Using Reverse Engineering to Teach Key Systems Concepts

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www.stevens.edu/ciese/sage
Workshop Goal

- To show that reverse engineering activities can be used to help students develop an understanding of important engineering concepts.
Systems and Global Engineering

- The SAGE Project is a partnership between Stevens Institute of Technology and the New Jersey Technology Education Association.
- The goal of the 3 year project is to develop systems engineering instructional materials for high school engineering and technology classes.
Systems Engineering

- Systems Engineering (SE) focuses on the big picture and the relationships among the systems and subsystems of complex projects such as:
  - Designing a new airliner
  - Operating a mass transit system
3-D CAD and other software packages have made it relatively easy for firms to collaborate on design and engineering over long distances.

For example, the new Boeing 787 Dreamliner is being engineered and built by 50 companies located in 13 states and 10 countries.
SAGE Instructional Modules

- Introduction to the Core Concepts of SE
- Home Lighting in Developing Countries
- Biodynamic Farming
- Water Purification
To simulate a systems and global engineering project approach, communication among participating schools is primarily electronic.

This is facilitated through the use of our online system, Collaboration Central.
Introduction to Core Concepts Module

- Students work in groups to reverse engineer Kodak and Fuji single-use cameras.
- They prepare assembly directions to swap. Students are challenged to reassemble the “other brand” camera.
- Classes select one or more sets of directions to post online.
Why Teach Reverse Engineering?

- Industry does it
- Many of today’s students lack hands-on experience
- It helps students learn about systems, materials and processes
- Reverse engineering encourages “systems thinking”
Related Standards

- **Mathematics**: Measurement, Problem Solving, Communications, Connections
- **ITEEA Standards for Technological Literacy**: Standards 1-11 and 13
- **Science**: Unifying Concepts and Processes, Science as Inquiry, Physical Science, Science and Technology, Science in Personal and Social Perspectives
Today’s Workshop

- Form groups of 3-4
- Make a sketch, to show what you think is inside the toy. Then disassemble it.
- Discuss materials, identify the individual parts and how they are combined to create systems and subsystems. Discuss design choices and tradeoffs.
- Prepare disassembly and reassembly directions with measurements
- Exchange toys and directions with another group
- Use the directions and provide feedback to the other group
- Share ideas about classroom implementation
Join the SAGE Project

- During the 2010 summer and fall free, online short courses will be offered to prepare teachers to implement the modules.
- All four instructional modules and will be offered in the fall of 2010.
- For more information:
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