Best Practice in Teaching SCIENCE

• **Increase collaboration and communication within and across grades** to improve articulation. Program consistency, clarity of curriculum expectations for achievement, and widespread responsibility for and commitment to student success are essential.

• **Increase in-depth study of a few important thematic topics**. Avoid superficial coverage of many topics according to an abstract scope-and-sequence. Increase integration of reading, writing, and math in science units. Select, adapt, and design science content and curricula to meet the individual and collective interests, knowledge, understanding, abilities, and experience of students.

• **Increase hands-on activities** that include: students identifying their own real questions about natural phenomena; observation activity, often designed by students aimed at real discovery, employing a wide range of process skills; students hypothesizing to explain data; information provided to explain data only after students have engaged in investigation process; students reflection to realize concepts and processes learned. Less emphasis on student acquisition of information and more on student understanding and use of scientific knowledge, ideas, and inquiry processes.

• **Decrease instruction based mainly on lecture and information-giving**; dependence on textbooks; questions, concepts, and answers provided only by the teacher; and lock-step patterns of instruction. Avoid cookbook labs in which students follow steps without a purpose or question of their own. Instead, provide opportunities for students to have scientific discussions and debates and have students engaged in inquiry and problem-based larning.

• **Employ strategies to find out what students already know** (or think they know). Make students' prior knowledge about science concepts known. Then challenge misconceptions or niave knowledge through demonstrations, experiments, and inquiry rather than through direct instruction alone.

• **Increase focus on underlying concepts** about how natural phenomena are explained. Decrease memorizing detailed vocabulary, definitions, and explanations without thorough connection to broader areas.

• **Increase questioning, thinking, and problem solving**. Help students see that it is okay to be skeptical, willing to question unsupported facts and commonly held beliefs; accepting ambiguity when data isn't decisive; willing to modify explanations open to changing one's opinion; and using logic, planning inquiry, hypothesizing, inferring.

• **Increase active application of science learning** to contemporary technological issues and social choices. Connect science to relevant topics and meaningful issues thus avoiding isolation of science from the rest of students' lives. Extend science beyond the walls of the school to include the resources of the community and the Internet.

• **Foster development of students' investigative abilities.** Science should not be approached as a set body of knowledge with all answers and information already known. Inquiry and problem- or project-based emphasizes that learning science is something that students do, not something that is done to them. "Hands on" and "minds

on" activities are essential. Help students think as scientists.

• **Create curiosity about nature and positive attitudes toward science** for all students including females and minorities. Avoid perpetuating the attitude that only a few brilliant "nerds" can enjoy or succeed in science study.

• **Increase collaborative small-group work** and partner lab work, with training to ensure it is efficient and includes learning for all group members. Collaboration mirrors the way scientists actually work and provides an effective structure for teachers to use. It is important for the teacher to develop skill in the role of facilitating students' investigative steps and experimental inquiry.

• **Develop a wide range of assessment strategies.** Focus evaluation on understanding of scientific concepts as well as scientific processes and attitudes. Reduce testing focused only on memorization of detail, ignoring thinking skills, process skills, attitudes. Broaden beyond testing for information in texts, and lectures to include more performance-based, alternative, and meaningful use assessments.

Reference: National Science Education Standards

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