FIRST® at Home
Coder Says

ACTIVITY SUMMARY

Students will practice *FIRST*® Core Values of communication, teamwork, discovery and innovation while creating a pseudo code to program their team members in completing a job or task.

Age Range & Grade Level: Ages 6 – 10, Grades 2 through 4
Program Connection: FIRST® LEGO® League Explore
Authored By: Jillian Mordarski, Project Manager, FIRST® LEGO® League

ACTIVITY OUTCOMES

Participants will:

1. Demonstrate teamwork and communication skills
2. Discovery basic coding concepts and practice logical thinking
3. Create a new code using the coding blocks provided to complete a task

RELEVANCE MATRIX – Subject Area Crosswalks and Core Values Addressed

Science	Math	Literacy	Social Studies	Computer Science
Movement, Motion	Spatial Reasoning, Shapes	Reading, Listening and Speaking		Coding Basics Pseudo Code
Discovery	Innovation	Impact	Inclusion	Teamwork

FUN! Our last core value should always be used when doing any *FIRST* activities.

KEY VOCABULARY

Communication	Technology	Programming	Pseudo Code
Core Values	Engineering		

MATERIALS & SUPPLIES NEEDED FOR THIS ACTIVITY

Coder Says Student Design Brief

GUIDANCE SET-UP

Description – Action – Guidance	Notes
Provide students with the *FIRST* Coder Says Design Brief.	
Review the problem statement and criteria/constraints with the students. Remind students they will be using the engineering design process and *FIRST* core values to work towards a solution.	Review the age appropriate engineering design process with your students.
Have students watch this short video. Reflect with the students what they learned about how coding is used in machines.	Video
Determine how students will complete the activity, what their length of time will be, how to collaborate and how to share their solutions. Have students work on their solutions.	For distance learning students could do a video or complete this activity over video chat
Have students share their solutions by adding their coding blocks to the game.	Use the reflect questions to allow students to think about their learning
Determine the assessment or grading to be used. See evidence of achievement below.	
Explore the *Go Further!* opportunities	See below
Wrap up – Have students complete their core values self-assessment and review.	

STUDENT OR TEAM ACTIONS

1. Review the problem statement and criteria/constraints.
2. Watch the coding and technology video
3. Reflect on the video using the questions
4. Determine a task and write a code to tell you partner how to complete the task
5. Share your solution and reflect on your learning
6. Explore the Go Further!
7. Complete your *FIRST* core values self-assessment

GO FURTHER!

Create a program using coding blocks and have someone complete a task. You can use the coding blocks you have or add your own.

EVIDENCE OF ACHIEVEMENT

Evaluation Rubric			
Category	**3 points**	**2 points**	**1 point**
Requirements	All requirements on the design brief were met.	Some of the requirements on the design brief were met.	Only a few requirements on the design brief were met.
Design	Clearly showed how the solution would help others.	Showed how the solution would help others.	Not clear how the solution would help others.
Collaboration	Demonstrated collaboration by sharing information or working with team members.	Shared some information or with team members.	Respect and inclusion being developed.
Knowledge Gained	All the questions are answered completely.	All the questions are answered but could have more detail.	The questions are not answered.

FIRST® at Home
Coder Says
Design Brief

PROBLEM STATEMENT

Many technologies today like cars, computers, or smart phones need to receive a set of commands to do a job or complete a task. Engineers need to write a code to tell the technology how to complete a specific set of instructions. This takes a lot of communication and teamwork.
To create smart technology, you must learn how to speak and write in this code. In this challenge you will be a coder and your team members are the technology. Write a code to make them do a specific job or task. Remember to use your *FIRST* Core Values!

CRITERIA & CONSTRAINTS

- You must use the set of coding commands provided to help you and others to learn to "speak" code.
- One person is the Coder the other person is the Robot(s). The "Coder" will hold up or say each coding block and have the technology person act out the motion listed for each.
- Say "Coder Says" then hold up or say a coding block. The technology person should act out the step that each block represents.
- Continue reading coding blocks until the task is complete.
- If a task cannot be completed, troubleshoot your code and try again.

ENGINEERING DESIGN PROCESS & *FIRST* CORE VALUES

FIRST Engineering Design Process | Explore *FIRST* Core Values

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BUILDING THE BACKGROUND & BRAINSTORMING

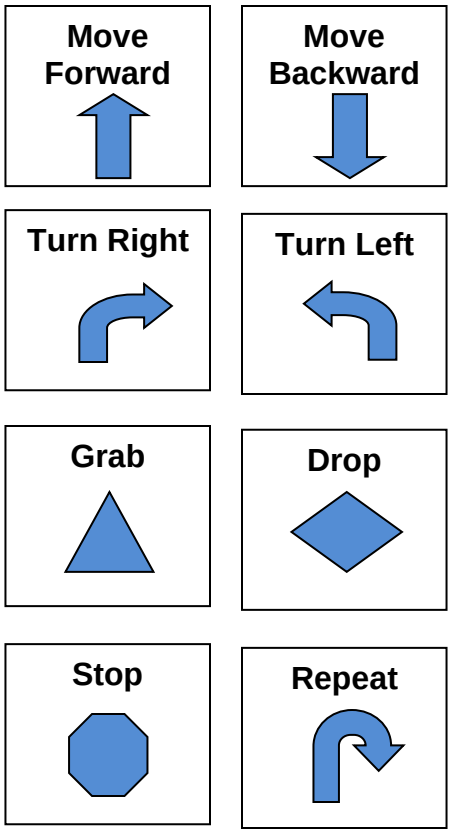
Watch the video "Coding for Kids Explained".

What are some other technologies that use code?

Could you use code to give a person direction to get somewhere or complete a task?

SKETCH YOUR DESIGN

Sketch your ideas for the code, then speak your code to your partner and see if it works.

What task will be attempted with this code?	Write your Code Here
	

REFLECTION QUESTIONS

1. What did you discover about writing the code?

2. How did you innovate during this activity?

3. Did communication and teamwork affect your success?

GO FURTHER!

Now create a new program using your own coding blocks and have someone complete a task. Do more complex movements with less steps.

CORE VALUES SELF-REFLECTION

	Amazing Skill	Great Job	Making Progress	Could Be Better
Discover	I approached the tasks looking for all possible answers independently and used perseverance to discover the answer on my own.	I approached the tasks and asked questions from one other person but persevered to discover the answer on my own.	I approached tasks but needed assistance multiple times to reach a point of discovery.	I depended on others to make the discovery for me.
Innovation	I used creativity and perseverance to solve problems on my own, coming up with unique solutions for the tasks I was given.	I used creativity and perseverance to solve problems on my own coming up with different solutions for the tasks I was given.	I used creativity but struggled with perseverance to solve problems on my own.	I struggled with being creative and only used the information given and needed a lot of encouragement from others to complete the task.
Impact	I approached the tasks applying understanding of the information with the impact it can have on me and my future as well as how I could help others.	I approached the tasks knowing and applying the information with impact it can have on me and my future.	I understand the tasks but struggle to apply how it will help me in my future or to influence others.	I understand the tasks but did not approach it with understanding the impact it can have on my future or others.
Inclusion	I approached all tasks with inclusion of others' ideas, I showed tremendous kindness by including others' views in my projects and work. I approached my solution thinking how all people would interact with the solution.	I approached most with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution mostly incorporates needs of others.	I approached some tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution meets only a few needs of others.	I did not approach tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution is not inclusive of different types of people.
Teamwork	I used collaboration, communication and project management to get all tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get most tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get some tasks accomplished for myself as well as the others.	I only sometimes used collaboration, communication and project management and accomplished a few tasks for myself as well as the others.
Fun	I kept a positive attitude throughout and found opportunities to have fun even through struggle. I looked for additional opportunities to have fun in my tasks.	I kept a positive attitude throughout and found opportunities to have fun even through struggle.	I saw the enjoyment and fun after the activity but struggled to see it during.	I only saw struggle in completing my tasks and did not look for times to have fun.

FIRST® *at* Home

Over Rover

ACTIVITY SUMMARY

Students will create a map or obstacle course much like what they would see on the surface of Mars, then create a set of commands or "code" to get the rover to the correct location to retrieve the supplies. Students can create a path and commands on paper or even create an obstacle course and act it out.

Age Range & Grade Level: Ages 6 – 10, Grades 2 through 4
Program Connection: *FIRST*® LEGO® League: Explore
Authored By: Jillian Mordarski, Project Manager, *FIRST*® LEGO® League

ACTIVITY OUTCOMES

Participants will:

1. Research the features of the surface on Mars.
2. Design a realistic pathway on Mars from a starting point to the location of supplies.
3. Apply what they have learned to a code for the rover to follow to retrieve supplies.

RELEVANCE MATRIX – Subject Area Crosswalks and Core Values Addressed

Science	Math	Literacy	Social Studies	Computer Science
Motion, Forces, Stability	Algebraic Thinking	Research, Content Reading	Career Connections, Engineering for social solutions	Decompose Problem, Create Programs
Discovery	Innovation	Impact	Inclusion	Teamwork

FUN! Our last core value should always be used when doing any *FIRST*® activities.

KEY VOCABULARY

Rover	Mars	Coding	Programing
Model	Obstacle	Sketch	

MATERIALS & SUPPLIES NEEDED FOR THIS ACTIVITY

Over Rover Design Brief, internet capable device, (optional) extra paper and physical objects for an obstacle course

GUIDANCE SET-UP

Description – Action – Guidance	Notes
Provide students with the Over Rover Design Brief.	
Review the problem statement and criteria/constraints with the students. Remind students they will be using the engineering design process to work towards a solution.	Review the age appropriate engineering design process with your students.
Have students watch the video on Rovers and Coding	PBS Kids: Kids Visit the Mars Yard
Determine how students will complete the activity, what their length of time will be, how to collaborate and how to share their solutions. Have students work on their solutions.	Pick a starting and ending point either on paper or in a space of your choice. There must be 3 different surfaces of Mars represented. Students must write the step by step code to get the rover to the supplies
Have students share their solutions and complete the reflection questions.	Act out or draw instructions and follow the EXACT steps until you no longer can or until you reach the ending point. Ask each pair if the outcome was what they expected. If it wasn't, why not?
Explore the *Go Further!* opportunities	See below
Wrap up – Have students complete their core values self-assessment and review.	

STUDENT OR TEAM ACTIONS

1. Review the problem statement and criteria/constraints.
2. Watch this short video on Rovers and Coding: PBS Kids: Kids Visit the Mars Yard
3. Research the questions and discuss.
4. Create a solution to solve the challenge.
5. Share your solution and reflect on your learning.
6. Explore the Go Further! opportunities.
7. Complete your *FIRST* core values self-assessment.

GO FURTHER!

Learn more about Mars and its Rovers:

https://spaceplace.nasa.gov/all-about-mars/en/

EVIDENCE OF ACHIEVEMENT

Evaluation Rubric			
Category	**3 points**	**2 points**	**1 point**
Requirements	All requirements on the design brief were met.	Some of the requirements on the design brief were met.	Only a few requirements on the design brief were met.
Design	Clearly showed how the solution would help others.	Showed how the solution would help others.	Not clear how the solution would help others.
Collaboration	Demonstrated collaboration by sharing information or working with team members.	Shared some information or with team members.	Respect and inclusion being developed.
Knowledge Gained	All the questions are answered completely.	All the questions are answered but could have more detail.	The questions are not answered.

FIRST® at Home Over Rover Design Brief

PROBLEM STATEMENT

Are you ready to fly into the future and blast off into outer space? Imagine you are living at a base camp on Mars! The supplies you need were delivered to Mars but are far from your location. You need to send a Mars Rover to retrieve the supplies and bring them back to your base camp. The Mars Rover is a type of Robot and needs to receive a set of commands to do a job or complete a task. Your task is to create a "code" to tell the robot how to complete a specific set of instructions. See your mission details below to retrieve the supplies!

CRITERIA & CONSTRAINTS

- Your solution can be presented as a physical model or drawing
- You must use the set of coding block commands provided to get the rover to the correct location.
- Create a map and/or obstacle course from your base camp to the supply location.
- Make sure you include at least 3 different surfaces found on Mars.
- Provide a drawing or show the coding blocks the rover used to navigate the surface of Mars and arrive at the correct location.

ENGINEERING DESIGN PROCESS & *FIRST* CORE VALUES

FIRST Engineering Design Process | Explore *FIRST*® Core Values

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BUILDING THE BACKGROUND & BRAINSTORMING

- Watch PBS Kids: Kids Visit the Mars Yard
- Reflect, research and answer the questions below.
- What is the surface like on Mars? What difficulties would a rover have?
- What ideas do you have for your own drawing or physical model of Mars?
- What features of the rover help you navigate the surface of Mars?

SKETCH YOUR DESIGN

Sketch your path to the supplies on the left and write your step by step code that you would need to get your rover from base camp to the supplies on the right.

Sketch the path to the supplies	Write the steps the rover will take to get to the supplies and back
Start Finish	

REFLECTION QUESTIONS

1. What surfaces did you include on you map of Mars?
2. Can you combine steps to make your code shorter?
3. What skills did you use or learn in this activity?

GO FURTHER!

Learn more about Mars and its Rovers:

https://spaceplace.nasa.gov/all-about-mars/en/

CORE VALUES SELF-REFLECTION

	Amazing Skill	Great Job	Making Progress	Could Be Better
Discover	I approached the tasks looking for all possible answers independently and used perseverance to discover the answer on my own.	I approached the tasks and asked questions from one other person but persevered to discover the answer on my own.	I approached tasks but needed assistance multiple times to reach a point of discovery.	I depended on others to make the discovery for me.
Innovation	I used creativity and perseverance to solve problems on my own, coming up with unique solutions for the tasks I was given.	I used creativity and perseverance to solve problems on my own coming up with different solutions for the tasks I was given.	I used creativity but struggled with perseverance to solve problems on my own.	I struggled with being creative and only used the information given and needed a lot of encouragement from others to complete the task.
Impact	I approached the tasks applying understanding of the information with the impact it can have on me and my future as well as how I could help others.	I approached the tasks knowing and applying the information with impact it can have on me and my future.	I understand the tasks but struggle to apply how it will help me in my future or to influence others.	I understand the tasks but did not approach it with understanding the impact it can have on my future or others.
Inclusion	I approached all tasks with inclusion of others' ideas, I showed tremendous kindness by including others' views in my projects and work. I approached my solution thinking how all people would interact with the solution.	I approached most with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution mostly incorporates needs of others.	I approached some tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution meets only a few needs of others.	I did not approach tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution is not inclusive of different types of people.
Teamwork	I used collaboration, communication and project management to get all tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get most tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get some tasks accomplished for myself as well as the others.	I only sometimes used collaboration, communication and project management and accomplished a few tasks for myself as well as the others.
Fun	I kept a positive attitude throughout and found opportunities to have fun even through struggle. I looked for additional opportunities to have fun in my tasks.	I kept a positive attitude throughout and found opportunities to have fun even through struggle.	I saw the enjoyment and fun after the activity but struggled to see it during.	I only saw struggle in completing my tasks and did not look for times to have fun.

FIRST® at Home
Design it!

ACTIVITY SUMMARY

Students will use the engineering design process, focusing on design, to share their solution with others or team members. Students will choose their own solution and create a design. They will then pass on the design to the next team member to contribute. *FIRST*® core values should be emphasized along with the engineering design process during the activity.

Age Range & Grade Level: *Ages 9+, Grade 4+*
Program Connection: *FIRST*® LEGO® League: Explore
Authored By: Jillian Mordarski, Project Manager, *FIRST*® LEGO® League
Inspired By: PBS Kids Design Remix Activity

ACTIVITY OUTCOMES

Participants will:

1. Research and brainstorm a solution to a problem
2. Create a design sketch of the solution to share
3. Apply the engineering design process

RELEVANCE MATRIX – Subject Area Crosswalks and Core Values Addressed

Science	Math	Literacy	Social Studies	Computer Science
Using observations to test a solution	Measurement, 2D/3D modeling	Research, Content Reading	Career Connections, Engineering for social solutions	Logical Thinking
Discovery	Innovation	Impact	Inclusion	Teamwork

FUN! Our last core value should always be used when doing any *FIRST*® activities.

KEY VOCABULARY

Engineering	Prototype	Design	Iteration
Model	Engineering Design Process	Brainstorming	Engineer

MATERIALS & SUPPLIES NEEDED FOR THIS ACTIVITY

Design It! design brief, paper, markers and (Optional) assorted materials for building a solution

GUIDANCE SET-UP

Description – Action – Guidance	Notes
Provide students with the *FIRST* Design It! Design Brief.	
Review the problem statement and criteria/constraints with the students. Remind students they will be using the engineering design process to work towards a solution.	Review the age appropriate engineering design process with your students.
Watch this Design Remix video with the students. Reflect on the process and relate it to the problem statement and activity the students will be completing.	https://pbskids.org/designsquad/remix/
Determine how students will complete the activity, what their length of time will be, how to collaborate and how to share their solutions. Have students work on their solutions.	Students must the engineering design process to show how they solved their problem.
Have students share their solutions by passing on their design to the next person to contribute. If doing this activity virtually students may need to send pictures of their design and print it out or can verbally share how they would add to the design.	Ask each student if the outcome was what they expected. If it wasn't, why not?
Explore the *Go Further!* opportunities	See below
Wrap up – Have students complete their core values self-assessment and review.	

STUDENT OR TEAM ACTIONS

1. Review the problem statement and criteria/constraints.
2. Read and talk about the engineering design process steps.
3. Watch the PBS Kids Design Remix video.
4. Research the questions and discuss.
5. Create a solution to solve the challenge.
6. Share your solution and reflect on your learning.
7. Explore the Go Further! opportunities.
8. Complete your *FIRST*® core values self-assessment.

GO FURTHER!

- Have more than one person improve upon your design.
- Build a prototype if you have not already.
- Do the design remix activity on PBS Kids and participate in design activities.
- Create your design using computer aided design software.

EVIDENCE OF ACHIEVEMENT

Evaluation Rubric			
Category	**3 points**	**2 points**	**1 point**
Requirements	All requirements on the design brief were met.	Some of the requirements on the design brief were met.	Only a few requirements on the design brief were met.
Design	Clearly showed how the solution would help others.	Showed how the solution would help others.	Not clear how the solution would help others.
Collaboration	Demonstrated collaboration by sharing information or working with team members.	Shared some information or with team members.	Respect and inclusion being developed.
Knowledge Gained	All the questions are answered completely.	All the questions are answered but could have more detail.	The questions are not answered.

FIRST® at Home
Design it!
Design Brief

PROBLEM STATEMENT

Engineers think about problems, ask questions and then explore solutions. To creation solutions they design, create and test many possible models. Testing and reviewing the results of the test helps make the design better the next time, this is called iteration. In this activity you are going to be an engineer, too! All you must do is use the engineering design process. The parts do not always go in order, you can start, stop and re-start at any part of the process as you learn new things!

CRITERIA & CONSTRAINTS

- Practice being an engineer by designing a solution to a problem.
- How will you solve this problem? Think of some solutions.
- Join with others to think of ways to make them better!
- Use your core values to work together on this solution.

ENGINEERING DESIGN PROCESS & *FIRST* CORE VALUES

Explore *FIRST*® Core Values

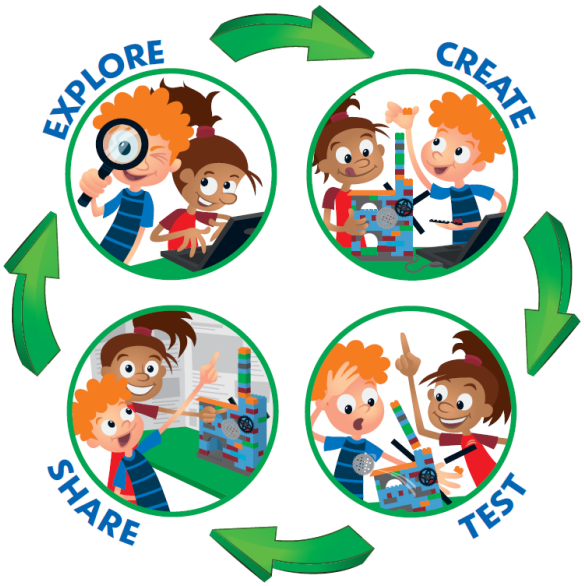
Engineering Design Process

Explore – The problem

Create – Solutions to the problem

Test – Find ways to test your solutions

Share – Communication what you learned



BUILDING THE BACKGROUND & BRAINSTORMING

Start **EXPLORING** your engineering journey here

- Watch PBS Kids and learn how Design Remix works.
- What are some items in your home that could be improved?
- Could you use the engineering design process to make it better?

SKETCH YOUR DESIGN

Choose an object in your home to do a design remix.

What is the purpose of this object?

CREATE - brainstorm and compete your design below.

Brainstorming	**Your Design**

TEST – Optional build a model of your design and see how well it works

SHARE – Determine who is on your design team, share your design and have them add on their ideas. If they are doing the same activity, they will share a design with you!

Who is on your design team?

REFLECTION QUESTIONS

1. Why did you choose this design?

2. What problem did you try to solve?

3. How did the engineering design process help you think about your design?

GO FURTHER!

- Have more than one person improve upon your design.
- Build a prototype if you have not already.
- Do the design remix activity on PBS Kids and participate in design activities.
- Create your design using computer aided design software.

CORE VALUES SELF-REFLECTION

	Amazing Skill	Great Job	Making Progress	Could Be Better
Discover	I approached the tasks looking for all possible answers independently and used perseverance to discover the answer on my own.	I approached the tasks and asked questions from one other person but persevered to discover the answer on my own.	I approached tasks but needed assistance multiple times to reach a point of discovery.	I depended on others to make the discovery for me.
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Teamwork	I used collaboration, communication and project management to get all tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get most tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get some tasks accomplished for myself as well as the others.	I only sometimes used collaboration, communication and project management and accomplished a few tasks for myself as well as the others.
Fun	I kept a positive attitude throughout and found opportunities to have fun even through struggle. I looked for additional opportunities to have fun in my tasks.	I kept a positive attitude throughout and found opportunities to have fun even through struggle.	I saw the enjoyment and fun after the activity but struggled to see it during.	I only saw struggle in completing my tasks and did not look for times to have fun.

FIRST® at Home
What's so simple?

ACTIVITY SUMMARY

Students will learn about simple machines, to incorporate in a solution to help others. They will share their solution with others or team members. Students will choose a simple machine to incorporate in a solution. *FIRST*® core values should be emphasized along with the engineering design process during the activity.

Age Range & Grade Level: *Ages 9+, Grade 4+*
Program Connection: *FIRST*® LEGO® League Explore
Authored By: Jillian Mordarski, Project Manager, *FIRST*® LEGO® League
Inspired By: PBS kids what are simple machines

ACTIVITY OUTCOMES

Participants will:

1. Learn about simple machines and how they can be used to help do work
2. Research and brainstorm a solution to help others
3. Incorporate a simple machine in a solution to help others

RELEVANCE MATRIX – Subject Area Crosswalks and Core Values Addressed

Science	Math	Literacy	Social Studies	Computer Science
Using observations to test a solution	Measurement, 2D/3D modeling	Research, Content Reading	Career Connections, Engineering for social solutions	Logical Thinking
Discovery	Innovation	Impact	Inclusion	Teamwork

FUN! Our last core value should always be used when doing any *FIRST* activities.

KEY VOCABULARY

Engineering, Simple Machine, Lever, Pulley, Wheel and Axel, Wedge, Inclined Plane, Screw

MATERIALS & SUPPLIES NEEDED FOR THIS ACTIVITY

Simple Machines design brief, paper, markers and (Optional) assorted materials for building a solution

GUIDANCE SET-UP

Description – Action – Guidance	Notes
Provide students with the What's so simple? Brief.	
Review the problem statement and criteria/constraints with the students. Remind students they will be using to work towards a solution.	Review the age appropriate engineering design process with your students.
Watch this what-are-simple-machines with the students. Reflect on the process and relate it to the problem statement and activity the students will be completing.	https://pbskids.org/designsquad/video/what-are-simple-machines/
Determine how students will complete the activity, what their length of time will be, how to collaborate and how to share their solutions. Have students work on their solutions.	Students must use a simple machine in their solution and show how they solved their problem.
Have students share their solution to the problem they solved and how they incorporated a simple machine to help do the work.	Ask each student in what other ways are the simple machine used?
Explore the *Go Further!* opportunities	See below
Wrap up – Have students complete their core values self-assessment and review.	

STUDENT OR TEAM ACTIONS

1. Review the problem statement and criteria/constraints.
2. Read and talk about the engineering design process steps.
3. Watch the PBS Kids what-are-simple-machines.
4. Research the questions and discuss.
5. Create a solution to solve the challenge.
6. Share your solution and reflect on your learning.
7. Explore the Go Further! opportunities.
8. Complete your *FIRST* Core Values self-assessment.

GO FURTHER!

- Build a prototype if you have not already.
- Find ways in incorporate more than one simple machine
- Go on a "simple machine" hunt in your house or neighborhood, try to identify something that is or has a simple machine

EVIDENCE OF ACHIEVEMENT

Evaluation Rubric			
Category	**3 points**	**2 points**	**1 point**
Requirements	All requirements on the design brief were met.	Some of the requirements on the design brief were met.	Only a few requirements on the design brief were met.
Design	Clearly showed how the solution would help others.	Showed how the solution would help others.	Not clear how the solution would help others.
Collaboration	Demonstrated collaboration by sharing information or working with team members.	Shared some information or with team members.	Respect and inclusion being developed.
Knowledge Gained	All the questions are answered completely.	All the questions are answered but could have more detail.	The questions are not answered.

FIRST® at Home
What's so simple?
Design Brief

PROBLEM STATEMENT

Did you know your home is full of inventions? An invention is something new that has been created. There are complex machines like a computer or car, but inventions can also be simple like a cup to hold water or paper to write on. Inventions can also help people. Often simple machines are used in inventions because they can help do the work. Can you create an invention that uses a simple machine and helps others?

CRITERIA & CONSTRAINTS

- Learn about simple machines.
- Use one or more simple machines in your invention.
- Draw or build your invention.
- Use your core values to help others.

ENGINEERING DESIGN PROCESS & *FIRST*® CORE VALUES

Explore *FIRST* Core Values

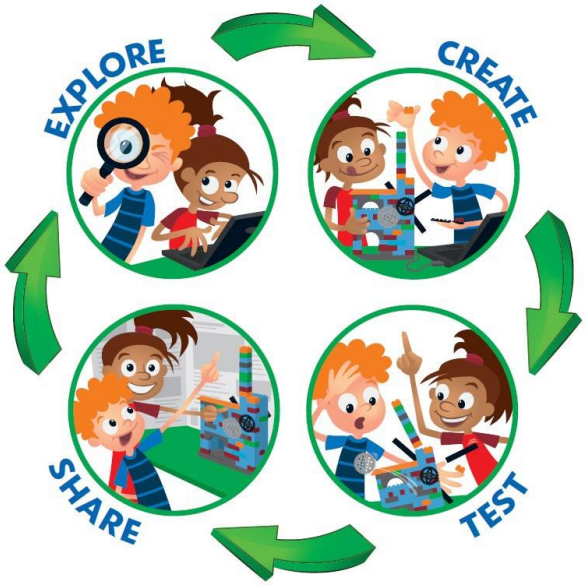
Engineering Design Process

Explore – The problem

Create – Solutions to the problem

Test – Find ways to test your solutions

Share – Communication what you learned



BUILDING THE BACKGROUND & BRAINSTORMING

Start **EXPLORING** your simple machine journey here

- Watch PBS Kids and learn about simple machines.
- Can you identify any simple machines in your home?
- Choose one or more simple machines to explore.

SKETCH YOUR DESIGN

Choose one simple machine to use in your invention What is the

purpose of this object? How does it help others?

CREATE - brainstorm and compete your design below.

Simple Machine	**Your Invention Design**

TEST – Optional build a model of your design and see how well it works

SHARE – Who will your invention help? What simple machine did you use?

REFLECTION QUESTIONS

1. Why did you choose this simple machine?

2. What work is your simple machine doing?

3. How did the engineering design process help you think about your design?

GO FURTHER!

- Have more than one person improve upon your design.
- Build a prototype if you have not already.

CORE VALUES SELF-REFLECTION

	Amazing Skill	Great Job	Making Progress	Could Be Better
Discover	I approached the tasks looking for all possible answers independently and used perseverance to discover the answer on my own.	I approached the tasks and asked questions from one other person but persevered to discover the answer on my own.	I approached tasks but needed assistance multiple times to reach a point of discovery.	I depended on others to make the discovery for me.
Innovation	I used creativity and perseverance to solve problems on my own, coming up with unique solutions for the tasks I was given.	I used creativity and perseverance to solve problems on my own coming up with different solutions for the tasks I was given.	I used creativity but struggled with perseverance to solve problems on my own.	I struggled with being creative and only used the information given and needed a lot of encouragement from others to complete the task.
Impact	I approached the tasks applying understanding of the information with the impact it can have on me and my future as well as how I could help others.	I approached the tasks knowing and applying the information with impact it can have on me and my future.	I understand the tasks but struggle to apply how it will help me in my future or to influence others.	I understand the tasks but did not approach it with understanding the impact it can have on my future or others.
Inclusion	I approached all tasks with inclusion of others' ideas, I showed tremendous kindness by including others' views in my projects and work. I approached my solution thinking how all people would interact with the solution.	I approached most with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution mostly incorporates needs of others.	I approached some tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution meets only a few needs of others.	I did not approach tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution is not inclusive of different types of people.
Teamwork	I used collaboration, communication and project management to get all tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get most tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get some tasks accomplished for myself as well as the others.	I only sometimes used collaboration, communication and project management and accomplished a few tasks for myself as well as the others.
Fun	I kept a positive attitude throughout and found opportunities to have fun even through struggle. I looked for additional opportunities to have fun in my tasks.	I kept a positive attitude throughout and found opportunities to have fun even through struggle.	I saw the enjoyment and fun after the activity but struggled to see it during.	I only saw struggle in completing my tasks and did not look for times to have fun.

FIRST® at Home
Test It!

ACTIVITY SUMMARY

Students will learn how Engineers must test their solutions. They will test their solution(s) to the problem. Students will see how to use parts of the Engineering Design Process many times to test and reach a solution. *FIRST*® Core Values should be emphasized along with the engineering design process during the activity.

Age Range & Grade Level: *Ages 9+, Grade 4+*
Program Connection: *FIRST*® LEGO®League: Explore
Authored By: Jillian Mordarski, Project Manager, *FIRST*® LEGO®League
Inspired By: NASA for Kids Intro to Engineering

ACTIVITY OUTCOMES

Participants will:

1. Research and brainstorm a solution to the problem
2. Test one or more solutions
3. Use the Engineering Design Process and track the parts you use most often

RELEVANCE MATRIX – Subject Area Crosswalks and Core Values Addressed

Science	Math	Literacy	Social Studies	Computer Science
Using observations to test a solution, Testing a hypothesis	Measurement, 2D/3D modeling	Research, Content Reading	Career Connections, Engineering for social solutions	Logical Thinking
Discovery	Innovation	Impact	Inclusion	Teamwork

FUN! Our last Core Value should always be used when doing any *FIRST* activities.

KEY VOCABULARY

Engineering	Simple Machine	Lever	Pulley	Wheel and Axel
Wedge	Inclined plane	Screw		

MATERIALS & SUPPLIES NEEDED FOR THIS ACTIVITY

Simple Machines design brief, paper, markers and (Optional) assorted materials for building a solution

GUIDANCE SET-UP

Description – Action – Guidance	Notes
Provide students with the What's so simple? Brief.	
Review the problem statement and criteria/constraints with the students. Remind students they will be using to work towards a solution.	Review the age appropriate engineering design process with your students.
Watch NASA for Kids Intro to Engineering video (2 minutes, 42 seconds) with the students. Reflect on the process and relate it to the problem statement and activity the students will be completing.	https://svs.gsfc.nasa.gov/cgi-bin/details.cgi?aid=10719
Determine how students will complete the activity, what their length of time will be, how to collaborate and how to share their solutions. Have students work on their solutions.	Students must test their solution and show how they solved their problem.
Have students share their solution to the problem they solved and how testing helped to solve the problem.	Ask each student how testing helped to solve the problem?
Explore the *Go Further!* opportunities	See below
Wrap up – Have students complete their core values self-assessment and review.	

STUDENT OR TEAM ACTIONS

1. Review the problem statement and criteria/constraints.
2. Read and talk about the engineering design process steps.
3. Watch NASA for Kids Intro to Engineering video
4. Research the questions and discuss.
5. Create a solution to solve the challenge.
6. Share your solution and reflect on your learning.
7. Explore the Go Further! opportunities.
8. Complete your FIRST core values self-assessment.

GO FURTHER!

- Practice sharing what you have learned after you test your solution, even if it did not work.
- Could you think of another way to solve the problem of fixing the space station you saw in the video?

EVIDENCE OF ACHIEVEMENT

Evaluation Rubric			
Category	**3 points**	**2 points**	**1 point**
Requirements	All requirements on the design brief were met.	Some of the requirements on the design brief were met.	Only a few requirements on the design brief were met.
Design	Clearly showed how the solution would help others.	Showed how the solution would help others.	Not clear how the solution would help others.
Collaboration	Demonstrated collaboration by sharing information or working with team members.	Shared some information or with team members.	Respect and inclusion being developed.
Knowledge Gained	All the questions are answered completely.	All the questions are answered but could have more detail.	The questions are not answered.

FIRST® at Home Activity
Test It!
Design Brief

PROBLEM STATEMENT

The Engineering design process is not a checklist, but a way of thinking. You can go back to any part of the process to help solve the problem. That's why testing is an important part of the process. Testing is how engineers see if their ideas work. This is how they gain knowledge of the problem and how it can or cannot be solved. Remember, getting it right the first time is not important. Try to solve a problem, keep track of how many parts of the Engineering Design Process you use until you can solve the problem. Focus on the step of **TESTING** your ideas.

If you receive a delivery at your front door but cannot touch it, how can you get it safely into your home? You cannot use gloves to pick it up. It could be mail, a box, a bag of groceries. You decide what your delivery is and how you can solve the problem of getting it safely into your home.

CRITERIA & CONSTRAINTS

- Practice using the engineering design process and focus on testing your ideas.
- How will you solve this problem? Think of some solutions.
- Test your solutions, did any of them work? Could you make anything better?
- Use your core values to work together on this solution.

ENGINEERING DESIGN PROCESS & *FIRST* CORE VALUES

Explore *FIRST* Core Values

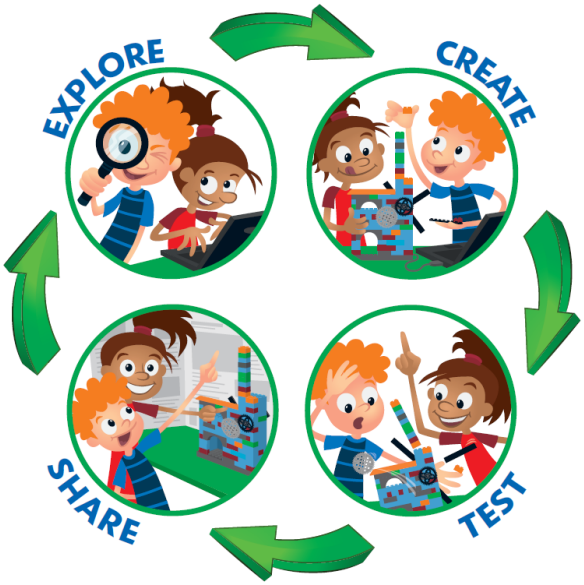
Engineering Design Process

Explore – The problem

Create – Solutions to the problem

Test – Find ways to test your solutions

Share – Communication what you learned



BUILDING THE BACKGROUND & BRAINSTORMING

Start **EXPLORING** your engineering journey here

- Watch the Intro to Engineering video (2 minutes, 42 seconds) from NASA for Kids
- Why do engineers not always solve a problem on the first try? In the video, what silly ideas did they brainstorm to solve the problem?
- How could you use the engineering design process to make an idea better?

SKETCH YOUR DESIGN

Think about the problem, what will be delivered to your home?

Can you think of ways to get the delivery into your home without using your hands (or feet)?

CREATE - brainstorm 2-3 ideas and select the one's you would like to test.

TEST –Build one or more models of your design and see how well it works.

SHARE – Share what happens when you test your models, how could you make them better? What parts of the engineering design process will you need to use?

REFLECTION QUESTIONS

1. Did your brainstorm include any FUN ideas?

2. How did you try to test and solve the problem?

3. How did the engineering design process help you think about testing your solution?

GO FURTHER!

- Practice sharing what you have learned after you test your solution, even if it did not work.
- Could you think of another way to solve the problem of fixing the space station you saw in the video?

CORE VALUES SELF-REFLECTION

	Amazing Skill	Great Job	Making Progress	Could Be Better
Discover	I approached the tasks looking for all possible answers independently and used perseverance to discover the answer on my own.	I approached the tasks and asked questions from one other person but persevered to discover the answer on my own.	I approached tasks but needed assistance multiple times to reach a point of discovery.	I depended on others to make the discovery for me.
Innovation	I used creativity and perseverance to solve problems on my own, coming up with unique solutions for the tasks I was given.	I used creativity and perseverance to solve problems on my own coming up with different solutions for the tasks I was given.	I used creativity but struggled with perseverance to solve problems on my own.	I struggled with being creative and only used the information given and needed a lot of encouragement from others to complete the task.
Impact	I approached the tasks applying understanding of the information with the impact it can have on me and my future as well as how I could help others.	I approached the tasks knowing and applying the information with impact it can have on me and my future.	I understand the tasks but struggle to apply how it will help me in my future or to influence others.	I understand the tasks but did not approach it with understanding the impact it can have on my future or others.
Inclusion	I approached all tasks with inclusion of others' ideas, I showed tremendous kindness by including others' views in my projects and work. I approached my solution thinking how all people would interact with the solution.	I approached most with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution mostly incorporates needs of others.	I approached some tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution meets only a few needs of others.	I did not approach tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution is not inclusive of different types of people.
Teamwork	I used collaboration, communication and project management to get all tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get most tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get some tasks accomplished for myself as well as the others.	I only sometimes used collaboration, communication and project management and accomplished a few tasks for myself as well as the others.
Fun	I kept a positive attitude throughout and found opportunities to have fun even through struggle. I looked for additional opportunities to have fun in my tasks.	I kept a positive attitude throughout and found opportunities to have fun even through struggle.	I saw the enjoyment and fun after the activity but struggled to see it during.	I only saw struggle in completing my tasks and did not look for times to have fun.

FIRST® at Home
Marble Maze

ACTIVITY SUMMARY

Students will be working as game designers to create an interactive maze game. They must try to make the game playable for blind or sight impaired people. Students will focus on collaboration while working on a maze design with another student. Students will take turns creating each part of the maze then passing off to the next team member. Students must include a simple machine device in their solution(s) and remember: have fun!

Age Range & Grade Level: *Ages 9+, Grade 4+*
Program Connection: *FIRST*® LEGO® League Explore
Authored By: Jillian Mordarski, Project Manager, *FIRST*® LEGO® League

ACTIVITY OUTCOMES

Participants will:

1. Research and brainstorm a solution to the problem.
2. Test one or more solutions.
3. Use the Engineering Design Process and track the parts you use most often.

RELEVANCE MATRIX – Subject Area Crosswalks and Core Values Addressed

Science	Math	Literacy	Social Studies	Computer Science
Using observations to test a solution	Measurement, 2D/3D modeling	Research, Content Reading	Career Connections, Engineering for social solutions	Logical Thinking
Discovery	Innovation	Impact	Inclusion	Teamwork

FUN! Our last Core Value should always be used when doing any *FIRST* activities.

KEY VOCABULARY

Engineering Maze Blind Sight Impaired Simple Machine Test

MATERIALS & SUPPLIES NEEDED FOR THIS ACTIVITY

Marble Maze design brief, paper, markers and (Optional) assorted materials for building a solution, cardboard, glue, tape, ruler, marble or small ball.

GUIDANCE SET-UP

Description – Action – Guidance	Notes
Provide students with the Marble Maze Design Brief.	
Review the problem statement and criteria/constraints with the students. Remind students they will be using to work towards a solution.	Review the age appropriate engineering design process with your students.
Determine how students will brainstorm the problem and solutions. Give examples of how someone that is blind or visually impaired may complete a task without sight.	Students will practice coding by giving specific directions to complete the marble maze. Ask them to practice giving directions to their teammate while the team member is blindfolded.
Determine how students will complete the activity, what their length of time will be, how to collaborate and how to share their solutions. Have students work on their solutions.	Students must test their solution and show how they solved their problem.
Have students share their solution to the problem they solved and how testing helped to solve the problem.	Ask each student how testing helped to solve the problem?
Explore the *Go Further!* opportunities	See below
Wrap up – Have students complete their core values self-assessment and review.	

STUDENT OR TEAM ACTIONS

1. Review the problem statement and criteria/constraints.
2. Read and talk about the engineering design process steps.
3. Brainstorm what someone who is blind or sight impaired may need to complete the game.
4. Research the questions and discuss.
5. Create a solution to solve the challenge.
6. Share your solution and reflect on your learning.
7. Explore the Go Further! opportunities.
8. Complete your *FIRST* Core Values self-assessment.

GO FURTHER!

Added Feedback – ask other people to play your marble maze to get additional suggestions to improve your idea then make improvements.

Think of other types of simple games that you could create make sure your design continues to be inclusive for people with disabilities.

EVIDENCE OF ACHIEVEMENT

Evaluation Rubric			
Category	**3 points**	**2 points**	**1 point**
Requirements	All requirements on the design brief were met.	Some of the requirements on the design brief were met.	Only a few requirements on the design brief were met.
Design	Clearly showed how the solution would help others.	Showed how the solution would help others.	Not clear how the solution would help others.
Collaboration	Demonstrated collaboration by sharing information or working with team members.	Shared some information or with team members.	Respect and inclusion being developed.
Knowledge Gained	All the questions are answered completely.	All the questions are answered but could have more detail.	The questions are not answered.

FIRST® at Home Activity
Marble Maze
Design Brief

PROBLEM STATEMENT

If you have played any type of game, you know how much fun it can be, but have you ever thought about how that game was created or designed? In this activity you will be working as game designers to create an interactive maze game. As game designers you must try to make the game playable for blind or sight impaired people. Collaborate on the maze design with another student by creating each part of the maze then passing off to the next team member. You must include a simple machine and remember to have fun!

CRITERIA & CONSTRAINTS

1. The maze base/bottom must be constructed with a flat structure.
2. The maze must be used by holding the maze to roll the marble.
3. The marble will begin at the start and may not be touched by the player during its journey.
4. The starting point and ending point must be clearly marked.
5. The marble may not jump over any walls.
6. Instructions for completing the maze must be clearly explained.
7. Time will begin when the marble starts rolling and ends when the marble passes the ending point.
8. If the marble stops moving, the run ends immediately with no score.

ENGINEERING DESIGN PROCESS & *FIRST*® CORE VALUES

Explore *FIRST* Core Values

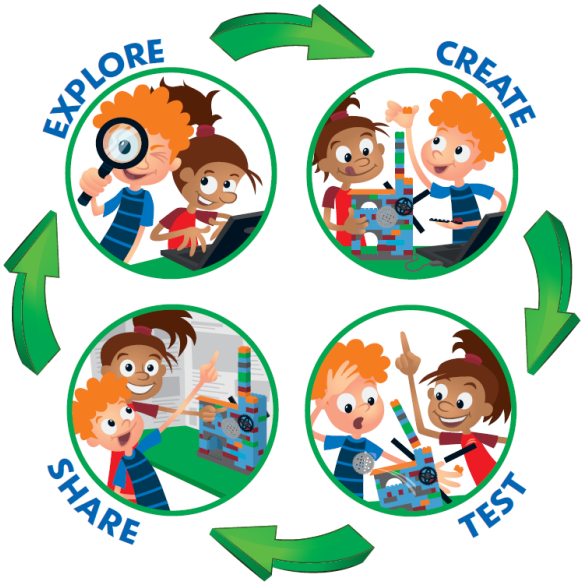
Engineering Design Process

Explore – The problem

Create – Solutions to the problem

Test – Find ways to test your solutions

Share – Communication what you learned



BUILDING THE BACKGROUND & BRAINSTORMING

Start **EXPLORING** your engineering journey here

Brainstorm ways that someone that is blind or visually impaired gets around safely.
How will you direct a person through a maze without using sight?
What modifications will you need to make a game for someone that is blind or sight impaired?

What parts of the engineering design process will you need to use?

SKETCH YOUR DESIGN

Generate a sketch of your maze design. Include how the device will look, the dimensions (size), materials used, and other important information about the design. Once you have sketched your design pass it to a team member. The team member will improve upon your sketch to complete the design.

Design Solution 1

Design Solution 2

Design Problem

Using the systems model, design and construct a Maze. The goal of your design and construction will be for the maze passenger (marble) to travel the longest time during one complete run.

Describe how Design 1 was modified to Design 2 to improve the Maze.

Did your new Design 2 work better or worse than your first Design?
Explain why.

REFLECTION QUESTIONS

1. How did you try to test and solve the problem?

2. How did the engineering design process help you think about testing your solution?

GO FURTHER!

Added Feedback – ask other people to play your marble maze to get additional suggestions to improve your idea then make improvements.

Think of other types of simple games that you could create make sure your design continues to be inclusive for people with disabilities.

CORE VALUES SELF-REFLECTION

	Amazing Skill	Great Job	Making Progress	Could Be Better
Discover	I approached the tasks looking for all possible answers independently and used perseverance to discover the answer on my own.	I approached the tasks and asked questions from one other person but persevered to discover the answer on my own.	I approached tasks but needed assistance multiple times to reach a point of discovery.	I depended on others to make the discovery for me.
Innovation	I used creativity and perseverance to solve problems on my own, coming up with unique solutions for the tasks I was given.	I used creativity and perseverance to solve problems on my own coming up with different solutions for the tasks I was given.	I used creativity but struggled with perseverance to solve problems on my own.	I struggled with being creative and only used the information given and needed a lot of encouragement from others to complete the task.
Impact	I approached the tasks applying understanding of the information with the impact it can have on me and my future as well as how I could help others.	I approached the tasks knowing and applying the information with impact it can have on me and my future.	I understand the tasks but struggle to apply how it will help me in my future or to influence others.	I understand the tasks but did not approach it with understanding the impact it can have on my future or others.
Inclusion	I approached all tasks with inclusion of others' ideas, I showed tremendous kindness by including others' views in my projects and work. I approached my solution thinking how all people would interact with the solution.	I approached most with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution mostly incorporates needs of others.	I approached some tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution meets only a few needs of others.	I did not approach tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution is not inclusive of different types of people.
Teamwork	I used collaboration, communication and project management to get all tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get most tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get some tasks accomplished for myself as well as the others.	I only sometimes used collaboration, communication and project management and accomplished a few tasks for myself as well as the others.
Fun	I kept a positive attitude throughout and found opportunities to have fun even through struggle. I looked for additional opportunities to have fun in my tasks.	I kept a positive attitude throughout and found opportunities to have fun even through struggle.	I saw the enjoyment and fun after the activity but struggled to see it during.	I only saw struggle in completing my tasks and did not look for times to have fun.

FIRST® at Home
Dream Team

ACTIVITY SUMMARY

Team members will learn about *FIRST*® Core Values and explore what it means to be a positive contributor of a team.

Age Range & Grade Level: *Ages 9+, Grade 4+*
Program Connection: *FIRST*® LEGO® League Explore
Authored By: Jillian Mordarski, Project Manager, *FIRST*® LEGO® League
Inspired By: *FIRST*® LEGO® League Explore, formerly *FIRST*® LEGO® League Jr Aqua Adventure Session 1

ACTIVITY OUTCOMES

Participants will:

1. Brainstorm what it means to be a good team member
2. Choose one characteristic
3. Show how this characteristic would make a good team member

RELEVANCE MATRIX – Subject Area Crosswalks and Core Values Addressed

Science	Math	Literacy	Social Studies	Computer Science
Using observations to test a solution	Measurement, 2D/3D modeling	Speaking, Listening and Communication	Career Connections, Engineering for social solutions	Logical Thinking
Discovery	Innovation	Impact	Inclusion	Teamwork

FUN! Our last Core Value should always be used when doing any *FIRST* activities.

KEY VOCABULARY

Engineering Team Member Core Values

MATERIALS & SUPPLIES NEEDED FOR THIS ACTIVITY

Dream Team design brief, paper, markers and (optional) LEGO® Bricks

GUIDANCE SET-UP

Description – Action – Guidance	Notes
Provide students with the Dream Team Brief.	
Review the problem statement and criteria/constraints with the students. Remind students they will be using to work towards a solution.	Review the age appropriate engineering design process with your students.
Be prepared to give examples of a good team member	Examples: helping, cheering, sharing, working hard, listening, drawing, building, researching, etc.
Determine how students will complete the activity, what their length of time will be, how to collaborate and how to share their solutions. Have students work on their solutions.	Students must show their ideas.
Have students share what makes a good team member.	Ask each student how working as a team helped to complete the task
Explore the *Go Further!* opportunities	See below
Wrap up – Have students complete their core values self-assessment and review.	

STUDENT OR TEAM ACTIONS

1. Review the problem statement and criteria/constraints.
2. Brainstorm the questions and discuss.
3. Create a solution
4. Share your solution and reflect on your learning.
5. Explore the Go Further! opportunities.
6. Complete your *FIRST* core values self-assessment.

GO FURTHER!

Charades: Have team members form groups of two or three. Ask each group to act out one of the characteristics of a good team member. They cannot use words and should try to communicate in less than one minute. After giving groups a few minutes to practice, have each group take a turn. If you have just one group, the Coaches can be the guessers.

EVIDENCE OF ACHIEVEMENT

Evaluation Rubric			
Category	**3 points**	**2 points**	**1 point**
Requirements	All requirements on the design brief were met.	Some of the requirements on the design brief were met.	Only a few requirements on the design brief were met.
Design	Clearly showed how the solution would help others.	Showed how the solution would help others.	Not clear how the solution would help others.
Collaboration	Demonstrated collaboration by sharing information or working with team members.	Shared some information or with team members.	Respect and inclusion being developed.
Knowledge Gained	All the questions are answered completely.	All the questions are answered but could have more detail.	The questions are not answered.

FIRST® at Home Dream Team Design Brief

PROBLEM STATEMENT

You are part of a team of engineers. Before you start work on new and exciting projects, you must learn to work as a team. Being an effective engineer often means you also must be a good team member. It is up to you and your team to decide what makes a good team member and learn how working together can be useful, fun, and hard all at the same time.

CRITERIA & CONSTRAINTS

- Learn something new about each team member
- Decide as a team what makes a good team member
- Pick one characteristic of a good team member
- Show how this characteristic could be used
- Share what being a good team member

ENGINEERING DESIGN PROCESS & *FIRST* CORE VALUES

FIRST Engineering Design Process | Explore *FIRST* Core Values

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BUILDING THE BACKGROUND & BRAINSTORMING

Reflect and answer the questions below:

- What are some things that make a good team member?
- How could you help other members of your team if they are having trouble or are having a bad day?
- Can you work with a partner, family, or others to chose one or more ways you can be a good team member and complete chart below?

SHARE YOUR IDEAS

Draw/build/or act out

Brainstorm	How could you help a team member	Your ideas

REFLECTION QUESTIONS

1. What do you think makes a good team member?

2. How did you decide to help another team member?

3. How did you choose to share with others?

GO FURTHER!

Play a game of charades – each team member must act out something a good team member may do.

CORE VALUES SELF-REFLECTION

	Amazing Skill	Great Job	Making Progress	Could Be Better
Discover	I approached the tasks looking for all possible answers independently and used perseverance to discover the answer on my own.	I approached the tasks and asked questions from one other person but persevered to discover the answer on my own.	I approached tasks but needed assistance multiple times to reach a point of discovery.	I depended on others to make the discovery for me.
Innovation	I used creativity and perseverance to solve problems on my own, coming up with unique solutions for the tasks I was given.	I used creativity and perseverance to solve problems on my own coming up with different solutions for the tasks I was given.	I used creativity but struggled with perseverance to solve problems on my own.	I struggled with being creative and only used the information given and needed a lot of encouragement from others to complete the task.
Impact	I approached the tasks applying understanding of the information with the impact it can have on me and my future as well as how I could help others.	I approached the tasks knowing and applying the information with impact it can have on me and my future.	I understand the tasks but struggle to apply how it will help me in my future or to influence others.	I understand the tasks but did not approach it with understanding the impact it can have on my future or others.
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Teamwork	I used collaboration, communication and project management to get all tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get most tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get some tasks accomplished for myself as well as the others.	I only sometimes used collaboration, communication and project management and accomplished a few tasks for myself as well as the others.
Fun	I kept a positive attitude throughout and found opportunities to have fun even through struggle. I looked for additional opportunities to have fun in my tasks.	I kept a positive attitude throughout and found opportunities to have fun even through struggle.	I saw the enjoyment and fun after the activity but struggled to see it during.	I only saw struggle in completing my tasks and did not look for times to have fun.

FIRST® at Home
Robot Repeat

ACTIVITY SUMMARY

Students will build a robot out of simple materials and describe to another student how to build the same robot. Students will focus on collaboration and build pattern recognition skills. Students will take turns in both roles. Students are not allowed to look at the robots until both are complete, remember have fun!

Age Range & Grade Level: *Ages 9+, Grade 4+*
Program Connection: *FIRST*® LEGO® League Explore
Authored By: Jillian Mordarski, Project Manager, *FIRST*® LEGO® League

ACTIVITY OUTCOMES

Participants will:

1. Practice pseudo coding.
2. Recognize patterns.
3. Use problem solving skills to reach a solution for a problem.

RELEVANCE MATRIX – Subject Area Crosswalks and Core Values Addressed

Science	Math	Literacy	Social Studies	Computer Science
Using observations to test a solution	Measurement, 2D/3D modeling	Research, Content Reading	Career Connections, Engineering for social solutions	Logical Thinking
Discovery	Innovation	Impact	Inclusion	Teamwork

FUN! Our last core value should always be used when doing any *FIRST* activities.

KEY VOCABULARY

Coding Pattern Describe Pseudo Code

MATERIALS & SUPPLIES NEEDED FOR THIS ACTIVITY

Robot Repeat design brief, about 10 LEGO bricks (same LEGO including shape, color, and size) for each child, optional cardboard divider. Other objects can also be used if each child gets the same (ex. piece of paper, paperclip, string, penny, cardboard, blocks, etc.)

GUIDANCE SET-UP

Description – Action – Guidance	Notes
Provide students with the Robot Repeat Brief.	
Review the problem statement and criteria/constraints with the students.	
Explain that coding is a set of instructions that computers use to complete a task. However, these instructions must be step by step.	Give an example: You cannot say "wash your hands" you would need to say walk left three steps, stop at the sink, place your right hand over the sink, place you left hand on the soap…."
Determine how students will complete the activity, what their length of time will be, how to collaborate, and work together only speaking	Students must test their solution and show how they solved their problem.
Have students share their solution to the problem they solved and how testing helped to solve the problem.	Ask each student how testing helped to solve the problem?
Explore the *Go Further!* opportunities	See below
Wrap up – Have students complete their core values self-assessment and review.	

STUDENT OR TEAM ACTIONS

1. Review the problem statement and criteria/constraints.
2. Create a solution to solve the challenge.
3. Share your solution and reflect on your learning.
4. Explore the Go Further! opportunities.
5. Complete your *FIRST* core values self-assessment.

GO FURTHER!

Give teams more LEGO or building materials, but they do not have to use all.

Students explain how to build something but not what it is until the other students have built their version

EVIDENCE OF ACHIEVEMENT

Evaluation Rubric			
Category	**3 points**	**2 points**	**1 point**
Requirements	All requirements on the design brief were met.	Some of the requirements on the design brief were met.	Only a few requirements on the design brief were met.
Design	Clearly showed how the solution would help others.	Showed how the solution would help others.	Not clear how the solution would help others.
Collaboration	Demonstrated collaboration by sharing information or working with team members.	Shared some information or with team members.	Respect and inclusion being developed.
Knowledge Gained	All the questions are answered completely.	All the questions are answered but could have more detail.	The questions are not answered.

FIRST® at Home Activity
Robot Rebuild
Design Brief

PROBLEM STATEMENT

Mechanical Engineers build robots out of many different types of materials and software engineers program the robot to do a task. Your task will be to work as both types of engineer to build a robot out of simple materials and describe to another student how to build the same robot. You will take turns in both roles. You are not allowed to look at the robots until both are complete, remember have fun!

CRITERIA & CONSTRAINTS

You must not look at the other student's robot until they are both complete.
You must use all the materials given to you.
You must not look at the design as your team member is building.
Each person will have a turn giving or receiving directions.

ENGINEERING DESIGN PROCESS & *FIRST* CORE VALUES

Explore *FIRST* Core Values

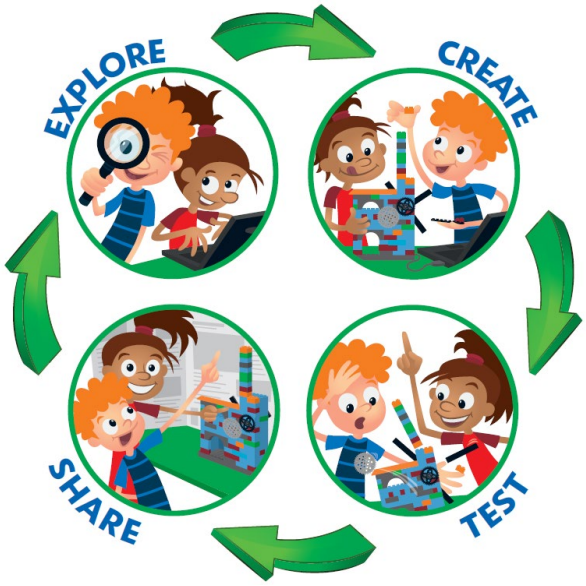
Engineering Design Process

Explore – The problem

Create – Solutions to the problem

Test – Find ways to test your solutions

Share – Communication what you learned



BUILDING THE BACKGROUND & BRAINSTORMING

Start **EXPLORING** your coding journey here

How do computers understand how to perform a task?
Will it be easy to tell someone how to build a robot just like yours? (no looking)

Create

1. **Build your robot out of the materials**
2. **Plan out the task your robot can perform by writing out the steps of actions or pseudo code**
3. **Share your design with your partner**

Draw what you have designed, did it look like your partners?

Rebuild 1

What parts of the engineering design process will you need to use?

Rebuild 2

What parts of the engineering design process will you need to use?

.

REFLECTION QUESTIONS

1. What did you learn along the way?

2. How did your robot design relate to the task your robot can perform?

3. Was your partners robot like you had described, did it look like your robot?

GO FURTHER!

Use more LEGO or building materials, but you do not have to use them all.
Explain how to build something but not what it is until the other student has built their version

CORE VALUES SELF-REFLECTION

	Amazing Skill	Great Job	Making Progress	Could Be Better
Discover	I approached the tasks looking for all possible answers independently and used perseverance to discover the answer on my own.	I approached the tasks and asked questions from one other person but persevered to discover the answer on my own.	I approached tasks but needed assistance multiple times to reach a point of discovery.	I depended on others to make the discovery for me.
Innovation	I used creativity and perseverance to solve problems on my own, coming up with unique solutions for the tasks I was given.	I used creativity and perseverance to solve problems on my own coming up with different solutions for the tasks I was given.	I used creativity but struggled with perseverance to solve problems on my own.	I struggled with being creative and only used the information given and needed a lot of encouragement from others to complete the task.
Impact	I approached the tasks applying understanding of the information with the impact it can have on me and my future as well as how I could help others.	I approached the tasks knowing and applying the information with impact it can have on me and my future.	I understand the tasks but struggle to apply how it will help me in my future or to influence others.	I understand the tasks but did not approach it with understanding the impact it can have on my future or others.
Inclusion	I approached all tasks with inclusion of others' ideas, I showed tremendous kindness by including others' views in my projects and work. I approached my solution thinking how all people would interact with the solution.	I approached most with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution mostly incorporates needs of others.	I approached some tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution meets only a few needs of others.	I did not approach tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution is not inclusive of different types of people.
Teamwork	I used collaboration, communication and project management to get all tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get most tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get some tasks accomplished for myself as well as the others.	I only sometimes used collaboration, communication and project management and accomplished a few tasks for myself as well as the others.
Fun	I kept a positive attitude throughout and found opportunities to have fun even through struggle. I looked for additional opportunities to have fun in my tasks.	I kept a positive attitude throughout and found opportunities to have fun even through struggle.	I saw the enjoyment and fun after the activity but struggled to see it during.	I only saw struggle in completing my tasks and did not look for times to have fun.

FIRST® at Home Activity
Seesaws

ACTIVITY SUMMARY

Have students build models of one-point fulcrums (seesaws) in pairs. Challenge students who enjoy building or mechanics to construct a model seesaw with a two-point fulcrum. (individually or with partners). Whether students create a model seesaw with a one-point or two-point fulcrum, challenge them to make their model visually interesting.

Age Range & Grade Level: *Ages 9+, Grade 4+*
Program Connection: *FIRST*® LEGO® League Explore
Authored By: Jillian Mordarski, Project Manager, *FIRST*® LEGO® League
Inspired By: WEDU, PBS Learning, Media Arts: Illuminated Art

ACTIVITY OUTCOMES

Participants will:
1. Identify how a fulcrum works.
2. Design solutions for a fun way to use a fulcrum in design.
3. Collaborate with a team member to create a custom solution to the design problem.

RELEVANCE MATRIX – Subject Area Crosswalks and Core Values Addressed

Science	Math	Literacy	Social Studies	Computer Science
Simple Machines, Force and Motion	Measurement, 2D/3D modeling	Research, Content Reading	Career Connections, Engineering for social solutions	Logical Thinking
Discovery	Innovation	Impact	Inclusion	Teamwork

FUN! Our last core value should always be used when doing any *FIRST* activities.

KEY VOCABULARY

Simple Machines Lever Fulcrum Artistic Design

Design Thinking

MATERIALS & SUPPLIES NEEDED FOR THIS ACTIVITY

You should offer a variety of recycled items cardboard, paper towel rolls, paper, plastic materials, etc. Scissors, glue/tape, rulers, straws, building blocks, LEGO, etc.

GUIDANCE SET-UP

Description – Action – Guidance	Notes
Provide students with the Seesaw Brief.	
Share the video about the artist impulse project to spark ideas for what the students can build.	
Discuss simple machines and levers. Show pictures and examples of fulcrums.	Lateral Office, one of the companies involved in creating the project and scroll down to the diagram of the two-point fulcrum at the bottom of the page.
Determine how students will complete the activity, what their length of time will be, how to collaborate, and work together only speaking	Students must test their solution and show how they solved their problem.
Have students share their solution to the problem they solved and how testing helped to solve the problem.	Ask each student how testing helped to solve the problem?
Explore the Go Further! opportunities	See below
Wrap up – Have students complete their core values self-assessment and review.	

STUDENT OR TEAM ACTIONS

1. Review the problem statement and criteria/constraints.
2. Create a solution to solve the challenge.
3. Share your solution and reflect on your learning.
4. Explore the Go Further! opportunities.
5. Complete your *FIRST* core values self-assessment.

GO FURTHER!

Build a two-point fulcrum and incorporate one or more artistic elements

EVIDENCE OF ACHIEVEMENT

Evaluation Rubric			
Category	**3 points**	**2 points**	**1 point**
Requirements	All requirements on the design brief were met.	Some of the requirements on the design brief were met.	Only a few requirements on the design brief were met.
Design	Clearly showed how the solution would help others.	Showed how the solution would help others.	Not clear how the solution would help others.
Collaboration	Demonstrated collaboration by sharing information or working with team members.	Shared some information or with team members.	Respect and inclusion being developed.
Knowledge Gained	All the questions are answered completely.	All the questions are answered but could have more detail.	The questions are not answered.

FIRST® at Home
Seesaws
Design Brief

PROBLEM STATEMENT

Your community would like to create an interactive space for everyone to enjoy. They need your input to make it fun! One idea in some communities has been to use one-point fulcrums which some people call seesaws. Please help us make a fun outdoor space for everyone to enjoy that is already nice to look at! If you need some ideas to start your brainstorming check out the video.

CRITERIA & CONSTRAINTS

- Brainstorm and draw your ideas.
- Create a one-point fulcrum.
- Each teammate must develop an artistic idea for the fulcrum.
- Refine your ideas and build the fulcrum that incorporates elements from both artistic ideas.

ENGINEERING DESIGN PROCESS & *FIRST*® CORE VALUES

Explore *FIRST* Core Values

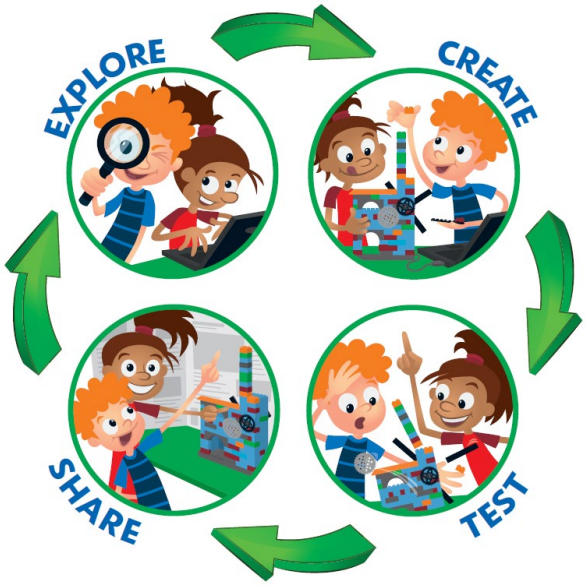
Engineering Design Process

Explore – The problem

Create – Solutions to the problem

Test – Find ways to test your solutions

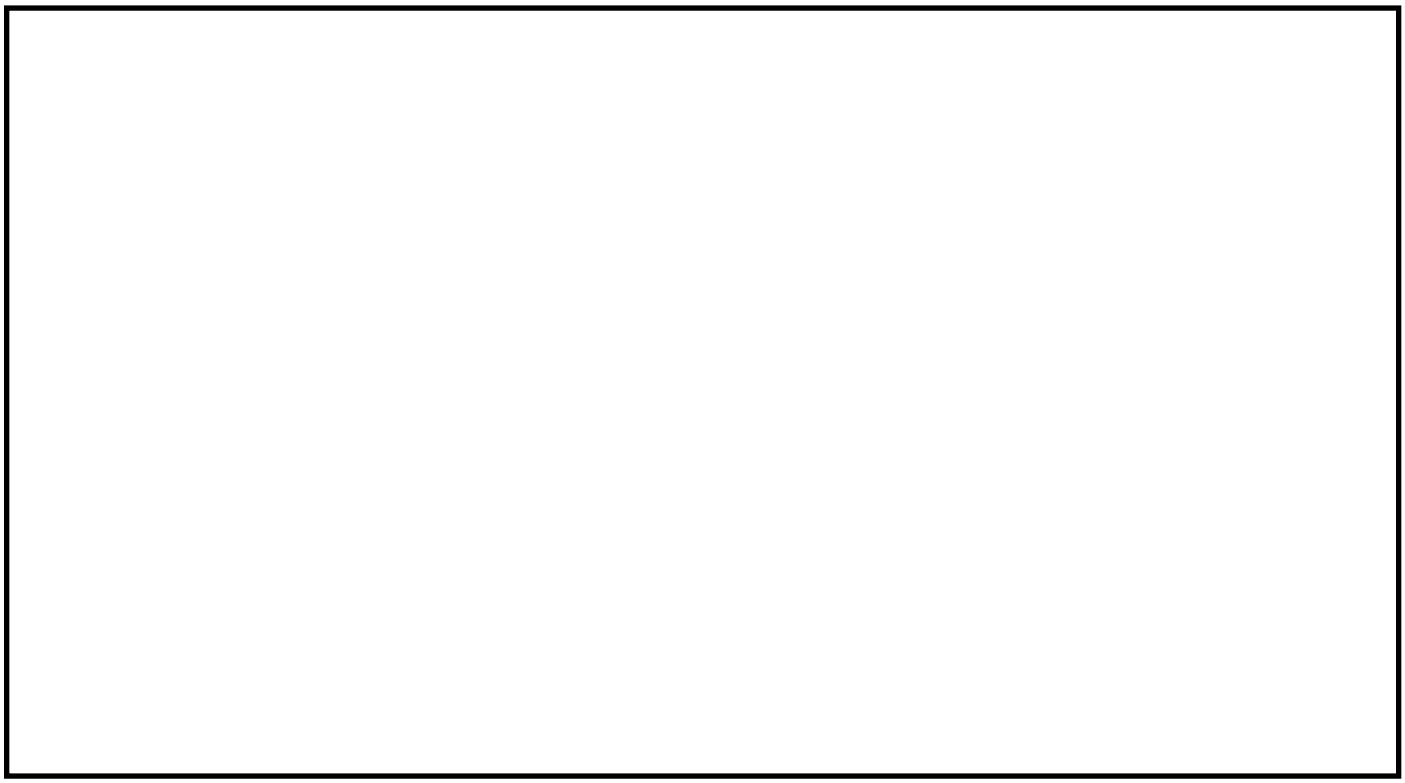
Share – Communication what you learned



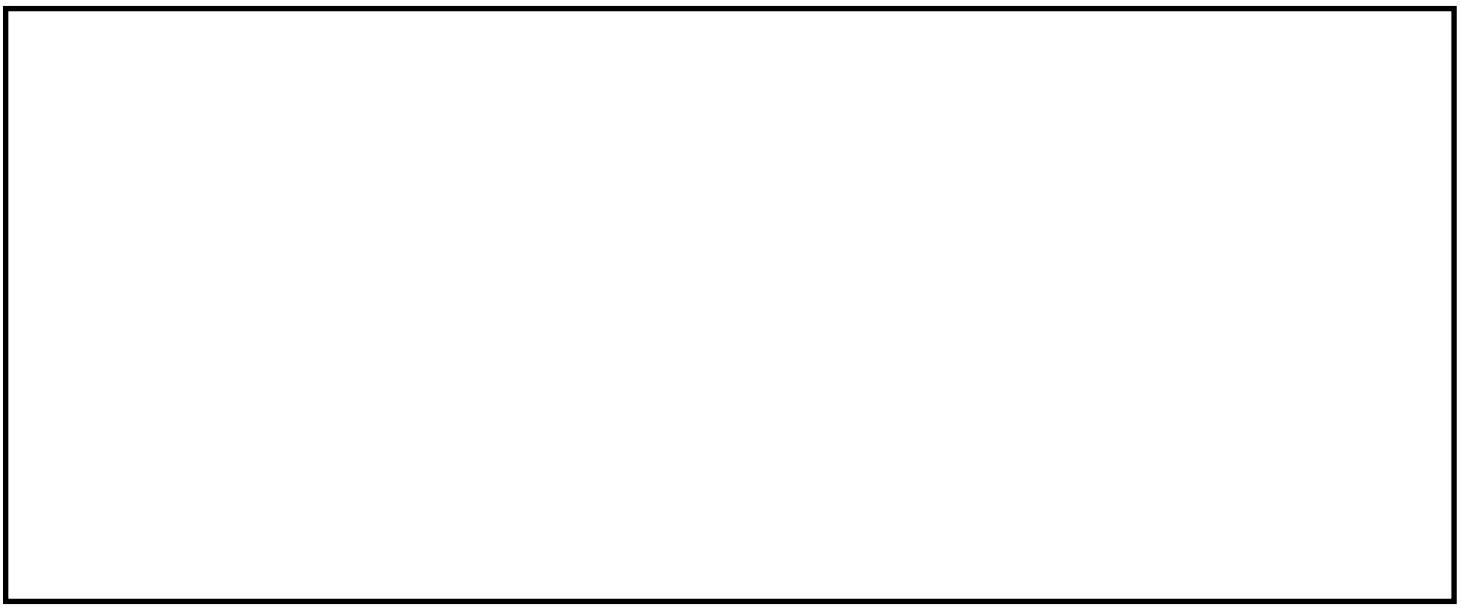
BUILDING THE BACKGROUND & BRAINSTORMING

Start **EXPLORING**

Building a one-point fulcrum



Creating an artistic idea for the fulcrum



Combine ideas for the final design

.

REFLECTION QUESTIONS

1. Why did you choose the artistic design features that you wanted on the seesaw?
2. How did your design improve with both team members ideas?
3. How did both the art and science work together to make your project better?

GO FURTHER!

Build a two-point fulcrum and incorporate one or more artistic elements

CORE VALUES SELF-REFLECTION

	Amazing Skill	Great Job	Making Progress	Could Be Better
Discover	I approached the tasks looking for all possible answers independently and used perseverance to discover the answer on my own.	I approached the tasks and asked questions from one other person but persevered to discover the answer on my own.	I approached tasks but needed assistance multiple times to reach a point of discovery.	I depended on others to make the discovery for me.
Innovation	I used creativity and perseverance to solve problems on my own, coming up with unique solutions for the tasks I was given.	I used creativity and perseverance to solve problems on my own coming up with different solutions for the tasks I was given.	I used creativity but struggled with perseverance to solve problems on my own.	I struggled with being creative and only used the information given and needed a lot of encouragement from others to complete the task.
Impact	I approached the tasks applying understanding of the information with the impact it can have on me and my future as well as how I could help others.	I approached the tasks knowing and applying the information with impact it can have on me and my future.	I understand the tasks but struggle to apply how it will help me in my future or to influence others.	I understand the tasks but did not approach it with understanding the impact it can have on my future or others.
Inclusion	I approached all tasks with inclusion of others' ideas, I showed tremendous kindness by including others' views in my projects and work. I approached my solution thinking how all people would interact with the solution.	I approached most with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution mostly incorporates needs of others.	I approached some tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution meets only a few needs of others.	I did not approach tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution is not inclusive of different types of people.
Teamwork	I used collaboration, communication and project management to get all tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get most tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get some tasks accomplished for myself as well as the others.	I only sometimes used collaboration, communication and project management and accomplished a few tasks for myself as well as the others.
Fun	I kept a positive attitude throughout and found opportunities to have fun even through struggle. I looked for additional opportunities to have fun in my tasks.	I kept a positive attitude throughout and found opportunities to have fun even through struggle.	I saw the enjoyment and fun after the activity but struggled to see it during.	I only saw struggle in completing my tasks and did not look for times to have fun.

FIRST® at Home
Robotic Arm

ACTIVITY SUMMARY

Have you ever seen a robotic arm? They can do a lot of helpful things, but sometimes they are too rigid and can only do a few tasks like move up and down or side to side. What if you were able to design a robotic arm that could act like animal arms and legs do? It could make a web like a spider, climb a wall like a chameleon, or fly like a bird? Many engineers are trying to create robotic arms that have features like an animal. Can you help to create a robotic arm that can "act" like an animal?

Age Range & Grade Level: *Ages 9+, Grade 4+*
Program Connection: *FIRST*® LEGO® League Explore
Authored By: Jillian Mordarski, Project Manager, *FIRST*® LEGO® League
Inspired By: Wild-Inspired Robotic Arms, PBS Learning Media

ACTIVITY OUTCOMES

Participants will:

1. Research how animals manipulate objects and how robotic arms work.
2. Design a robotic arm that would work the way animals manipulate objects.
3. Build and test a prototype of your animal robotic arm.

RELEVANCE MATRIX – Subject Area Crosswalks and Core Values Addressed

Science	Math	Literacy	Social Studies	Computer Science
Using observations to test a solution, Biomimicry, Animal Characteristics	Measurement, 2D/3D modeling	Research, Content Reading	Career Connections, Engineering for social solutions	Design Thinking
Discovery	Innovation	Impact	Inclusion	Teamwork

FUN! Our last core value should always be used when doing any *FIRST* activities.

KEY VOCABULARY

Coding	Pattern	Describe	Biomimicry	Robot
Prototype				

MATERIALS & SUPPLIES NEEDED FOR THIS ACTIVITY

You should offer a variety of recycled items cardboard, paper towel rolls, paper, plastic materials, etc. Scissors, glue/tape, rulers, straws, building blocks, LEGO bricks, etc.

GUIDANCE SET-UP

Description – Action – Guidance	Notes
Provide students with the Robotic Arm Design Brief.	
Review the problem statement and criteria/constraints with the students. Watch the video wild-inspired robotic arms	https://nhpbs.pbslearningmedia.org/resource/nvmms.sci.eng.roboarm/wild-inspired-robotic-arms/
Determine how students will complete the activity, what their length of time will be, how to collaborate, and work together only speaking	Students must test their solution and show how they solved their problem.
Have students share their solution to the problem they solved and how testing helped to solve the problem.	Ask each student how testing helped to solve the problem?
Explore the *Go Further!* opportunities	See below
Wrap up – Have students complete their Core Values self-assessment and review.	

STUDENT OR TEAM ACTIONS

1. Review the problem statement and criteria/constraints.
2. Create a solution to solve the challenge.
3. Share your solution and reflect on your learning.
4. Explore the Go Further! opportunities.
5. Complete your *FIRST* Core Values self-assessment.

GO FURTHER!

Build your design, test it out, make it better!

EVIDENCE OF ACHIEVEMENT

Evaluation Rubric			
Category	**3 points**	**2 points**	**1 point**
Requirements	All requirements on the design brief were met.	Some of the requirements on the design brief were met.	Only a few requirements on the design brief were met.
Design	Clearly showed how the solution would help others.	Showed how the solution would help others.	Not clear how the solution would help others.
Collaboration	Demonstrated collaboration by sharing information or working with team members.	Shared some information or with team members.	Respect and inclusion being developed.
Knowledge Gained	All the questions are answered completely.	All the questions are answered but could have more detail.	The questions are not answered.

FIRST® at Home Robotic Arm Design Brief

PROBLEM STATEMENT

Have you ever seen a robotic arm? They can do a lot of helpful things, but sometimes they are too rigid and can only do a few tasks like move up and down or side to side. What if you were able to design a robotic arm that could do things like animals? Sling a web like a spider, climb a wall like a chameleon, or fly like a bird? Many engineers are trying to create robotic arms that have features like an animal. Can you help to create a robotic arm that can "act" like an animal?

CRITERIA & CONSTRAINTS

- Think about how animals manipulate objects.
- Brainstorm and draw your ideas.
- Each teammate must have input on an animal "like" feature for the robotic arm.
- Refine and complete and build a prototype of your robotic arm.

ENGINEERING DESIGN PROCESS & *FIRST*® CORE VALUES

Explore *FIRST*® Core Values

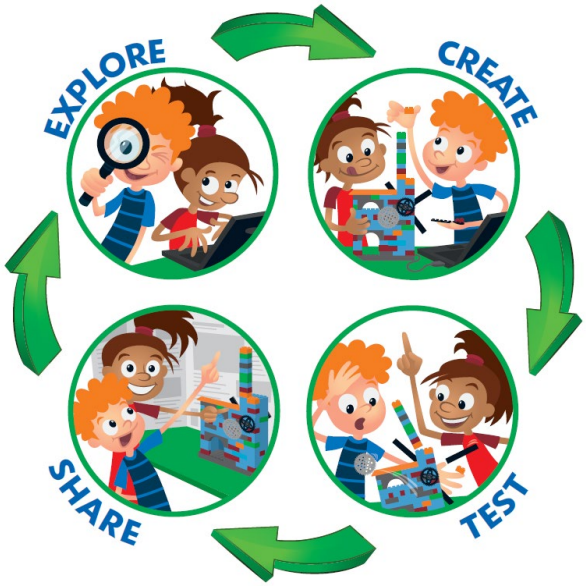
Engineering Design Process

Explore – The problem

Create – Solutions to the problem

Test – Find ways to test your solutions

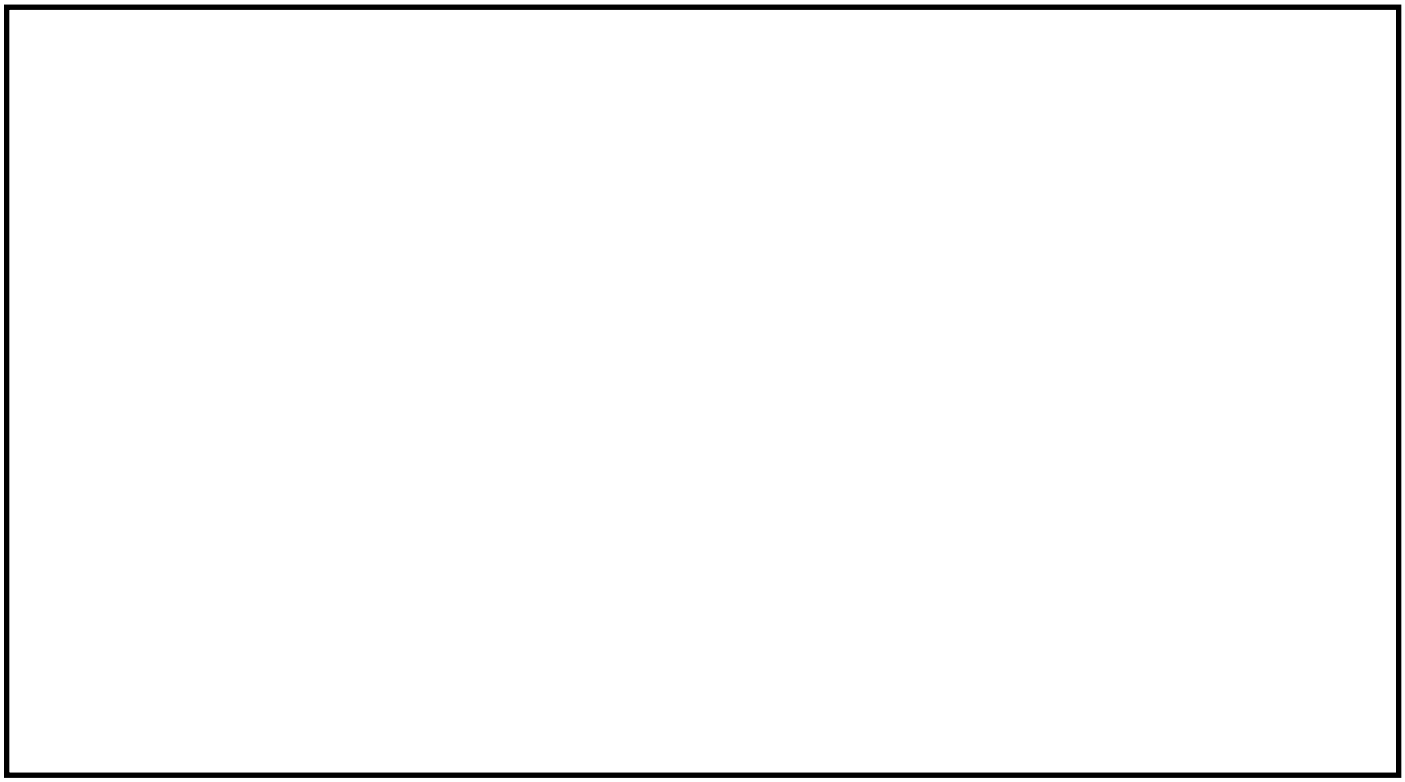
Share – Communication what you learned



BUILDING THE BACKGROUND & BRAINSTORMING

Start **EXPLORING**

Animal Features/ Robotic Arm



Incorporating at least two animal features

CREATE
Robotic Arm prototype

REFLECTION QUESTIONS

1. How does a robotic arm help do things?
2. What challenges did you have with your design?
3. What is an animal robot arm able to do that a human type arm cannot?
4. What animals did you choose?
5. Why would that animal feature be helpful?

GO FURTHER!

Build your design, test it out, make it better!

CORE VALUES SELF-REFLECTION

	Amazing Skill	Great Job	Making Progress	Could Be Better
Discover	I approached the tasks looking for all possible answers independently and used perseverance to discover the answer on my own.	I approached the tasks and asked questions from one other person but persevered to discover the answer on my own.	I approached tasks but needed assistance multiple times to reach a point of discovery.	I depended on others to make the discovery for me.
Innovation	I used creativity and perseverance to solve problems on my own, coming up with unique solutions for the tasks I was given.	I used creativity and perseverance to solve problems on my own coming up with different solutions for the tasks I was given.	I used creativity but struggled with perseverance to solve problems on my own.	I struggled with being creative and only used the information given and needed a lot of encouragement from others to complete the task.
Impact	I approached the tasks applying understanding of the information with the impact it can have on me and my future as well as how I could help others.	I approached the tasks knowing and applying the information with impact it can have on me and my future.	I understand the tasks but struggle to apply how it will help me in my future or to influence others.	I understand the tasks but did not approach it with understanding the impact it can have on my future or others.
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Fun	I kept a positive attitude throughout and found opportunities to have fun even through struggle. I looked for additional opportunities to have fun in my tasks.	I kept a positive attitude throughout and found opportunities to have fun even through struggle.	I saw the enjoyment and fun after the activity but struggled to see it during.	I only saw struggle in completing my tasks and did not look for times to have fun.

FIRST® at Home
Stretching Paper

ACTIVITY SUMMARY

Engineers often look at a lot of different solutions and try them out quickly to see if they will work. The concept of failing fast to work towards a better solution is explored in this activity. Students will work with a limited amount of materials to solve a problem and will iterate quickly as they test and determine their concept could be better.

Age Range & Grade Level: *Ages 9+, Grade 4+*
Program Connection: *FIRST*® LEGO® League Explore
Authored By: Libby Simpson, Director of Education, *FIRST*® Education

ACTIVITY OUTCOMES

Participants will:
1. Use the engineering process to solve a problem.
2. Simulate a real-world engineering problem.
3. Stretch a piece of paper as far as possible using only the materials given.

RELEVANCE MATRIX – Subject Area Crosswalks and Core Values Addressed

Science	Math	Literacy	Social Studies	Computer Science
Using observations to test a solution,	Measurement	Research, Content Reading	Career Connections, Engineering for social solutions	Design Thinking
Discovery	Innovation	Impact	Inclusion	Teamwork

FUN! Our last Core Value should always be used when doing any *FIRST* activities.

KEY VOCABULARY

Iteration Design Thinking Engineering Design Process

MATERIALS & SUPPLIES NEEDED FOR THIS ACTIVITY

FIRST Stretching Paper Design Brief, Paper, Tape, Scissors, Ruler

GUIDANCE SET-UP

Description – Action – Guidance	Notes
Provide students with the Robotic Arm Design Brief.	
Review the problem statement and criteria/constraints with the students. Read the Design Problem with the students. Explain that this activity is about the engineering design process. Explain that it is an engineer's job to solve problems. Tell the students that today there is no correct solution but requirements for what needs to be done. Compare this to a real-world engineering project and what an engineer has to accomplish.	Review the engineering design process cycle on the design brief and in the links.
Determine how students will complete the activity, what their length of time will be, how to collaborate, and work together only speaking	Students must test their solution and show how they solved their problem.
Have students share their solution to the problem they solved and how iteration helped to solve the problem.	Ask each student how iteration helped to solve the problem?
Explore the *Go Further!* opportunities	See below
Wrap up – Have students complete their Core Values self-assessment and review.	

STUDENT OR TEAM ACTIONS

1. Review the problem statement and criteria/constraints.
2. Create a solution to solve the challenge.
3. Share your solution and reflect on your learning.
4. Explore the Go Further! opportunities.
5. Complete your *FIRST* Core Values self-assessment.

GO FURTHER!

Do this activity with other students. How far were they able to stretch the paper? Can you make it a competition? Who can stretch paper the farthest?

EVIDENCE OF ACHIEVEMENT

Evaluation Rubric			
Category	**3 points**	**2 points**	**1 point**
Requirements	All requirements on the design brief were met.	Some of the requirements on the design brief were met.	Only a few requirements on the design brief were met.
Design	Clearly showed how the solution would help others.	Showed how the solution would help others.	Not clear how the solution would help others.
Collaboration	Demonstrated collaboration by sharing information or working with team members.	Shared some information or with team members.	Respect and inclusion being developed.
Knowledge Gained	All the questions are answered completely.	All the questions are answered but could have more detail.	The questions are not answered.

FIRST® at Home Stretching Paper Design Brief

PROBLEM STATEMENT

As an engineer you are sometimes presented with problems that do not have an easy solution. It is your job to figure out how to solve the following problem using only the materials given and your imagination. Remember to create and try ideas quickly and fail fast. That way you can learn from what didn't work and try again. Your task is to stretch the paper as far as you possibly can. You will be given one sheet of paper and a few inches of tape. You will also be allowed to use scissors. If you want to redesign your idea at any point you must throw out the existing paper and tape to get more. You may do this as many times as you like, until you come up with a solution.

CRITERIA & CONSTRAINTS

- The paper must stretch at least 10 feet – you may go further.
- You must not use more than one sheet of paper and the tape you are given in any one solution.
- You must work in a team and come up with a solution together.
- You may NOT use any other materials or tools to stretch the paper.
- After you design and create your stretched paper show your results and explain how you solved the problem.

ENGINEERING DESIGN PROCESS & *FIRST*® CORE VALUES

Explore *FIRST*® Core Values

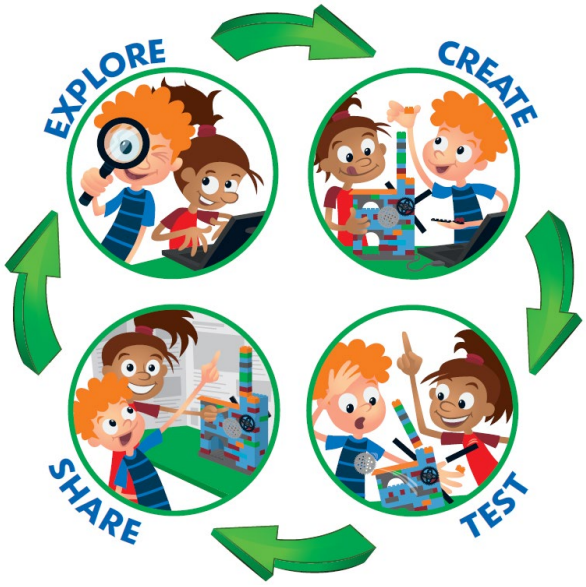
Engineering Design Process

Explore – The problem

Create – Solutions to the problem

Test – Find ways to test your solutions

Share – Communication what you learned



BUILDING THE BACKGROUND & BRAINSTORMING

Start **EXPLORING**

Brainstorm ideas for how you can stretch the paper

CREATE & TEST

Did you stretch the paper 10 feet? If not try again below.

REFLECTION QUESTIONS

1. What differences did you notice between the explore and create phases?
2. How did you know that you needed to iterate your design?
3. What part of this activity took the longest?
4. How long were you able to stretch the paper?
5. If you had a teammate, how did that help you solve the problem?

GO FURTHER!

Do this activity with other students. How far were they able to stretch the paper? Can you make it a competition? Who can stretch paper the farthest?

CORE VALUES SELF-REFLECTION

	Amazing Skill	Great Job	Making Progress	Could Be Better
Discover	I approached the tasks looking for all possible answers independently and used perseverance to discover the answer on my own.	I approached the tasks and asked questions from one other person but persevered to discover the answer on my own.	I approached tasks but needed assistance multiple times to reach a point of discovery.	I depended on others to make the discovery for me.
Innovation	I used creativity and perseverance to solve problems on my own, coming up with unique solutions for the tasks I was given.	I used creativity and perseverance to solve problems on my own coming up with different solutions for the tasks I was given.	I used creativity but struggled with perseverance to solve problems on my own.	I struggled with being creative and only used the information given and needed a lot of encouragement from others to complete the task.
Impact	I approached the tasks applying understanding of the information with the impact it can have on me and my future as well as how I could help others.	I approached the tasks knowing and applying the information with impact it can have on me and my future.	I understand the tasks but struggle to apply how it will help me in my future or to influence others.	I understand the tasks but did not approach it with understanding the impact it can have on my future or others.
Inclusion	I approached all tasks with inclusion of others' ideas, I showed tremendous kindness by including others' views in my projects and work. I approached my solution thinking how all people would interact with the solution.	I approached most with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution mostly incorporates needs of others.	I approached some tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution meets only a few needs of others.	I did not approach tasks with inclusion of others' ideas, I tried to understand others' views and include them in my projects and work. My solution is not inclusive of different types of people.
Teamwork	I used collaboration, communication and project management to get all tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get most tasks accomplished for myself as well as the others.	I used collaboration, communication and project management to get some tasks accomplished for myself as well as the others.	I only sometimes used collaboration, communication and project management and accomplished a few tasks for myself as well as the others.
Fun	I kept a positive attitude throughout and found opportunities to have fun even through struggle. I looked for additional opportunities to have fun in my tasks.	I kept a positive attitude throughout and found opportunities to have fun even through struggle.	I saw the enjoyment and fun after the activity but struggled to see it during.	I only saw struggle in completing my tasks and did not look for times to have fun.

FIRST® at Home
Model Chair

ACTIVITY SUMMARY

This activity is the culminating activity that incorporates a variety of skills from being a good team member to simple machines. Students will design a scale model chair that uses animal characteristics as fun design elements.

Age Range & Grade Level: *Ages 9+, Grade 4+*
Program Connection: *FIRST*® LEGO® League Explore
Authored By: Libby Simpson, Director of Education, *FIRST*® Education

ACTIVITY OUTCOMES

Participants will:

1. Generate a sketch of a scale model chair.
2. Build a model chair that meets the design criteria.
3. Create instructions for a person or machines to re-create your model chair.

RELEVANCE MATRIX – Subject Area Crosswalks and Core Values Addressed

Science	Math	Literacy	Social Studies	Computer Science
Using observations to test a solution, Sketching	Measurement, Shapes	Research, Speaking and Listening	Career Connections, Engineering for social solutions	Design Thinking
Discovery	Innovation	Impact	Inclusion	Teamwork

FUN! Our last Core Value should always be used when doing any *FIRST* activities.

KEY VOCABULARY

Model Pseudocode Comfortable Prototype

MATERIALS & SUPPLIES NEEDED FOR THIS ACTIVITY

FIRST Model Chair Design Brief, Paper (file folders work very well as a building material), Scissors, Tape (Optional: Cardboard, Duct Tape)

GUIDANCE SET-UP

Description – Action – Guidance	Notes
Provide students with the Model Chair Design Brief.	
Review the problem statement and criteria/constraints with the students. Read the Design Problem with the students. Explain that this activity is about the engineering design process. Review the expectation for each design requirement.	Review the engineering design process cycle on the design brief and in the links.
Determine how students will complete the activity, what their length of time will be, how to collaborate, and work together only speaking	Students must test their solution and show how they solved their problem.
Have students share their solution to the problem they solved and how iteration helped to solve the problem.	
Explore the *Go Further!* opportunities	See below
Wrap up – Have students complete their core values self-assessment and review.	

STUDENT OR TEAM ACTIONS

1. Review the problem statement and criteria/constraints.
2. Create a solution to solve the challenge.
3. Share your solution and reflect on your learning.
4. Explore the Go Further! opportunities.
5. Complete your *FIRST* Core Values self-assessment.

GO FURTHER!

Build your model chair into a full-scale prototype that you can sit in. Materials such as cardboard and duct tape are great building materials for this project.

EVIDENCE OF ACHIEVEMENT

Evaluation Rubric			
Category	**3 points**	**2 points**	**1 point**
Requirements	All requirements on the design brief were met.	Some of the requirements on the design brief were met.	Only a few requirements on the design brief were met.
Design	Clearly showed how the solution would help others.	Showed how the solution would help others.	Not clear how the solution would help others.
Collaboration	Demonstrated collaboration by sharing information or working with team members.	Shared some information or with team members.	Respect and inclusion being developed.
Knowledge Gained	All the questions are answered completely.	All the questions are answered but could have more detail.	The questions are not answered.

FIRST® at Home Model Chair Design Brief

PROBLEM STATEMENT

The Amazing Animals company wants to design fun chairs for students. They hired your engineering company to design a few examples of these chairs. The chairs are made by robots in their factory, so you will need to prepare instructions for the robots. Review the criteria below and create a design and prototype to share with the company.

CRITERIA & CONSTRAINTS

- Work with your engineering team to complete all steps.
- The chair should be able to hold a typical size child or adult
- The chair should have a seat and a supported back, does not require arms but can have arms.
- The prototype materials for the chair should be paper and tape.
- Create step by step instructions for how the robot will build the chair.
- Plan your presentation for the Amazing Animals company to share your design idea and prototype during a quick 30 second meeting.

ENGINEERING DESIGN PROCESS & *FIRST*® CORE VALUES

Explore *FIRST*® Core Values

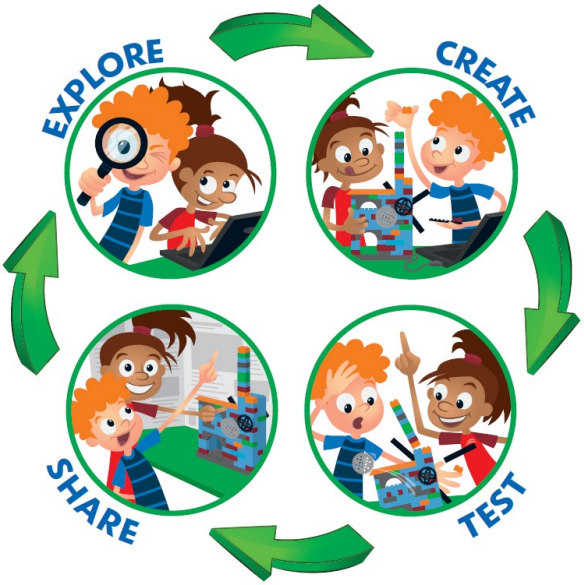
Engineering Design Process

Explore – The problem

Create – Solutions to the problem

Test – Find ways to test your solutions

Share – Communication what you learned



BUILDING THE BACKGROUND & BRAINSTORMING

Start **EXPLORING**

Brainstorm ideas for your model chair.

Design 1	Design 2

CREATE & TEST

Create a protype of your chair

SHARE
Prepare for sharing your design and instructions

Write your pseudocode here

PRESENT
Plan your presentation to the Amazing Animals Company. Remember you only have 30 seconds!

REFLECTION QUESTIONS

1. What are the important features of your chair?
2. How did completing this as a team help your design?
3. Did your step by step instructions for the robot, change your design?
4. Was features of your chair made it comfortable?

GO FURTHER!

Build your model chair into a full-scale prototype that you can sit in. Materials such as cardboard and duct tape are great building materials for this project.

CORE VALUES SELF-REFLECTION

	Amazing Skill	Great Job	Making Progress	Could Be Better
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