

Assessment tools help accomplished science teachers better understand the science skills, background knowledge, reading proficiency, and math abilities that their students have acquired prior to taking their class. Teachers also use assessment to identify the learning and cognitive styles of each student in order to ascertain the best ways to deliver curriculum. Accomplished teachers regularly lay the foundation for each unit of study by assessing students' prior knowledge and identifying student preconceptions. (See [Standard I—Understanding Students](#).)

# Standard I

## Understanding Students

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Accomplished science teachers continuously seek to understand their students, and they use this knowledge to enhance student learning.

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### Introduction

Accomplished science teachers<sup>1</sup> possess a deep understanding of their students' readiness for learning, developmental characteristics, backgrounds, and learning profiles—including their approaches to learning science. Accomplished teachers' appreciation of their learners is rooted in a knowledge of early adolescent and young adult learners and is refined through extensive experience working with individual students. Teachers gain insight into their students through both formal and informal activities, ranging from administering surveys to interacting with students in the cafeteria. Accomplished teachers understand that students exhibit a wide range of abilities and that individual students may excel in some respects and need support in others.

Accomplished science teachers continuously monitor their students throughout the year in order to expand their understanding. Teachers apply their knowledge of students to seek out appropriate resources, differentiate instruction, and improve learning. Accomplished science teachers use their knowledge of students to ensure that all instruction meets students at their current emotional, social, and developmental levels and supports moving them forward. Teachers frequently communicate, through both words and actions, the belief that all students can learn science.

Accomplished teachers have a genuine interest in their students. They model respect within their classroom and promote respectful behavior among their students. Accomplished teachers know that it is essential to understand students in order to meet their learning needs, and they value creating productive and positive relationships with students as vital to building community and creating an environment that is conducive to success.

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<sup>1</sup> All references to teachers in this document, whether stated explicitly or not, refer to accomplished science teachers.

## Academic Readiness for Learning

Accomplished science teachers perceive that their students' readiness to learn science is ever-changing rather than fixed. Accomplished teachers understand that readiness is multidimensional and that students may be ready to learn one aspect of science but not yet ready to learn a related concept or skill. For example, a student might know the general chemical equation for photosynthesis but not yet be ready to build a conceptual model to match the equation.

Accomplished science teachers realize that students' readiness for learning particular science content and skills depends on two major academic dimensions: their general academic background and their skills and knowledge specifically related to science. Accomplished teachers carefully preassess their students in regard to both of these dimensions.

Accomplished science teachers begin by obtaining a broad sense of the strengths and needs of their students in regard to reading and writing, numeracy, analytical skills, technological skills, collaboration, inquiry, and processing. Strategies for gathering this information include examining students' academic records; administering pretests; making observations; discussing students with colleagues; partnering with parents<sup>1</sup> to learn about students' interests, past difficulties, and successes; and conversing with students themselves. For example, an accomplished teacher striving to understand students' reading needs might consult with a reading coordinator in order to access students' reading scores.

Accomplished science teachers determine the scientific background that students bring to a particular subject or unit. Teachers are familiar with the details of the science curriculum in their school or district and the opportunities that their students have had to learn science. In the case of students who have transitioned from other schools, accomplished teachers seek to become familiar with the curriculum that students experienced. Teachers do not automatically assume that students have mastered this entire curriculum. Teachers know that students may have gaps in their understanding of some science concepts and that it is the teacher's responsibility to identify and address those gaps. For example, a student who lacks an understanding of mass and volume will need explicit, meaningful instruction in those concepts before the student can understand density. (See [Standard III—Curriculum and Instruction](#).)

## Developmental Characteristics

Accomplished science teachers understand their students' sociocultural, emotional, intellectual, and physical development, and they use this extensive knowledge base to maximize instruction. Accomplished teachers keep up with current research on child development and learning. (See [Standard V—Learning Environment](#) and [Standard VII—Advancing Professionalism](#).)

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<sup>1</sup> The terms family and parent are used throughout this document to refer to people who are the primary caregivers, guardians, or significant adults in the lives of children.

Accomplished science teachers are aware that a student's degree of social and emotional confidence influences learning. Teachers understand the social and emotional needs typical of the age group that they teach, and they comprehend how these needs impact classroom dynamics. For example, teachers understand that the social inclinations of their students affect how productively they can work in groups. Teachers are sensitive to developmental issues related to self-image, societal expectations, family structure and dynamics, and changing peer influences. Accomplished teachers are intentionally aware of current adolescent trends and cultural changes, and they know how to appropriately incorporate aspects of preteen, teen, and young adult culture into science education.

Accomplished science teachers understand that their adolescent students become increasingly capable of sophisticated thought, such as abstract and spatial reasoning, over time. Teachers make the effort to discern the intellectual capabilities of students, understanding that students' cognitive abilities may vary dramatically. Because accomplished teachers know that their students are beginning to become aware of their own thought processes, they understand the benefits of providing students with opportunities to assess the strengths and weaknesses of their own approaches to problem solving.

Accomplished science teachers understand that developmental progress can vary greatly across the population, and that there are no distinct boundaries dividing early adolescents and young adults. For example, a given 17-year-old could be less developmentally ready to comprehend scientific concepts than a particular 11-year-old. Accomplished teachers combine their knowledge of developmentally appropriate, age-based strategies with their own observations in order to differentiate instruction in a way that is appropriate for their students. Accomplished teachers can provide evidence of how they differentiate content, processes, and products to accommodate their students' developmental differences. (See [Standard III—Curriculum and Instruction](#).)

Accomplished science teachers understand that physical development affects how a student thinks, behaves, is treated, and learns in the classroom. For example, a smaller student who appears younger may be treated as less mature intellectually than the student actually is. Accomplished teachers make modifications to the classroom environment and instructional strategies to accommodate the physical changes that their students are experiencing. These teachers also invite parents and colleagues to assist in supporting students during these changes. (See [Standard V—Learning Environment](#).)

## Learning Profile

Accomplished science teachers are aware that students have different learning profiles, and teachers choose or design curriculum and instructional strategies that give educational access to all students. Accomplished teachers adjust to the varied learning styles and personality profiles of their students. Teachers are proactive in learning about the exceptionalities and language needs of their students as they

relate to their students' learning goals and specific accommodations. They know how to support and challenge gifted and talented students, English language learners, students with exceptional needs, and others. Accomplished teachers design instruction that emphasizes students' strengths and raises their abilities in areas that are not as strong. Accomplished science teachers also understand that students choose to use their knowledge and skills in many different ways and provide opportunities for students to do so. (See [Standard III—Curriculum and Instruction](#) and [Standard VIII—Diversity, Fairness, Equity, and Ethics](#).)

Accomplished teachers are aware of what engages and motivates their students, and they use this knowledge to plan instruction. Accomplished teachers make use of their students' strengths and preferences to help them learn science. For example, a teacher might give students opportunities to use art, music, storytelling, building, crafting, and technology to explore and apply their understandings of natural phenomena.

## Relevant Student Background

Accomplished science teachers are sensitive to how students with diverse abilities, interests, experiences, linguistic heritages, socioeconomic statuses, ethnicities, religious traditions, sexual orientations, body images, geographic references, and family backgrounds and configurations come to understand science. Accomplished science teachers realize that whereas some aspects of a student's background are obvious, others are subtle or even hidden. Furthermore, even if an issue is not particularly sensitive with regard to the student, it may be sensitive with regard to a friend, sibling, or loved one. Accomplished teachers understand their students' backgrounds, but they also make a strong effort to be tactful in their discussion of all sensitive issues.

## Techniques for Learning about Students

Accomplished science teachers are aware of the many ways they can learn about their students. Teachers are proactive in soliciting feedback directly from students to determine their learning styles, their abilities, and the activities they prefer. Teachers may use autobiographies, questionnaires, interviews, and conversations to elicit this information. By knowing their students, accomplished teachers find ways to make science content and instruction both valuable and meaningful.

Accomplished science teachers are aware of the changing nature of student strengths and needs; thus, teachers continually look for information by examining student work and communicating with colleagues and parents to better understand their students. In addition to accessing individual student data, teachers make efforts to learn about the sociocultural aspects of students' communities. If information is not easily available, accomplished teachers are creative and persistent in seeking out other resources.

## Diversity, Fairness, Equity, and Ethics

Accomplished science teachers use their knowledge of students to ensure an equitable and fair classroom. Teachers ensure that they meet the needs of all students while maintaining high expectations for all. Accomplished teachers make an effort to uncover their own assumptions and biases and do not allow them to interfere with student learning. Teachers make a concerted effort to expose all students, especially traditionally underserved students, to a variety of learning experiences, such as summer opportunities, workshops, speaker series, and internships, so they can recognize that science is an important part of their lives. Science teachers encourage all students to see that they can pursue science and science-related careers, and teachers often act as mentors or seek out other appropriate mentors for students.

Accomplished science teachers use their understanding of students to address issues of diversity in their teaching. They learn about and show respect for students' belief systems, especially when addressing controversial subjects. Teachers are sensitive to the ways they discuss different family structures. When it is appropriate to do so, they link issues in science with students' personal and cultural backgrounds, being sure to do so in a way that recognizes the complexity of these interactions.

Accomplished science teachers are sensitive to the confidential nature of personal student information. They are knowledgeable about the ethical and legal responsibilities related to their knowledge of students; for example, teachers know what they are legally required to report in an effort to protect and keep their students safe. Accomplished teachers carefully follow ethical guidelines regarding the sharing of information. For example, they keep their students' grades, medical records, IEPs, and other personal information confidential. Accomplished teachers educate other teachers in these areas and advocate for sensitivity and confidentiality related to student information. Accomplished teachers model discretion for all of their colleagues. For example, they intervene tactfully but firmly if they overhear other teachers discussing students in a public space such as a hallway. (See [Standard VIII—Diversity, Fairness, Equity, and Ethics](#).)

## Reflective Practices

Accomplished science teachers continuously reflect on how well they know their students and how they use this information to inform their instruction. Through daily instructional and assessment practices, accomplished teachers reflect on their students' readiness for learning in relation to specific goals. They reflect on how best to identify content gaps, literacy levels, and other elements that contribute to readiness, and they use this information to develop lesson plans and select instructional materials. Accomplished science teachers reflect on whether they have differentiated instruction and assessment to ensure that readiness needs have been addressed.

Accomplished science teachers reflect on their ability to identify the developmental stages their students are going through and how they use this understanding to frame

instructional practices. Teachers understand that the developmental process varies greatly among their students and reflect on the degree to which their instructional activities are supportive of these differences.

Accomplished science teachers realize that reflecting on learning profiles is a vital part of understanding the whole student. Accomplished teachers reflect on their knowledge of the wide range of learning styles and preferences that exist in their classrooms. They determine if student needs are being met by looking for understanding during science discourse and by assessing students' abilities to answer complex questions. When teachers determine that there are student needs that they cannot address by themselves, they reflect on ways to obtain additional information and ideas from colleagues and others.

Accomplished science teachers reflect on what they know about their students' backgrounds and how they implement this knowledge to enhance student learning. They reflect on how they can update their understandings of exceptionalities and other aspects of students' backgrounds through professional development, conversations with colleagues, and other appropriate means.

Accomplished science teachers reflect on the techniques they use to learn about students. They ponder whether their techniques effectively elicit the information they are seeking. Teachers also reflect on how they can make the process of learning about students appropriately transparent and seamless.

Accomplished science teachers reflect on the degree to which they are aware of and responsive to the diversity within their classroom. They reflect on the assumptions they make about their students, possible biases they possess, and how they can use their knowledge of students' backgrounds to ensure a fair and equitable learning experience. Accomplished science teachers reflect on whether they have provided accommodations and flexibility in their instructional practices in such a way as to reach their students. Accomplished teachers reflect on their sensitivity in exploring and discussing their understanding of students.