

Tami's Tower:

Let's Think About Engineering

Introduction

This lesson plan explores concepts relating to solving problems utilizing engineering design. Students will construct structures out of a variety of block pieces. At the end of this lesson students will make conclusions about how pieces can be used to create a variety of structures; design in such a way to overcome challenges.

Vocabulary Words: Balance, Sturdy, Shake, Rectangle, Triangle, Square, Half-Circle, Polygon

Materials: Digital devices for each student able to play Tami's Tower: Let's Think About Engineering (<https://ssec.si.edu/tamis-tower>), Tami's Tower worksheets, pictures of real world buildings and scissors.

Engagement

Teacher will share the following passage with students

Tami, a golden lion tamarin is very hungry. She needs your help to reach the fruit. Cut out the shapes and Tami on your worksheet. Use the shapes to build a tower for Tami to climb. Place the first shape on the light green square on the ground. Build a tower and place Tami on top. Try to have Tami touch the red fruit.

1. Give students the Tami's Tower worksheet. Students will need scissors to cut out shapes in the Engage section.
2. Students will build towers using the cut-out shapes, to reach the fruit line.
3. Once students have reached the goal using all the shapes. Students will attempt to reach the goal line only using rectangles and then only using squares (and triangles).
4. Ask the following questions:
 - Which of three towers is sturdy?
 - Which of the three towers is tall? line?
 - Did you have to turn any shapes to make it to the line?

Exploration

1. Give students the Tami's Tower Explore and Extend worksheet and set up them up with a device that can play Tami's Tower.
2. Students will play up through the first five levels of Tami's Tower. As students play Tami's Tower, they will learn how to develop and identify sturdy structures.
3. After Level 5, students will complete the Explore section on the worksheet. In the activity, students will circle the sturdy tower.

Explain

1. Collect students together for a whole-class discussion.
2. Ask the following questions:
 - a. As you played your game did your towers look different from other students?
 - b. Did they look the same?
 - c. Can the same shapes make different towers?
 - d. What are some ways to make a sturdy tower?
 - e. What happens in the game if your tower is not sturdy?
3. In this discussion the teacher will clarify that the same shapes can be used to make many different types of towers. Sturdy towers are usually wide while towers that fall are usually skinny and tall.

Extend

1. Students will return to their digital devices to finish their playthrough of Tami's Tower. If students finish the game they can continue their experience by playing in the sandbox mode. Make sure to see the Summary Screen at the end of the student's playthrough to assess the student's metacognitive responses to their engineering challenges.
2. After a set time established by the teacher, students will complete the Extend section of their worksheet.
3. Teacher will hand out building pictures to students (See page 8).
4. Students will look at one building picture. They will replicate the building through sketching the shapes found in the Tami's Tower game.

Evaluation

1. Students will share their drawings of strong towers with the class.
2. Ask the following questions:
 - i. Why are these sturdy towers?
 - ii. How many shapes were used to make your towers?
 - iii. What would happen if you took away one block from the tower?
 - iv. The tower base?
 - v. The tower top?
3. Students will hand in their worksheets to the teacher for assessment.
See rubric on next page.

Evaluation Rubric

Tami's Tower: Let's Think About Engineering		
Concepts and Practices	Indicators of Success	Indicators of Difficulty
Because there is always more than one possible solution to a problem, it is useful to compare and test designs.	Students iterate model designs as needed to solve a given problem.	Students cannot iterate model designs to solve a given problem.
A great variety of objects can be built up from a small set of pieces.	Students master the ability to develop multiple types of structures, using the same group of shapes, to solve a problem.	Students cannot develop multiple structures from using the same group of shapes.
Developing and Using Models	Students are able to assess the qualities of their models (tall vs. sturdy) and how to adjust models to solve a given problem.	Students are not able to assess the qualities of their models nor are they able to improve them to solve a given problem.
Structure and Function	<p>Students consider how the shape of each block contributes to its function in the overall tower.</p> <p>Students are accurate in their prediction of the stability of their model as seen in the end game, summary screen.</p>	<p>Students are unable to consider how the shape of each block contributes to its function in the overall tower.</p> <p>Students are accurate in their prediction of the stability of their model as seen in the end game, summary screen.</p>

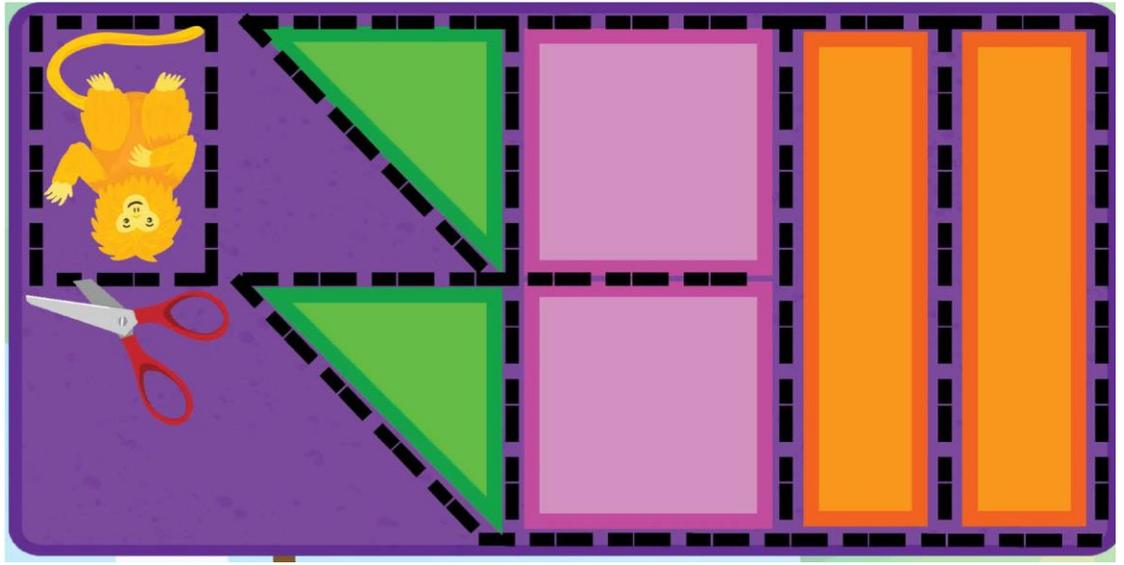
Tami's Tower: Let's Think About Engineering Worksheet A

Name _____

Engage

Help Tami Reach the Fruit!

Use the shapes to build a tower.



Tami's Tower: Let's Think About Engineering Worksheet B

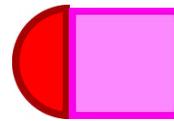
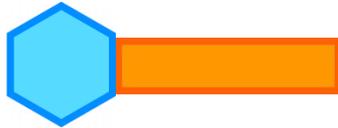
Name _____

Explore

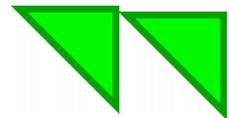
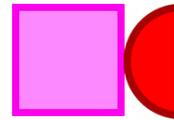
Which is Sturdy?



Or



Or



Or



Extend

Draw a Building Using Shapes

Story

“Mm, that fruit looks tasty!”

Tami the Golden Lion Tamarin gazed up at the plump, red fruit hanging from the tree above her. Her mouth watered as she imagined eating it. Tami stood up on her hind legs and stretched her long fingers as high as she could, but the fruit was still far out of reach.

“I’m not tall enough to pick the fruit by myself,” Tami thought. “How will I be able to reach it?”

Just then, Tami’s friend the American Alligator walked by. “Good morning, Tami,” Alligator said, “What seems to be the problem?”

“I reach and I reach,” said Tami, “but I can’t seem to get close to that ripe, red fruit up there.” She pointed and Alligator’s eyes turned toward the fruit.

“That looks nice and juicy!” Alligator agreed. Alligator thought for a moment, and then said, “I know I’m not very tall, but maybe you could stand on my back to get a little more height. Then you might be able to reach.”

“What a good idea!” Tami quickly hopped onto Alligator’s back and stretched her hand as high as it would go. It still didn’t come close to reaching the fruit. Disappointed, she climbed down. “Thanks for your help, Alligator, but I still wasn’t tall enough.”

“At least we tried,” said Alligator. “I’m going to get some food for myself now. Good luck reaching the fruit, Tami!”

Tami was trying to think of other ways she could make herself taller when the Giant Panda came up to her. “You look puzzled, Tami,” said Panda. “Is there something I can help you with?”

Tami explained what was wrong and Panda agreed that it was quite a problem. Then, Panda’s face lit up. “I’m heavy and strong. What if I jump and stomp on the ground next to the tree? Then maybe the fruit will fall to the ground and you can catch it.”

“What a smart, strong friend I have!” said Tami. “Let’s try it!”

With that, Tami ran under the fruit and Panda began stomping with all her might near the bottom of the tree. She jumped and pounded the ground until the tree was shaking with the force. The branches swayed back and forth with each stomp, and the fruit bounced up and down, hanging by its stem. Tami held her hands up, ready to catch the fruit when it broke free from the branch.

After a few minutes, though, the fruit still hadn't fallen and Panda was getting tired. "Whoof," she gasped, out of breath. "I think that's all the stomping I can do for one day. I'm going to take a nap. Sorry, Tami."

"That's okay, thanks for trying." Tami was running out of hope. She had been trying to reach the fruit all morning and hadn't been able to get her hands near it.

"What's going on, Tami?" said the Asian Elephant, who was passing by on her way to cool off in the pond. "You look unhappy."

"Look at that fruit, Elephant? Doesn't it look like the juiciest fruit you've ever seen?"

Elephant agreed that it looked like a very tasty fruit. "But I don't understand, Tami. What's the problem?"

"I can't reach it," Tami said sadly. "I'm not tall enough."

"I'm taller than you," Elephant said. "Maybe I can reach it." She stretched out her trunk to try to pick the fruit but couldn't quite reach it.

Tami frowned. "Thank you for trying, Elephant, but I guess I won't be eating that fruit."

"Wait!" Elephant exclaimed. "We can use those stones and fallen branches to build a tower. Then you can climb up and reach the fruit."

"But how can we build a tower that is tall enough for me to reach the fruit and stable enough to be safe to climb?" Tami looked at Elephant, wondering what she had planned.

"It's simple," said Elephant. "We'll put the large, flat stones on the bottom to make a sturdy base. Then, we'll lean the branches together on top of the stones to make a cone shape. That way, you'll be able to climb up the branches and reach the fruit."

Elephant used her strong, flexible trunk to lift the heavy, flat stones and place them under the fruit tree. She stacked them so that they didn't wobble and then placed branches in the spaces between stones so the branches would stand up. She leaned the branches together in the middle of the pile so they held each other up. When she was done, the tips of the branches were inches below the ripe, juicy fruit.

"Okay, you can climb up the tower now," said Elephant proudly.

Tami wasn't sure the tower would be stable, but when she put her foot on a branch and it didn't move, she cautiously began to climb. As she got higher and the branches didn't wobble at all, she began to climb faster, thinking of the sweet juice of the fruit above her.

At the top of the tower, Tami reached out with both hands and grabbed the fruit. Just as she had imagined, it was soft, yet firm. Perfectly ripe. She scurried down the tower, holding the fruit in the crook of one arm as she used the other to steady herself.

When she got back to the bottom of the tower, she could wait no longer. She bit into the fruit. Through a full mouth, she said, "Thank you, Elephant! I thought I would never be able to reach this fruit."

"You're welcome, Tami," Elephant replied. "I'm always happy to help a friend, and it's good to use my brain once in a while." She began to walk toward the pond.

"Elephant, wait!" called Tami. When Elephant had turned around, Tami said, "That was such a good solution to my problem. You should become an engineer."

"Maybe I will, Tami," Elephant said. "Maybe I will."