



## Accommodating Middle School Students with Dyslexia in Science

### About This Guide

This guide was developed by the Interstellar Boundary Explorer (IBEX) Education and Public Outreach staff to assist teachers of middle school students with language-based learning disabilities (LBD; commonly referred to as dyslexia and other related terms) to provide reading accommodations for their students when using the **GEMS Space Science Sequence for Grades 6-8** curriculum materials. These accommodations were identified and recommended by experienced teachers of middle school students with LBD. If your school does not use the GEMS Space Science Sequence for Grades 6-8, the accommodations contained in this guide should be useful and adaptable to other similar types of lessons and materials. You are encouraged to try these accommodations not only with students with LBD but also with any students who need additional reading supports. Even those who have grade-appropriate reading and decoding skills may benefit from these suggestions. You are also encouraged to converse and partner with your school or district's reading specialist, Title I specialist, and/or other grade-level appropriate reading and language instructors to implement the accommodations in this guide.

### About Dyslexia

According to the definition adopted by the International Dyslexia Association Board of Directors in 2002 and used by the National Institute of Child Health and Human Development (NICHD): **Dyslexia is a specific learning disability that is neurological in origin. It is characterized by difficulties with accurate and / or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge.** (*quoted from <http://www.interdys.org/FAQ/WhatIs.htm>*)

What, then, constitutes effective instruction for students with LBD? According to the International Dyslexia Association, "the methods supported by research are those that are explicit, systematic, cumulative, and multisensory, in that they integrate listening, speaking, reading, and writing... The strategies emphasize planning, organization, attention to task, critical thinking, and self-management. While all such aspects of teaching are essential for students with dyslexia, **these strategies also enhance the potential of all students.**" (*emphasis added; quoted from Moats, Luisa, et al. Knowledge and Practice Standards for Teachers of Reading. International Dyslexia Association, 2010. <http://www.interdys.org/standards.htm>*)

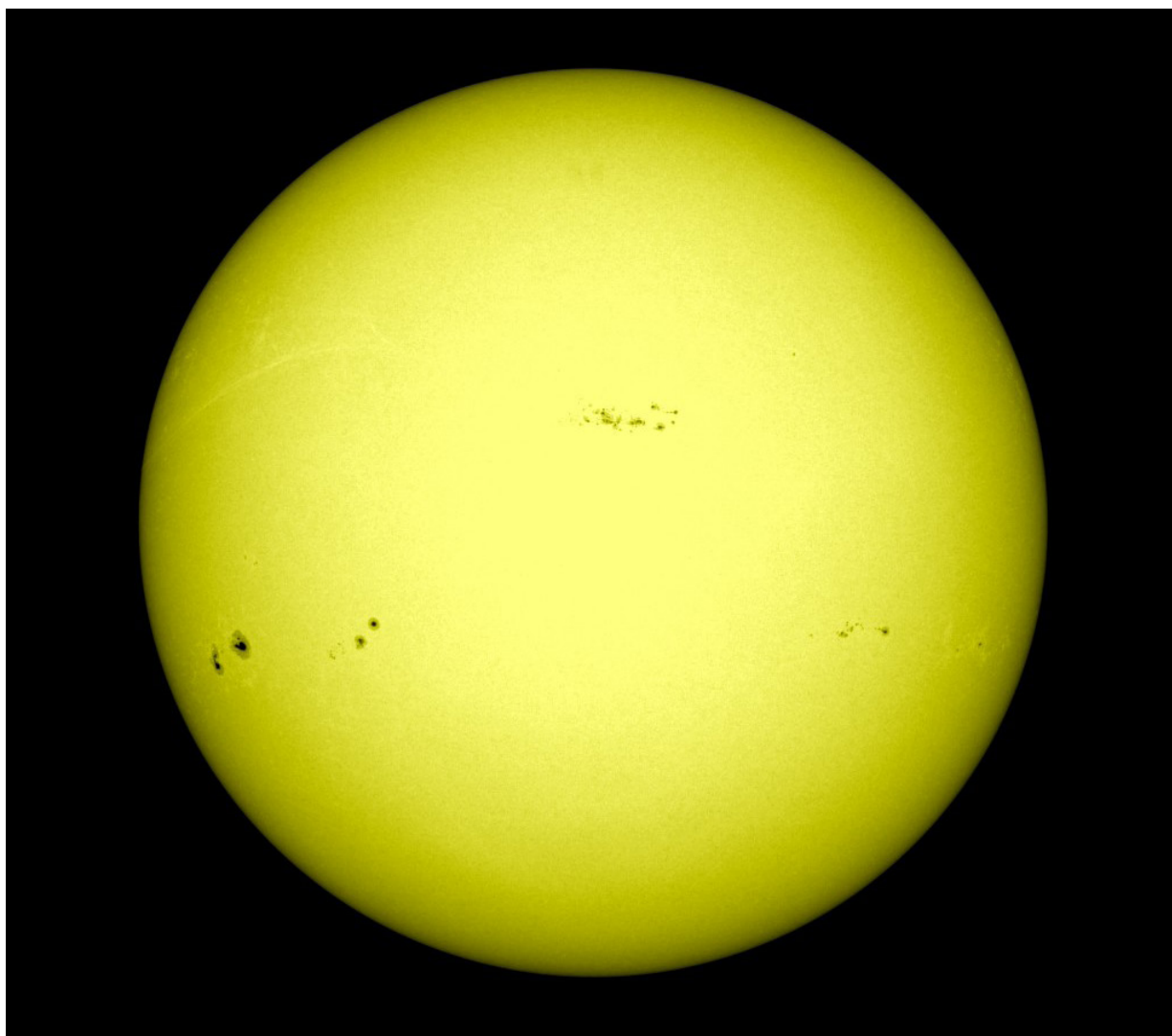
# strategy guide

## Accommodating Middle School Students with Dyslexia in Science

### About the GEMS Space Science Sequence for Grades 6-8

In partnership with the IBEX Education and Public Outreach (E/PO) program and E/PO programs for other NASA spacecraft missions, the Lawrence Hall of Science *Great Explorations in Math & Science* program has developed the GEMS Space Science Sequence for Grades 6-8. Units in the GEMS Space Science Curriculum for Grades 6–8 include:

- How Does the Sun Affect the Earth?
- Why are There Seasons?
- The Solar System
- Beyond the Solar System



*An image of the Sun taken by NASA's Solar Dynamics Observatory on May 1, 2013. A number of large and small sunspots are visible. Image credit: Image courtesy of NASA/SDO and the AIA, EVE, and HMI science teams.*

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## Reading Accommodations

### **Accommodation: Allow extra time**

Students who have significant problems with reading fluency may need extra time in which to complete reading or written assignments, both in class and at home.

This accommodation is appropriate for any lesson or activity in the GEMS Space Science Sequence for Grades 6-8 (GEMS SSS) curriculum, but may be especially useful for the pre- and post-unit questionnaires that accompany each of the four GEMS SSS units: 1.2, 1.8, 2.1, 2.6, 3.1, 3.11, 4.1, 4.7

### **Accommodation: Provide desk copies of materials.**

If a lesson calls for tables, graphs, charts, and other materials to be projected in front of the class, provide desk copies of the text so that students can read along in class as the teacher presents the information, assuming the instructions do not already stipulate that this should be done as part of the lesson.

This accommodation is appropriate for the following lessons from the GEMS Space Science Sequence for Grades 6-8 (GEMS SSS) curriculum: 1.1, 1.3, 1.4, 1.5, 1.6, 2.1, 2.2, 2.3, 3.2, 3.5, 3.7, 3.9, 3.11, 4.2, 4.3

### **Accommodation: Distribute text ahead of the lesson.**

If students are to read aloud in class or if they are given only a certain period of time in which to read text in class before using it to respond to questions, distribute readings a day or more ahead of the lesson to give them time to practice reading the text.

This accommodation is appropriate for the following lessons from the GEMS SSS curriculum: 1.1, 1.4, 1.8, 2.6, 3.9, 4.2, 4.5, 4.6

### **Accommodation: Make readings accessible via recordings or screen readers.**

Four of the lessons in the GEMS SSS utilize readings that are several paragraphs in length. This amount of text can be daunting to some students, at first, to read silently or out loud in class, but even smaller amounts of text can be difficult for struggling readers to attempt. To assist them with deciphering the text, allow students to listen to screen-reader software as it reads an accessible version of a PDF of the text aloud. One additional benefit of using a text-to-speech software is that if the software or e-reader includes the ability to adjust reading speeds, the speed of the audio speech can be adjusted gradually so that students can increase their own reading speed as they read along with the audio.

If a computer with screen-reading software is not available, the teacher can make an audio recording of the text using a tape or MP3 recorder so that students can listen and follow along as the text is read to them. A PDF of all GEMS Space Science Sequence for Grades 6-8 reading materials has been created to be accessible via a computer screen reader. For those who have the GEMS SSS curriculum materials, this PDF can be requested from the Lawrence Hall of Science at [gems@berkeley.edu](mailto:gems@berkeley.edu).

## Reading Accommodations (continued)

This accommodation is appropriate for the following long-format student readings from the GEMS SSS curriculum: 1.8, 2.6, 3.9, 4.5. Materials from the following lessons are included in the screen-reader accessible PDF: 1.1, 1.2, 1.4, 1.8, 2.1, 2.4, 2.6, 3.1, 3.5, 3.7, 3.9, 3.11, 4.1, 4.2, 4.5, 4.7.

### **Accommodation: Separate written concepts using different text colors.**

When projecting and writing many lines of text in a format that does not already incorporate a way to delineate each concept (e.g. boxes around different concepts, concepts on different pages, etc.), use different text colors to separate main ideas and details so that the main idea is visually distinct from its corresponding details. Because teachers may have students with color-blindness, try not to use combinations of colored text that would be difficult for these students to identify. The two types of color-blindness most often diagnosed are 1) the inability to distinguish the colors red and green and 2) the inability to distinguish the colors blue and yellow. If you are hand-writing colored text on a paper or on a transparency, or if you are using different text colors in printed material, try not to use combinations of red and green colors or combinations of blue and yellow colors in the same product.

Here is an example of how to write lines of text using two text colors:

**Jupiter is the largest planet in our Solar System.** (note orange-colored text for the main idea)

Jupiter is much larger than Earth. (note blue-colored text for detail)

Jupiter's gravity is 2.5 times that of Earth.

Jupiter rotates much more quickly than Earth does.

**Mercury is the smallest planet in our Solar System.** (note orange-colored text for the main idea)

The surfaces of Mercury and Earth are made of rock. (note blue-colored text for detail)

Mercury and Earth both have magnetic fields.

Both Earth and Mercury have craters on their surfaces.

This accommodation is appropriate for lesson 1.1 from the GEMS SSS curriculum.

### **Accommodation: Separate written or typed concepts using more “white space.”**

When writing or typing lists of words or sets of individual sentences, separate the lines in the list with two or three extra spacings, providing more visual separation, a.k.a. “white space,” between the lines. For example:

Jupiter is the largest planet in our Solar System.

Mercury is the smallest planet in our Solar System.

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This technique aids students who may only look at the first letters of words and then try to guess what the words are without actually reading entire words. More space around words and lines allows students to focus on each succeeding letter of each word.

This accommodation is appropriate for lesson 1.1 from the GEMS SSS curriculum, though it can be used with any lesson that involves projecting lines of text or lists of words. Also, please note that the color-coding accommodation and the line-spacing accommodation do not have to be used at the same time. Educators can use either one, but using both at the same time is not needed.

### **Accommodation: Allow students to include drawings in written work.**

Students may find that writing only words, phrases, sentences, and/or paragraphs might make it more difficult for them to express themselves. Give students the option to include drawings to represent various concepts as part of their written work. As they become more comfortable with writing and utilizing science vocabulary, the use of drawings can be reduced.

This accommodation is especially appropriate for the pre- and post-unit questionnaires that accompany each of the four GEMS SSS units, but can be used with any worksheets or other writing assignments.

Utilize this accommodation with the following lessons from the GEMS SSS curriculum: 1.1, 1.2, 1.3, 1.4, 1.6, 1.7, 1.8, 2.1, 2.2, 2.3, 2.4, 2.6, 3.1, 3.5, 3.7, 3.11, 4.1, 4.4, 4.7.

### **Accommodation: Use video clips and/or online activities to accompany lessons.**

Show a video clip and/or online games or activities related to a particular concept or topic to provide another visual and aural method of presenting similar information. The CD-ROM that accompanies the GEMS SSS contains extra visuals and materials that the teacher can show to accompany lessons and activities; other online videos may also prove useful as additional resources. Use the CD-ROM if you have the ability to project a computer screen; if students can access an internet-connected computer in the classroom, in a computer lab, or in the school library, the list of resources below may also prove to be beneficial. It is important to remember that these online resources are not meant to replace lesson instruction; rather, they can be used as additional lesson support for students.

The following online NASA resources are recommended to accompany GEMS SSS lessons or units:

### **Resources to support Unit 1: How Does the Sun Affect Earth?**

**Space Weather Media Viewer:** The Space Weather Media Viewer features near-real-time imagery from a wide variety of NASA missions, as well as video interviews with prominent scientists about the causes of space phenomena and other Sun topics. <http://1.usa.gov/Jth7R>

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**Video: NASA Scientists Answer Top Space Weather Questions, Part I (from NASA):**

<http://bit.ly/ZBmesg>

**Video: NASA Scientists Answer Top Space Weather Questions, Part II (from NASA):**

<http://bit.ly/XjLoxv>

**Video: Space Weather Vocabulary video (from NASA):**

<http://bit.ly/Yep1GA>

**Video: The Solar Cycle video (from NASA):**

<http://bit.ly/WEptjO>

**Video Tour of the Electromagnetic Spectrum:** This NASA resource on the web introduces electromagnetic waves, their behaviors, and how scientists visualize these data. Each region of the spectrum is described and illustrated with engaging examples of NASA science. <http://1.usa.gov/ejZjUT>

### Resources to support Unit 2: Why Are There Seasons?

**Videos: The GLOBE Program:** The GLOBE Program has developed a series of videos providing an overview of the Program; the Earth as a System video contains information about seasons and related topics. <http://1.usa.gov/13S6moW>

### Resources to support Unit 3: The Solar System

**NASA Interstellar Boundary Explorer (IBEX) mission games and activities:** The IBEX website contains games and activities for visitors to explore concepts related to the science of the IBEX mission. <http://bit.ly/YU0tTj>

**Video: Using Color to Search for Alien Earths (from NASA):**

<http://bit.ly/Zg72P9>

**Online resource: Eyes on the Solar System (from NASA, requires free download):** Eyes on the Solar System” is a 3-D environment full of real NASA mission data. Explore the cosmos from your computer. Hop on an asteroid. Fly with NASA’s various spacecraft. See the entire solar system moving in real time. <http://1.usa.gov/NFdjCj>

### Resources to support Unit 4: Beyond the Solar System

**Video Tour of the Electromagnetic Spectrum:** This NASA resource on the web introduces electromagnetic waves, their behaviors, and how scientists visualize these data. Each region of the spectrum is described and illustrated with engaging examples of NASA science. <http://1.usa.gov/ejZjUT>

**Sorting the Universe (IBEX game):** We can organize objects in the Universe into different realms, the

## Reading Accommodations (continued)

Earth-Moon realm, the Sun & Heliosphere realm, the Milky Way Galaxy, and the Universe. Try your hand at sorting different astronomical objects into one of these four realms. <http://bit.ly/16mFPiM>

**Video: Hubble and Exoplanets (from NASA):** <http://bit.ly/W2h0Wv>

**Video: Using Color to Search for Alien Earths (from NASA):**  
<http://bit.ly/Zg72P9>

**Video: Kepler: The Search for Earth-Size Planets Begins (from NASA):** <http://bit.ly/Y6htTY>

**Video: NASA's Kepler Mission Discovers Multiple Planets Orbiting Twin Suns (from NASA):** <http://bit.ly/YWo7v2>

**Video: Hubble Ultra Deep Field Flythrough (no narration, from ESA):** <http://bit.ly/10wLEpI>

**Video: Examining different pieces of the Hubble Ultra Deep Field (no narration, from ESA):** <http://bit.ly/X0jDUM>

**Video: Episode 16: Deep Universe (from NASA):** Take a look at some of the most distant galaxies Hubble has ever seen, and find out why, when we look at the most distant objects in the universe, we are also seeing the cosmos' earliest objects. <http://bit.ly/10EllSt>

## Organizational Strategies

### **Accommodation: Use an activity binder or lab notebook**

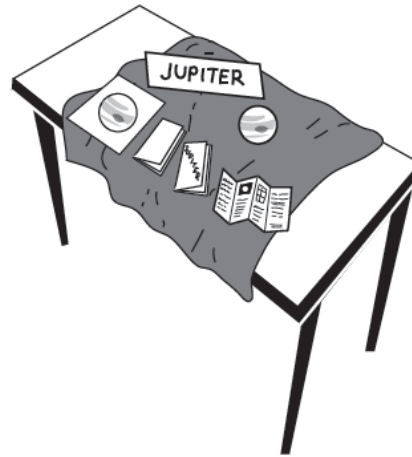
The GEMS SSS lessons use a variety of worksheets, graphs, charts, readings, unit questionnaires, and other materials that can seem overwhelming to some students. To give students structure for the worksheets, readings, and other materials for a unit or set of lessons, they can paste their materials into a lab notebook, slot them into a deep-pocket folder organized by lesson and unit, or use another method selected by the teacher that allows them to organize their papers in a coherent way. Students may need to refer to a set of materials created by the teacher as an example if they do not have previous experience with this sort of organizational tool. If done consistently, this method will allow students to locate information more easily. This organizational method is already recommended by the GEMS SSS.

## Organizational Strategies (continued)

### **Accommodation: Make a demonstration copy of a lesson's final product**

This accommodation is best highlighted in lesson 3.5, "Researching Objects in the Solar System." In this lesson, pairs of students research a Solar System object using text and other information provided in the GEMS SSS materials. The assignment is for students to create a classroom learning station for their Solar System object, containing a travel brochure, scale model of their object, and other materials. A sample drawing of what the learning station can look like is included in the copymaster files for Unit 3. This drawing can be shared with students.

A sample learning station for lesson 3.5:



## Vocabulary Strategies

### **Accommodation: Introduce new vocabulary words before lessons. Try to introduce no more than two or three vocabulary words per day. Include instruction in both phonology and phonetics.**

In the GEMS Space Science Sequence for Grades 6-8, scientific inquiry and space science vocabulary words for each unit can be found in several of the lessons on the right side of the right-hand "Teacher Considerations" page. Provide the words from these lists, and any other lists you generate yourself after reviewing the lessons, to your students as they are encountered in the lessons. Try to introduce no more than two or three vocabulary words per day, if possible, so that students are not overwhelmed. An example of the vocabulary word lists in the GEMS units follows, from page 147 in the book titled "Unit 1: How Does the Sun Affect Earth?" This is the vocabulary list addressed through all the lessons in Unit 1.

#### **Key Vocabulary**

##### **SCIENTIFIC INQUIRY VOCABULARY:**

Control, Evidence, Model, Observation, Prediction, Scale, Scale Model, Scientific explanation

##### **SPACE SCIENCE VOCABULARY:**

Coronal mass ejection (CME), Electromagnetic (EM) energy, Magnetosphere, Matter, Particle, Shield, Solar flare, Solar particle, Solar wind, Spectrum, Star, Ultraviolet (UV)

It is recommended that vocabulary instruction include both phonology (i.e., the study of speech sounds) and phonetics (i.e., the sounds of speech and their production, combination, description, and representation). Your school's or district's reading specialist, Title I specialist, and/or other grade-level appropriate reading and language instructors would be particularly helpful resources for this effort.



## Vocabulary Strategies (continued)

**Accommodation: In written materials, underline/circle/identify key vocabulary and any definitions or explanations, cause and effect, and/or facts and concepts that support a particular viewpoint.**

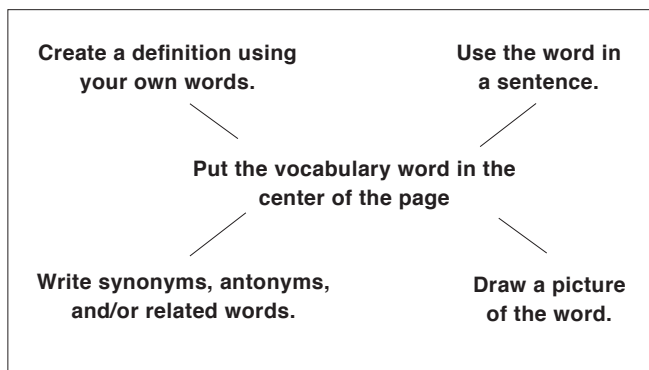
A few of the activities in the GEMS Space Science Sequence for Grades 6-8 incorporate readings that are several paragraphs long, and other worksheets involve readings that are several sentences long. Students can underline any key vocabulary words that they encounter, along with any definitions or explanations of those words that are in those readings.

For example, from the student reading in lesson 3.9, “Where Does the Solar System End?”:

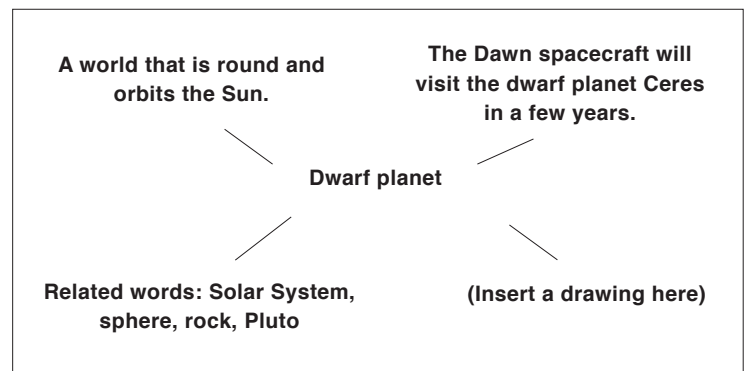
This bubble that surrounds the Sun and the Solar System is called the *heliosphere*.

**Accommodation: Create vocabulary word maps.**

Students can create vocabulary word maps to aid in their deciphering of the meaning of text. This gives students the opportunity to activate prior knowledge and use previously encountered words and concepts and relate them to the new vocabulary word. Various types of word maps exist. If you use one, provide examples so students can see how they should be constructed. Here is an example of one. If you use a version similar to this with students, you may want to reduce the instruction text. Also, some students may have trouble writing the definition or using the word in a sentence. For some students, working in pairs may make them more comfortable with this process.



For example, here is a word map for the vocabulary word “dwarf planet”:



**Accommodation: Create an illustration or drawing for key concepts and vocabulary words.**

Each of the GEMS SSS units contains a number of key concepts written as complete sentences. The teacher posts the key concepts in the classroom as they are encountered in each of the lessons. Students can create a drawing or illustration for each of the concepts to help remind them of the information in each of the key concept pages. Illustrations created during one school year may be saved by the teacher to use in subsequent years with future students.

For example, students may encounter the following key concept from activity 2.1: “The Sun is very close to the center of Earth’s orbit.” A drawing that a student might create could have the Sun in the middle and the Earth’s orbit as a circle around the Sun.