Preparation of Elementary Teachers to Meet the NGSS Challenge

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Focus on Energy developed a coherent set of resources for introducing scientific ideas about energy to students and teachers in Grades 4 or 5.

What Should 5th Graders Know About Energy?
Energy as a MODEL for understanding the world (not disconnected facts or terminology)
Key ideas:
- Forms and their indicators (e.g., motion/speed)
- Transfer and transformation
- Dissipation
- Tracking energy gains & loss (precursor to conservation)
- Learning about energy means learning to use energy ideas to describe, explain and predict behavior

What Can Wait?
- Full understanding of conservation
- Indicators vs factors (e.g., thermal energy vs temp)
- Technical terms (kinetic, potential, fields)
- Degradation/entropy
- Microscopic (atomic/molecular) understanding
- Quantitative calculations (e.g., ½ mv²)
- Gravity

What Are Key Curriculum Features?
- 13–15 classes in three units: Motion/
  Elastic, Thermal, Electrical Energy
- Each lesson includes:
  - Investigation question
  - Guided hands-on investigation
  - Sense-making (individual, small-group, all-class)
- Class collectively builds and refines model of energy
- Age-appropriate, general, semi-quantitative representational tools (energy bars, energy cubes) for thinking and communicating the “energy story”

It works for elementary students:
- Preliminary data from 8 Grade 4 and 5 classrooms.
- No significant difference between low and high SES schools.
- 40% spontaneously (no prompt) included dissipation.

Other observations:
- Students exhibit authentic model-based science reasoning.
- Accessible to ESL and SPED students.

It also works for teachers:
- Teachers had intensive 1-week summer workshop.
- Experienced the same curriculum – activities, model-building, representations, sense-making discussions.
- Adults and children have many of the same conceptual challenges in understanding energy.
- Teachers also found curriculum engaging and showed large learning gains.