“A Squirrel Came and Pushed Earth”: Popular Cultural and Scientific Ways of Thinking for ELLs

Kathryn M. Ciechanowski

Through the analysis of scientists’ practices and ways of talking and thinking, students can bring together everyday and academic languages to help them learn science.

Probably every elementary teacher has experienced a moment like this. You are gearing up to tackle a set of science concepts and preparing to conduct a science activity. Then, a student veers the discussion in an unanticipated direction and takes the class off course. Ms. Montclair, the third-grade teacher in this study, was no exception (all names are pseudonyms). Time and again students brought popular movies and cartoons to bear on their thinking about science topics:

Ms. Montclair: Today we’re doing an investigation or model on landforms.... Do you think the thin part [of Earth]—the crust—stays the same or changes?

Students: Changes.

Geno: An earthquake came.

Mona: A squirrel came and pushed earth.

Ms. Montclair: A squirrel, really?

Rafi: That’s from Ice Age.

Ms. Montclair: Oh, from a movie.

In this case, Ms. Montclair engaged in discussion of how forces (e.g., earthquakes) move earth’s crust and form mountains and volcanoes. Yet students were thinking about a popular movie in which an animated fictional character causes monumental change to earth and starts the Ice Age. As Ms. Montclair tried to get students to take up the scientific thought processes, they navigated back and forth between multiple academic and everyday texts.

Students—especially the English-language learners (ELLs)—faced multiple demands from the science texts and instruction. To make sense of the text, the third graders drew from numerous resources such as family experiences and travels, children’s magazines and books, and popular culture (e.g., movies, television, and print texts). In many cases, Ms. Montclair found their resources to be helpful and enlightening to class learning; however, in other cases, she did not take up their use of resources—particularly popular culture—as these resources distracted from her science focus. Students faced challenges in negotiating academic and everyday resources, in part, because they required further guidance in how to leverage their linguistic and cultural resources.

In this article, I begin with an exploration of the following questions: How do ELLs learn the language of schools? How do ways of thinking and talking vary between different contexts? Through the use of textual analysis, described in the methodology section, I investigate the linguistic and discursive features of texts that represent different ways of talking and thinking. In the following sections, I focus on disciplinary representations in the science textbook and their specific linguistic and discourse structures, particularly because instruction was heavily textbook based. Additionally, I analyze a popular cultural movie that students brought to bear on their learning of science. I used the movie storybook because students in this
study often drew from popular culture-inspired children’s literature (e.g., Disney storybooks or Ripley’s Believe It or Not picture books) and because it is an easily accessible source for teachers of the everyday language of popular culture (also see Tables 1, 2, and 3 for additional exemplars). After discussion of two types of texts, I demonstrate how some students—even in brief and unguided moments—were able to navigate between and bring together their everyday and academic resources to enhance their understanding. In the discussion, I explore the implications for teachers and suggest practices to help students navigate between different texts.

How Do ELLs Learn the Language of Schools?

Language is inextricably woven through everyday life, academic tasks, and societal contexts. Although children acquire language naturally at home and in communities as they progress from infancy to toddlerhood and beyond, learning sophisticated uses of language in schools and broader contexts often takes explicit instruction. Wong, Fillmore, and Snow (2000) reported,

All students require instructional support and attention to acquire the forms and structures associated with it [academic text]. This is especially true for English language learners. Often explicit teaching of language structures and uses is the most effective way to help learners. (p. 22)

Explicit instruction is important because ELLs often cannot rely on what sounds right or what looks right since they have had less exposure to English (for example, they may be less likely to distinguish *laffs* as an intentional misspelling used as a rhetorical tool in a popular cultural text, depicted in Table 1). Effective instruction connects language learning not only to school learning but also to developing a critical understanding of how language is used to empower (and disempower) people in society (Moll & Gonzalez, 1994; Valdés, 2001). Teaching English explicitly but as a separate entity disconnected from content learning and social contexts makes language learning seem irrelevant, uninteresting, and lacking a purpose.

Explicit teaching of linguistic structures should go beyond the word or sentence level to an exploration of the relationship between word, sentence, pragmatic, and social aspects of communicating in the real world for particular purposes.

The grammar instruction that learners of English as a second or foreign language require if they are to achieve advanced literacy skills must be discourse-based and discourse-grounded so that learners acquire not only

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Comics and Jokes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topic</td>
<td>Water on Earth</td>
</tr>
<tr>
<td>Textbook</td>
<td>“Look at a map of Earth. You can see that most water on Earth is found in the oceans. This water is salt water. Many plants and animals live in the ocean. But salt water isn’t good for the plants and animals that live on land or in fresh water.” (Frank et al., 2005, p. D7)</td>
</tr>
<tr>
<td>Popular culture</td>
<td>“More Laffs</td>
</tr>
<tr>
<td></td>
<td>Q) Why do sharks live in saltwater?</td>
</tr>
<tr>
<td></td>
<td>A) Because pepper water makes them sneeze.” (Pilkey, 2001, p. 57)</td>
</tr>
<tr>
<td>Classroom field notes</td>
<td>Teacher directs choral reading of pages D6–D7.</td>
</tr>
<tr>
<td>Mona:</td>
<td>I have another question: Is there such thing as pepper water?</td>
</tr>
<tr>
<td>Ms. Montclair:</td>
<td>You mean like...?</td>
</tr>
<tr>
<td>Mona:</td>
<td>Because on this joke it says...[repeats joke].</td>
</tr>
</tbody>
</table>
| Ms. Montclair: | Okay, what do you think? [Mona shrugs.]
| Ofelia: | If you got water and put pepper in it. |
| Ms. Montclair: | But does that come from the ground? |
| Students: | No. |
| Ms. Montclair: | That’s what makes the joke funny, right? |
### Table 2
**Nonfictional narrative**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Layers of Earth</th>
</tr>
</thead>
</table>
| **Textbook**         | “If you could cut the Earth open, you would see three different layers of rocks. At the surface of the Earth is the solid outside layer, called the crust. The crust is the part of the Earth you have seen.”  
“The crust is a thin outer layer. The rocks here are solid.” (Frank et al., 2005, p. C8) |
| **Popular culture**  | “I had dreamed of finding the *Titanic* since I was a boy. No one had seen it in almost seventy-five years. It lay two and a half miles down on the bottom of the Atlantic Ocean. This is far deeper than any diver can go.” (Ballard, 1993, p. 6) |
| **Classroom field notes** | Ms. Montclair: On this globe, it's bumpy, what's that supposed to show you?  
Students: Mountains.  
Ms. Montclair: What's blue?  
Students: Water.  
Ms. Montclair: What's below water?  
Students: Sand.  
Ms. Montclair: It's still part of the crust....  
Adriana: You know how *Titanic* went really deep, is there magma down there?  
[On the board, the teacher draws a ship sinking.]  
Ms. Montclair: You cannot go down into magma—it's still crust.  
Adriana: Yah, but it said really, really, really deep. |

### Table 3
**Science Fiction Movie**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Dinosaur fossils</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Textbook</strong></td>
<td>“Dinosaurs became extinct long before there were any scientists to study them. But scientists today can use fossils to learn how dinosaurs looked and how they lived. Using fossil bones, scientists can put together skeletons of dinosaurs. The skeletons show how large the dinosaur was and whether it walked on two legs or four.” (Frank et al., 2005, p. C22)</td>
</tr>
<tr>
<td><strong>Popular culture</strong></td>
<td>Transcript of <em>Jurassic Park</em> First Trailer</td>
</tr>
<tr>
<td></td>
<td>“Since the beginning of time, man has searched the earth for evidence of its past. While some have looked for clues to the mystery, one man has found the way to bring the mystery back to life.... Hidden on [this] private island, science has defied evolution. ‘Where do you get a hundred-million-year-old dinosaur blood?’ Genetics has mastered the creation. ‘We’ve made living biological attractions so astounding that they’ve captured the imagination of the entire planet.’ And, extinction is a thing of the past. ‘Welcome to Jurassic Park.’...‘Dinosaurs and Man—two species separated by 65 million years of evolution—then, suddenly thrown into the mix together....’”</td>
</tr>
</tbody>
</table>
| **Classroom field notes** | Ms. Montclair: Extinct—what does it mean?  
Maricruz: Dinosaurs are all gone.  
Geno: I know how you can make one. A mosquito took some dinosaur blood away and it’s stuck it somewhere....  
Mateo: In *Jurassic Park* the scientist says, “I’ll tell you something” and he goes into the basement and starts making dinosaurs—a big T. Rex—and he put a goat in it. All of the sudden you see a claw and drips of red stuff. Dinosaurs escape and they [the scientists] are all chasing dinosaurs....  
Ms. Montclair: Did people live in the time of dinosaurs?  
Students: No. |
In other words, instruction should focus on linguistic structures as they are explicitly connected to specific ways of talking, thinking, and interacting in socially appropriate ways in different contexts.

Gee (2002) wrote, “There is no such thing as language (e.g., English) or literacy (e.g., reading and writing) in general” (p. 162). In other words, there is no one version of English that will apply across all contexts; thus, children must learn how to appropriately use varieties of language in different contexts. “People do not learn English. Rather, they learn a specific ‘social language’ (variety or register of English) fit to certain social purposes and not others” (Gee, 2002, p. 162). For instance, ELLs may appear to be proficient in English when talking on the playground with friends, but they need to move beyond basic interpersonal communication skills to learn the academic and disciplinary language required to be successful in reading, writing, and talking in science (Cummins & Swain, 1986).

ELLs find it particularly challenging to learn the nuances of English words and to develop the facility with academic vocabulary and scientific meanings (e.g., see Table 2 for an example of scientific meanings of crust). Therefore, ELL teachers should explicitly connect each variety of English to its appropriate contexts and purposes, such as teaching and learning science, rather than teach separate or disconnected vocabulary or grammar lessons. Teachers should help children understand the differences and similarities in language used across everyday, academic, and disciplinary texts—not only textbooks but also trade books and student-chosen everyday texts, as well.

**How Do Ways of Thinking and Talking Vary Between Different Contexts?**

In different contexts (e.g., schools, local communities, the mass media), people integrate their use of language with particular ways of thinking, talking, valuing, and interacting in socially appropriate ways (Gee, 1996). So, for example, the scientific author of an academic text—who belongs to a scientific community in which accuracy, objective descriptions, and precise measurements are highly valued—makes language choices, in large part, based on these values (Lemke, 1990). Scientists would typically provide precise descriptions of how phenomenon act in the natural world (e.g., the glacier moves slowly) that are supported by quantified measurements, often using discrete numerals and explicit units of measurement (e.g., 30 centimeters).

In contrast, the writer of a cartoon movie script belongs to different communities (e.g., film marketing professionals and popular culture authors), which value entertainment, artistic achievement, and viewer engagement. This writer may aim to hook viewers with a high level of action, special effects, advanced animation techniques, likeable characters, and a storyline with rising action to a captivating climax. The author typically does not provide quantifications, precise measurements, or a scientific account of natural phenomenon. But, using words that convey action, emotion, and humor (e.g., action verbs, exaggeration, and demonstrative adverbs and adjectives), the author may try to captivate the interests of young children. In both cases, the scientific and popular culture authors choose specific words and language structures to serve particular purposes appropriate to each community’s values.

Learning to communicate in a content area (e.g., talking science) involves learning beliefs and values in addition to a set of linguistic forms (Hicks, 1995). Content area learning requires that students be socialized into the thinking processes, ways with words, and habits of mind of the content area. To be successful in school, students may need to translate everyday resources to scientific ways of talking and thinking expected in the content area. The scientific community is only one of many social spaces students must navigate and from which they learn particular ways of talking and thinking. Thus, instruction must take up particular ways of talking and thinking from everyday communities, as well. A science class in practice is a contact zone in which multiple ways of talking and thinking, various value systems, and different forms of representation are brought to bear on reading and writing (Moje, Collazo, Carrillo, & Marx, 2001). To be successful in a particular context such as science class, students must be able to navigate across the multiple linguistic structures, textual styles, and value-laden resources.
Methodology: How Were Data Collected and Analyzed?

The participants in this study were two third-grade bilingual science classes (i.e., 35 participants) in a Spanish/English immersion school of choice in which third graders received half of their instructional time in each language. Students displayed a range of bilingual proficiency levels from English-dominant to Spanish-dominant (and a few balanced bilingual abilities). A few were recently arrived immigrants while most families spent from a few years to two or three generations in the United States.

Ms. Montclair—a European American bilingual female—alternated between science and social studies units, each lasting approximately two to four weeks of instructional time. The researcher was a bilingual Latin American female who spent six months engaging in classroom observations (recorded as field notes), gathering artifacts such as classroom texts and written work, conducting in-process interviews, and collaborating on pre- and postunit assessments. Interviews and observations were focused by purposefully sampling 12 focal children to target a representative sample of participation levels and literacy levels and a range of observed social characteristics in the general school population.

For this particular study, the primary method of analysis was textual and discourse analysis. Analysis of text allows educators to note language features that might pose challenges to ELLs such as “potential points of confusion with semantics (meaning)” and “complex grammar or syntax (word order)” (Avalos, Plasencia, Chavez, & Rascón, 2007, p. 321). However, besides textual analysis used to help teach decoding and comprehension, textual analysis from a discourse theoretical perspective (Gee, 1996) aids in understanding text within larger contexts and the textual features that represent specific purposes and values. Linguistic features are not random features of the text but communicate a particular way of talking and thinking. Expository and narrative texts not only have different language features (Avalos et al., 2007) but also serve different purposes and are tools to achieve specific ends (see Tables 1–3 for exemplars). As a researcher, I chose a particular form of discourse analysis to analyze not only the linguistic features per se (i.e., reading the word) but also the contexts in which these texts are situated and the values and meanings that these linguistic features impart (i.e., reading the world).

Findings: Bringing Together Popular Culture and Science

To illuminate how the content areas include texts that represent different ways of thinking and talking, I examined two passages from resources drawn upon during the study of landforms. In a unit based on the science textbook, students often referred to the movie Ice Age as a source of their knowledge about glaciers. The student often turned to movie storybooks and popular culture-based books in their self-chosen reading, thus the movie storybook is an authentic and readily available source of everyday language. Carefully chosen texts can also be instructional vehicles that can combine language and literacy instruction for ELLs.

These scientific and everyday examples are instructive for several reasons. First, they demonstrate the kinds of language structures and thought processes that students must unpack to effectively read and write in science class, which are particularly tricky for ELLs. Second, they exhibit ways of thinking and talking typical to popular cultural texts that not only complicate students’ thinking about scientific concepts but also enhance opportunities for learning about natural phenomena. Finally, they demonstrate the rich potential for deep content learning and meaningful language development when instruction builds on the intersections among multiple texts and explicitly helps students navigate across these.

Glaciers: Language Used in the Science Textbook

In their study of earth science, third graders read a textbook section titled, “How Glaciers Change the Land,” in which the authors describe different forces that cause erosion (e.g., wind, water, frozen water, or glaciers). Analysis of this section demonstrates several scientific structures contained within a single page of text: causal relationships, relationships of taxonomy, precision and objectivity, and nominalizations.

Causal Relationships. Scientists often write about how a natural phenomenon is caused by processes or forces in nature, and these phenomena or processes are related in specific ways that are often
represented in words, flow charts, diagrams, or models. For instance, beginning with the lines, "Erosion can also be caused by moving ice. Glaciers are huge sheets of ice. They form in places where it’s so cold" (Frank et al., 2005, p. C44), we see how the author used the verb caused to emphasize causal relationships between natural phenomena—representing a scientific genre called science explanations.

Causal relationships and the words chosen to demonstrate them are key features necessary to understanding the science text, yet they can be particularly challenging for science novices because they require moving from a simple retelling of a lived experience to explaining a "general description of a scientific process" (Schleppegrell, 2004, p. 117). In these explanations, scientists often use the general present tense verb (e.g., form) and talk about forces or processes as the agent of an action (instead of people or animal characters).

**Relationships of Taxonomy.** Scientists emphasize relationships of taxonomy; in other words, they describe the relationship between higher and lower level classifications. For example, the superordinate category represented in this chapter is forces on land, and the subordinate category is glaciers because they represent one of multiple forces that change land. In subsequent paragraphs, the authors introduce two new subcategorizations of glaciers: “Valley glaciers form near mountain peaks. They move slowly downhill like rivers of ice.... Continental glaciers are sheets of ice that are much bigger than valley glaciers” (Frank et al., 2005, p. C44). Valley and continental glaciers are types of glaciers characterized by specific locations, speeds, and sizes. As part of their work, scientists spend considerable effort classifying phenomena and articulating the relationships among properties, characteristics, and categories of phenomena. This scientific text is especially demanding for ELLs because it is densely packed with many key concepts, explanations, and taxonomies without any explicit mention of how the pieces of information fit together into the overall structure.

**Precision and Objectivity.** In general, scientific texts attempt to maintain neutrality and an informational tone, steering clear of colorful or emotional language. “The language of science is often represented as abstract, objective, and information-oriented” (Schleppegrell, 2004, p. 117). For example, in the passage about valley and continental glaciers, the authors often use verbs such as form and move, which are typical to scientific texts and belie an emphasis on precision and objectivity. This kind of language is particularly challenging to ELLs because it avoids first person pronouns and uses passive voice, making the text seem boring, abstract, and distant from their personal life.

**Nominalizations.** The authors used nominalizations (i.e., when actions or processes become nouns or things) to provide succinct terms that can be understood across scientific communities. For example, Frank et al. (2005) wrote, “After weathering breaks up rocks, erosion moves the pieces around. Erosion is the movement of weathered rock and soil” (p. C42). In this case, weathering and erosion are generalized terms for different sets of processes that can be caused by many forces such as water, wind, or ice. A lot of information is packed into each singular term that would otherwise need a long clause to explain. Further, the author uses nominalizations for the terms erode or move (i.e., erosion and movement), “condensing what might otherwise be a lengthy explanation about this process into a single nominal element” (Schleppegrell, 2004, p. 72). In nominalizations, general scientific processes (i.e., weathering or erosion) are the agents of action, making these concepts seem abstract with an unspecified and intangible agent. They provide succinct descriptions of scientific concepts; yet, they can make a text particularly dense and difficult for novice science readers, especially ELLs.

**Careening Ice: Language Used in Popular Cultural Texts**

When studying glaciers, students talked frequently and at length about the movie Ice Age, perhaps partly because it provided more visual connections and
concrete images of glaciers than did the textbook. Indeed, in this excerpt, Ms. Montclair considered showing a clip of the movie in class and promised to search for a helpful part to show.

Ms. Montclair: Have you seen the movie Ice Age?
Alexis: The glacier squeezes together and a little squirrel gets stuck in it.
Mark: Can I bring it?
Ms. Montclair: Bring it tomorrow and maybe we can see it in recess or something. I’ll look at it and see if any parts will help us.

The teacher did not end up showing the movie during academic time. The humorous and imprecise ways of talking and thinking in Ice Age seemed distant from the scientific language and academic expectations in class. Close analysis of the linguistic and textual features of an adapted storybook of Ice Age (Krulik, 2002) demonstrates how the author’s language choices impart a value on entertainment, action, comedy, and fun. The author achieves these values using fast-paced action and using humor and make-believe characters, described in the following sections. The final section contrasts the language used in both the everyday and academic texts represented in this study.

Fast-Paced Action. The storybook adaptation begins with a squirrel trying to bury an acorn in a glacier. His force on the glacier cracks it and causes pieces to separate and drift away, leading the squirrel to run quickly to escape the fast-moving glaciers. In stark contrast to the slow movement of glaciers depicted in the textbook, the verbs in Ice Age text impart a sense of commotion and fast pace. The author writes, “The tiny scrat jumped up and down on his acorn, attempting to stomp it into the ground. This forced a crack in the ice—not just a small crack, but a rift that spread across the ice plain and all the way up a tall glacier” (Krulik, 2002, p. i). The squirrel-like creature exerted enough force to produce a rift that spread a long distance.

With verbs such as jumped, stomp, forced, and spread, the reader can sense fast-paced action in this scene. The subsequent sentences describe how the ice careened across glaciers and was knocking them down—such chaos that frozen rocks were falling all around. These verb structures lead to a feeling of excitement and commotion drawing readers immediately into the story, in contrast to the controlled and precise verbs (e.g., form, move, and are) in the science textbook. The word choices in this story demonstrate value placed on audience engagement, which is achieved through action, excitement, and fast pace.

Humor and Make-Believe Characters. Likewise, the humorous and fictional nature of this story is achieved through the use of emotionally based adjectives and adverbs in addition to anthropomorphism, in which the author uses strategies to personify the squirrel by giving him emotions. In the midst of the chaos of this scene, the scrat watched with fear as ice flew around him. This human-like characteristic adds to the emotional connection and the viewer engagement in this scene.

What is more, the scrat is described as tiny, yet the crack produced by his diminutive force was “not just a small crack” and “spread across” two substantive formations of ice (Krulik, 2002, p. i). Humor is achieved when a tiny creature only wanted to bury his acorn but unknowingly caused the beginning of the ice age. A squirrel and its food-preserving behaviors seem to be so small and commonplace, yet in this story they caused a mammoth event. This juxtaposition of an unremarkable and earth-changing event adds to the comical and unbelievable nature of this text.

Comparisons in Language

In contrast, the science textbook seemed lacking agents and described the changes to land as being caused by general processes such as erosion. The forces (e.g., glaciers moving slowly) are so large that they seem abstract and hard to imagine. It may be hard for an adult, let alone a third grader, to visualize a huge sheet of ice sliding over rock and piling up hills that create whole valleys or scooping out rock that forms huge holes that become lakes.
the scientists seemed concerned with describing the logical connections among abstract or generalized processes, the author of Ice Age (Krulik, 2002) described an illogical—yet funny and engaging—scene in which a small critter caused an entire ice age that forever changed life on earth.

The author of Ice Age (Krulik, 2002) seemed less concerned with creating logical and precise descriptions of concepts and events. In contrast, the authors of the science textbook (Frank et al., 2005) demonstrated a concern for precisely describing different types of glaciers and defining the unique qualities of valley and continental glaciers. But the author of Ice Age used a number of vague and imprecise terms to talk about ice formations and glaciers. In the short span of five sentences she wrote about "cracks in the ice," "ice plain," "glacier," "chunks of ice," "frozen rocks," and "Ice Age" without describing any of the terms (Krulik, 2002, p. i). Indeed, the third graders in this study repeatedly asked for clarification about the size of a glacier. But concepts about ice formations were muddled in this story; they created the impression that ice was breaking and flying everywhere and that chaos ensued. As exemplified in these two textual exemplars, the scientific and popular cultural authors talk and think about glaciers differently because of varying intentions, purposes, and membership in communities.

**Implications for Teaching**

As Mona exemplified, students occasionally brought together knowledge from academic curriculum and from everyday resources to gain deeper meaning about natural and social phenomena. Their everyday resources informed their learning of curriculum, and their knowledge from school informed how they made sense of out-of-school texts. However, these intersections may have contained untapped potential for students to learn more deeply about content and to negotiate multiple resources.

In this study, Ms. Montclair dedicated nonacademic time or a brief two minutes during class to discuss everyday resources that were prominent in students’ thinking and conversation. She described the considerable pressure to get through the curriculum to keep up with the district’s pacing chart and to prepare students for the upper grades. Perhaps at times the use of everyday resources seemed to be a distraction from her instructional goals.

Without significant attention to use of resources, students did not always fully leverage or skillfully
navigate across multiple sources of knowledge and variety of texts. What would have been the outcome if Ms. Montclair asked students: How do scientists think about movement of glaciers? How do cartoon authors think about glaciers and moving ice? What evidence is there in each text about how the authors think? How do their particular ways with words give them (or not) power in society? By posing these questions and helping students investigate the linguistic, textual, and visual cues to answer these questions, the teacher could help students gain a deeper understanding of scientific phenomenon, how scientists do their work, how popular cultural authors do their work, and how to navigate sources of knowledge to access particular meanings.

Learning to Negotiate Meaning
Each content area class is a contact zone (Bhabha, 1994) in which multiple forms of representation and sources of knowledge come together in ways that have the potential to be sites of deep learning. For example, constructivist instructional approaches incorporate techniques such as collaborative group work and inquiry-based learning to help students gain experience navigating across resources and negotiating for meaning. Faltis and Coulter (2008) described an ELL classroom in which the teacher expected students to negotiate meaning but scaffolded their learning of science and language. During group work, this teacher used realia to connect vocabulary to concrete objects, body language to act out specific concepts, and colorful highlighters to mark keywords.

Having students of different language and academic abilities exchange information requires them to negotiate for meaning; that is, to clarify ideas, to confirm or disconfirm understanding, to restate ideas, and to use precise language in ways that are aligned with scientific language uses... Negotiations... enable students to try out and appropriate different ways of expressing meaning through language. As students negotiate, they develop proficiency in language, and at the same time, appropriate the particular register needed for meaningful interaction... (pp. 135–136)

Learning scientific language can be especially challenging for ELLs, so activities—such as group work—that allow students to try on new words and get a feel for them promote student competency in talking, thinking, and inquiring like a scientist. In this kind of educational context, students use all available languages, resources, and sources of knowledge to take up scientific ways of talking and to engage in scientific communities. The teacher provides support and explicit instruction in appropriately using multiple texts, forms of representations, and varieties of language.

Navigating a Variety of Resources Including Popular Culture
In the classes in this study, children frequently talked about television shows, cartoons, movies, magazines, and books from popular culture. However, Alvermann, Moon, and Hagood (1999) suggested, “Consumers of all ages and backgrounds, but children and youth in particular, often are criticized for mindlessly buying into these cultural artifacts” (p. 2). Some educators cringe at the thought of using popular culture as a tool for historical and scientific learning and would prefer to leave these texts beyond the walls of the classroom (Wineburg, Mosborg, Porat, & Duncan, 2007). Yet increasingly, educators recognize popular culture’s influential role in students’ understanding of natural and social scientific phenomena. “Rather than pretending that we can do away with popular culture, we might try instead to understand how its forces can be marshaled—rather than spurned or simply ignored—to advance students’ historical [and scientific] understanding” (Wineburg et al., 2007, pp. 67–68).

In an example from social science, Wineburg and colleagues (2007) described how teachers could take up the narratives students bring to class (e.g., the popular movie Forrest Gump) and “stretch them or call them into question” (p. 68) so that they become resources for thinking critically about dominant, mainstream narratives and for uncovering silenced or hidden narratives. For example, many students in their study cited Forrest Gump as a key resource in their thinking about American history, particularly about Vietnam War protests. The authors suggest that teachers could draw from resources beyond the textbook and use the popular movie to engage students in critical thinking about the soldier-turned-protestor’s pivotal role in changing public opinion about the war. In other words, “by stopping the DVD
Learning to Talk and Think Like Scientists

Scientists belong to a community of people who communicate with each other and share particular values and beliefs. “We communicate best with people who are already members of our own community: those who have learned to use language in the same ways that we do” (Lemke, 1990, p. x). As demonstrated earlier, scientists value logical relationships among natural phenomena (i.e., cause and effect) and, thus, spend significant time and effort describing generalized processes that occur in nature (as evidenced by present tense verbs and forces or processes as agents of action).

Students, however, may not understand how scientific communities are constructed through specific ways of making language choices, reasoning, observing, analyzing, and shaping arguments. “Science teachers belong to a community of people who already speak the language of science. Students, at least for a long time, do not” (Lemke, 1990, p. x). Science teaching should socialize students into these ways of talking and thinking and into becoming part of this scientific community. “We have to learn to see science teaching as a social process and to bring students, at least partially, into this community of people who talk science” (Lemke, 1990, p. x).

Students are often most comfortable understanding and using language from their everyday life and discussing ideas not with scientific language but with informal, everyday language. Teachers and students should exploit their everyday language as much as possible as students gradually take up and use scientific words and discourse. Lemke (1990) suggested that teachers regularly employ translation practice in which students translate back and forth from everyday and scientific language. “Students should regularly have oral, and occasionally written, practice in class in restating scientific expressions in their own colloquial words, and also in translating colloquial arguments into formal scientific language” (p. 173).

For example, Ms. Montclair could have students construct comedic stories about forces in nature then, conversely, restate the stories in scientific ways, noting explicitly how the scientific version employs a shift in focus and structure (or perhaps turn textbook language into a popular culture-type script). The power in this approach comes from how the teacher guides students in understanding the nuances in language and the values or purposes underlying language differences. “Teachers should explicitly discuss with students the fact that scientific language tends to use certain forms of grammar and argumentation, emphasize abstract principles rather than human actions, and avoid humor, fantasy, and many kinds of metaphor” (Lemke, 1990, p. 173). Children should explore differences and similarities in everyday and scientific language and should learn how to navigate across these kinds of text types.

Integrating Academic Languages and Everyday Languages

As Mona’s exemplar shows, untapped potential exists within the contact zone where points of innovation and contestation can be leveraged in productive ways to further students’ content understanding. With carefully planned and responsive instruction, teachers and students can cocreate learning environments and practices in which they use everyday and academic resources and find ways to exploit the potential of each. Through analysis of students’ and scientists’ practices and ways of talking and thinking, students can bring together everyday and academic languages in the learning of science. The teacher can explicitly guide students in navigating across texts and understanding different forms of representation to enhance learning.

“A Squirrel Came and Pushed Earth”: Popular Cultural and Scientific Ways of Thinking for ELLs
References

Literature Cited

Ciechanowski is an Assistant Professor in ESOL/Bilingual and Literacy Education in Teacher and Counselor Education at Oregon State University, Corvallis, USA; e-mail Kathryn.ciechanowski@oregonstate.edu.