sequential progression toward scientific understanding, and allows for multiple access points for different students. The ultimate goal of science education and thus of a high-quality science curriculum is to develop members of society who can apply their science understandings to their daily lives.

Accomplished science teachers make many curricular decisions, whether or not they have the opportunity to select their textbooks, select standards-based content, or determine sequence and timing. Teachers make curricular decisions such as selecting ancillary materials, organizing outside resources such as field trips, providing enrichment activities for students with exceptional needs, making modifications in sequencing, contextualizing lessons for the local population or specific student needs, and making cross-disciplinary connections. Teachers base curricular decisions on considerations such as the availability of resources; the characteristics of high-quality curriculum materials; standards; current research on how students learn science; and the assessed needs of students, teachers, and the community. Teachers recognize the complexities of teaching and learning science, and they select, design, and utilize curriculum materials that support rigorous and relevant science instruction, meet the needs and interests of diverse learners, and engage students.

When it comes to choosing, developing, or enhancing the curriculum, accomplished science teachers see themselves as members of a learning community. They collaborate to plan and develop comprehensive science programs. Whenever possible, teachers take advantage of opportunities to develop or select science curricula, advocate for purposeful curricular choices aligned with standards, and seek out information about the known effects of the curriculum on student learning. Teachers may augment the existing curriculum to provide opportunities for students to further explore additional relevant or engaging science topics in order to deepen core conceptual understandings. Accomplished teachers are mindful of curricular goals and use them to guide instruction.

Instruction

Philosophy and Important Principles

Accomplished teachers have deep science content knowledge and specific pedagogical content knowledge that they apply to provide high-quality instruction. Accomplished teachers use instructional strategies that match the thinking required by the curriculum and the needs of the students. Teachers are able to make connections between the curriculum and students’ prior experiences, prior knowledge, and everyday understandings.

Accomplished science teachers draw on their knowledge of crosscutting principles such as patterns of change and cycles to help students identify connections across science disciplines. Teachers make learning relevant by connecting science lessons to current or historical events. Accomplished science teachers realize that the process of making meaningful connections supports conceptual understandings that help develop the unifying concepts of science.
Accomplished science teachers mirror the processes that scientists use in their efforts to understand the world; by doing so, teachers help students develop an understanding of how scientific knowledge is generated. Teachers guide students to develop the habits of mind of scientists, the capability to engage in scientific inquiry, and the skills to reason in a scientific context. Accomplished teachers understand that, ultimately, students should be able to hypothesize, model, develop explanations from evidence, and engage in scientific discourse. Students should also become critical consumers of scientific information. (See Standard II—Knowledge of Science.)

Accomplished science teachers instruct their students in scientific inquiry. Teachers realize that establishing an inquiry-based classroom helps students develop deep understandings of science and a sense of ownership over their own learning. Accomplished teachers foster their students’ intellectual independence—at first, modeling and demonstrating thought processes for students, and gradually making way for increasingly student-generated questions. Teachers understand that self-directed learners become more effective lifelong learners. Accomplished teachers also understand that students’ ability to apply knowledge to novel situations is directly related to the depth of their understanding of what they have learned.

Methods and Strategies

Accomplished science teachers identify and use appropriate methods and strategies to improve student learning. They develop an instructional framework of short- and long-term goals based on each student’s knowledge and abilities. Teachers involve their colleagues and the students themselves in this process. Teachers use assessment to select appropriate individual and classroom goals and strategies and to determine whether those goals have been met and those strategies have been effective. Planning is based on department or schoolwide data as well as data collected from whole-class and individual assessments. (See Standard IV—Assessment.)

Accomplished teachers understand student conceptual development and often anticipate and solicit student preconceptions—whether accurate, inaccurate, or underdeveloped—related to a given topic. When necessary, teachers take steps to help students reconstruct their thinking through appropriate activities that show the discrepancy between their original conceptions and more scientifically accurate explanations.

Accomplished science teachers use a variety of means to engage students in learning. They frame the content of their lessons with intriguing examples relevant to students’ everyday lives, such as current events, pop-culture references, and modern technology. Teachers use essential questions to focus student thinking and foster intellectual curiosity. Accomplished teachers understand that students will be motivated to perform best when instruction is appropriately challenging; therefore, teachers provide opportunities for students to work at a level of difficulty that is slightly above their comfort level. Accomplished teachers understand that students come with different interests, readiness levels, and learning profiles, and teachers