Design thinking
Robotics

OVERVIEW

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

OBJECTIVES

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

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

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

MATERIALS

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
1 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.	
2 Guided discussion - Now that students have learned how to program a robot, what is another important part to robotics? Target: Developing a good design is very important for robotics.	**2** Students raise their hands to provide answers.
3 Explain that before building, students will go through the design thinking process to think creatively and systematically about building the best robot.	

4 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
1 Distribute the design thinking worksheet.	**1** Students fill in the blanks on the first page of the worksheet as the steps are explained.
2 Start by explaining the steps to the design thinking process: • 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. • Define: Define the challenge you are taking on, based on what you have learned about your users and about the context. • 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 of the problem and people you are designing for with your imagination to create ideas for solutions.

- Prototype: Build samples of your ideas that can be tested. Don't get too attached to any one design.
- Test: Put your prototypes to the test. Take notes on what works and what needs to change in the next iteration.

3 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.	**3** Students watch the battle and take notes on their handout.
4 Tell students to work on the first three sections of the handout by themselves.	**4** Students fill in the empathize, define, and ideate sections of their handout individually.
5 Share - Split students into groups of two. Each student will explain and justify their ideas with a partner.	**5** Students explain and justify their ideas with a partner.
6	**6**

Tell students that collaboration (working together) is an important part of creating a good product. With their partner, students will create a new sketch that uses the best pieces from each participant.

With their partner, students sketch an idea for their attachment that incorporates the best ideas from each partner.

7 Ask students what happens after ideate. What do students think is the most important part of that process?

7 Still in groups, students build their first prototype.

8 Guided discussion

Target:

- Prototype comes after ideate
- 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.

8 Students raise their hands with suggestions. After the discussion, students start to build their prototypes with their group.

9 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

9 Students battle their robots, and then fill out the test section of their handout.

	each other and should move in a straight line towards the other robot.	
10	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!