

**FIRST  
LEGO  
LEAGUE**

**EXPLORE**

# ENGINEERING NOTEBOOK



PRESENTED BY:



**HANDS ON  
TECHNOLOGY**



Dear teams,

We are the non-profit association HANDS on TECHNOLOGY e.V. Since our foundation in 2002, we have successfully supported STEM education and have organized research and robotics tournaments. We conduct FIRST LEGO League in Germany, Austria and Switzerland.

We are really happy that you will join us this season! On behalf of our whole team and the board, we would like to wish lots of fun, memorable moments and a lot of success while planning,

building, tinkering and testing as well as at your exhibition!

Your team at



For more information, go to [www.hands-on-technology.org](http://www.hands-on-technology.org)



EXPLORE



FIRST® LEGO® LEAGUE GLOBAL SPONSORS

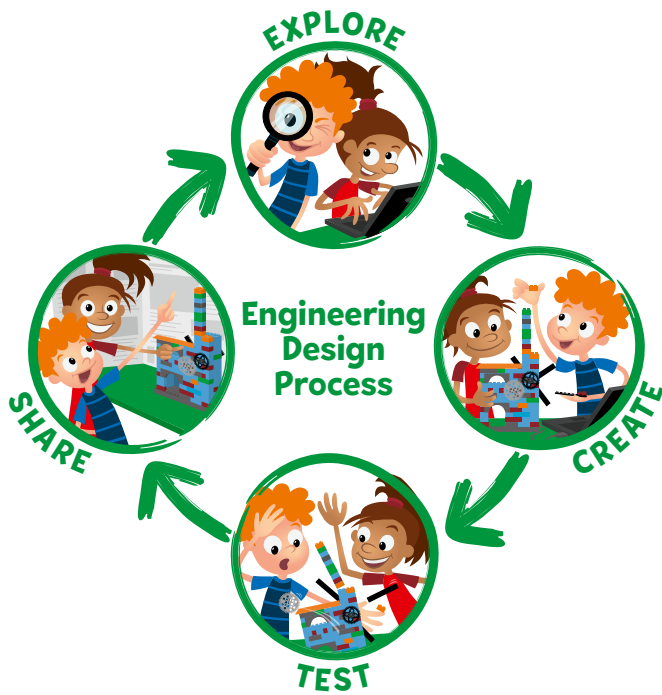


The LEGO Foundation

# Welcome!

## Team Members:

1.	4.
2.	5.
3.	6.

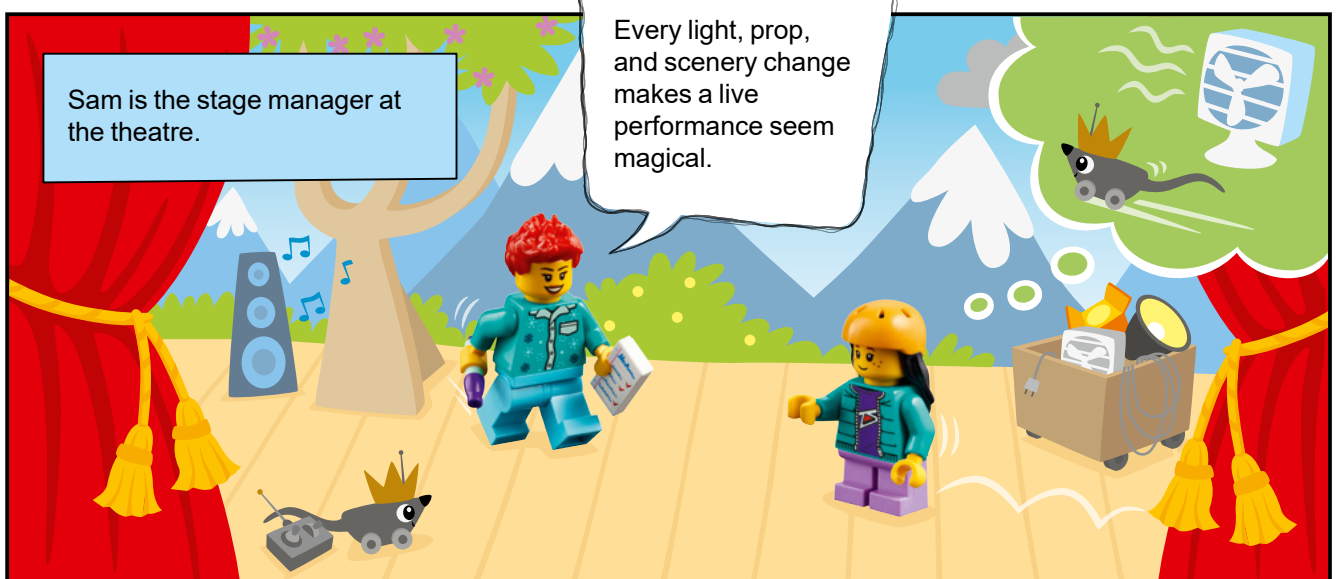
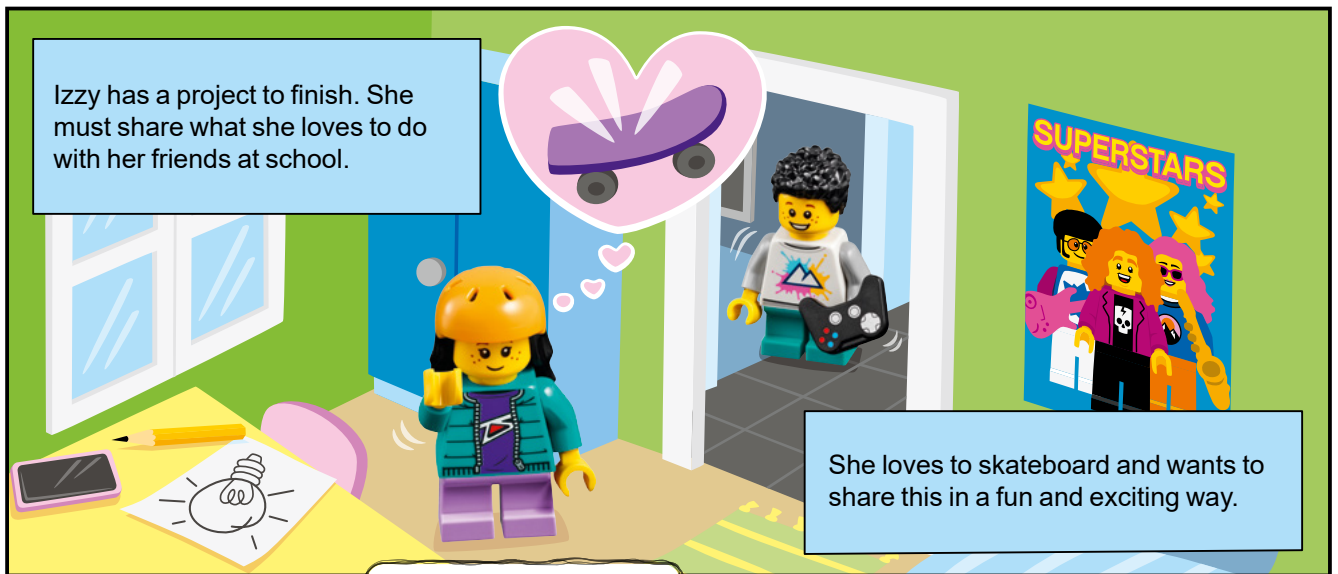


Together with your teammates, you will:

- Discover real-world challenges and opportunities in this season's theme.
- Create a team model and program it to make part of it move.
- Test and improve your code and build changes.
- Track your work in the *Engineering Notebook*.
- Make a team poster that reflects your team's journey.
- Share your model and poster with reviewers at an Explore festival.
- Celebrate your accomplishments with family and other teams at the festival.



# Explore Story



# Explore Story



# Team Progress

Come back to these pages throughout your team journey to update your personal and team goals and to share your progress.

**START HERE!**

<b>What do you want to do? When do you need it to be done?</b>	<b>What challenges did you face? What progress have you made?</b>

# Core Values

## DISCOVERY

We explore new skills and ideas.

## INCLUSION

We respect each other and embrace our differences.

## INNOVATION

We use creativity and persistence to solve problems.

## TEAMWORK

We are stronger when we work together.

## IMPACT

We apply what we learn to improve our world.

## FUN

We enjoy and celebrate what we do!

**Draw or write an example of your team using each Core Value when directed in the sessions!**



**You will develop new skills as you work together.**

# Session 1

## Activity 1 Tasks (15-20 minutes)

- Read the Explore story and explore the MASTERPIECE<sup>SM</sup> theme.
- Talk about your own hobbies or interests.
- Think about how you use art or creativity in your hobbies or interests.
- Draw a picture of what you love to do.

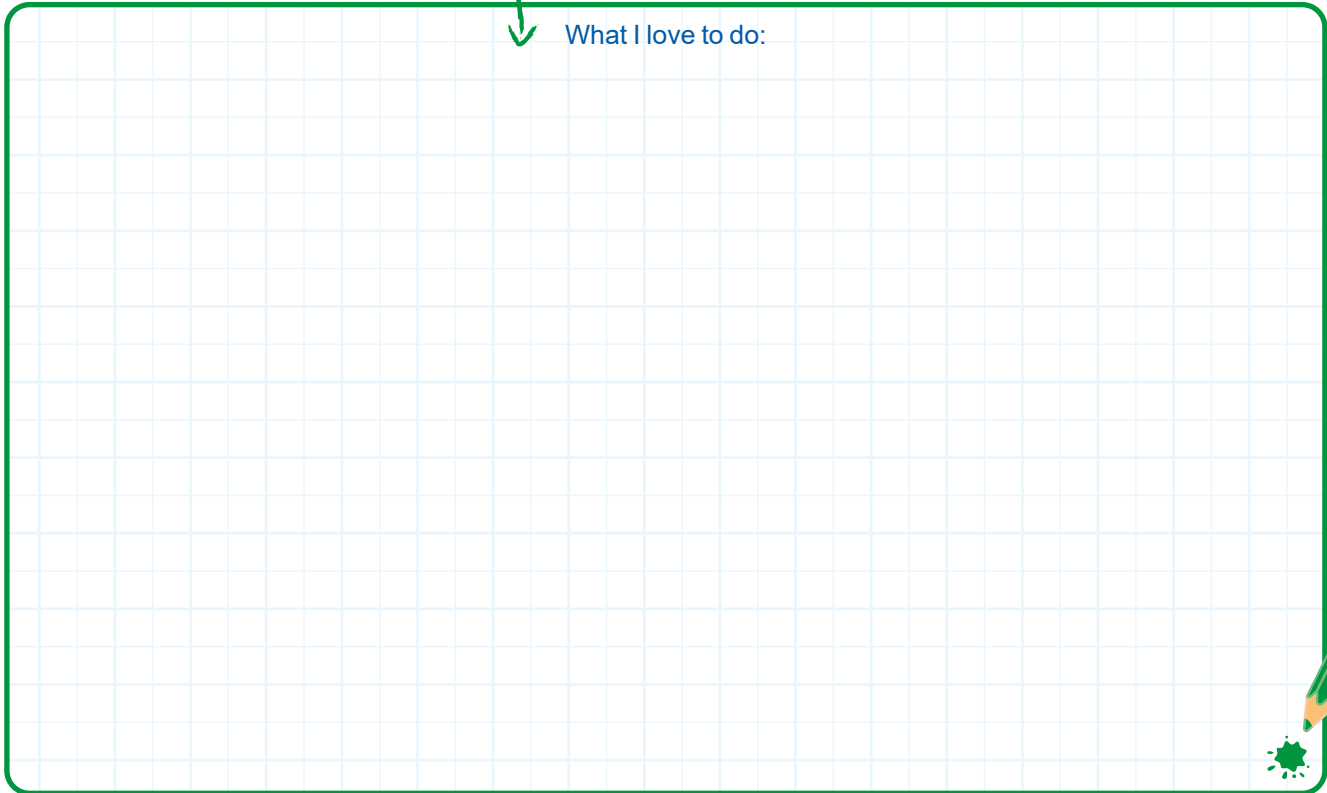
Your team needs:



Where did you learn about your hobby or interest?

What **tools** or **objects** do you need for your hobby?

What I love to do:





# Hobbies and Interests

Your team needs:



## Activity 2 Tasks (15-20 minutes)

- Explore how people share what they love to do.
- Talk about places in your community where people share what they love to do.

## Challenge

- Discuss the creative ways Izzy could get her friends interested in skateboarding.
- Use the prototyping pieces to build a place where Izzy could share her love of skateboarding.
- Share your ideas.

My ideas:

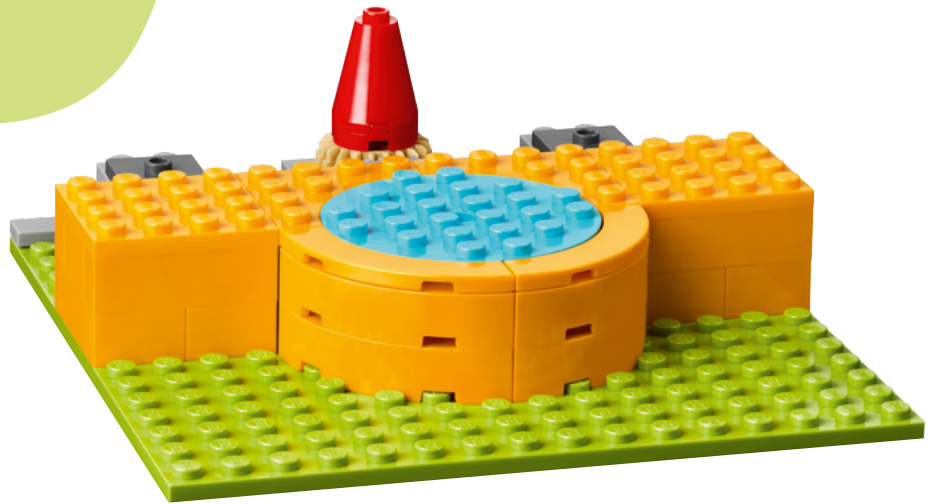


# Session 2

## Activity 1 Tasks (15-20 minutes)

- Follow the building instructions in Book 1 to make the basic stage.
- Talk about what you would share if you were on the stage.
- Identify the icons on the mat. Think about what the icons represent.
- Move the stage to different icons on the mat and discuss what could be shared there.

### Your team needs:



# Behind the Scenes

## Your team needs:



Which experts could help make my skateboarding show more exciting?



## Activity 2 Tasks (15-20 minutes)

- Follow the building instructions in Book 1 to make the minifigures.
- Explore the minifigure items.
- Re-read the Explore story (p. 4-5). Explain how the characters might use one or more of the items to help them in their job.

## Challenge

- Using the minifigures and stage, build another scene for the Explore story that shows the stage being used in a different way.
- Share your scene and explain what is happening.

My ideas:

# Session 3

## Activity 1 Tasks (15-20 minutes)

- Follow the building instructions in Book 2 to build the music concert pieces.
- Add the music concert pieces to the basic stage you built last session.
- Place the concert stage on the mat near the music notes.
- Discuss how sound or music is used to help performers entertain their audience.

## Your team needs:



What instruments have you seen being played during a concert?

What kind of technology is used in the music industry?



Scan me to see a video of the music concert model!



# Sound All Around

## Your team needs:



What skills and what technology do you need as a sound engineer? Find out more on page 30!

I think Izzy should skateboard to exciting music or some cool sound effects!



← Noah

## Activity 2 Tasks (15-20 minutes)

- Identify the concert pieces that were added to the basic stage.
- Discuss what other technology you would like to add to the concert stage.

## Challenge

- Build examples of the additional technology using the prototyping pieces and add them to the stage.
- Share the technology represented in your model.

My ideas:

# Session 4

## Activity 1 Tasks (15-20 minutes)

- Open the SPIKE™ Essential app. Complete your lesson.
- Make the model go in a different direction or rotate at a different speed.
- Write down your ideas below for how to change the program.
- Modify the program based on your ideas.
- Run your new program. See what happens.

## Your team needs:



## Your lesson:



FIRST® LEGO® League  
Explore Unit:  
**Lesson 1**

This kind of technology would be great to use in a theater!



Sam

Write your ideas!

Grid area for writing ideas.



# Theater Technology

## Your team needs:



A rotating or revolving stage can make it easier to move props or scenery.

What responsibilities does a stage manager have in a theater?  
Find out more on page 30!



## Activity 2 Tasks (15-20 minutes)

- Modify the SPIKE model from the previous task so that it represents a rotating stage.
- Open the SPIKE™ Essential app.
- Change the program to make the stage rotate every 10 seconds. Try it out!

## Challenge

- Build two different scenes on your rotating stage. The scenes can be about what you love to do!
- Place your stage on the mat. You could use the theater icons as building locations!
- Share the scenes you built and explain how you coded the model.



# Session 5

## Activity 1 Tasks (15-20 minutes)

- Open the SPIKE™ Essential app. Complete your lesson.
- Code the model to flash a light when a team member approaches the sensor.
- Modify the program based on your ideas and test it out!

### Challenge

- Code the model to display a different light pattern that is unique to your team.

### Your team needs:



### Your lesson:



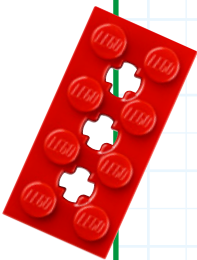
FIRST® LEGO® League  
Explore Unit:  
**Lesson 2**

Lights and sounds can help a museum exhibit be more interactive!



← Anna

Write your ideas!



Show how you include everyone's awesome ideas!



# Museum Exhibit

## Your team needs:



A light show could help Izzy's skateboard skills really stand out!

How could I use technology like this in a museum exhibit? Check out page 31.



## Activity 2 Tasks (15-20 minutes)

- Modify the SPIKE model from the previous task so that it represents a museum exhibit.
- Open the SPIKE™ Essential app.
- Change the program so that it displays a new light pattern. Try it out!

## Challenge

- Change the program so that the model will play a sound when someone approaches your exhibit.
- Share what you built and explain how you coded the model.

Draw your ideas!

Modify the program to create a unique light pattern!

# Session 6

## Activity 1 Tasks (15-20 minutes)

- Open the SPIKE™ Essential app. Complete your lesson.
- Code the model to move backward.
- Write down your ideas for how to change the program below.
- Change the existing program based on your ideas. Test it out!

## Challenge

- Modify the model so that it has four wheels.

## Your team needs:



## Your lesson:

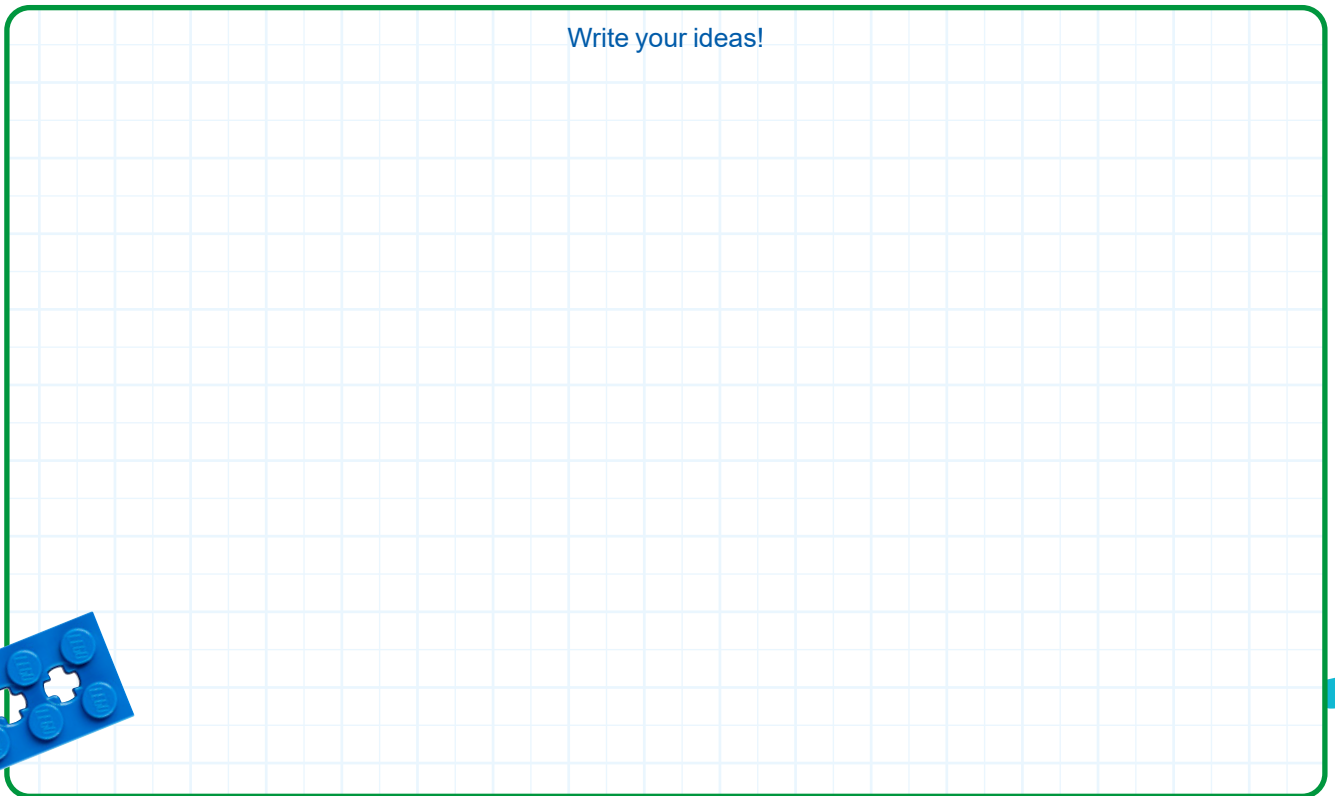


FIRST® LEGO® League  
Explore Unit:  
**Lesson 3**



← Emily

Write your ideas!



## Visual Effects

Your team needs:



### Activity 2 Tasks (15-20 minutes)

- Modify the SPIKE model from the previous task so that it represents a vehicle with a camera.
- Open the SPIKE™ Essential app.
- Change the program so that the vehicle drives slowly. Try it out!

### Challenge

- Pick two icons on the mat that Izzy should skate between.
- Change the program for your vehicle to move between the two icons.
- Share how you coded your moving camera.

Can your camera  
keep up with me?



Actors and athletes are two examples of people that could be filmed with moving cameras. See page 31 for more!

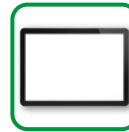
## Activity 1 Tasks (15-20 minutes)

- Build the motor and hub base following instructions in Book 2.
- Connect the motor and hub to the basic stage model from Session 2.
- Open the SPIKE™ Essential app. Try the program provided in Book 2 to motorize your model.
- Write a new program to rotate the center of the stage where the performer stands.

## Challenge

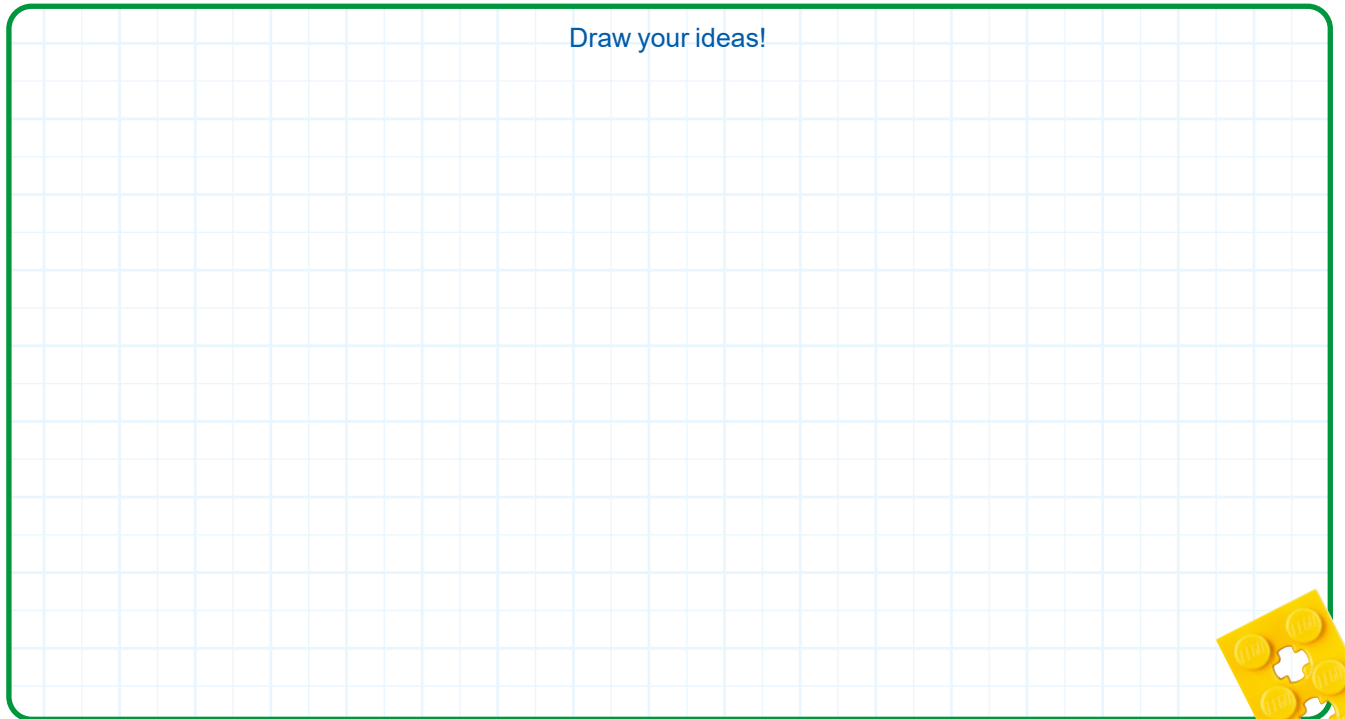
- Pick a hobby or interest you and your team want to share on the stage. Draw your ideas for how you could do this below!

## Your team needs:



Scan me to see a video of the motorized music concert model!

Draw your ideas!



## Setting the Stage

Your team needs:



Will you build a museum exhibit, a concert, or a play?

### Activity 2 Tasks (15-20 minutes)

- Decide where on the mat you will build your model.
- Use the prototyping pieces to add to your stage and make it exciting for an audience!

### Challenge

- Change the model and the program to show off a different hobby or interest.
- Share your build and explain the different kinds of technology you used.



How can you redesign the model or change the program?

# Sessions 8 & 9

## Session Tasks (80-100 minutes)

- Design a team model that shows how technology helps you share what you love to do.
- Brainstorm your solutions.
- Explore the list of required parts on the next page.
- Draw your team model design and label the required parts.
- Create your team model together. Use the mat and build the different parts of your show!

## Your team needs:



Build a team model of a place where an audience is immersed by a concert, performance, or exhibit.

## Draw your team model on the mat.

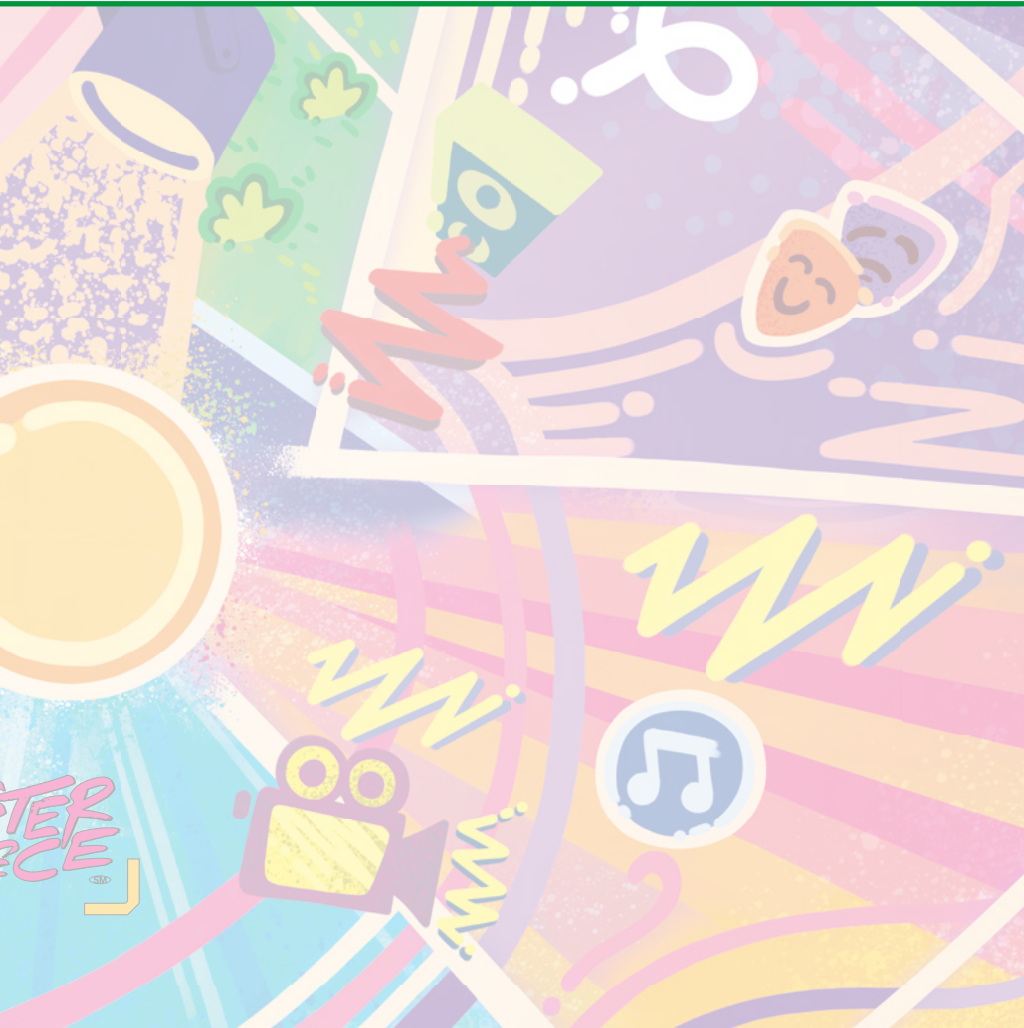
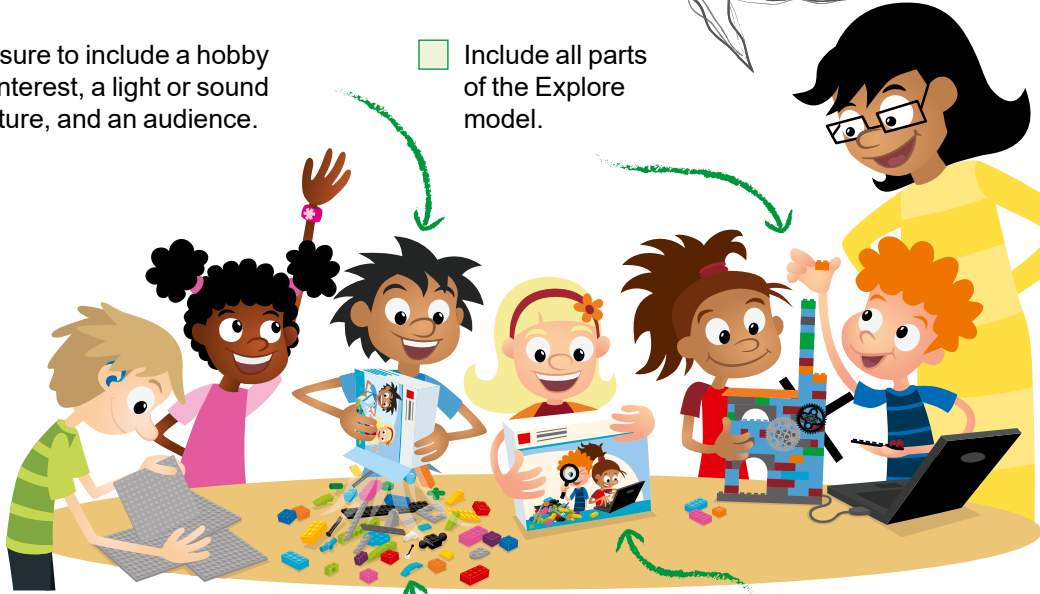


# Team Model

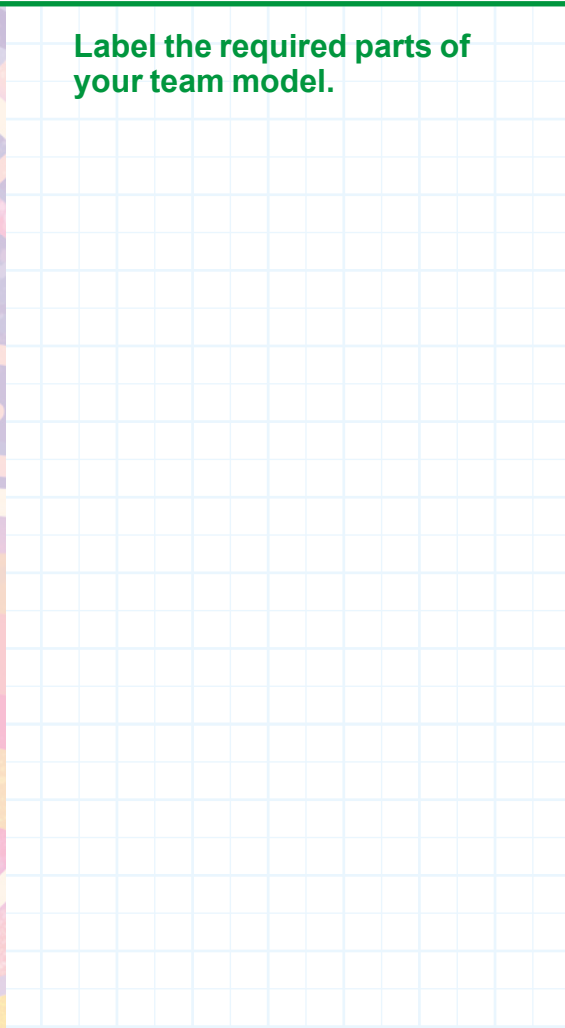
## Requirements

Build a team model that represents a unique way to share your team's hobbies and interests with others.

- Be sure to include a hobby or interest, a light or sound feature, and an audience.
- Include all parts of the Explore model.
- Motorize the Explore model.
- Use LEGO coding.
- Be made of only LEGO® elements.
- Use the MASTERPIECE™ mat.



Label the required parts of your team model.



# Sessions 10 & 11

## Session Tasks (80-100 minutes)

- Find your poster board and art supplies.
- Brainstorm what to put on your poster.
- Use the next page as a draft for your ideas.
- Work together to create your team poster.  
Teamwork!
- You can use words, drawings, and photos on your poster.

## Your team needs:



Describe your team journey throughout the sessions.

Congratulations on all you have learned. Now, make a team poster to share about it!







# Team Poster

Here's your chance to capture ideas for your team poster.

**Sample Topics:** *Explore, Create, Test, Share, Core Values, Team Journey*

The poster template features a central vertical column of five colored LEGO bricks: purple, red, yellow, green, and blue. Each brick has three white cross-shaped holes. Four horizontal grid boxes are arranged on either side of the central column, with the top two boxes connected to the purple brick, the middle two boxes connected to the red, yellow, and green bricks, and the bottom two boxes connected to the blue brick. A pencil icon is located in the bottom right corner of the rightmost grid box.

## Tasks (40 minutes)

- Gather your completed team model and team poster.
- Talk about what your team would like to share at your event!
- Complete the next page to prepare for your event.
- Look over the reviewing sheet with your coach.
- Practice your presentation.
- Communicate what you have learned with others.

You will be taking part in a **FIRST® LEGO® League Explore Festival**. Invite your family and friends to your special event!

Share what you have learned and how your team had fun!

## Sample Festival Roles

I'm going to share what we explored.

I will describe the team model.

I will explain the program and how it motorizes the team model.

We will show how the poster captures our team journey!

I can reflect on how our team used Core Values.



## Prepare for Event

Let's celebrate how well we all worked together! It is much more fun when everyone on the team is included.

Consider what you will share at the event.

- Can you describe your team model?
- Explain how your team used innovation and creativity to share what you love to do.

- What did you learn about the season challenge?
- How did you use Core Values?

- What part of your team model is motorized?
- How did you code your motorized part?

- What did you include in your team poster?
- How does the poster show your team journey?



**Use this page to draw your designs and ideas!**



# Career Connections



## Sound Engineer

A sound engineer mixes different sounds, controls volume, and creates an optimal listening experience.

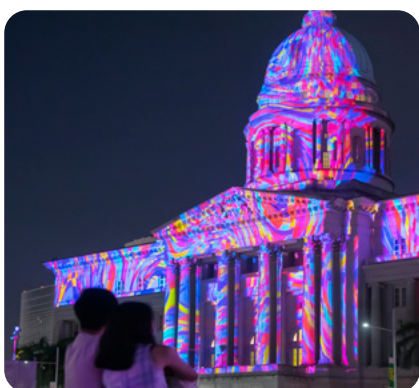
*Links to Session 3*



## Stage Manager

A stage manager is responsible for making sure the lights, sound, and props are working properly and in the right place.

*Links to Session 4*



## Visual Effects Director

A visual effects director produces images and settings that help the audience engage with the performance.

*Links to Session 6*



### Exploration

*(Recommend completing after Session 4)*

**Look at the careers on these pages. Choose a job role, research it, and answer the questions.**

- Explain the job. What are some of this job's daily tasks?
- What is this job's yearly salary?
- What education or training is required?
- What companies could people in this job work for?

### Fields of Study

- Graphic Design
- Audio Engineering
- Sculpture
- Cinematographer
- Musical Theater
- Computer Animation
- Photography



## Museum Curator

A museum curator selects which objects will be featured in an exhibit that will help teach people about history or the future.

*Links to Session 5*



## Actor

An actor is an artist that performs in front of a camera or an audience. Actors often use costumes, makeup, puppets, or other props to help bring their character to life.

*Links to Session 6*



## Sports Photographer

A sports photographer is skilled at taking pictures of athletes in action. Photographers often use large lenses so they can zoom in while keeping a safe distance.

*Links to Session 6*



## Reflection

*(Recommend completing after Session 12)*

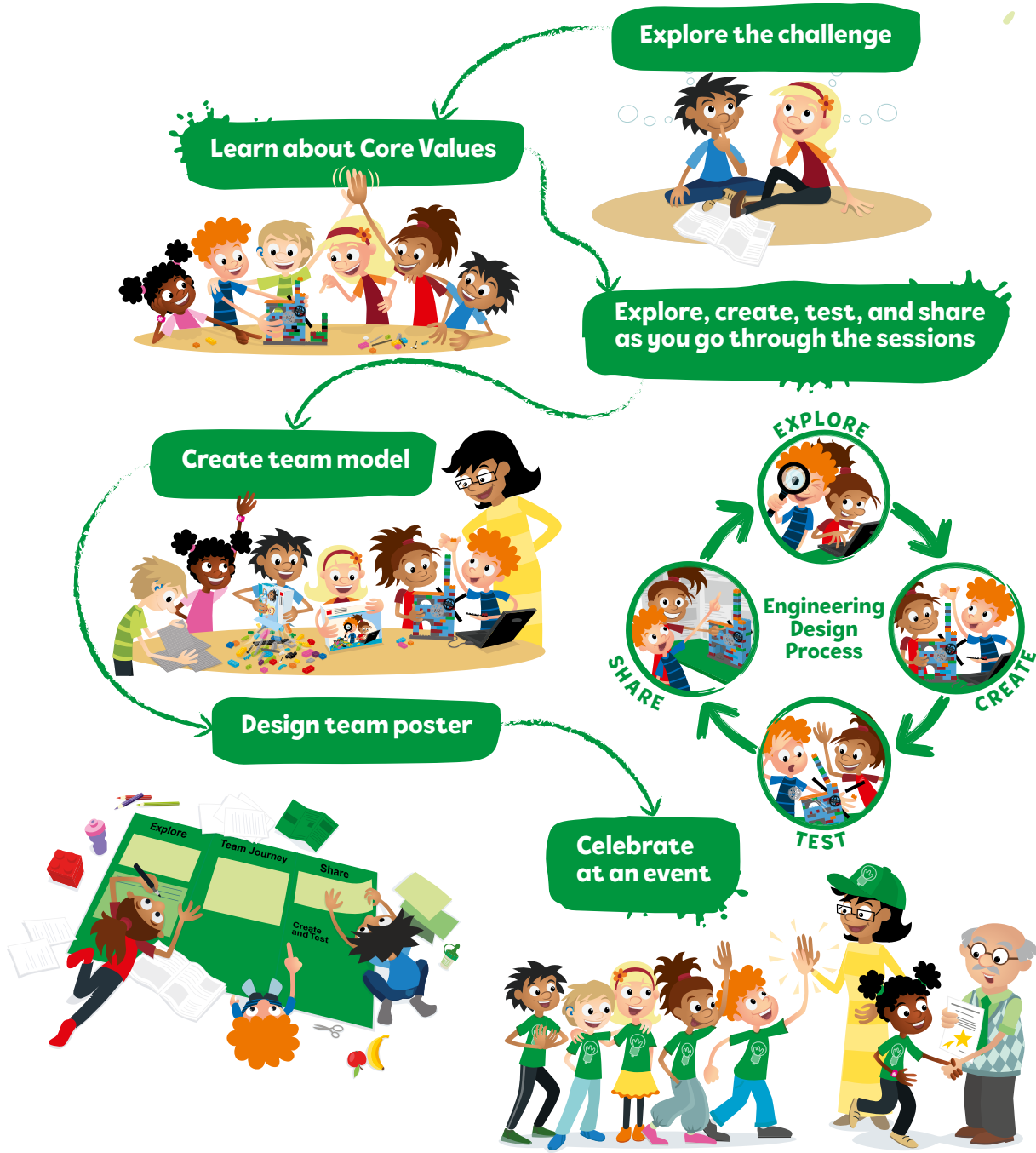
**Look at the careers on these pages. Think about these jobs and what interests you.**

- What skills are needed in these jobs?
- What interests you about these jobs?
- Can you think of other jobs that relate to the arts?
- Can you explore one of these careers for more information?



**Scan me for  
career resources**

# Team Journey



**FIRST. IN SHOW. SM**



PRESENTED BY **Qualcomm**