

# Using Reverse Engineering to Teach Key Systems Concepts

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[www.stevens.edu/ciese/sage](http://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

# GLOBAL ENGINEERING

- 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

# COLLABORATION

- 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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