Supporting ESL Students in Learning the Language of Science

Because language is infused into all aspects of the teaching of science, students whose knowledge of English is limited are likely to have difficulty accessing scientific concepts and expressing their understanding of these concepts in oral and written language. Therefore, teachers are faced with the challenge of modifying their instruction in ways that will assist ESL students.

Effective academic language instruction for ESL students across the curriculum is built on three fundamental pillars:

1. Activate Prior Knowledge/Build Background Knowledge
2. Access Content
3. Extend Language

In developing scientific knowledge through language, and language abilities through science, we can apply these three instructional principles in powerful ways.

1. Activate Prior Knowledge/Build Background Knowledge

Prior knowledge is the foundation of learning. When students read a scientific text, they construct meaning by bringing their prior knowledge of language, science, and of the world in general to the text. Students may not explicitly realize what they know about a particular topic or issue. Activating their prior knowledge brings it to consciousness and facilitates learning.

Activating prior knowledge and building background knowledge are important for all students, but particularly for ESL students who may be struggling with unfamiliar vocabulary and grammatical structures in addition to complex new concepts. Building this context permits students to understand more complex language and to pursue more cognitively demanding activities. It lessens the cognitive load of the text and frees up brain power.

Activation of prior knowledge enables teachers to validate ESL students' background experiences and affirm their cultural knowledge. Inviting students to contribute what they already know to the class discussion communicates to students that the cultural and linguistic knowledge they are bringing into the classroom is valuable.

Dr. Jim Cummins
Professor
Modern Language Center & Curriculum Department
Ontario Institute for Studies in Education
The University of Toronto
Toronto, Canada

"Activation of prior knowledge enables teachers to validate ESL students' background experiences and affirm their cultural knowledge."

PEARSON Scott Foresman

Strategies for activating prior knowledge and building background knowledge

A variety of strategies to activate students' prior knowledge are embedded in Scott Foresman *Science*.

- ***Brainstorming/discussion*** This type of language interaction can happen in the context of a whole class, in small groups, or in pairs; for example, students can interview a partner to find out what each one knows about a particular topic. Discussion can also be highly effective in making abstract concepts more concrete and comprehensible.
- ***Use of graphic organizers*** These can be used to capture the results of brainstorming and discussion. For example, K-W-L charts can be used to record what students already **K**now, what they **W**ant to know, and, after the lesson, what they have **L**earned. Word webs and many other graphic organizers enable students to record and organize their information.
- ***Visuals in texts*** Photographs, charts, and graphs can be used to stimulate discussion about aspects of what is depicted and to encourage students to predict what the text is likely to be about.
- ***Short-term direct experiences*** Quick activities that begin each lesson provide opportunities for students to observe science-related phenomena and can stimulate discussion of what students have observed. Teachers help students relate their observations or experiences to the content of the science lesson.
- ***Long-term direct experiences*** Class projects and formal inquiry activities provide an avenue for students to actively relate to abstract concepts.
- ***Writing about what we know*** Dialogue journals for note taking and responses to written prompts are useful means for the student to both record information and review it later.

2. Access Content

We can also support or *scaffold* students' learning by modifying the input itself. We provide this scaffolding by embedding the content in a richly redundant context with multiple routes to the meaning in addition to the language itself. Building this redundancy enables ESL students to access the content despite any limitations in English language proficiency.

"Building redundancy enables ESL students to access the content despite any limitations in English language proficiency."

Strategies that improve student access to academic content

The following methods, which you will find embedded in Scott Foresman *Science*, can help students more effectively get access to meaning.

- ***Use Visuals*** Visuals enable students to "see" the basic concept we are trying to teach much more effectively than if we rely only on words.
- ***Dramatize/Act Out*** For beginning ESL students, *Total Physical Response,* where students physically represent a phenomenon or act out commands, can be highly effective.
- ***Clarify Language*** Language-oriented activities aim to clarify the meanings of new words and concepts. Teachers can modify their language by paraphrasing ideas and explaining new concepts and words. They explain new words by providing synonyms, antonyms, and definitions either in English or in the home language of students. Important vocabulary can be repeated and recycled as part of the paraphrasing of ideas. The meaning can also be communicated and/or reinforced through gestures, body language, and demonstrations.

- ***Make Personal and Cultural Connections*** Notes in the Scott Foresman *Science* Teacher's Edition suggest ways to link content to students' everyday experiences. These content connections validate students' sense of identity and make the learning more meaningful.
- ***Make Cross-Curricular Connections*** The more cognitive operations students perform related to a particular issue or problem, the deeper their comprehension becomes.
- ***Provide Hands-on Experiences*** The more we can contextualize or personalize abstract concepts by embedding them in students' hands-on experiences, the more comprehensible they will become for students. Hands-on projects also allow students to link the conversational language they use in the "real" world and the more abstract and specialized language they are learning in science. Discussions about concrete phenomena and problems demystify the language of science. The abstract concepts we learn in science help us understand what we see with our very own eyes and vice versa.
- ***Encourage Learning Strategies*** Learning strategies are useful for all students, but particularly for ESL students who face obvious challenges in accessing curricular content. Examples of strategies included in Scott Foresman *Science* are: planning tasks or activities, visualization, grouping and classifying information, taking notes and summarizing information, questioning for clarification, and using multiple resources and reference materials to find information or complete a task.

3. Extend Language

A systematic focus on and exploration of language is essential if students are to develop knowledge of the specific vocabulary and text structures that are used in scientific discourse. Students can systematically collect the meanings of words and phrases they encounter in science texts in a personal or group *language bank*.

Strategies that help students accelerate their acquisition of academic language

A variety of strategies to activate students' prior knowledge are embedded in Scott Foresman *Science*.

- ***Explore Etymology*** Paradoxically, the complexity of scientific language provides some important opportunities for language exploration. A large percentage of the less frequent academic and technical vocabulary of English derives from Latin and Greek roots. So word formation often follows some very predictable patterns.
- ***Identify Rules and Conventions*** When students know some of the rules or conventions of how academic words are formed, they have an edge in extending their vocabulary. It helps them not only figure out the meanings of individual words but also how to form different parts of speech from these words.
- ***Relate Academic Words to Students' First Language*** This encourages students to relate the English word to their prior knowledge of the word (or related words in their first language). It also provides students with an opportunity to display and feel proud of their first language linguistic expertise.
- ***Identify and Practice Conjugates*** When we demystify how academic language works, students are more likely to recognize parts of speech in their

"When students know some of the rules or conventions of how academic words are formed, they have an edge in extending their vocabulary."

reading of complex text across the curriculum and to become more adept at inferring meanings from context. For example, a student who recognizes that *acceleration* is a noun (rather than a verb or adjective) has taken a step closer to the meaning of the term in the context of a particular sentence or text.

- ***Model Appropriate Academic Language*** If teachers provide good models, then students can extend their own command of more formal registers of language. In addition, students must be given the opportunity and incentive to use academic language in both oral and written modalities. For example, after a concrete hands-on group experience or project, students are asked to report back to the class orally about what they did and what they observed and then to write about it.

Conclusion

Science will assume relevance to students and be learned much more effectively when students can relate the content of instruction to their prior experience and current interests. In addition to activating students' prior knowledge and building background knowledge, we may need to modify our instruction in specific ways to make the content accessible to ESL students who are still in the process of catching up to native-speakers in academic English language proficiency.

These supports should focus not only on making the scientific content comprehensible to students but also on extending their awareness of how the language of science works. In this way, students can develop insights about academic language that will bear fruit in other areas. When we integrate these active uses of language with the science curriculum, students benefit both with respect to their knowledge of scientific content and language abilities.

REFERENCES

Chamot, A. U., and J. M. O'Malley (1994). The CALLA *Handbook: Implementing the Cognitive Academic Language Learning Approach*. Reading, MA: Addison-Wesley.

Collier, V. P., and W. P. Thomas (1999). Making U.S. schools effective for English language learners, Part 1. *TESOL Matters,* 9:4 (August/September), pp. 1 & 6.

Cummins, Jim (2001). *Negotiating identities: Education for empowerment in a diverse society.* 2nd edition. Los Angeles: California Association for Bilingual Education.

Díaz-Rico, L., and K. Z. Weed (2002). *The crosscultural, language, and academic development handbook: A complete K–12 reference guide.* 2nd edition. Boston: Allyn & Bacon.

Gibbons, P. (1991). *Learning to learn in a second language.* Newtown, Australia: Primary English Teaching Association.

Meyer, L. (2000). Barriers to meaningful instruction for English learners. *Theory into Practice,* 34(2):228–236.

Neuman, S. B. (1999). Books make a difference: A study of access to literacy. *Reading Research Quarterly,* 34(3):286–311.

PEARSON Scott Foresman

scottforesman.com
(800) 552-2259