Secondary Science Core Teaching Practices
Delphi Study Final Descriptions

The practices below resulted from three rounds of practice suggestions, ratings, and justifications. These titles and descriptions include small revisions made after, and in response to, the final round of panel evaluations and comments. These are 'final' descriptions in the sense that the Delphi study is over, but these practices and descriptions are really just a starting point for such future work as decomposing these practices into different performance levels, correlating these practices with student learning, and developing effective professional development centered on these core practices.

Twenty-four expert panelists (see the Round 3 Results file for demographic data on participating panelists) contributed to these results, including 10 state and nationally recognized secondary science teachers and 14 distinguished professors including science education researchers, science teacher educators, and scientists.

Rank Ordered Teaching Practices after Round 3
These practices exceeded the 4.00 agreement threshold as core (5-point Likert scale)
See the Round 3 Results File for descriptive statistics

1. Engaging Students in Investigations
2. Facilitating Classroom Discourse
3. Eliciting, Assessing, & Using Student Thinking about Science
4. Providing Feedback to Students
5. Constructing and Interpreting Models
6. Connecting Science to its Applications
7. Linking Science Concepts to Phenomena
8. Focusing on Core Science Ideas, Crosscutting Concepts and Practices
9. Building Classroom Community

N/A Adapting Instruction*

* "Adapting Instruction" was not placed on the Round 3 survey for panelist rating, but received a mode of 5 on the Round 2 survey and is thus included in this list for reporting purposes as suggested by a panelist .

Final Practice Descriptions

Engaging Students in Investigations
The teacher engages students in investigations of the material world – both investigations planned by the teacher and those planned by students. Fluency with this practice is demonstrated by the teacher providing opportunities for students to investigate phenomena and engage in the practices of science that include the posing of questions, collecting and analyzing data, arguing from evidence, building explanations, and communicating ideas about the claims and evidence tied to the investigation. Furthermore, this practice focuses on how well the investigation facilitates understanding of a core scientific or engineering idea, crosscutting concept, or practice.

Facilitating Classroom Discourse
The teacher creates opportunities for students to engage in science-related talk with the teacher and among peers. Fluency with this practice is demonstrated by the teacher providing opportunities for small group and whole class discussion; facilitates students' sharing of evidence- and/or model-based explanations and arguments; and encourages students to take up, clarify, and justify the ideas of others. Furthermore, this practice focuses on the extent to which the teacher can establish the normative rules for discourse between students and model common discursive practices used in science.

Eliciting, Assessing, & Using Student Thinking about Science
The teacher elicits student thinking about scientific concepts and practices. Fluency with this practice is demonstrated by the teacher effectively probing student thinking, both formally and informally, and through a variety of assessment practices – such as questioning – identifying students' mental models and conceptions of the material world and scientific practices, and using this information to guide future instruction.

Providing Feedback to Students
The teacher provides specific verbal and/or written feedback as well as opportunities for peer or self-reflection on students' understanding and/or use of science and engineering core ideas, crosscutting concepts, and practices. Fluency with this practice is demonstrated by the teacher providing feedback or provides opportunities for peer and self-evaluation based on student thinking. Such feedback should provide formative advice about the quality of the student's work and progress toward the learning goal.

Constructing and Interpreting Models
The teacher provides opportunities for students to interpret, construct, test, revise, and use scientific models that help develop explanations for natural phenomena. Fluency with this practice is demonstrated by the teacher's use of various models (e.g. physical, analogical, abstract) as part of understanding science and engineering ideas and practices. Furthermore, fluency is demonstrated by how the teacher helps students devise, revise, and use models for the development of evidence-based explanations.

Connecting Science to its Applications
The teacher connects core ideas, crosscutting concepts, and practices with applications relevant to students' everyday experiences. Fluency with this practice is demonstrated by the teacher engaging students in discussions or activities that integrate the significance of scientific accounts and practices in students' daily lives and the world around them, including connections to science in current events, the historical context of science, and STS issues.

Linking Science Concepts to Phenomena
The teacher engages students with real-world phenomena and organisms through demonstrations, hands-on activities, and laboratory investigations and provides multiple opportunities for students to develop a scientific understanding of the phenomena. Fluency with this practice is demonstrated by the teacher choosing phenomena related to scientific and engineering concepts and connecting to students' prior knowledge so as to create opportunities for students to use models and theories as explanatory tools and develop a deeper understanding of the material world.

Focusing on Core Science Ideas, Crosscutting Concepts and Practices
The teacher plans lessons and units that integrate the core science or engineering ideas (e.g. Biological Evolution), concepts that cut within and across disciplines (e.g. Energy Flows), and scientific and engineering practices (e.g. Engaging in Argument from Evidence). Fluency with this practice is demonstrated by the teacher providing instruction, activities, and assessments that connect and focus on ideas of and about science and engineering that are central to developing deep understanding across disciplines.

Building Classroom Community
The teacher creates and maintains a safe, collaborative, learning community wherein students are willing to venture ideas, discuss their confusions, participate regardless of language level or perceived limitation, adhere to class norms, and work together toward common learning goals. Fluency with this practice is demonstrated by the teacher establishing and maintaining expectations for respectful behavior in the classroom and lab as well as providing support for discursive participation in science learning activities from all students.

Adapting Instruction
The teacher uses data that indicate students' scientific knowledge and ability to engage in scientific practices to adapt and revise future instruction. Fluency with this practice is demonstrated by the teacher recognizing the learning needs of students and adapting instructional methods or the instructional plan to match those needs. Decisions are based on students' partial and alternate understandings of scientific concepts as well as the academic language needs of students.