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Teaching Science to English-as-Second-Language Learners: Teaching, learning, and assessment strategies for elementary ESL students

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By Gayle A. Buck

YOUR PRINCIPAL TELLS YOU that two new students will be joining your classroom. She mentions that both students are labeled English-as-Second-Language (ESL) or Limited-English-Proficiency (LEP). This concerns you. Teaching ESL students is something that you were not prepared in preservice university classes to do and haven't encountered in your educational experiences. This news leaves you with many questions. What teaching strategies meet the needs of children who speak limited English? What learning strategies will you need to foster in these children? How will you assess their learning?

You are not alone with this experience or your questions. The population of our country and our schools is changing. The next 50 years will see a large influx of new citizens; this influx of new citizens is bringing different cultures, experiences, and first languages. The classroom roster is a reflection of this changing population.

The number of reported LEP students enrolled in public and nonpublic schools has been increasing since 1986. In 1997, 22 State Education Agencies (SEA) in the United States reported the percentage of LEP students increased more than 10 percent, and nine SEAs reported increases of 25 percent or greater (Macias, 1998). Overall, the number of students who speak languages other than English at home increased by more than 68 percent in the past 10 years (Teachers of English to Speakers of Other Languages, 1997).

This article relates to the *National Science Education Standards'* Teaching Standard B: Teachers of science guide and facilitate learning. In doing this, teachers recognize and respond to student diversity and encourage all students to participate fully in science learning (National Research Council, 1996).

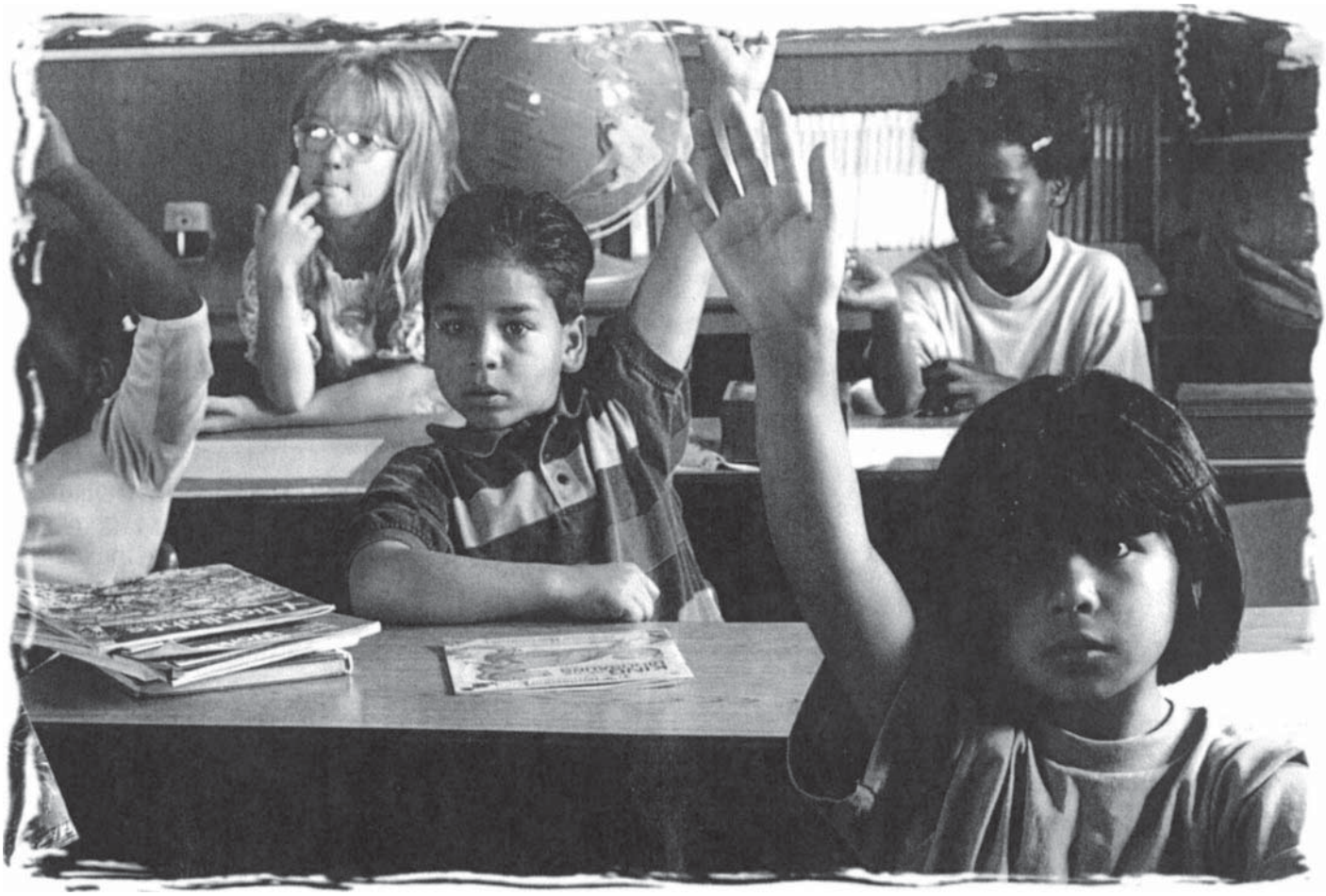
The ESL/LEP Student

The two new students identified as ESL or LEP refers to their English-speaking ability. It does not make a statement about their cognitive ability. Therefore, the following strategies will address their language and cultural differences. These students may be at various stages of language development; therefore, use the following categories to determine each child's stage of language development prior to determining a plan of action.

Beginning—Students in this category have very limited or no understanding of the English language. English is seldom used for optional communication. These students may respond nonverbally to Simple commands. As students progress, they may begin to use single words or simple phrases. At the earliest stages, these learners construct meaning from nontext features such as graphs, maps, and tables. They gradually proceed to construct meaning from the words; however, the construction is often incomplete.

Intermediate—Students at this level understand more complex speech but still require repetition. They have acquired a vocabulary of key words or phrases covering many common situations. These students use English spontaneously; however, they may have difficulty expressing all their thoughts due to restricted English-speaking ability.

Advanced—Students at this level have adequate language skills for most day-to-day communication.



What teaching strategies meet the needs of children who speak limited English?

They may have difficulty understanding some idioms, figures of speech, and words with multiple meanings. They may have difficulty with complex structures and abstract academic concepts (TESOL, 1997).

Teaching Strategies for ESL Children

A change in your student population will require an adjustment to your science teaching practice. However, even if you haven't encountered ESL children in the elementary classroom, many of the strategies recommended for ESL students will be familiar—especially in science education. Science teaching lends itself to inquiry and using authentic materials, hands-on approaches, and visual representations. If applied, these and similar strategies will help meet the needs of ESL students.

I suggest these basic strategies to add to your existing science teaching routine. As you conduct a science lesson, include visuals that illustrate the subject matter. For example, if you're describing various stages of a plant's life cycle, use pictures to illustrate the seed, the seed developing a root, stem and leaf formation, flower development, and the new seed. These pictures directly relate to your discussion and can be sequenced in a logical order. Other basic strategies you might want to include:

- use the chalkboard more (Frequently draw pictures to support an oral discussion on the plant cycle. Write any new words such as *root* and *stem* as you introduce them.);
- give step-by-step directions, one at a time (Students make observations of actual plants. After they have had an opportunity to observe, students note how the plants are alike. Third, they draw a picture to show how the plants are different Fourth, students look to see how the plants are different In each case students complete the first task before being given the next direction.);
- prepare lists of terms on large paper (Clearly post frequently used terms such as *stem, bulb,* and *bud* in the room as your proceed through the unit. ESL students should be encouraged to look to this sheet whenever they encounter a word that they cannot easily recall.);
- rephrase unclear statements using different words and simpler sentences (Break up statements such as "New plants can be grown from

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parts of plants that are restricted to the underground" to statements such as "There are plant parts that we cannot see because they are buried in the dirt." "These plant parts can grow new parts that come above the dirt." "We can then see these new parts.");

- at frequent intervals summarize what has been taught (Don't wait to review until right before the test. After each new concept has been explored, review the concept with the students and check for understanding.);
- and pair up native and nonnative English-speaking students for collaborative work (Have the students work with partners to plant seeds and observe their growth. When you're assigning partners, pair a nonnative English-speaking student with an English-speaking student) (Sutman, 1986).

It is also important to

- vary instructional delivery (Use picture books, hands-on activities, demonstrations, and group discussions throughout the plant unit.);
- encourage parent participation in classroom activities (Invite parents to the classroom to work with students as they plant and monitor the growth of their seeds.);
- actively involve students in peer instruction (Ask an English-speaking student to explain concepts that weren't clearly understood. Oftentimes, one fourth-grade student could explain any concepts in ways that are more easily understood by another fourth-grade student);
- and make connections to students' out-of-school experiences (Ask students to talk about the plants they are familiar with. Have them describe these plants through the various seasons. Many times an ESL child will have a common knowledge of a plant that is unknown to the other students and the teacher. This is an excellent opportunity to have a nonnative English speaker teach the native English speakers something.) (Anstrom, 1996).

Although ESL students may be lacking some necessary skills and experiences, they also bring a wealth of new skills and experiences that can greatly enhance the classroom environment

Other teaching strategies may or may not require an adjustment to your teaching practice. Many strategies will not only benefit ESL students but also non-ESL children. For example, hands-on science activities allow students to follow along without having to solely depend on the spoken word. However, make sure the activity directly relates to the concept being taught, and be aware of possible **misconceptions that may occur to students who are relying on the activity to illustrate the concept.** For example, the classic model volcano could provide a misconception of the inner workings of a volcano if the students are not able to follow a careful explanation. You may also want to keep any connected readings and classroom discussions to short time frames and scatter them throughout the activity.

Learning Strategies

Not only will you need to make accommodations to your own teaching style, but it is important to consider ESL students' learning strategies. Learning strategies that may need to be reviewed include:

- prior knowledge schemata (Begin with the plant unit by having students share the various plants they have observed in nature. Discuss how the plant changes throughout the seasons. Help students connect those observed changes to the new unit on plant cycles.);
- question generating (Frequently set aside time for students to generate a list of questions they still have about plants. This gives students time to process the information and explore any gaps in understanding.);
- scaffolding (During the first several hands-on activities of the unit, have completed examples and demonstrations prepared for the ESL children. As they get more experience with hands-on activities, they will need less support);
- and summarizing (Once you have completed a concept, have the ESL children summarize what they learned. This allows them to work for understanding throughout the unit.) (Chamot, 1999).

If you use inquiry activities, you may need to provide the new students with general skills. For example, in many countries the students are not encouraged to question what the teacher is illustrating; however, these questioning skills are the foundation of today's inquiry lessons. Therefore, students may need some practice in asking questions in the classroom.

Many of the previously mentioned learning strategies will help

students succeed in the classroom; however, they may have some unique learning strategies that may continue to benefit them if they are allowed to foster such skills. The best sources to find out this information are the students themselves. Working through some coursework with students could give^you valuable knowledge of not only the learning strategies they lack, but those that they possess as well. For example, one of your new students may have an exceptional skill in creating stories to understand a concept. That child might then create a story to describe the life cycle of the plant.

You may find that a general overview of learning-strategy skills could greatly benefit all children. However, the ESL children may need extra assistance and guidance in areas such as note taking and questioning for clarification. In addition, ESL children can often benefit by learning the strategy of "self-talk." Self-talk is useful in reducing the level of anxiety ESL children may have as they try to learn in an unfamiliar environment. In self-talk, the child learns to internally reassure him/herself with positive comments (Chamot and O'Malley, 1997).

Assessment Strategies

A variety of authentic assessment strategies can help accurately assess the developing knowledge of your ESL students. These include

- portfolios—Have the students pick out their best work from the plant cycle or other unit. Ask them to describe what the pieces of work reveal about what they learned.
- oral response—Give the ESL children a tape recorder and let them orally explain what they have learned.
- pictures and posters—Ask the ESL children to draw what they have learned. This can also be followed by an oral explanation.
- performance—-Have the children perform the concept they have learned.

These strategies, as well as long-term projects and self-assessments, can help ESL students succeed in the classroom. Take some time and effort to make the assessment more relevant to the lives of the new students. Talk to students, parents, and/or community members to establish goals for the students and determine appropriate measurement strategies. Ask them to describe assessment strategies they may have previously encountered or those that they feel comfortable describing.

A variety of test-taking tips can make the assessment process more valid, focusing on the desired understandings instead of language skills. These include

- having a bilingual aide transcribe the activity sheets into the students' first languages,
- providing the ESL student with extra time to complete the task,
- allowing ESL students to use an English dictionary,
- and having an older student or an adult to read the test aloud to the ESL students.

Concluding Thoughts

Having the task of educating students whose first language is different from your own can be overwhelming. However, it may help to realize that you already know a great variety of strategies that will help these children learn. Many of those strategies are especially conducive to science learning. It is also important to remember that, although your new students may be lacking some necessary skills and experiences, they also bring a wealth of new skills and experiences that can greatly enhance your classroom environment.

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