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Reflections

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Instructional Practices Called for by NGSS from the Perspective of an IPS or FM&E Teacher

Harold Pratt

The *Next Generation Science Standards*[1] (*NGSS*) were released in May, 2013, and since then much has been written[2] about how to read and understand the unique design and new vision of the standards. *Introductory Physical Science* (*IPS*) and *Force, Motion, and Energy* (*FM&E*) teachers may be wondering how their curricula align with *NGSS*. Without going into detail, rest assured that the content in both courses is front and center in *NGSS*, just as with the *National Science Education Standards*. An equally important question is "Does the *NGSS* suggest pedagogy or an instructional philosophy or style different from that in *IPS* and *FM&E*?"

The unique design of *NGSS* places a series of performance expectations—which integrate science and engineering practices, disciplinary core ideas and crosscutting concepts—as the primary elements in the standards. The integrated nature of the performance expectations have significant implications for instruction that may require a change in daily instructional practices for many non-*IPS*/*FM&E* teachers, though the standards themselves do not specify the nature of instruction. The role of standards is to describe student outcome performances; the type of instruction is determined by individual teachers or by school district or state curriculum policies.

With this background in mind, the question that is probably in many *IPS* or *FM&E* teachers' minds is "Will the *NGSS* affect *my* teaching?" Although not addressing *IPS* or *FM&E* teachers specifically, Brian Reiser, one of the writers of both *NGSS* and the *Framework for K-12 Science Education* (the guiding document for the development of *NGSS*) has

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tackled the issue in a recent article.[3] A brief review of the article will indicate how *Introductory Physical Science* and *Force, Motion, and Energy* fit the classroom practices he describes.

Reiser identifies three interrelated goals that affect how teachers adhering to *NGSS* need to support student learning:

- *Core Ideas*: The *Framework* and *NGSS* shift emphasis away from the breadth of too much content to a focus on the in-depth development of core explanatory ideas.
- *Practices*: The *Framework* and *NGSS* outline a central role for science and engineering practices in which students develop key explanatory ideas and models through investigation and apply them to make sense of phenomena.
- *Coherence*: Building explanatory ideas requires treating science learning as a coherent progression (i.e. a storyline) in which learners build ideas across time and between science disciplines.

These three goals can be thought of as an approach to teaching science that emphasizes the role of explanatory core ideas, how the practices are used to build the ideas, and how they fit together (coherence). To stress how this emphasis will affect teaching, Reiser lists three shifts in teaching practices that may affect teachers.

1. "The goal of instruction needs to shift from facts to explaining phenomena."

   Instead of learning about ideas as ends in themselves because they have been identified as important, students will figure out the scientific ideas to explain how and why phenomena occur. Lessons or activities should start with phenomena and progress to models that explain what has been observed or investigated.

2. "Inquiry is not a separate activity—all science learning should involve engaging in practices to build and use knowledge."

   The emphasis on inquiry in science and engineering practices is a commitment to "figuring out." It involves students posing questions, designing investigations, constructing explanations from evidence, and engaging in argumentation to reach consensus conclusions.

3. "Teaching involves building a coherent storyline across time."

   If explanations are to be grounded in phenomena and evidence, the justification for the order of lessons must flow from the phenomena themselves, not the traditional structure of the discipline. Ideas must build from activity to activity in a logical way, developing more complex and extensive explanations.

As an interesting exercise, compare the above goals with the following description of *Introductory Physical Science* and *Force, Motion, and Energy* from a 2005 issue of *Reflections*.[4]

> "Both courses focus on important, fundamental concepts essential to all science disciplines… They trade breadth of coverage for depth of understanding…"
>
> "Both courses have a clear story-line. What is learned in early chapters is used in the later ones."
>
> "The learning of individual concepts begins with a question or a problem."
>
> "Most of the content and development of inquiry skills comes from doing investigations, summarizing data, and drawing conclusions from the results."

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IPS and *FM&E* teachers should recognize the broad goals and teaching "shifts" outlined by Reiser as already in place in their teaching, and they will find that the pedagogy in the two courses is "aligned" with the instructional approach expected from *NGSS*.

Keep up the good work; you were already in the "next generation"!

[1] NGSS Lead States. (2013). *Next generation science standards: For states, by states*. Washington, DC: The National Academies Press.

[2] Pratt, H. A. (2013). *The reader's guide to the next generation science standards*. Washington, DC: NSTA Press.

[3] Reiser, B.J. (2013). *What professional development strategies are needed for successful implementation of the next generation science standards?* Invitational Research Symposium on Science Assessment: Washington, DC: K-12 Center at ETS. (Used with permission.)

[4] Haber-Schaim, U. (2005). *The underlying principles of IPS and FM&E.* Reflections #19: Spring, 2005. Lakewood, CO: Science Curriculum Inc.

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Happy Holidays to all!