that you mapped out prior to the start of the activity.
- Check to be sure that the game field has been properly reset before alliances place their robots into their starting positions.
- Before you start the match, ensure both alliances have selected their autonomous OpMode and are prepared to begin.
- Work with the mathematician specialist on the team to calculate scores and provide them to the teams and those watching.

Test and Improve:

- Provide students with time to reflect and answer questions regarding how they scored and what they can do to improve their game strategy.
  - Were you able to score points in each of the ball game periods?
    - How many points did you score in the autonomous period?
    - How many points did you score in the driver-controlled period?
    - How many points did you score in the end game period?
  - Did your team get any penalties during the ball game?
  - Did your alliance win?
  - What did your team do well during the ball game?
  - What can your team do better in the next match?

TASK 4: THE FINAL MATCH

Identify the Problem:

- This will be the last round that teams will compete in for this activity.
- Since this match will be the teams' last chance to score points, encourage them to remain calm and communicate with the other team in their alliance.
- Teams should think back to their first two matches t and try to learn from any mistakes they might have made.

Test and Improve:

- Be sure to provide the final score to both alliances after a match concludes so that teams can track their scores against other teams in the competition.
- When teams finish with their final match, have them tally their final score.
- You could have an award ceremony to celebrate the top performers from the game.
- Teams should reflect on the following questions:
  - Were you able to improve your robot's performance between your first and final matches?
  - Did you work well with the other teams in your alliances?
  - What did you do well during the three matches?
  - What could you do better now that you've finished playing?

TASK 5: TEAM PRESENTATION

Test and Improve:

- Now it is time for teams to present their robot and brand to the community.
- They spent time during the last activity preparing their presentation and brand. They should take five minutes to present their Engineering Design Process and what they have learned on their journey of building a robot.
- After students have presented, have them take a few minutes to reflect as a team and answer the following questions:
  - How did the presentation go?
  - Did you communicate clearly so that the audience could hear?
  - Did each member of your team speak?
  - Did you tell your story in a way that might impact others?

Guiding Questions

- Did the robot perform as expected?
- Were there mechanical issues that needed fixed?
- Were there programming issues that needed fixed?
- Was the robot ready to go?
- Were there issues in presentations? If so, why?

Suggested Extensions/Modifications

- Modification – If teams have trouble scoring points in the autonomous period of the game, have them focus on only the driver-controlled period.
- Extension – Provide ways for teams to further interact with the community and audience at this event.

Teacher Reflection Questions

- Did teams use the *FIRST* Core Values and philosophies while they were competing in the game?
- Did teams understand the rules of the game?
- Were they able to score points during the game?
- Did teams avoid taking penalties while they were playing?
- How would you change your community event in the future?

Student Artifacts

In their Engineering Notebook, students should have recorded:

- Responses to the questions from the Getting Started section.
- Responses to the questions from Task 1.
- Responses to the questions from Task 2.
- Responses to the questions from Task 3.
- Responses to the questions from Task 4.

Checkpoint

- Did students have fun participating in matches?
- Were students able to articulate their Engineering Design Process to the community?
- Are students excited about further participation in *FIRST* events in the future?
- Were students able to practice *Gracious Professionalism* after they learned their final scores?