Science Teaching Around the World: Lessons for U.S. Classrooms

■ **Part III in a series of three articles**
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■ Part II appeared Oct. 10

PART III – IMPLICATIONS FOR U.S. SCIENCE TEACHING

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What can international comparisons tell us about how to improve science teaching and learning in the United States?

In the final installment of this three-part series, we explore the implications of key findings from the Trends in International Mathematics and Science Study (TIMSS) 1999 Video Study.

The TIMSS Video Study of Science

The TIMSS Video Study examined science teaching practices in the United States and four countries that outperformed the United States in science achievement on the 1995 and 1999 TIMSS assessments: the Czech Republic, Japan, Australia, and the Netherlands. A random sample of 100 eighth grade science lessons in each country was videotaped during one school year. This process captured a range of science content and illustrated typical science teaching practices in each country.

Key Findings and Implications

Although many teaching strategies were common to all five countries, the TIMSS Video Study revealed two major differences between the United States and the other countries. Each finding has potential implications for improving science teaching in the United States.

Finding #1 – Each of the higher-achieving countries had its own distinct core pattern of science teaching. In contrast, U.S. lessons were characterized by variety.

Implication – While there is no one right way to teach science, having a consistent science teaching pattern supports student achievement.

Finding #2 – Although their teaching approaches were different, each higher-achieving country had a strategy for engaging students with core science concepts and ideas. Science lessons focused on content. In U.S. lessons, content played a less central role and sometimes no role at all; instead, lessons were typically built around a variety of activities.

Implications – To engage students with science content, teachers should make science ideas prominent in science lessons, develop coherent science content storylines, and make explicit and clear links between activities and science ideas.

Summary of Science Teaching Patterns: Activities and Content

Country	Activity pattern	Science content pattern
■ Czech Republic	Talking to learn…	about challenging content
■ Australia and Japan	Using inquiry activities and evidence…	to develop a few big ideas using a coherent content storyline
■ Netherlands	Learning independently…	with high expectations for independent content learning
■ United States	Variety of activities…	with weak or no links between activities and content

Developing a Science Content Storyline

In the United States, the emphasis on motivating students through engaging activities may have overshadowed the importance of developing science content ideas and inquiry practices. To strengthen the science content development—the storyline—of lessons, teachers and curriculum materials need to focus more directly on the science ideas in the lesson. Activities should support a clearly specified learning goal and a coherent content storyline.

Strategies for Building a Coherent Storyline:

- Identify one main learning goal.
- Communicate the purpose with goal statements and focus questions.
- Select activities and content representations matched to the learning goal.
- Sequence the content storyline.
- Link science content ideas and activities.
- Highlight for students important ideas and links among them.
- Summarize and synthesize important ideas.

Linking Activities to Science Ideas

U.S. teachers know that hands-on science activities are important. The next step is to select, sequence and link those activities to content ideas so students understand important science concepts. As part of their lesson planning, teachers should consider how to set up and follow up each activity in the lesson to engage students in thinking about the science ideas related to the activity, not just on procedures or results. In addition, teachers should review each potential lesson activity and real-life issue to make sure it matches the lesson's learning goal and advances the content storyline.

Rethinking Ideas About Effective Science Instruction

The TIMSS Video Study results challenge us to think more deeply about the role of science content and how schools can better link hands-on inquiry teaching to the development of science content understandings. Using videotapes to go inside hundreds of eighth grade science classrooms provides a unique opportunity to see how students in different countries experience science teaching, to consider alternative ways of teaching science, and to rethink ideas about effective science instruction. These observations offer promising directions for improving science teaching in the United States.

Enhancing Instruction in Science

Based on the findings from the TIMSS 1999 Video Study, and to help teachers develop a deeper understanding of science ideas and better connect hands-on inquiry-based learning to the development of science content understanding, Pearson created a new professional development program: Enhancing Instruction in Science.

Designed for science teachers in grades 2-8, Enhancing Instruction in Science helps teachers work with students to draw coherent connections between classroom content and activities and larger conceptual ideas about science. (www.PearsonAchievement.com)

Additional Resources

A five-CD set with five full lesson videos from each country, along with commentaries by the teachers and researchers, is available from the Online Store at www.PearsonAchievement.com.

The full TIMSS Video Study science report and a highlights report are available at http://nces.ed.gov/timss.

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