2007 SPS Summer Internship
S.O.C.K. & Compadre

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ComPADRE
Communities for Physics and Astronomy
Digital Resources in Education

Organization Chart

National Science Digital Library → ComPADRE → The Nucleus

Partners

- NSF
- American Institute of Physics
- AAPT
- APS
- AAS
- SPS
Some Planned Modifications

• Textbook Review Section
  – Addition of 80 new titles from NSDL collection.
  – Awaiting permission to cross link with reviews from American Journal of Physics & other reviews.

• Hiring of Forum Moderators to enhance discussion forum and overall activity on the website.
Moderator Tasks

• Participate and add topics to discussion forums.
• Encourage physics clubs to sign up and post events in their region.
• Contact AZC’s for information on events in their zone.
• Post a review of textbooks you are currently using.
• Come up with possible ideas for fun activities on the website.
S.O.C.K.
SPS Outreach Catalyst Kit

This kit was initiated in 2001 as part of a physics outreach effort by the SPS National Office.

Goals

- Provide SPS chapters with ideas for physics projects and demonstrations.
- Promote a student’s natural curiosity to continue exploring the world around them.
- Encourage chapters to start physics outreach programs in their community.
- Present scientific inquiry as fun and exciting activities enjoyable for everyone.
2006 Results

- 28 SOCK were available to chapters
- Over 65 chapters requested for a kit.
- Activities involved 30 SPS faculty & staff and nearly 130 SPS student members.
- Approximately 3,000 K-12 students reached.

Concordia College

Eastern Michigan University

& many more!
Chapter Requests

• We need to have projects which cover a wider range of students.
• Higher demand for more demos and hands-on activities which will grab their attention.
• More concise instructions on experiments.
• More experiments on the fundamental concepts of physics.
• Include activities which will relate to student’s day-to-day experiences.
This Year’s Adjustments

The Adaptive Lesson Plan

– Middle school students are targeted age group.
– Complete step-by-step lesson plans.
  • Suggestions & alternate experiments available to adjust for audience age level.
  • Lesson can be decomposed into individual demonstrations and experiments.
  • Estimate of time to prepare and implement lesson.
  • Complete technical pages on the use and set up of equipment.
– Suggested topics of discussion.
– Listing of additional web resources.
2007 SOCK Theme
Motion & Collisions

Before Collision
\[ m_1 \quad v_1 \]
\[ m_2 \quad v_2 \]

After Collision
\[ m_1 + m_2 \quad v \]

Rocket Body
Fuel
Oxidizer
Nozzle
Exhaust

\[ m = \text{mass flow rate} \]
Crash Test “Smarties”

Adapted from lesson plan by: Lisa M. Weis

The Gear
Lesson Objectives

• Students will be able to describe the relationship between the starting height and the maximum speed of the dynamics cart.
• Students will be able to assess the amount of damage to a crash test dummy and draw conclusions regarding the safety of seat belt arrangements.
• Learn the various methods available for collecting data.
• Plotting information on graphs to derive mathematical relationships.
The Plan & Testing

_Tuckahoe Elementary School Experiment_

1. Have students measure & record final speed of the dynamics cart rolling down a ramp with varying heights.
2. Have the students plot their data on a global graph and then discuss the results of their recorded speeds vs. height of the ramp.

Conservation of Mechanical Energy

\[ KE_i + PE_i = KE_f + PE_f \]

\[ mgh = \frac{1}{2} mv^2 \]
What’s the Big Deal??

How about applications in collisions and seat belt safety.

3. Let’s do some experiments with crash test dummies! (Mr. Bill)

Oh NO!
They’re gonna hurt me!
4. Students created Play-do figures and then used the same ramping system to test various speeds of collisions with different seat belt configurations.

5. They observed the crash and rated the damage to each figure.
Lesson Extensions

References to websites with additional information.

Non-Stretching Seatbelt

The task of the seatbelt is to stop you with the car so that your stopping distance is probably 4 or 5 times greater than if you had no seatbelt. A crash which stops the car and driver must take away all its kinetic energy, and the work-energy principle then dictates that a longer stopping distance decreases the impact force. For the example car crash scenario the stopping distance is one foot, the force on a 160 lb driver is about 4800 lb or 2.4 tons, and the deceleration about 30 g's. A moderate amount of stretch in the seatbelts will reduce the average impact force.

Forces in Car Crashes

What force is required to stop the car in a distance of one foot? What force will be exerted on the driver? With and without seatbelt?

30 miles/hr

3200 lb automobile

Car collapses one foot upon impact.

Initial kinetic energy

\[ \frac{1}{2}mv^2 \]

Work required to stop the car

\[ F_{avg}d = \frac{1}{2}mv^2 \]

<table>
<thead>
<tr>
<th>Force on car</th>
<th>Calculation of force on car</th>
<th>Example of force on driver</th>
</tr>
</thead>
</table>

Hyperphysics Website

Hosted by: Georgia State University Department of Physics and Astronomy

“Seatbelts” and “Car Crash Example” web pages displayed.
Discussion

- Compared graphs of speed and damage assessment.
- Various methods of recording statistical data.
- Ways we could improve the experiment.
- Different strategies car designers use to make cars safer.

“I can not thank you enough for the effort your team made to impress upon my students the importance of seatbelt safety.”—Mrs. Theresa Coffman

Tuckahoe Elementary Teacher
Special Thanks To

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Dave Donnelly, Lyle Barbato, & Matt Riggsbee

American Institute of Physics
Jack Hehn & Jim Stith

Society of Physics Students & AIP Education Division
Gary White, Liz Caron, Doug, Sonja, Stephanie, Tracy, Sacha, Lydia, Yvonne, & the rest of 2nd Floor.

2007 Interns
Ryan, Meagan, Andy, Krystyna, Enrique, Andrea, Jesus, & Katie.
Let’s Try It!

1. Strap in figures as shown.

2. Two people hold each end of spandex. Third person sets cart in place. Fourth person takes speed.

3. Use both hands on each side of the cart to pull back.

4. Pull back as far as you want keeping spandex taught.

5. Record the speed and assess the damage to the figures.

Let it go!!!