

## Science Success for Students With Special Needs

Strategies for helping all students master science standards

By Marcee M. Steele

No Child Left Behind requires a science component to state tests beginning in 2007. Recent special education legislation (Individuals With Disabilities Act amendments) emphasizes the placement of students with mild disabilities in the general education classroom. Therefore, students with learning, behavior, and communication disorders will typically be learning science from classroom teachers rather than in separate special education classes. They will be required to pass the same standardized science tests as the children without disabilities; however, many of their characteristics interfere with success in science. Deficits in memory, low-level reading and writing skills, language difficulties, organizational problems, and social-emotional issues are just a few of the characteristics that can impede science achievement and standardized test performance. This article highlights instructional, study, and test-taking strategies useful in preparing *all* students, but particularly students with mild learning challenges, for suc-



cess in science class and hopefully on high-stakes tests as well.

### Teaching Strategies

Below are suggestions for instructional modifications that teachers can do to help students with learning problems understand science concepts.

**Collaborate with special education and general education teachers.** Collaboration is essential for planning instructional strategies that will be effective for students with learning and behavior disorders. When special education and science teachers plan and teach together, the combined

expertise in science content and individualization will foster development of appropriate lessons for all students.

**Create lessons based on themes or big ideas.** Many science standards and programs emphasize broad concepts for organizing science instruction, and this approach can benefit students with memory problems. They will have fewer ideas to learn at one time and more practice with the concepts as they are covered across many science lessons. Lessons based on themes help students with mild disabilities focus on a few important ideas

rather than getting lost in numerous details. For example, the theme of energy could be the foundation for subsequent units on sound, light, electricity, heat, food, and machines rather than planning separate units on each of these topics without showing connections.

In addition, the major science themes integrate and relate ideas across the curriculum, thus giving even more review in another context for students who have problems with memory and generalization. For example, in a unit on weather, students can use mathematical skills when they measure with a barometer, relate to social studies when they compare weather patterns across a country or state, and incorporate literature by reading and writing stories focused on weather conditions.

***Incorporate explicit instruction on the lesson topics.*** Although most science standards emphasize a constructivist classroom and inquiry science lessons, it is beneficial to incorporate some explicit instruction for students with mild disabilities. Directly summarizing the key points learned from a lesson provides students with notes on the new information for later study. For example, prior to a lesson on sound, teachers could preview key concepts and terms such as *vibration*, *sound waves*, and *echo* by providing explanations and definitions using PowerPoint slides, handouts, or dictation. At the conclusion of the lesson, the key concepts can be discussed again so that students have the opportunity to put the ideas in

their own words and relate them to real-life examples.

***Use graphic organizers and visual representations.*** Teachers can prepare notes as organizers for presentation before, during, and after the lesson. The notes can be outlines, key ideas, critical questions, or sentences with blanks for students to complete.

At the start of a lesson, graphic organizers can relate new material to previous information, introduce new concepts, explain related assignments, discuss the purpose of the lesson, and clarify difficult terms. After the lesson, teachers can present summaries, key questions, and lists of important concepts for emphasis. A set of questions, for example, for a lesson on the atmosphere might ask students to explain ways that air protects people, reasons that smog is harmful, and uses of oxygen.

Visual representations can be useful for students with difficulties in processing and reading comprehension. Graphic organizers, tables, and charts are helpful visual displays that can represent key ideas and their relationship to each other. Pictures that represent ideas can be beneficial for comprehending and conceptualizing. Charts of solids, liquids, and gases; acceleration graphs; and diagrams of moon phases, for example, clarify the concepts and their relationships.

***Model behaviors and strategies you want students to follow.*** When teachers assign small-group tasks in the elementary science class, it is helpful to prepare students so that

everyone has a chance to participate. Teachers can model appropriate strategies such as measuring small objects

with a ruler prior to a group task involving classification of plants by size. It is also important to assist students with language and learning problems as they prepare reports and projects so they will have success in that format. Group and partner activities can be valuable but need to be explained clearly, with specific rules and tasks for each student involved. Each student might have a different task, such as placement of objects to be used in an experiment on magnetism, slowly pushing a bar magnet toward the object, slowing pushing a horseshoe magnet, measuring the length, recording results, and reporting to the class.

Students with reading disabilities may benefit from modifications regarding science textbook use if a textbook is used. Highlighting key passages for students; eliminating sections that are not as critical; using visual representations of material such as charts and outlines; reviewing vocabulary prior to the lesson; and clarifying the parts of the textbook such as glossary, index, and appendix are useful strategies. In addition, teachers can model outlining using textbook features such as titles, headings, and subheadings and taking notes from the textbook in forms such as lists and summaries.



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## Study Strategies

In addition to instructional modifications for teachers, there are numerous study strategies for students that can help students get the most of the science instruction.

**Study Guide Use.** Prior to a science lesson, teachers can create and distribute study guides with key questions, lists of main ideas, and definitions. Teachers can then instruct the students to use them after the lessons to help them focus by reciting the answers, definitions, and main ideas aloud or with a partner. The guides can be particularly useful for students with attention, memory, and organizational deficits.

**Material Review Tips.** Study strategies that emphasize organizational skills can lead to better performance on high-stakes science tests. Teachers can set aside time at the end of each unit to ensure that all students have related materials or assign partners to ensure that all books, guides, charts, and resources are available to complete homework assignments. Teachers can also set (or even require) a study goal of a certain number of minutes each night after completing written science assignments. Contracts, grades, and other incentives can ensure this extra time is used effectively. Even 5 or 10 minutes will establish a pattern of reviewing each night rather than waiting to study all material the day before the test. Teachers could even set aside class time each day or week for students to

review new material and encourage this practice.

Many students with learning disabilities and attention deficits are not active learners and do not use strategies to help them comprehend and remember new material; however, they can learn to employ specific study strategies when they are trying to understand and memorize. Strategies in which students preview, read, and then check their comprehension can be rewarded and modeled. These strategies may include using or making flash cards with questions on one side and responses on the other for independent review of key material; mnemonic strategies to memorize information (e.g., names of bones, energy forms) by associating with pictures, first letters, and keywords; and various self-instruction study strategies (e.g., revising notes, writing summaries, making visual representations such as charts and diagrams). These facts and terms then provide a foundation for activities and projects involving the creation of meaning such as important uses of energy and purposes of various bones in the body.

**Note-Taking Practices.** Elementary teachers can incorporate instruction on note taking into science lessons so students with learning, memory, and attention problems will be able to generalize and use the strategies immediately with science content. To help students improve their note-taking skills, teachers can model how to identify main ideas and concepts for notes or

provide framed outlines with some information completed and blanks for students to fill in as they listen or read. Highlighting is another note-taking strategy that teachers can explain, model, and reinforce.

## Strategies for Tests

In addition to instructional modifications and an emphasis on study skills, it is also useful for teachers to provide students with test-taking strategies. These tips are useful in all testing situations, including high-stakes science tests.

**Practice appropriate strategies before the test.** All students should be taught general test-taking behaviors, such as healthy eating, appropriate sleep habits, wearing comfortable clothing, and staying calm during the test. Also helpful for all students is practicing analyzing directions and questions to be sure students are responding to all parts and interpreting accurately before writing answers.

Some test-taking strategies are more effective at addressing some learning challenges than others. For example, students with attention problems likely will benefit from practice staying on task for longer periods of time, while students with memory problems might better benefit from practice using concepts they have rehearsed and memorized in response to test questions. For some students, test-taking strategies should be taught, practiced, and then reviewed just before the

test. This is helpful for students with processing and memory problems to remember to use the strategies during the test.

**Taking the test.** Whether traditional tests or more inquiry-focused tests are used, it is helpful to teach students to preview an entire test and then start on the questions that they know best. They may want to mark questions that are more difficult so that they remember to complete them later. Practicing activities with test directions related to science questions is particularly beneficial for students with learning and communication disorders who may not be familiar with terminology frequently used to describe science tasks, questions, and experiments. Teachers can discuss key vocabulary such as “explain,” “describe,” “compare,” and “analyze” to show students how to determine the type of response needed based on these words.

Students can also learn to write down a few key words to help with memory as they read the questions and make lists or outlines before writing responses to essay questions. Then they can refer to these words as they are answering the questions.

Finally, teach students to underline or highlight key words when taking tests to be sure they follow directions accurately. Students should be encouraged to check that they have answered all questions and that their responses include all needed information before they complete their exams.

The strategies summarized in this article are appropriate for use in other subjects as well, including mathematics and social studies. Although the recommendations are critical for the success of students with mild learning disabilities, the ideas are beneficial for all students. With deliberate attention to these topics, you can provide students with the tools they need to succeed in class and on tests.

**Marcee M. Steele (steelem@uncw.edu) is a professor of special education at the University of North Carolina Wilmington in Wilmington, North Carolina.**

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## Connecting to the Standards

This article relates to the following *National Science Education Standards* (NRC 1996):

### Teaching Standards

#### Standard B

Teachers of science guide and facilitate learning.

#### Standard D

Assessment practices must be fair.

Special needs students interested in the U of Connecticut should check out the Center for Students with Disabilities. There, they can see the full range of services the school offers. Along with basic accommodations for those with learning disabilities, it also provides a number of other great programs for other types of special needs students. One is the Beyond Access Program, which offers courses (for a fee) that will train students on how to succeed in college with their disability.