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Supporting emergent bilinguals' argumentation: Evaluating evidence in informational science texts

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ABSTRACT

Much of the research on teaching argumentation has focused on the genre, its features, and ways to support students in orally constructing or writing an argument, but far less is known about what students need to do as readers in preparation for writing an argument. The case study presented here explores how close attention to language features commonly found in informational science texts can support fourth-grade emergent bilinguals in identifying and evaluating evidence. It illustrates how, with functional grammar metalanguage of *usuality* and *likelihood,* a teacher can facilitate discussions about words in science texts that indicate authors' degrees of uncertainty and in turn support students' evaluations of evidence. Analysis of the instructional discourse also reveals potential pitfalls in this approach, as degrees of uncertainty expressed by an author do not make evidence inherently strong or weak. The strength of evidence must be determined through considering its relationship to the claim.

1. Introduction

Teaching students how to construct a text-based argument in science involves teaching students how to read and understand informational science texts from which they can draw evidence. Yet reading science texts and extracting evidence to support an argument is a complex process for a variety of reasons, one being that authors of science texts use particular words and phrases that enable them to make reasonable claims. Readers who do not attend to these words that communicate likelihood, or degrees of uncertainty, may oversimplify an author's claim. Consider the following sentence from the text used in the study presented here: "In these experiments, damage to other living things appears to be low." If a reader fails to notice the way the word *appears* communicates a lack of certainty, this claim will be misinterpreted. Especially when learning English as an additional language, a reader may replace an unfamiliar verb with a more common verb that is similar but, unbeknownst to the reader, significantly changes the meaning of the sentence. For example, if a reader replaces the phrase *appears to be* with *is*, this claim will be interpreted as a proven fact rather than a finding based on empirical research that accounts for degrees of uncertainty. In addition to communicating degrees of uncertainty, particular words and phrases in science texts reveal authors' perspectives, attitudes, and biases in subtle ways (Palincsar & Schleppegrell, 2014). Although often assumed to be objective, authors of science texts are *people* whose stances are reflected in the texts they write. By focusing on how specific words and phrases communicate degrees of uncertainty and reflect an author's personal perspective, teachers can facilitate students' critical analysis of informational science texts (O'Hallaron, Palincsar, & Schleppegrell, 2015) and, in particular, teachers can support students' evaluation of text-based evidence.

Noticing the ways in which authors' word choices shape both how and what information is presented can raise students' awareness of the relationship between language and meaning. Developing such metalinguistic awareness is especially important for students learning English as an additional language. Bilingual students generally possess greater degrees of metalinguistic awareness than monolingual speakers (Menyuk & Brisk, 2005), but they often do not leverage this knowledge in support of their meaning-making with texts in their second language (Grabe, 2009). To facilitate students' metalinguistic awareness in service of meaning-making, teachers need to be cognizant of the language demands specific to each subject area they teach (Bunch, 2013; Turkan, de Oliveira, Lee, & Phelps, 2014), and they need to leverage the linguistic resources their students possess (Jiménez et al., 2015). Cultivating emergent bilinguals' metalinguistic awareness

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by focusing on an author's word choice gives these students more opportunities to make form-meaning connections at the micro level of a text (Palincsar & Schleppegrell, 2014). To comprehend science texts and use them as sources for evidence in an argument, students must learn how to notice and decipher the meaning of individual words and phrases that communicate degrees of uncertainty. By doing so, they can more accurately determine if and how a piece of evidence can support their argument.

To talk about language, teachers need a metalanguage to name text features and discuss their function (Schleppegrell, 2013). In the study presented here, the teacher used a functional grammar metalanguage of *usuality* and *likelihood* to help students notice and discuss the meaning of words that communicated degrees of uncertainty so that students could evaluate the strength of evidence. This particular metalanguage is associated with Systemic Functional Linguistics, SFL (Halliday, 1978). SFL is a sociolinguistic theory of language development that helps to explain how language develops in social contexts for communicative purposes (Halliday, 2004; Wells, 1994). When applied to classroom contexts, using an SFL-inspired metalanguage can support emergent bilinguals' critical analysis of text (O'Hallaron et al., 2015; Schleppegrell, 2010), writing (Gebhard, Chen, & Britton, 2014; Gebhard, Harman, & Seger, 2007; Harman, 2013; O'Hallaron, 2014a,b) and academic language development (Moore & Schleppegrell, 2014; Schleppegrell, 2004, 2013). This line of instructional research is responsive to calls for an integration of explicit attention to language in meaningful, content-focused learning contexts (Lee, Quinn, & Valdés, 2014), and this research speaks to what is required of students when constructing an argument in science.

Argumentation in science requires the integration of science content knowledge, reasoning, and language. When texts are used as sources for evidence, constructing an argument requires reading comprehension, finding potential text-based evidence, and evaluating evidence to determine whether or not it can support a claim. The act of determining if and how a piece of evidence supports a claim can be one of the most challenging aspects of developing an argument (O'Hallaron, 2014a,b). Much work has been done on scientific discourse (e.g., Cavagnetto, 2010; Lemke, 1990; Passmore & Svoboda, 2012), the link between argument and scientific thinking (e.g., Kuhn, 1993), and writing in science (e.g., Halliday & Martin, 1993), but an instructional approach that integrates attention to the language in informational texts students rely upon to support argumentation in science, or other content areas, is not happening in most U.S. classrooms. It is often the case that it takes a while for research to make its way into teachers' hands in any large-scale way, but it may also be the case that using an SFL-inspired metalanguage to facilitate language and content learning requires specialized knowledge. In order for such knowledge to become an integral part of teachers' pedagogies, more understanding is needed—by teachers as well as those responsible for curriculum and professional development—about the kinds of linguistic knowledge teachers need to support emergent bilinguals in meeting both content and language objectives. With this study, I aim to redress these gaps by asking: How can close attention to language support emergent bilinguals in identifying and arguing about evidence? What are the challenges teachers may encounter when adopting such an approach? What kinds of knowledge do teachers need so that a focus on language can serve disciplinary goals?

2. Theoretical and research perspectives

2.1. Argument in science

Argumentation is central to the discipline of science (Cavagnetto, 2010; Eduran, Simon, & Osborne, 2004; Kuhn, 1993; Osborne & Paterson, 2011), and with the recent advent of standards that emphasize disciplinary literacies (Shanahan & Shanahan, 2012), argumentation has assumed a prominent position in school science. According to the Next Generation Science Standards (NGSS) and the National Research Council's framework for K-12 science education (National Research Council, 2012), students are expected to develop a holistic understanding of science through engaging in scientific and engineering practices such as engaging in the development of arguments supported by evidence for the purpose of collectively building and evaluating knowledge (Lee, Quinn et al., 2014). These disciplinary practices—developing arguments, building and evaluating knowledge—are language intensive; they require students to use scientific discourse to construct knowledge, communicate conceptual understanding, and persuade other people.

Constructing an argument in science often includes reading and critically analyzing informational texts. For students to construct an argument and skillfully use evidence from informational texts to support their claims, they need to understand both the scientific issue under discussion and the structure of an argument (Christie, 2012). To develop students' understanding of an issue, teachers can use informational texts that provide information about the concepts and topics that reside at the center of the issue. Referred to as sense making of the phenomena (Berland & Reiser, 2009), this phase of constructing an argument also includes connecting evidence with claims. It is through constructing the causal relationships among phenomena, as written about in text or observed in an experiment, that supports robust conceptual understanding. "Reading provides opportunities for students to revisit concepts about physical phenomena experienced directly or through models in the classroom, to view these phenomena in the wider context of the world outside the classroom, and to learn about how these phenomena are studied by professional scientists" (Cervetti, Barber, Dorph, Pearson, & Goldschmidt, 2012, p. 634). Furthermore, through reading about and discussing the pertinent concepts, students can become familiar with the ways in which authors use language to explain or describe the concepts (Christie, 2012). The ways in which authors use language in informational science texts are unique, and they present particular challenges for students, especially for those who are learning English as an additional language.

2.2. The challenge of science texts

The informational science texts that students read to develop domain knowledge and draw evidence consist of technical vocabulary, abstract concepts, and complex linguistic features, which pose unique challenges for readers (Fang & Schleppegrell, 2008). Authors use technical vocabulary to name, classify, and/or describe complex structures, processes, and phenomena (Fang & Schleppegrell, 2008). For many young readers, especially emergent bilinguals, this vocabulary may be unfamiliar until students have had substantial exposure to concepts in a variety of contexts. Another challenge is the level of abstraction in science texts. Processes are often packaged into abstract nouns; this *nominalization* requires careful monitoring of comprehension because the reader has to decipher implied cause and effect relationships that can be omitted in nominalization (Fang & Schleppegrell, 2008). *Endophoric referents* (e.g., this, that, they) can present an additional challenge in informational texts (Schleppegrell, 2004). To establish referential relations throughout a text, a reader must track to what or whom a pronoun refers (Van den Broek & Kremer, 2000).

One challenge of particular importance when using texts to support argumentation in science are the ways in which authors of science texts communicate degrees of uncertainty. Scientists use arguments because they are tentative about their findings yet their