

# Design thinking

## Robotics



## OVERVIEW

Students will be able to use the design thinking method to creatively design their sumo robots.

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### OBJECTIVES

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1. Students will be able to list the steps of the design thinking process.
2. Students will be able to apply the concepts of design thinking.



### AGENDA

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**Length: 90 minutes**

1. Explain - Students see the sumo ring and start to think about how to build in terms of defense, offense, and simple attachments.
2. Engage - Students learn about design thinking, then prototype and test their attachments in a sumo battle.



### VOCAB

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- Design thinking process - An iterative process that cycles through developing ideas, creating prototypes, and testing solutions.



### MATERIALS

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1. [Design thinking handout](#)
2. Mindstorm robot kits
3. Lego EV3 software



## EXPLAIN



Length: 10 minutes

Students see the sumo ring and start to think about how to build in terms of defense, offense, and simple attachments.

Teacher Actions	Student Actions
<p><b>1</b> Show students the Sumo ring. Explain that the goal of the game is for one robot to push the other one outside of the ring.</p>	
<p><b>2</b> Guided discussion - Now that students have learned how to program a robot, what is another important part to robotics?</p> <p>Target: Developing a good design is very important for robotics.</p>	<p><b>2</b> Students raise their hands to provide answers.</p>
<p><b>3</b> Explain that before building, students will go through the design thinking process to think creatively and systematically about building the best robot.</p>	

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The three most important aspects students should consider are: defense, offense, and simple attachments.

- defense - your robot should be able to defend itself from attacking robots
- offense - effectively knock over, wedge, or push opponent off sumo mat
- simple attachments - clip attachments on and off in less than 3 minutes.



## ENGAGE



Length: 35 minutes

Students learn about design thinking, then prototype and test their attachments in a sumo battle.

Teacher Actions	Student Actions
<p><b>1</b> Distribute the design thinking worksheet.</p>	<p><b>1</b> Students fill in the blanks on the first page of the worksheet as the steps are explained.</p>
<p><b>2</b> Start by explaining the steps to the design thinking process:</p> <ul style="list-style-type: none"><li>• Empathize: Understand the way your users do things and why, their physical and emotional needs, how they think about world, and what is meaningful to them.</li><li>• Define: Define the challenge you are taking on, based on what you have learned about your users and about the context.</li><li>• Ideate: You ideate in order to move from identifying problems to creating solutions for your users. Ideation is your chance to combine the understanding you have</li></ul>	

<p>of the problem and people you are designing for with your imagination to create ideas for solutions.</p> <ul style="list-style-type: none"> <li>• <b>Prototype:</b> Build samples of your ideas that can be tested. Don't get too attached to any one design.</li> <li>• <b>Test:</b> Put your prototypes to the test. Take notes on what works and what needs to change in the next iteration.</li> </ul>	
<p><b>3</b> Demo a sumo battle using two robots that have no attachments. The robots should start facing each other and be running a simple program that moves straight forward.</p>	<p><b>3</b> Students watch the battle and take notes on their handout.</p>
<p><b>4</b> Tell students to work on the first three sections of the handout by themselves.</p>	<p><b>4</b> Students fill in the empathize, define, and ideate sections of their handout individually.</p>
<p><b>5</b> Share - Split students into groups of two. Each student will explain and justify their ideas with a partner.</p>	<p><b>5</b> Students explain and justify their ideas with a partner.</p>
<p><b>6</b> Tell students that collaboration (working together) is an important part of creating a</p>	<p><b>6</b> With their partner, students sketch an idea for their attachment that incorporates</p>

<p>good product. With their partner, students will create a new sketch that uses the best pieces from each participant.</p>	<p>the best ideas from each partner.</p>
<p><b>7</b> Ask students what happens after ideate. What do students think is the most important part of that process?</p>	<p><b>7</b> Still in groups, students build their first prototype.</p>
<p><b>8</b> Guided discussion</p> <p>Target:</p> <ul style="list-style-type: none"> <li>• Prototype comes after ideate</li> <li>• When prototyping, it is important for the students to build quickly instead of working on a perfect version. The idea will have to be fixed many times before the final product is ready.</li> </ul>	<p><b>8</b> Students raise their hands with suggestions. After the discussion, students start to build their prototypes with their group.</p>
<p><b>9</b> Students begin prototyping their design. Whenever two groups are ready, they should test their robots by doing a Sumo battle with them. For today, the robots will always be aimed directly at each other and should move in a straight line towards the other robot.</p>	<p><b>9</b> Students battle their robots, and then fill out the test section of their handout.</p>



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After the test, students either improve their current design or go back and build another prototype from their ideas.

If a group is satisfied with their front attachments, have their robot start faced away from their opponent. Tell students that their robot needs have good defense on all sides!