Design Squad: Today’s Students, Tomorrow’s Engineers

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NSTA WEB SEMINAR

Inspiring the next generation of engineers
Tell us about you!

Which of the following is your primary subject area?

A. Earth/Space Science
B. Biology/Life Science
C. Physical Science/Technology
D. Integrated/General
Do you use engineering activities in your classroom?

A. Not at all
B. A little bit
C. Regularly
AGENDA

- Design Squad Overview
- The Teacher’s Guide
- Talking to Kids about Engineering
- More Resources
- Q & A, Next steps
What is Design Squad?
POLL QUESTION

Are you familiar with Design Squad?

A. Yes, I’ve seen the show.
B. Yes, I’ve visited the Web site.
C. Yes, I’ve seen BOTH the Web site and the show.
D. No, I know very little about Design Squad.
DESIGN SQUAD

36 episodes  1 host  6 contestants
Two teams     One challenge
One winner    $10,000 scholarship from Intel
Web site 35 hands-on activities
EVALUATION: SERIES

After viewing four Design Squad episodes:

• students’ understanding of the Design Process increased.

• their stereotypes of engineers were broken.

• they wanted to enroll in an engineering afterschool program.

• they understood the science content on the shows.

• they had a better sense of teamwork.

• AND they liked it!

Goodman Research Group, Inc.  October 2007
Every aspect of *Design Squad* reinforces the design process.

Use it with kids to:

- expand their thinking
- become more innovative
- learn from their mistakes
DESIGN PROCESS

How design challenges enhance student learning:

• Give hands-on applications of physical science concepts

• Integrate a wide variety of curricular topics

• Promote interdisciplinary thinking

• Put physical science concepts in a relevant context
Let’s Pause for Questions
The Design Squad Teacher’s Guide
OVERVIEW

• 3 units focused on:
  ▪ electricity
  ▪ force
  ▪ sound

• Teacher Facilitation Notes

• 7 hands-on challenges integrating the design process
OVERVIEW

- Linked to standards
- Performance Rubric
- Materials List
- Online video library
  - 9 animations
  - 19 design process
  - 3 profiles
UNIT 1: Electrifying Games

Kick Stick: build a motorized “kick stick” that can hit a Ping Pong ball across the floor.

Electric Gamebox: invent a hit-the-target game that uses the kick stick.

Concepts: circuits, electricity
UNIT 1: Electrifying Games

Animations
UNIT 1: Electrifying Games

Making It Real: Driving Home the Electrifying Games Unit

1. Raise awareness of engineering
2. Relate students’ work to science and engineering
3. Meet an engineer
4. Make the engineering real
UNIT 2: Sounds Good

**String Thing:** online game

**Build a Band:** Build a four-stringed instrument that can play a tune

**Headphone Helper:** Add a headphone to your instrument to make it easier to hear

**Concepts:** sound, vibration, pitch
UNIT 3: Breezy Blimps

**Concepts:** force, Newton’s Laws, air pressure, and buoyancy

**Sky Floater:** Make a balloon hover at eye level for five seconds, and then make it move by creating air currents

**Sky Glider:** Build a blimp that travels in a straight path across the room

**Concepts:** force, Newton’s Laws, air pressure, and buoyancy
UNIT 3: Breezy Blimps

Concepts: force, Newton’s Laws, air pressure, and buoyancy

Blimp Jet: Add a jet-propulsion system so that a blimp flies straight and far under its own power.
Which units are you most likely to integrate into your curriculum?

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<th>Unit 1: Electrifying Games</th>
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<td>Unit 2: Sounds Good</td>
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<td>Unit 3: Breezy Blimps</td>
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TEACHER GUIDE SIGN UP

pbs.org/designsqaud/engineers/newsletter.html
Talking to Kids About Engineering
• High schoolers have no idea what engineers do.

• Think they work alone in a cube all day doing math problems
Engineers dream up creative, practical solutions and work with other smart, inspiring people to invent, design, and create things that matter. They are changing the world all the time.
WHAT DO ENGINEERS DO AT WORK?

• Think creatively.
• Work with great people.
• Explore possibilities.
• Change the world and make a difference.

For more info, visit EngineerYourLife.org
D Squad Pro File Video

For more info, visit EngineerYourLife.org
Let’s Pause for Questions
More Resources from Design Squad
POLL QUESTION

Have you used Design Squad educational resources?

A. Yes, I use them all the time
B. I’ve used them on occasion
C. Not yet
Learn how to integrate the design process into the projects you do with kids with this online training

pbs.org/designsquad/parentseducators/workshop/welcome.html
ONLINE TRAINING

Experience the design process in action with clips from the show.
Watch an activity, from start to finish.
FREE RESOURCES

Educator’s Guide
4 Units, 10 Activities

Event Guide
5 Activities

Activity Guide
5 Activities

On the Moon
6 Activities

Invent It, Build It
6 Activities

Send requests to:
designsqaud_feedback@wgbh.org
RESOURCES

- 10 Activities
- 4 Units
- Leader Notes
- Reproducible Handouts
- Linked to standards

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RECOMMENDED ACTIVITY

CHALLENGE 2: DANCE PAD MANIA

YOUR CHALLENGE
Build a dance pad that lets you use your feet to sound a buzzer or flash a light.

MATERIALS
- 1.5-volt AA battery
- AA battery holder (optional)
- Magnet
- Light bulb for lights to take (enough for half the group)
- No hardware or power for use in devices, scissors, or paper clips

BRAINSTORM AND DESIGN
Divide your group into teams of two. Half the teams will make floor pads that flash a light, and the other half will make floor pads that sound a buzzer. When you work as a team, you can often solve design challenges more quickly. For example, you can share knowledge, get new ideas, and translate solutions to problems. You can also learn a lot by working as a team or by observing other teams make their pads and seeing how they solved problems.

Your dance pad is essentially a simple electronic circuit. Before you begin designing, brainstorm answers to the following questions and record your ideas in your design notebook.

- What kind of buzzers or light bulbs do you want to use?
- How will you build your pad to sound a buzzer or light it on and off?
- How will you test your pad?
- How can you make it sturdy enough to withstand constant stomping?
- How do you want it to sound or flash?

BUILD, TEST, AND REDИСГИ
As you build, make sure the circuit works and that it will be able to stand up to some rough treatment! Once you’ve built your pad, test it. Step on it seams in an area to turn the buzzer or light on and off. How well does it work? When you make your pad, you had to debug some problems. For example, our wire sometimes got stuck, and our pad stopped working. Also, our switch didn’t always work. It seems like this happens to you. Figure out a way to fix the problem so that your pad works every time.
After using the Educator’s Guide:

- program leaders found it useful and wanted to use it again.
- they felt more comfortable talking about engineering.
- they developed a better understanding of the Design Process.
- students’ understanding of engineering and science concepts improved.
- AND students liked the engineering activities!

Goodman Research Group, Inc.  October 2007
RESOURCES

• 5 Activities
• Leader Notes
• Reproducible Handouts
• Linked standards

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RECOMMENDED ACTIVITY

ZIP LINE

YOUR CHALLENGE
Design and build something that can carry a ping pong ball from the top of a zip line string to the bottom in four seconds (or less).

BRAINSTORM & DESIGN
Look at your materials and think about the questions below. Then sketch your ideas on a piece of paper or in your design notebook.
1. Using those materials, what can you design that can carry a ping pong ball down a zip line?
2. How will your ping pong ball center stay on the zip line as it goes from the top to the bottom?
3. What kinds of materials should be in contact with the zip line so that the center slides quickly?

BUILD, TEST, EVALUATE & REDESIGN
Use the materials to build your ping pong ball car. Then make a zip line. Run the line between the back of a chair and a stack of books. Make sure the high end is about two feet above the low end. Test the car by cutting it on the line. When you test, your design may not work as planned. The design process is all about "If at first you don't succeed, try, try again." On Design Squad, we say, "Fall fail — success will come!" Study the problems and then redesign. For example, if your ping pong ball car:

- needs changing the ball — check that if it has a Bayes gauge that leans to hold the ball.
- needs turning down — make sure there’s nothing blocking your car from where it touches the line.
- doesn’t balance well — adjust the weights. Add weight or move them so they are further below the zip line. Giving this changes the car’s center of gravity, the point where all parts are in balance with each other. See how changing the numbers and positions of washers affects the car’s balance.
- takes longer than four seconds to travel the zip line — find ways to reduce friction. Sometimes, the wheels will be faster when you’re sliding in something as smooth as a rolling disc. You’ll find friction anywhere things rub together experiment with different materials to see if you can reduce friction and speed up the ping pong ball car.
RESOURCES

• 5 Activities for kids ages 9-12
• Leader Notes
• Reproducible Handouts
• Linked standards
• Available in English and Spanish

Send requests to: designsquad_feedback@wgbh.org
RECOMMENDED ACTIVITY

HARMLESS HOLDER

MATERIALS

[Image of children working on a project]
• 6 Activities for Grades 3-12
• Leader Notes
• Reproducible Handouts
• NASA Background
• Linked to ITEA standards
A NASA/DESIGN SQUAD CHALLENGE
TOUCHDOWN

Landing on the moon is tricky. First, since a spacecraft can go as fast as 18,000 miles per hour (29,000 km/hour) on its way to the moon, it needs to slow way down. Then it needs to land gently. That lander has astronauts inside, not crash-test dummies. Easy does it!

WE CHALLENGE YOU TO...
...design and build a shock-absorbing system that will protect two "astronauts" when they land.

BRAINSTORM AND DESIGN
Think about how to build a spacecraft that can absorb the shock of a landing.

- What kind of shock absorber can you make from these materials that can help soften a landing?
- How will you make sure the lander doesn’t tip over as it falls through the air?

BUILD
1. First, design a shock-absorbing system.
2. Then, put your spacecraft together.
3. Finally, add a cable for the astronauts. Tape the cup to the platform. Put two astronauts (the large marshmallows) in it.

MATERIALS (per lander)
- 3 pieces of stiff paper or cardboard approximately 4 x 8 in (10 x 20 cm)
- 3 small paper plates or plastic cup
- 3 mini cans (2 x 3/4 in x 1 1/2 in)
- 12 regular marshmallows
- 10 miniature marshmallows
- 3 rubber bands
- 20 plastic straws
- scissors
- tape

NOTE: The cup has to stay open—no lids!
RESOURCES

- 5 Activities
- Suggestions for running an event
- Reproducible handouts
- Tip sheet for volunteers
- Reproducible signs on Web site
- Linked to standards
RECOMMENDED ACTIVITY

**POPFLY**

*Your Challenge*

It's football with a twist. Invent a way to send a Ping-Pong ball flying high enough to catch it. Take some painter's tape, a wooden block, and a tape. Now, add your skill. Ready, set, launch!

**Materials**

- Duct tape
- 3-4 paint straws
- 1 Ping-Pong ball
- 1 wooden block or spool
- 3 or paper cubes (for redesign)

**Brainstorm and Design**

Using the materials (and your foot), make something that launches a ball high enough so you can catch it. When we made ours, we came up with lots of ways to send our ball flying. Most of our designs (but not all) used levers. Levers are handy because they can convert a small motion (the flick of your feet) into a large motion (the end of the lever flinging your Ping-Pong ball into the air). Now, let your imagination (and Ping-Pong balls) fly high.

**Build**

Think of different ways to put it all together and get that ball flying!

**Test**

How high did it go? Did it fly high and straight enough for you to catch? Could your tallest friend catch it?

**Redesign**

Even the best inventions can be improved. Now that your ball can fly through the air with the greatest of ease, challenge yourself to:
- send the ball twice as high
- pop up a tennis ball
- pop up two balls at once
- launch a ball for a partner to catch
Let’s Pause for Questions
Q and A

Next Steps
GET YOUR FREE GUIDES

Teacher’s Guide Sign Up:
http://pbskids.org/designsqquad/engineers/newsletter.html

All other guides: Send an e-mail to designsquad_feedback@wgbh.org with:
  • a list of guides you would like to receive
  • your mailing address (work or home)
• Take the online training!
• Sign up for our e-newsletter
• Watch the show and visit the Web site
• Join us on Facebook!
• Check out www.EngineerYourLife.org
• Spread the word
KEEP IN TOUCH!

Thank you!

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