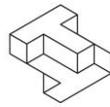


Play Potential

Lab Related Activity: *Physics of Roller Coasters*



The Tech
Museum of Innovation

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Students use what they have learned about kinetic energy, potential energy, and rollercoaster engineering to design either a piece of playground equipment or an amusement park ride to be more inclusive of all people. In this design challenge, they will learn about how to accommodate people of diverse physical needs.

Grades 2-8 | Estimated Time: 60 minutes

Student Outcomes

Students will be able to analyze other inclusive structures to develop their own ideas for design.
Students will be able to create an original ride or structure that is more inclusive.
Students will be able to identify potential modifications that would increase inclusive designs.
Students will be able to label potential energy and kinetic energy points of their design.

Next Generation Science Standards

Grades 3-5: 4-PS3-4; 3-5-ETS1-1, 2
Grades 6-8: MS-ETS1-1, 2

California State Science Standards

Grade 2: PS1.c
Grade 5: I&E5.g
Grade 7: I&E7.d

Common Core ELA Standards

Grade 2: SA2.1a,b
Grade 3/4: L&S1.8; SA2.2a,b
Grade 5: L&S1.3; SA2.2a-c
Grade 6: SA 2.2a
Grade 8: LS1.2

Vocabulary

Familiarity with these terms and concepts will enhance students' experience in the activity.

- **Inclusion/inclusive:** Intended to accommodate diversity.
- **Accessible:** ability to access or use
- **Potential Energy:** Energy of position; energy that is stored and held in readiness. Includes chemical energy, such as fossil fuels, electric batteries, and the food we eat.
- **Kinetic Energy:** Energy of motion. $KE = \frac{1}{2} \text{ mass} \times \text{velocity}^2 = \frac{1}{2} mv^2$ Note that small changes in speed can result in large changes of KE (because speed is squared). Net force \times distance = KE. Includes heat, sound, and light (motion of molecules).
- **Playground:** A place, often outside, where children can play.
- **Amusement Park:** An outdoor area with rides, entertainment, games, and snacks.

Materials (one set per group of 4 students)

- (One per class) Television, computer display, or projector for looking at websites or videos
- Paper
- Drawing materials

Teaching points:

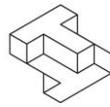
1. Review rollercoasters, potential, and kinetic energy.
2. QUESTION: What around our school or our community do we play ON that also uses kinetic and potential energy?
Answer: Playground
3. Playgrounds and amusement parks are a lot of fun, but they are not always accessible for everyone. Today you are going to design a playground, amusement park, or a toy that is more inclusive.

Procedure:

4. Show the students examples of how playgrounds or amusement parks can be modified.
 - a. <http://www.morganswonderland.com/>
<http://www.pbs.org/newshour/updates/special-needs-children-find-thrills-texas-amusement-park/>

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- b. Bremerton Beyond Accessible Playground
<https://youtu.be/LITlEjfjIUE>
 - c. Inclusive Playground built by a community
<https://www.youtube.com/watch?v=PMlgSN968Z4>
 - d. <https://www.playlsi.com/en/playground-design-ideas/inclusive-play>
 - e. <http://www.inclusiveplaygrounds.org/me2/principles>
5. QUESTION: In the video or on the websites what are some ways the rides were changed to allow more people to use them?
Possible answers: widen the ramps, make the ground even, created swings with seatbelts, created equipment that people can share together.
6. QUESTION: What other needs could there be that need to be addressed? What do you think would make a good playground toy or amusement park ride?
7. For this assignment, I would like you to pick 1 amusement park ride or a piece of playground equipment and design a way to make it more inclusive to all children. Some aspect of your design has to include a ride that moves, label how potential and kinetic energy are used to make the ride fun.
Things to consider in your design include:
- a. Is it wide enough or does it need a ramp to allow a wheelchair through?
 - b. Does this design consider mobility issues?
 - c. Is it safe?
 - d. Is it fun?
 - e. What if someone has a hard time seeing or hearing? Will it be fun for them too?
8. (Optional): Walk to the nearest park or playground to allow the students to think of inspiration.
9. Give students time to think and draw their designs.
(Optional) label the areas with the most potential and kinetic energy.
10. Have students share their designs with the class.

Teaching Points:

11. QUESTION: Why is it important to design spaces and things that are inclusive? How would you feel if you couldn't play at the playground?
12. How do you feel after designing something that will make play time more accessible for another student? How do you think the student who was previously unable to access the playground or ride feel now?
13. As engineers we need to look for problems and use them as opportunities to make improvements where we can.

Taking it Further

- Have students combine their ideas into a presentation to share with their home and school club, principal, or school board.
- Use the idea of a swing to start a unit on pendulums.
- Have students make models or miniature prototypes of their invention.