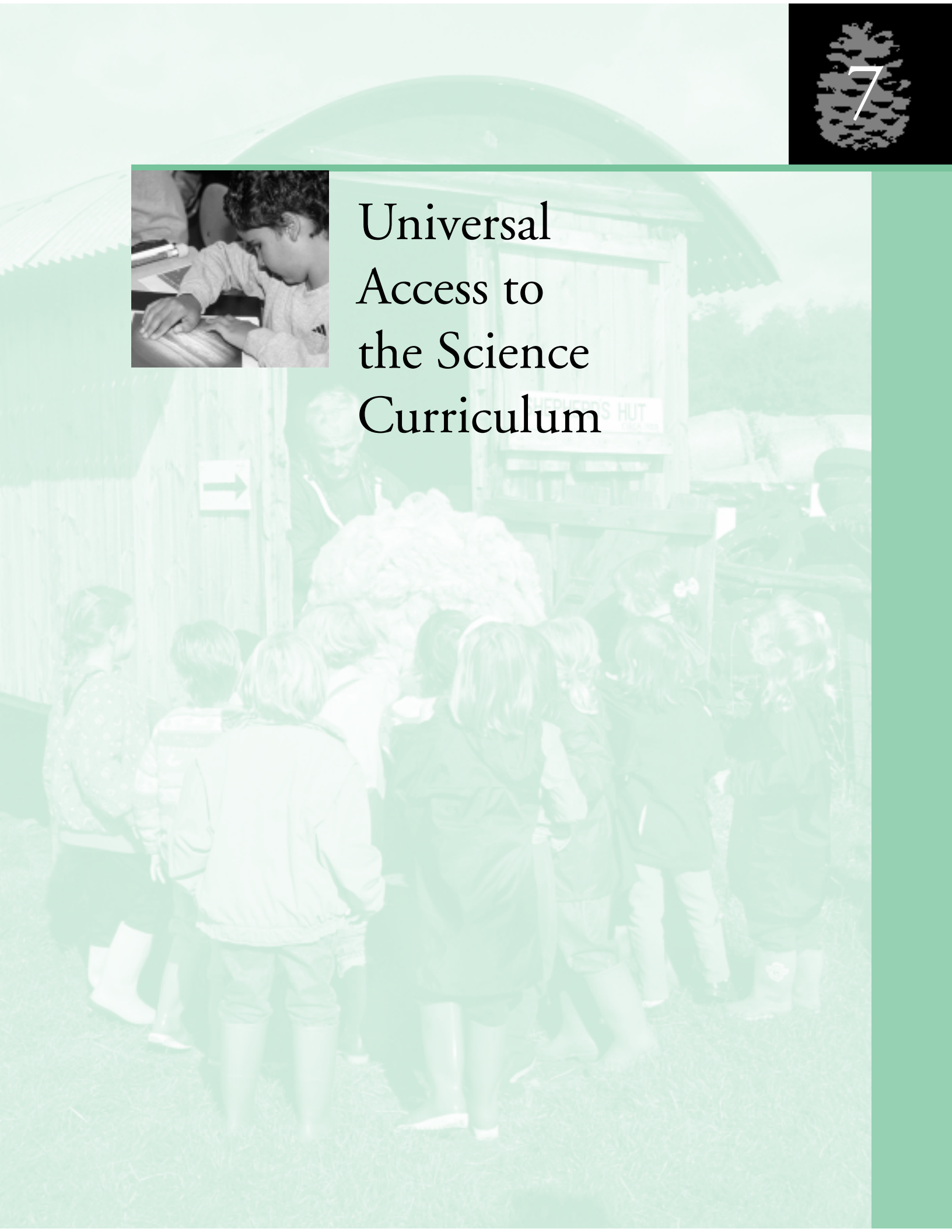




Universal Access to the Science Curriculum





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Science education is intended for all students. Academic instruction must be designed so that each student has the opportunity to master the science standards that provide systematic and coherent access to this challenging subject. Toward that end, this chapter discusses all students' needs to develop basic skills and academic language. It addresses the special needs of English learners and students with disabilities in their quest to master the standards, including those in the Investigation and Experimentation strand. The chapter also emphasizes that advanced learners need to be given meaningful assignments that extend the depth and breadth of their understanding of the standards.

Science and Basic Skills Development

The acquisition of scientific knowledge and ideas requires foundational and fundamental skills in English–language arts and mathematics. Students pursuing the science content reflected in the standards and described in this framework need to master the grade-level standards in English–language arts and mathematics. The standards for both science and English–language arts call for students to read and compre-

hend informational text and write grammatically correct expository essays. Because of the strong relationship between mastery of basic skills in reading, writing, and mathematics and mastery of science content, teachers must reinforce application of those skills in science instruction. Teachers must also ensure that students learn to use scientific terminology correctly and develop academic language (as discussed more fully below).

Academic Language Development

Studying science involves acquiring a new vocabulary and learning that some familiar words may have different meanings in science. This aspect of scientific literacy needs to be taught explicitly in order to minimize misconceptions that might otherwise arise from word usage in differing environments. For example, the terms *control* and *theory* have different definitions in common use compared with scientific use. Students will also begin to acquire new terms that have Latin and Greek roots, prefixes, and suffixes. An understanding of root words and affixes will not only improve vocabulary but also increase students' ability to comprehend words they have not encountered

before. For example, students will come to know that *biology* is a combination of *bio-*, derived from the Greek word for life, and *-logy* (also rooted in Greek), meaning study.

English Learners

Support for English learners may consist of the preteaching of essential elements of scientific vocabulary. Instruction for English learners in the academic language of science is critical and must be specifically designed, planned, and taught. It includes direct instruction and experiences for students in English phonology, morphology, syntax, and semantics, and it must support students as they move toward proficiency in the academic language of science. The Investigation and Experimentation strand provides an additional opportunity for teachers to reinforce English learners' understanding of the academic language of science.

In the *Reading/Language Arts Framework* English learners are classified as follows:¹

- Students in kindergarten through grade two
- Students in grade three through twelve who are literate in their primary language
- Students in grades three through twelve who have limited prior academic experience or literacy in their primary language

The biggest challenge in the teaching of science is addressing the needs of English learners in the latter two groups. Students in grades three through twelve who have strong literacy skills in their primary language

can be expected to transfer many of those skills to English and to progress rapidly in learning the academic language of science. Students in grades three through twelve with limited prior schooling will require intensive support in learning the academic language of science.

Advanced Learners

Ensuring mastery of the science standards through challenging and enriched instruction is the goal for advanced learners. Students who readily understand the basic underpinnings of the standards pursue a richer understanding of standards-based science content. Advanced learners in kindergarten through grade eight must be encouraged to extend their knowledge of science through the enrichment opportunities included in state-adopted instructional materials. Enrichment lessons have high levels of standards-based science content proportionate to the amount of time that the lessons take. For example, advanced learners are encouraged to explore the history of a scientific concept or a complex method of experimentation. Enrichment projects need to be designed so that the student does most of the work in the classroom.

Students with Disabilities

Students with disabilities are provided with access to all the content standards through a rich and supported program that uses instructional materials and strategies that best meet their needs. A student's 504 accommodation plan² or individualized education program (IEP)³ often includes suggestions

for a variety of techniques to ensure that the student has full access to a program designed to provide him or her with mastery of the science standards, including those in the Investigation and Experimentation strand. Teachers must familiarize themselves with each student's 504 accommodation plan or IEP to help the student in achieving mastery of the science standards.

There are numerous ways in which a teacher can implement accommodations in science instruction. Disabilities vary widely, and accommodations must be tailored to the student's individual and unique needs. Some accommodations help ensure safety while the students participate in investigation and experimentation activities. Examples of some simple safety accommodations are as follows:

- Use of tape with a textured surface to help visually impaired students locate buttons and knobs
- Insulation of exposed hot pipes to protect a student who lacks sensation in the lower extremities and who would likely be in a wheelchair
- Benches at an appropriate height for wheelchair access
- Facilities for emergency showers and eyewashes accessible to wheelchair users

Labels may be printed in larger fonts for low-vision students. Because of the incidence of red-green color-blindness in some male students, instructions and safety notices are not to be red-green color coded, and chemical indicators must not be of the type that change from red to green. Details of laboratory instructions and protocols need to be written for students with hearing impairments or with auditory processing disorders. The following measures may be taken to help all children, especially those with sequencing disabilities or attention deficit disorder: printed instructions detailing each step of a laboratory exercise, checklists to indicate whether each step has been accomplished, and color coding information.

Educators may visit the following Web sites to obtain resources for understanding and addressing the needs of students with disabilities:

- "California Special Education Programs: A Composite of Laws Database," *Education Code*, Part 30, Other Related Laws, and *California Code of Regulations, Title 5* at <http://www.cde.ca.gov/sp/se/ds/>

Notes

1. *Reading/Language Arts Framework for California Public Schools, Kindergarten Through Grade Twelve*. Sacramento: California Department of Education, 1999, p. 233.
2. A Section 504 accommodation plan is a document typically produced by school districts in compliance with the requirements of Section 504 of the federal Rehabilitation Act of 1973. The plan specifies agreed-on services and accommodations for a student who, as the result of an evaluation, is determined to have a “physical or mental impairment [that] substantially limits one or more major life activities.” In contrast to the federal Individuals with Disabilities Education Act (IDEA), Section 504 allows a wide range of information to be contained in a plan: (1) the nature of the disability; (2) the basis for determining the disability; (3) the educational impact of the disability; (4) necessary accommodations; and (5) the least restrictive environment in which the student may be placed.
3. An IEP is a written, comprehensive statement of the educational needs of a child with a disability and the specially designed instruction and related services to be employed to meet those needs. An IEP is developed (and periodically reviewed and revised) by a team of individuals, including the parent(s) or guardian(s), knowledgeable about the child’s disability. The IEP complies with the requirements of the IDEA and covers such items as (1) the child’s present level of performance in relation to the curriculum; (2) measurable annual goals related to involvement and progress in the curriculum; (3) specialized programs (or program modifications) and services to be provided; (4) participation with nondisabled children in regular classes and activities; and (5) accommodation and modification in assessments.