

Strategies for Teaching Science to English Language Learners

In the past few years, 42 percent of American public school students were of racial or ethnic minorities, up 22 percent from 30 years before. Most of this increase in diversity was due to immigration from Latin America and Asia, and with this increase in ethnic diversity came a corresponding increase in linguistic diversity. For example, in 2002, nearly 42% of students in Los Angeles Unified School District, the second largest district in the country, were classified as English language learners.

The Institute of Education Sciences of the United States Department of Education defines English language learners (ELL) as: “Individuals who (1) were not born in the United States or whose native language is a language other than English; or (2) come from environments where a language other than English is dominant; or (3) are American Indians and Alaskan Natives and who come from environments where a language other than English has had a significant impact on their level of English proficiency; and who, by reason thereof, have sufficient difficulty speaking, reading, writing, or understanding the English language, to deny such individuals the opportunity to learn successfully in classrooms where the language of instruction is English or to participate fully in our society.” Today’s science teachers must be prepared to teach students whose first language is not English. In this section we reference ELL strategies and activities that are found throughout this book.

The science classroom is often a frustrating place for English language learners. Science has a complex vocabulary that is difficult even for native English speakers to learn. Difficulty learning English should not be confused with an inability to think scientifically. Many of the strategies that are useful for English language learners are effective for differentiating instruction for other students as well. Use a variety of methods to see which work best with your teaching style and students.

24.7.1 – ELL: Listening

Speak slowly, distinctly, and write down key terms – Anyone who has learned a foreign language in class, then traveled to a country where the language is spoken, has noticed that it is difficult to understand natives because they seem to “talk too fast”. What seems normal speed to a native speaker is extremely fast to a language learner or to a student with a hearing impairment. The addition of the complex terms and concepts of science can make learning even more difficult. Write down key terms so students can see them and connect them to the spoken word.

Closed Captioning – Most science videos are equipped with closed captioning. Turn on the closed captioning so students can see what narrators and actors are saying (16.5.4). This helps English language learners correlate written and spoken English, and helps them see spelling and sentence construction. Closed captioning is also invaluable for the hearing impaired.

24.7.2 – ELL: Visualization

Emphasize visual literacy - It is often said that math and music are universal languages –ones that can be read regardless of one’s primary language. Although these claims are debatable, it is clear that an English-speaking student can read and understand an equation in a Swahili textbook, and a Greek musician can play a score drafted by a Japanese composer. Regardless of linguistic background, people around the world can interpret mathematical equations and musical scores. In addition, they can also interpret pictures, and with minimal linguistic skills, can interpret charts and graphs. Visual literacy, or the ability to evaluate, apply, or create conceptual visual representation, is relatively independent of language, and is therefore invaluable to learning science and English simultaneously. Vector diagrams (16.1), scientific diagrams (16.2), pictorial riddles (16.3), photographic analysis (16.4), movie analysis (16.5), and map development and analysis (21.1-21.7), are a few of the many activities that can be used to build visual literacy.

Graphic Organizers – Graphic organizers are a means of introducing and assessing concepts in a manner that encourages meaningful learning. Graphic organizers are diagrams or maps that show the relationship between new and existing concepts, thereby facilitating integration of new and familiar ideas. They require minimal language and are therefore helpful tools when teaching science to English language learners. Conceptual grids (9.1), Venn diagrams (9.2), flow charts (9.3), mind maps (9.4), and concept maps (9.5) are some of the more common graphic organizers.

Use charts, graphs and figures – Scatter and line graphs (20.4), column and bar charts (20.5), pie and area graphs (20.5), and high-low, combination and log plots (20.7) can communicate concepts with minimal use of spoken or written language. The layout of such visual aids should be clear and uncluttered.

Manual video control – Science videos often introduce a variety of new terms and concepts, most of which even native speakers never remember. Pause the video to discuss key concepts. Use the bookmark and video clip features to return to precise sequences for review (16.5.4). Use the step-frame, slow motion, and replay features to focus student attention on key concepts.

24.7.3 – ELL: Interpersonal strategies

Group projects & cooperative learning – Many of the activities in this book employ group work and cooperative learning. Such activities provide opportunities for students to exchange, write, and present ideas. Projects use a variety of skills that work together to increase understanding and retention.

Partner English learners with strong English speakers – The best way to learn something is to teach it. Partnering English learners with strong English speakers benefits both. It may be particularly beneficial to pair English learners with bilingual students who can translate laboratory and activity procedures. Develop your seating chart so English language learners are sitting near the front of class and adjacent to bilingual students who can assist them.

Think/Pair/Share – Students learn to speak English by speaking English, but it is often counterproductive to ask English language learners to read passages or give descriptions to the entire class. Students are often embarrassed by their minimal science knowledge and English skills, and public exposure may make them more uncomfortable and reserved. By contrast, English language learners are often eager to share their ideas in their new language with their peers. The think/pair/share strategy gives all students the opportunity to practice English by explaining science concepts. Provide students with time to write a response to a thought provoking question, then additional time to discuss it with their neighbor before sharing their conclusion with the class. The think/pair/share technique increases student participation and involvement, and is a particularly effective way of encouraging English language learners to express science concepts in English.

Encourage participation- Many English learners come from countries in which student participation is not encouraged. They may be reluctant to speak, not only because of their lack of proficiency in English, but also because of they are uncomfortable in an environment where they are asked to share their ideas. A positive and supportive environment has a significant influence on student comfort level, participation, and success. Requiring English language learners to speak in front of class may be counter-productive and cause great anxiety. Encourage them to express themselves, but don't force them onto the stage prematurely.

24.7.4 – ELL: Structure

Consistent routines – English learners are freer to concentrate on new concepts if they are familiar with classroom routines.

Road map to science – English language learners benefit greatly from a “road map” that shows where they are in the science curriculum. Use organizational structures when teaching earth and space science (8.2), biology (8.3), chemistry (8.4), or physics (8.5) to English language learners.

Outlines – Provide students with a copy of your lecture/discussion outline. This will help ELL students know where you are, and where you are going with your lesson.

Relate to prior knowledge – Make use of student background knowledge of science concepts. Discover what your students already know about a given topic and build upon this knowledge.

24.7.5 – ELL: Laboratory

Hand-on activities – Kinesthetic learning events provide an excellent learning environment for English language learners. Hands-On Chemistry Activities with Real-Life Applications, and Hands-On Physics Activities with Real-Life Applications by Norman Herr and James Cunningham provide numerous hands-on activities of benefit for English language learners.

24.7.6 – ELL: Demonstrations

Clear, procedural steps – The science laboratory can be a confusing and potentially dangerous setting for English language learners. Present procedures clearly using flow charts, pictures, and outlines.

Model laboratory activities – Demonstrate activities in front of class to ensure that English language learners can see the procedures before engaging in an activity.

Pictorial guide – Provide a visual reference to glassware and other materials used in experiments and activities. Review safety symbols and post them in the room and in the lab handout.

24.7.7 – ELL: Reading and Writing

Journaling – Students become better writers by writing. Require English language learners to keep science journals (3.2.1) in which they write lecture notes, new terms, and responses to prompts.

Science reading comprehension activities – Cloze (2.1) and jigsaw (2.2) are two techniques for developing and assessing reading comprehension, and can be used when making formative assessments of language and science learning.

24.7.8 – ELL: Instruction

Wait time – Teachers are often uncomfortable with silence and either call on the first student to raise their hand, or answer questions themselves, thereby short-circuiting the thought processes of most students, particularly English language learners who are trying to translate terms while formulating an explanation. Let students know that you expect all to be mentally engaged, and for this reason you provide wait-time sufficient for the majority to develop an answer before calling on any individual.

Analogies – Use analogies to relate new concepts to previously learned concepts (10.2, 10.3, 10.4, 10.5).

24.7.9 – ELL: Vocabulary

Language-based science games – Reinforce vocabulary with Science Bingo (13.3), and concepts with Science Pictionary (13.4). These games require minimal spoken language and provide an excellent review of science vocabulary.

Picture glossary – One of the best ways to learn the vocabulary of a new language is with pictorial flash cards. A picture of the concept is on one side while the term (in the language to be learned) is on the reverse. The student learns to correlate concepts directly with words, eliminating the need for translation.

Common lexicon – People construct understanding by integrating new ideas with pre-existing knowledge. Ask students what they already know, then develop a common classroom vocabulary that can be used to develop new understandings.

Root words – A knowledge of Greek and Latin prefixes, suffixes, and roots can greatly enhance student understanding of scientific terms and facilitate a better understanding of English and other European languages. Approximately 50% of all words in English have Latin roots, many of which are shared with Spanish, French, Portuguese and Italian. Learning scientific root words thereby helps one understand the vocabulary of a variety of languages, particularly English (1.1, 1.2, 1.3, 1.4).

Cognates – Many science terms are used internationally. Identify such terms (2.3, 2.4) and ask your students to notify you whenever they recognize a new term that is pronounced or written similarly in their first language. This helps build your knowledge of cognates (words that are similar in two or more languages) so you can help future learners master science vocabulary.

Mathematics translation – English language learners find word problems much more challenging than symbolic math problems. The English language is exceedingly complex, with numerous nuances that must be learned. Students need to be able to translate common words to math symbols (14.1), natural language to algebraic expressions (14.2), and algebraic expressions to natural language (14.3). The activities in this book help students develop such skills.

Word wall – Post new vocabulary terms on the wall in an organized, grouped manner. For example, you may wish to post new biology terms in columns according to the level of organization (cell, tissue, organ, etc.) (8.3).

