

ABSTRACT

“K-6 Gets a Piece of the PIEE (Partnerships Implementing Engineering Education)” is part of a program funded by the National Science Foundation to develop and implement a technology and engineering curriculum in grades kindergarten through six in the Worcester Public School System. In 2005-06, a team of graduate fellows and undergraduate students are creating, testing, and finalizing a series of children’s stories as a way to pioneer the teaching of engineering and technology at the elementary school level. Young students often cannot be taught engineering via the same methods as high school and college-aged students. For example, students in grades kindergarten and one cannot read or write. Nevertheless, concepts such as creative design, materials selection, and proper tool use can be effectively taught. After studying a variety of pedagogical techniques, graduate fellows wrote and illustrated a prototype book in the aforementioned series, *Sparky’s Engineer*. The story introduces children in grades kindergarten through three to a variety of engineering professions. It was tested in twelve classrooms and its success was determined by assessing student knowledge and obtaining feedback from professional educators. Following collection of highly positive results, six additional stories and a corresponding set of lesson plans were created. The entire series of seven books is currently in the final stage of testing. Curriculum plans, representative lessons, and program successes are described below.

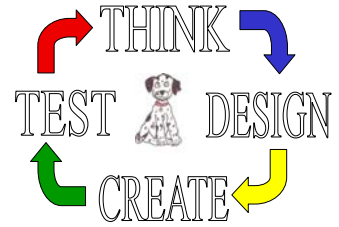
MASSACHUSETTS FRAMEWORKS

Story Title	MA Frameworks
Sparky's Engineer	<ul style="list-style-type: none"> Introduces the Engineering Design Process and various engineering professions.
The Saturday Morning Superhero	<ul style="list-style-type: none"> Provides an example of how the Engineering Design Process can be used to solve problems. Identifies and explains some possible uses for natural materials and human-made materials.
Mr. Fox's Box	<ul style="list-style-type: none"> Ask questions about object, organisms, and events in the environment. Tell about why and what would happen if? Identify and describe characteristics of natural materials and human-made materials. Identify and explain some possible uses for natural materials and human-made materials. Identify and describe the safe and proper use of tools and materials to construct simple structures.
The Five Pilgrims	<ul style="list-style-type: none"> Ask questions about objects, organisms, and events in the environment. Tell about why and what would happen if? Make predictions based on observed patterns. Discuss observations with others. Describe the weather changes from day to day and over the seasons. Sort objects by observable properties such as size, shape, color, weight, and texture. Identify and describe characteristics of natural materials and human-made materials. Identify and explain some possible uses for natural materials and human-made materials. Identify and describe the safe and proper use of tools and materials to construct simple structures.
Tree House	<ul style="list-style-type: none"> Identify materials used to accomplish a design task based on a specific property, i.e., weight, strength, hardness, and flexibility. Identify and explain the appropriate materials and tools to construct a given prototype safely. Identify a problem that reflects the need for shelter, storage, or convenience. Describe different ways in which a problem can be represented, e.g., sketches, diagrams, graphic organizers, and lists. Identify relevant design features for building a prototype of a solution to a given problem.
The Amazing Mine Story	<ul style="list-style-type: none"> Identify and explain some possible uses for natural materials (e.g., wood, cotton, fur, wool) and human-made materials (e.g., plastic, Styrofoam). Identify tools and simple machines used for a specific purpose, e.g., ramp, wheel, pulley, lever. Tell about why and what would happen if? Make predictions based on observed patterns. Name and use simple equipment and tools (e.g., rulers, meter sticks, thermometers, hand lenses, and balances) to gather data and extend the senses.
Jasmine's Explorer Notebook	<ul style="list-style-type: none"> Ask questions about objects, organisms, and events in the environment. Tell about why and what would happen if? Discuss observations with others. Describe how human beings use parts of the body as tools and compare their use with the ways in which animals use those parts of their bodies.

PROTOTYPE STORY: SPARKY'S ENGINEER



Sample page from prototype book *Sparky's Engineer*: Sparky considers engineering professions.



Sparky as mascot for the “Engineering Design Process”.

LITERATURE PIECES



Six Cover Pages of Technology/Engineering Literary Works for Grades Kindergarten through Six

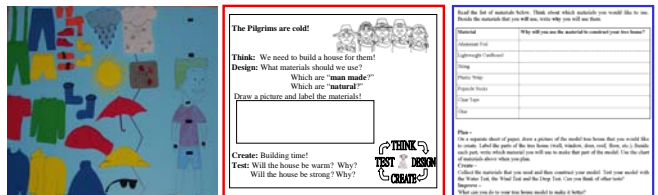
WORKSHEETS, GAMES, and HANDS ON ACTIVITIES



Third grade students constructing model “Tree Houses”.

First grade “Civil Engineered” towers.

Kindergarten “Robot”, designed by students.



A weather board used to practice the engineering design process.

First Grade Worksheet for *The Five Pilgrims*: use of Engineering Design Process to create houses from man made and natural materials.

Third Grade “Tree House” Design Worksheet: materials selection, design, planning, and improvement of models.

RESULTS

- Worcester Public Schools Teachers:** Enthusiastic response to *Sparky's Engineer*, *Tree House*, *The Amazing Mine Story*, *The Saturday Morning Superhero*
- Worcester Public Schools Students:** Enjoyed illustrations, identified with plots, learned engineering terms, completed hands-on activities
- Our Findings:** Storybooks are an attractive option to teach engineering:
 - Self-contained
 - Highly accessible to students and educators
 - Inexpensive storybooks and accompanying lessons