Language in academic subject areas and classroom instruction: what is academic language and how can we teach it?

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In this paper, I define academic language as a set of linguistic *registers* that construe multiple and complex meanings at all levels and in all subjects of schooling. I show how the challenges of academic registers extend far beyond learning vocabulary by illustrating how meaning related to agency, logical connection, reference, and interpretation are presented in the grammatical as well as lexical features of texts at different levels. I then review research on the role oral language can play in supporting students' development of academic registers: by engaging them in movement between everyday and specialized ways of construing the new knowledge they are developing, by making the reasoning expected in different subjects explicit, and by explicit talk about form-meaning relationships. I discuss disciplinary differences in the challenges of academic language and make recommendations for further research on oral and written academic registers.

Introduction

Let's start with a sentence from an 11th grade history textbook:

> The destruction of the buffalo and removal of Native Americans to reservations emptied the land for grazing cattle.

This sentence is, of course, out of context; we'll see the passage it came from in a few minutes and learn what students are expected to do with it. But let's consider the challenges of language like this by thinking about how a teacher might express the same ideas in explaining what the sentence means:

> Settlers and hunters killed all the buffalo and the government forced all the Native Americans to leave their lands and move to reservations. Because the animals and people who had lived on the plains were gone, the land was available, so ranchers began to raise cattle.

The textbook sentence presents a lot of information in one sentence. In order to explain what it means, a teacher needs several clauses, each expanding on some part of the written sentence. The textbook organizes information by distilling concepts into a few words, creating sentences that are densely packed. To express the meaning in this sentence in the way it might be explained to

students, I had to think about each sentence constituent and transform it into some other wording. Each phrase of the two-part subject, *The destruction of the buffalo and removal of Native Americans to reservations,* became a whole clause and the two clauses together a sentence. In the textbook sentence the notion 'empty' is presented as an action. In the explanation of the sentence this notion of emptying the land for cattle raising is made explicit as a cause-effect sequence with *because*. In construing *empty* as an activity, the textbook sentence represents the actors responsible for the 'emptying' of the land as *The destruction of the buffalo and removal of Native Americans to reservations.* These are not people or groups of people; they are abstractions, and as abstractions, they leave out information that has to be put back in to explain who destroyed the buffalo and removed the Native Americans. In this case, some may argue with my decision about how to name the actors, and others might think I didn't say enough about the extinction of the buffalo and about what happened to Native Americans as I explained the textbook sentence.

This exemplifies how understanding the textbook language requires some interpretation. *Destruction of the buffalo* and *removal of Native Americans to reservations* are nominalizations; noun phrases that condense information that requires whole clauses and sometimes many clauses to reconstruct. Nominalization is a linguistic resource for building up knowledge and developing explanations and theories. It is not possible to build up educational knowledge without this linguistic resource, but to understand language like this, students need to recognize the knowledge that is incorporated into the phrases and understand how an author can build from one sentence to another by condensing and distilling concepts and presenting them in these dense forms.

When writers use nominalizations, they demonstrate that they are expecting the reader to be able to connect with the information that has been distilled into these words and phrases. Typically they can assume this because the text has already provided information–for example, about the buffalo and Native Americans–so students can be assumed to be familiar with these events. But of course such an assumption is not always warranted, and the texts of schooling are packed with language like this; nominalizations that condense a lot of information into a single word or phrase. When we try to recover that information as readers, for example, to tell someone else what it means, we need to expand the noun phrases into clauses with subjects, verbs, and objects, requiring that information be added. The information that is added reveals the knowledge and interpretation that the reader brings to the task.

The textbook language speaks with an authoritative voice, but there is always some judgment and attitude behind that voice; often expressed in language that subtly and implicitly introduces a point of view. In this case, the sentence implies a causal relationship between the destruction and removal and the growth of ranching on the plains that others would challenge. These aspects of this academic language sentence–its density of information, eliding of agency, and authoritative incorporation of an implicit point of view–are some of the ways that the language of schooling challenges students. In a few minutes I'll return to this example with more information about the text in which it appears in the disciplinary context of learning history. But first I develop the notion of academic language further.

What is academic language?

Academic language is the language used in schooling for purposes of learning. It evolves along with the knowledge students develop across the years of schooling and across different subject areas, becoming more dense and abstract as students advance. Because what takes place in school is the development of new knowledge that is specialized, the language used to construe that knowledge takes on specialized features that make it different from the language we use in living our everyday lives. Students encounter the linguistic patterns of academic language in the contexts, tasks, talk, texts and tests of school subjects. Academic language draws on discourses of mathematics, science, history, language arts, and other subjects, recontextualized for purposes of schooling and becoming more challenging at every level.

Everyone learns the language of the speech communities that they are born into, and every speech community has evolved ways of using language that are functional for that community's needs. Every speech community has complex ways of using language and elaborated genres and speech events. For schooling, too, specialized ways of using language have evolved that are functional for presenting and engaging in the tasks, texts, and tests students encounter. Even most students whose home language is the same as the variety used in schooling face new expectations for language use at school, as learning school subjects necessarily entails using language in new ways; but for English language learners and speakers of socially marginalized dialects the challenges are great. Academic language forms are used to do the things we expect good students to accomplish: to read and write reports and arguments; to hypothesize, draw generalizations from specific cases to build a theory and develop an explanation; to speak and write in a voice that is authoritative in its presentation. As students

move on in school, academic language takes on features of scientific and technical fields and the language of bureaucracy, so developing facility with reading, writing, and speaking in new ways is important for participating in and contributing to society. While academic language is sometimes contrasted with spoken language, it is more appropriate to contrast academic language with 'everyday' language, as academic language is both spoken and written. It is the language of interaction in the classroom in discussion on academic topics as well as the language of the texts students read and write. Students develop academic language over different timescales: over the course of a unit of study for each topic, over each year of learning, over their whole schooling experience.

The notion of academic language developed out of research in the 1970s and 1980s that focused attention on the challenges of the language children engage with at school. Heath's (1983) ethnographic research, for example, illustrated how children are socialized in different ways in their use of language because of differences in the ways language is valued and used in their communities. This positions them to respond in different ways when presented with literacy situations. Snow's (1983) analysis of children's interactions with their caregivers showed that some children engage in what she called 'decontextualized' language, not supported by face-to-face dialogue, and that the 'literate' features of this language make it different from the language of informal social interaction. Cummins (e.g., 1981; 1984), drawing on research with bilingual children, argued that assessment of these students' language proficiency should involve more than tests of spoken interaction, including tasks requiring students to use language that can be understood without reference to the context in which it is produced and that calls for focused attention to language itself. Both Cummins and Snow pointed to particular features such as more complex sentences and more precise and elaborate vocabulary as characteristic of academic language. Other work in this time period established that children whose home language experience does not include language used in the ways expected at schooling will face challenges in learning school language (e.g., Snow et al., 1989), and that their teachers may find it difficult to follow their reasoning (e.g., Michaels, 1981), or may fail to recognize the logic in their writing (e.g., Shaughnessey, 1977). This research stimulated much interest in issues of language use at school.

At the same time, functional linguists were developing frameworks for describing language in its social context in specific and elaborated ways. In particular, a meaning-based

grammar grounded in Michael Halliday's theory of systemic functional linguistics (SFL) (Halliday, 1978; 1985) became available, providing a framework researchers could use to look systematically at relationships between form and meaning in the language used in different social contexts. While in the U.S., issues of dialect variation took prominence in discussions about language and schooling, researchers in Canada (e.g., Mohan, 1986; Mohan et al., 2001) and Australia (see Christie, 2004 and Martin, 1993, for reviews of this work) were analyzing register variation and exploring features of the language used in schooling, using SFL theory and discourse analysis tools. Frances Christie set an agenda for this work, arguing that language is the "hidden curriculum" of schooling (1985; 1999) and that success in school is largely a language matter, calling for students to learn to manipulate the patterns of discourse characteristic of the knowledge, information and ideas that schools value. She suggests that "[t]hose who fail in schools are those who fail to master the genres of schooling: the ways of structuring and of dealing with experience which schools value in varying ways" (Christie 1985, p. 24). Following from this, she and others set out to articulate what is it that students need to be able to do in language in order to be successful in learning activities.

Functional linguists have provided fruitful analyses of language in the context of schooling over the past 30 years. Their work, grounded in discourse analysis of the texts students engage with at school and the classroom interaction through which teachers and students talk about academic content, identifies key genres (tasks and text types) of different disciplines and describes the patterns of language that construct those genres. This research shows how academic language involves constellations of features that together construct texts that challenge students because of the *fields of knowledge* that they construe, the *tenor* of the interpersonal relationships they enact and the *modes* through which students encounter them. Variation in the language that construes the field, tenor, and mode variables is the source of variation in academic language registers.

Register variation is language variation according to contexts of use. This is in contrast with *dialect* variation, which is language variation according to the *user* or the speech community. Speakers of all dialects of English draw on a range of linguistic resources, depending on whom we are interacting with, the topics/fields we are engaged with, and the mode through which we are interacting or presenting our messages. These three variables–the field of activity, the tenor of the interaction, and the mode of language use–are always represented in

every clause we write or utter, so exploring variation in the language that realizes each of these variables helps us see what is distinctive in academic registers. (Snow & Ucelli (2009) also use a three-way distinction to describe academic language, with *self and audience, message,* and *organization* as variables.) The fields addressed in schooling call for language relevant to the disciplinary learning. The texts students engage with at school call for understanding and presenting diverse authorial perspectives. The mode of language use often calls for presenting knowledge in speech and writing that can be understood without dialogue and interaction. Each of these aspects of the context of schooling shapes the *language of schooling* (Schleppegrell, 2001; 2004), the academic registers used to present knowledge to students and through which they need to engage with and report on what they have learned.

Illustrating register variation: two texts

As shown above, academic registers vary in the ways they organize and present information, in the ways they develop logical reasoning, and in the ways interpretation is incorporated. In this section, variation in the ways these and other functions of language are typically encountered in the texts students read at school is illustrated in example texts at two levels. The examples are different in many ways and are not meant as definitive of academic registers; students encounter other genres, engage with other topics, and deal with texts at other levels of schooling, but these texts illustrate aspects of comprehension challenges, especially for English language learners (ELLs). In particular, the discussion shows how word meaning is shaped by the texts in which words occur and how the meanings built up in the texts come from both their lexical and grammatical features. It also suggest how teachers can raise students' consciousness about how meaning is presented in texts through attention to their linguistic patterns and illustrates how register variation can be a focus of attention in classroom discussion.

Academic language in early schooling: an example

Even the early years of schooling require that students engage with challenging academic registers, and the language becomes more abstract and dense as they move through the grades. Consider this text passage from a story about how children in Iceland help puffling chicks to survive their first hours. It appears in a widely-adopted third grade reading and language arts program:

> In the darkness of night, the pufflings leave their burrows for the first
> flight. It's a short, wing-flapping trip from the high cliffs. Most of the
> birds splash-land safely in the sea below. But some get confused by the

village lights—perhaps they think the lights are moonbeams reflecting on the water. Hundreds of the pufflings crash-land in the village every night. Unable to take off from flat ground, they run around and try to hide. Dangers await. Even if the cats and dogs don't get them, the pufflings might get run over by cars or trucks. (From *Night of the Pufflings* by Bruce McMillan)

Teachers report that this paragraph is difficult for students to understand. The challenges come from the academic language register used by the author, and are not just from the vocabulary. While some of the words–for example, *pufflings, burrows, village, moonbeams,* may be outside the experience of many children, most of the words are not unusual. It is the patterns in which they occur that make this text challenging for many young readers. This passage draws on a literary register to construct a text that is written to entertain as well as to inform. Phrases like *in the darkness of night; a short, wing-flapping trip from the high cliffs;* and *dangers await* put words together in ways not typical of ordinary talk. This is challenging, but just learning the meaning of words and phrases is not enough to understand the text. To go beyond identifying words and phrases that seem unusual or challenging and explaining what they mean, we need a linguistic framework that helps us analyze how various meanings and functions are realized in different grammatical and lexical options; in differences in *register*. The SFL *functional grammar* relates linguistic form and meaning in ways that enable us to examine the form-meaning variation in different registers, and insights from this grammar are used here to describe some linguistic patterns that are important for understanding this passage.

The linguistic patterns in focus concern the ways academic registers present *agency*, make *logical connections,* develop *cohesive reference chains*, and present an author's *interpretive perspective*. The choice of these features is in one sense arbitrary, as other meaning patterns characteristic of academic registers are also represented in this text. But in discussing this example and then an example from the upper grades, looking at how these four areas of meaning are construed in language helps us recognize challenges in the patterns of language that students engage with and how they evolve into more abstract forms. This illustrates that a wide range of language patterns are implicated in understanding and producing the language of schooling, requiring attention to language that goes far beyond vocabulary development and knowledge of word meaning. As I discuss each of these areas of meaning in relation to the two texts, I also describe how teachers are engaging students in conscious exploration of the ways

these meanings are presented in the texts they read and write.

Agency

       Agency refers to the linguistic presentation of responsibility for actions. As students read and learn from texts, questions about *who did it?* are often raised, and learning to recognize and comprehend the various ways that authors elide agency or make it explicit is an important part of becoming a critical and engaged reader. Whether and how to construe agentive responsibility for actions depends in part on genre and disciplinary conventions, on the task being undertaken with language, and on the way the text (spoken or written) is developing information. We saw above that nominalization, a common feature of history texts, is a resource for eliding agency. Another resource for eliding agency is passive voice, where agents may not be represented at all (e.g., *the amount was increased*).

       But passive voice can also be used with agency still presented, using a phrase with *by*. We see that choice in this sentence with two clauses that describe what the pufflings may encounter if they land in the village:

> Even if the cats and dogs don't get them,
> the pufflings might get run over by cars or trucks.

The purpose of the sentence is to illustrate the *dangers* that *await* the newly-hatched pufflings. To recognize "who is doing what" in these clauses, students need to understand how agency is presented in both *active voice* (the first clause), and *passive voice* (the second clause). The author uses passive voice in the second clause to structure the text for smooth information flow, to put the reference to *them* and the *pufflings* in close proximity, but this means that the subjects of the two clauses stand in different relationships to the actions expressed in the verbs. In the first clause, it is the *dogs and cats* who are the ones doing the action ('getting them'), while in the second clause, it is the *cars or trucks*. The reader needs to recognize this shift in structure and meaning in the shift from active to passive voice. While this may seem straightforward to native speakers of English, the forms are not transparent to students learning English, and discussion about passive voice and its form and meaning can help students answer questions about *who is doing what* in texts like this. Recognizing agency is important in reading texts of all kinds, and learning to explore the ways authors present agency offers students interesting and engaging opportunities for learning more about how English works.

<u>Logical connections</u>

Another important area of meaning in the texts students encounter at school comes in the ways authors make logical connections as they develop a text. One resource for presenting the developing logic of a text is through *conjunctions*, a resource for connecting clauses in relationships of addition, time, comparison, and consequence (Martin & Rose, 2007). We saw in the history sentence in the introduction that conjunctions are not the only linguistic resource that makes such connections, and we'll soon return to this point. But here we can see that understanding the conjunctions students encounter in academic registers can be a challenge. They are often used in different ways than in informal interaction, and the meanings they present are often complex and challenging for teachers to explain.

For example, in the sentence about the dangers to the pufflings, the author uses the complex conjunction *Even if* at the beginning of the first clause to introduce a consequential relationship of *concession.* There are two ways the pufflings can be killed; by cats and dogs and by cars and trucks. By using *even if* the author implies that cats and dogs are the most likely danger, but that the pufflings the cats and dogs don't get are also endangered by cars and trucks. Recognizing the nuances of this meaning of the concessive *even if* is connected with the use of *might* in the second clause, as the concession and possibility interact. English language learners benefit when their teachers are able to draw attention to the logical connection being made here and what it means. Concession is important for developing arguments and discussions, and eventually students need to use concession in their own writing. The logic of concession is challenging, and coming to understand it in texts like this is the beginning of developing that understanding for productive use. Only through multiple encounters, with explicit discussion about the meanings involved, do learners come to understand the nuanced meanings in these logical connections.

<u>Cohesive reference chains</u>

Another challenge of reading is making connections across spans of text. English language learners and other struggling readers often fail to recognize that the same concept or character is being referred to as writers and speakers use a range of linguistic resources, including pronouns and synonyms, to develop cohesive chains of reference. Taking time to identify and relate the words and phrases through which long reference chains are developed helps students gain insight into what they are reading and how the language resources work.

One of the reference chains in this passage builds cohesive reference to the pufflings. The reference chain is highlighted here:

> In the darkness of night, **the pufflings** leave their burrows for the first flight. It's a short, wing-flapping trip from the high cliffs. **Most of the birds** splash-land safely in the sea below. But **some** get confused by the village lights—perhaps **they** think the lights are moonbeams reflecting on the water. **Hundreds of the pufflings** crash-land in the village every night. Unable to take off from flat ground, **they** run around and try to hide. Dangers await. Even if the cats and dogs don't get **them**, **the pufflings** might get run over by cars or trucks.

To understand this passage, students have to connect the pronouns and synonyms back to *the pufflings* in the first sentence. For example, the word *some* has to be connected back to what it refers to; in this context, *some* contrasts with *most of the birds,* which itself refers back to *the pufflings.* In the sentence *Unable to take off from flat ground,* ***they*** *run around and try to hide,* **they** is also the subject of *unable to take off from flat ground.* Making these connections is complex, and students need help seeing how authors construct such reference chains. As students explore texts and track reference, they gain insights into how academic registers are constructed.

Recognizing the author's *interpretive perspective*

One of the key goals of education is to develop students' capacity to read critically, reflecting on what they read and recognizing how they are being positioned by an author to take up a particular point of view. Helping students recognize and consider how authors use language to infuse their points of view or interpretive perspectives into a text develops their critical capacities and enables them to approach new texts more reflectively.

Every text, spoken or written, projects the voice of the author, but academic registers often convey an author's perspective in implicit ways. Here's an example from this passage:

> But some get confused by the village lights—perhaps they think the lights are moonbeams reflecting on the water.

Relevant to the author's perspective, readers need to recognize that this sentence offers an explanation about why the pufflings land in the village, suggesting that they are confused by the village lights. The *perhaps* introduces an important aspect of the meaning, indicating that this is a *possible* interpretation of the pufflings' actions. Recognizing and highlighting this as the interpretive perspective of the author helps students recognize the multiple voices in the texts they read, and raises their awareness about linguistic resources available to them for infusing

their own perspectives into the texts they produce.

Focusing on how *agency, logical connections, cohesive reference chains,* and *an interpretive perspective* are construed in this short text illustrates some of the challenges of academic language and illustrates how explicit discussion of form-meaning connections can help learners read for deeper understanding. Engaging with the academic register of this text and exploring its language contributes to students' learning in three ways: they engage more deeply with knowledge about pufflings; they learn about the relationship an author can take up *vis a vis* the reader in offering interpretation; and they learn about how language can be organized in clauses of different types and through reference chains to build a text like this. These are the some of the ways the register elements (field, tenor, mode) that students confront early in schooling are configured. The next section illustrates how features of academic registers become even more challenging as students get older.

Academic language in adolescence: an example

Academic registers are not fixed constructs that students learn once and for all, as the "academic-ness" of the language students encounter becomes greater as they progress through the years of schooling. Learning to comprehend and produce academic registers extends even beyond K-12 education and has to be supported again at every new level (Schleppegrell & Colombi, 2002). Christie (2002) charts changes in the language students work with and produce, showing how the development of linguistic abstraction and other language features is part of students' academic language growth in adolescence. The introduction to this paper illustrated some aspects of the challenging linguistic demands of reading history in adolescence with a sentence from an 11th grade history textbook. This is the paragraph where the sentence appears:

> **Demand spurs growth** During the 1860s and 1870s, cattle ranching
> boomed. The destruction of the buffalo and removal of Native Americans
> to reservations emptied the land for grazing cattle. The open plains offered
> a rancher limitless pasture that was free for the taking. At the same time,
> the growing population of eastern cities drove up the demand for beef"
> (Cayton, Perry, Reed and Winkler 2000, p. 186).

One of the tasks the chapter asks of students is to create a cause-and-effect chart that organizes information about the growth of the cattle industry. To do so, they need to recognize how meanings about causes and effects are presented in this text. *Agency*, *logical connections, cohesive reference chains*, and the author's *interpretive perspective* are all implicated in

understanding this text, which illustrates some aspects of how academic registers evolve over the years of schooling, becoming more dense and abstract.

<u>Agency</u>

We saw in the introduction that the sentence about *the destruction of buffalo and removal of Native Americans to reservations* distills information in a way that effaces agency. This makes recognizing the social actors involved in these events a challenge, as they are not represented in the language. If, as the subhead suggests, *demand spurs growth,* students need to be able to recognize *who* is demanding *what* and *what* is *growing*. Unpacking the language reveals gaps in information that need to be recovered in order to create a cause and effect table representing the points the author is developing here.

This is another illustration of the limitations of treating academic language as mainly a vocabulary challenge. While focusing on the challenges in understanding word meaning may seem natural, learning the meaning of the words in isolation is often of little help. For example, to learn the meanings of *destruction* and *removal;* or to learn the rules of word formation that turn *destroy* into *destruction* or *remove* into *removal* does not help students see how the meaning of these words is tied to understanding the knowledge that has been condensed into these phrases, along with how the phrases are related to the meaning in the rest of the sentence. In a corpus study of 3.3 million words from a range of academic disciplines, Hyland and Tse (2007) show that words in 'academic' word lists (e.g., Coxhead, 2000) occur with different range and frequency, and mean different things in different disciplines. Vocabulary development requires opportunities to engage in multiple exposures to new words in meaningful and relevant contexts (Corson, 1997; see review in Spycher, 2009), and it is the focus on meaning in context that is most important for students' learning to control new vocabulary. The contexts of learning vocabulary are both interactional and textual, and engagement with new words in different but related registers provides opportunities for deeper understanding. Through such engagement, vocabulary development will often be an *outcome* of learning, rather than something that happens in advance of learning content.

Of course recognizing that the agency has been elided in this text does not help students recover it. But a focus on the form language takes here does point students toward the knowledge that is missing, offering them a means of evaluating the adequacy of their prior knowledge of these events in responding to the assigned task.

Logical connections

The logical relationships in this text are realized in a different way than we saw in the pufflings text, making it more difficult to recognize the cause-effect relationships being built up here. Rather than connecting clauses with conjunctions (e.g., *even if*), this paragraph infuses the logical relationship of causality into the clause through verbs and other lexical choices. This segment has no overt markers of causality; no *because, thus, as a result,* or other 'causal' signals. Instead, the *causes* of the growth of the cattle industry have to be understood from the verbs *spur, emptied,* and *drove up* and the relationships the clauses construct. Students need more than the focus on connectors and overt expressions of causality that are often suggested to develop academic language. To create a cause and effect chart, the verbs have to be recognized as incorporating causal relationships that relate the destruction of buffalo and removal of Native Americans to the availability of the land.

Treating *spur* as a causal verb and treating *demand* as an agent of the cause uses language in metaphorical ways. History texts are rife with metaphor, and here there are metaphors in both the lexical and grammatical selections; in both the vocabulary and in the grammatical structure. Students need to relate the meaning of *spur* in its sense of "the accessory to a boot that a rider uses to force a horse to move" to the abstract economics concepts in this text. This makes it a lexical metaphor; a word with two meanings, one concrete and one abstract. But here *spur* is also a grammatical metaphor (Halliday, 1998), as in the context of the text, using *spur* as a verb infuses it with causal meaning that connects *demand* and *growth,* which are also grammatical metaphors.

Halliday has drawn attention to the ways meaning and grammatical constituency interact, defining *grammatical metaphor* as the construal of concepts in ways that are not congruent with the core 'meanings' of the word classes. Congruently, nouns are things, verbs are processes, adjectives are qualities, and conjunctions make logical links; and this is the way these word classes are most typically used. But in academic registers, grammatical metaphors often present processes in nouns, as if they were things (*the buffalo were destroyed --> destruction of the buffalo*, for example), and verbs can present things or qualities as if they were logical relationships (*spur* and *empty* as cause, for example). Grammatical metaphor enables a writer to create abstractions that can participate in building arguments and structuring texts in ways that enable the development of an explanation, and to infuse a clause with causal and other meanings

without explicit conjunctions. This is one of the ways complexity is built into academic texts, as tension between the meaning of a word and the semantic role it has in the clause. *Destruction* is a process, not a thing, and yet it participates in the clause as if it were a thing, as a noun. While grammatical metaphor increases the density of text, it also enables conciseness and precision. Being able to manipulate linguistic resources through grammatical metaphor gives students a large and unlimited resource for construing agency, causality and other abstract constructs. Halliday (1993a) suggests that control of grammatical metaphor is the key feature of language development in adolescence, and the work of Christie (2002; Christie & Derewianka, 2008) provides empirical support for this. In history classrooms, students have enjoyed recognizing and unpacking the meanings presented in grammatical metaphor, learning simultaneously about history and about academic language (Schleppegrell et al., 2004; 2008).

Cohesive reference chains

To understand and represent the causes and effects in this text, students need to recognize the reference chains that explicate how *demand* causes (*spurs*) *growth.* The *demand* in the subtitle is developed in *the growing population of eastern cities* and *drove up the demand for beef.* The *growth* in the subtitle is developed in the words *boomed, limitless pasture that was free for the taking,* and *drove up.* To recognize how the argument about demand spurring growth is developed, the reader needs to make these cohesive connections and see their relationships. It is recognizing the relationships being developed that is most important in understanding the meaning here, as the notion of *growth* is presented as both effect and cause, and the argument is complex. Practice in tracking chains of reference in texts like this gives students strategies for analyzing meaning in other dense texts they encounter, as they learn that each new linguistic structure can be related to some other point in the text.

Recognizing the author's *interpretive perspective*

Every text presents an interpretive perspective, and in history teaching one of the main goals is to raise students' awareness that there are different interpretive possibilities in judging evidence and developing arguments. In this text there is no signal like the *perhaps* of the early reading text that foregrounds the author's interpretive perspective. Instead, the text is presented in unmodulated declarative sentences that speak with authority. Of course there is interpretation in this passage; the interpretation is in the explanation of causes and effects, and other historians might interpret the evidence used by this textbook author in different ways. The point here is that

the interpretation is infused into the explanation of causes without making itself felt as interpretation, and so it positions students to accept it as fact, rather than analyzing it as a *possible* way of interpreting the evidence. By making the interpretive perspective of an author a point of discussion in reading all texts, and exploring the language resources authors use to infuse particular points of view into the texts they write, students can learn to question and challenge interpretations even when they are presented in authoritative language.

In this history textbook passage, the author presents what appear to be 'facts,' supported by register choices that are both lexical and grammatical. The *field* knowledge about the growth of the cattle industry in the American west is presented in an authoritative *tenor* that can be challenged by a reader who can recognize the interpretive perspective infused in the text, and the dense *mode* can be unpacked to explore the meanings that are implicit.

Summary

These examples from early literacy education and secondary history illustrate some of the developments in academic language that students encounter over time, as the texts they engage with become more dense and abstract as the knowledge to be developed also becomes more specialized and advanced. Writers and speakers make choices about how they will present meanings of different kinds, and these examples illustrate typical choices in the ways academic registers at different levels construe *agency*, make *logical connections,* develop *cohesive reference chains,* and present the author's *interpretive perspective.* In the early years, students confront changes in voice that make understanding agency challenging, complex logical connections in conjunctions, long reference chains, and authorial voices that offer comments and perspectives they need to recognize. By the later years, the authorial voices are often multiple and implicit, the agency elided, the logic infused rather than explicit, and the reference chains dense and abstract. And these features are only suggestive of the full range of ways academic registers construe meaning, as many other language features are implicated in the comprehension and production of the knowledge students develop in school–for example, features related to how genres of different kinds are structured, how speakers and authors define and describe, how they present the views of others, how they argue in ways that seem objective, and how they manage new and old information.

The content/knowledge and language of schooling are inseparable in practice and use, as students encounter content knowledge as it is presented in dense and challenging language and

they need to produce challenging language in order to demonstrate their knowledge. As the texts students encounter become more suffused with grammatical metaphor, their meanings are construed in language that no longer flows in the congruent rhythms of the language of everyday interaction. These forms of academic registers can be alienating in their nominalizations and other incongruent ways of presenting knowledge, as they leave out social actors and explicit logical connections. Students can recognize that grammatical metaphor is a resource for packaging information in ways that enable theories to be built up and arguments to be made, and that this resource can also help them present what they know and want to argue. This understanding of academic language has important implications for how we understand the challenges of learning and for how teachers can support the learning of language and content with students who come from backgrounds where their exposure to academic language will come mainly through schooling.

Supporting academic language development

Engaging in conscious exploration of the language can support students' grade-level content learning, and analyzing points of form-meaning connection can engage students in recognizing the evolution of the language along with the knowledge. By developing strategies for highlighting and talking explicitly about the meanings in the texts they read, teachers can support students' comprehension and offer models for their speaking and writing. Development of familiarity and facility with academic language can play a key role in students' learning across school subjects, as the knowledge that schools aim to develop is presented in and assessed through language that involves to a great extent the learning of new registers.

This section draws on research to suggest how teachers can support students' academic language development through use of oral language in the classroom. Oral language offers students opportunities to move between everyday and academic registers as they develop knowledge across all subject areas. Oral interaction in the classroom can build on the language students bring with them to school as a resource for further learning and can make the reasoning in different subject areas visible to students. In addition, explicit talk about language in the classroom in ways that make connections between the forms language takes and the knowledge it presents can help students gain the consciousness about language they need to adopt new registers for academic tasks and contexts.

Oral interaction that develops academic registers

The fact that ELLs often develop proficiency in informal spoken English comparatively quickly has sometimes led their teachers and others to assume that their oral language development was complete, and that any difficulties they may have producing language at school were due to cognitive and not linguistic limitations. Today the need for development of academic oral language is clearly recognized, but research in this area is sparse. Saunders and O'Brien's (2006) review of research on oral language finds few studies in this area, but those they report on (Snow et al., 1987; Carlisle et al., 1999) indicate that measures of oral language need to account for the differences in register required in different kinds of tasks. These studies found significant relationships between oral language measures and reading achievement when the oral measures called for academic, rather than informal, uses of language.

Developing academic oral English is especially challenging because students have few opportunities to develop oral language at school; Harklau's (2002) ethnographic study of ELLs in secondary school classroom makes this point. Researchers in second language development have long argued for more focus on spoken production by language learners, recognizing oral language as useful for "pushed" and "comprehensible" output (Swain 2005; Swain & Lapkin, 1998). Tong et al. (2008) demonstrate that effective instruction enhances ELLs' growth in oral academic language, and they argue that this growth is critically important because oral language is used so often for assessment and placement purposes. In their highly-cited review of research on English language learners, August & Shanahan (2006) call for "efforts to increase the scope and sophistication of [ELLs'] oral language proficiency" (p. 448).

One way oral academic language proficiency can be developed is through interactive language use in the classroom, focused on modeling and supporting use of academic registers. Genesee and Riches (2006) review research that concludes that interactive and direct approaches to instruction are needed, as "simply exposing students to literacy-rich learning environments is not sufficient to promote acquisition of the specific skills that comprise reading and writing" (p. 139). They point out that *instructional conversations* combine interactive and direct approaches and call for more research on this kind of instruction. Instructional conversations model reasoning and provide students with practice explaining, justifying, and interpreting in ways that are valued by different disciplinary communities. Teachers of all subjects are best positioned to model valued ways of talking and thinking about the principles that underlie the knowledge

students are engaging with, and doing so in interaction with students provides opportunities to practice and develop academic registers (Lindholm-Leary & Borsato, 2006).

Academic language develops over the years of schooling, presenting new challenges at each level and in each new subject area. But because learning is a developmental process that builds from what students already know into new knowledge, classroom interaction, even in advanced contexts, does not draw only on academic registers. Teachers and students continually move back and forth between everyday and academic ways of talking about what is being learned. Understanding this movement and how it supports students' engagement with and control of academic registers is an important aspect of preparing to better support teachers and students in promoting academic language development.

Pauline Gibbons is one of the leading researchers exploring the interaction of registers in the academic language development and disciplinary learning of ELLs (e.g., 2006; 2008). Her fine-grained discourse analysis of classroom language in a two-year ethnographic study of fifth grade science classrooms in a low SES urban school in Australia with a high proportion of ELLs (Gibbons, 2006) illustrates how, in interaction with peers and their teachers, students move from talking about what they are learning in situated, here-and-now registers as they experiment in 'hands-on' ways, into the more 'decontextualized', scientifically exact, presentational language needed to develop oral and then written reports. A key construct from Gibbons is her notion of a *mode continuum,* the idea that students move from 'everyday' ways of talking about what they are learning into more technical, subject-specific ways of using language by engaging in oral discourse with their peers and their teacher. Students move between concrete knowledge and abstract theoretical knowledge by engaging in substantive conversation while learning and by transforming new knowledge into different forms for new contexts or audiences.

Gibbons shows how over the course of a unit of study on magnetism, as students experiment with magnets, then give oral reports, listen to teacher explanations, and finally write reports on magnetism, they move from simply recounting their experience in a context where everyone understands what they are referring to into creating explanations that are not reliant on shared experience for understanding. Language and knowledge develop together as the teacher focuses students' attention on scientifically appropriate language for representing their new knowledge and as students practice new ways of talking and writing about magnets.

Here Julianne reports on her group's hands-on experience with the magnets in the first

days of the unit:

> We put paddle pops around the foam and then we got a magnet and we put it in . and we got another magnet and we put it on top but it wasn't touching the other magnet . and then when we turned in around . it attach together/ the two magnets . and when we put on the side they em attach together (p. 159-160).

Later, Julianne wrote a journal entry about this:

> The magnet which we put next didn't touch the other magnet. When we turned it over it stucked on the other. (p. 166)

Both the spoken report and the journal entry are simple recounts of what happened in the group work. Julianne uses everyday rather than scientific terms, organizes the report according to the sequence of events, and constructs the information as a retelling of her personal experience. She is learning about magnets, but has not yet learned to present her new knowledge in ways that will be recognized as scientific understanding.

Gibbons points out that learning is cumulative and that ELLs need opportunities to go deeply into the content they are learning, engage in many kinds of interaction as they learn, and have explicit instruction in and focus on the ways language is used to talk and write about the new concepts they are learning. She points out that research on language development needs to be tracked over a unit of work as it unfolds over many days of classroom activity, as students' language develops along with their content knowledge through activities that move them along the mode continuum from action to reflection. Over the course of this unit, the teachers introduced technical language about magnetism, poles, attraction and repulsion to give students new ways of talking more formally about their hands-on experiences. They used a linguistic metalanguage based in functional linguistics to focus students on the shifts in register that they needed to adopt to be "more scientific," discussing the genre expectations of the recounts, reports, and discussions that students produced. They explicitly guided students in orally reconstructing their experience of experimentation with magnets and in constructing new knowledge about magnets through what Gibbons calls "bridging" discourse; moving back and forth between students' everyday ways of talking about magnets into more formal language, building on students' experience but also providing them with opportunities to learn to talk about science in new ways. As they wrote, students engaged in explicit work on language, focused, for example, on such grammatical issues as the tense to use in writing a generic report rather than a

recount of their experience.

The teachers focused on both the knowledge to be learned and the language in which to express it in several ways: 1) by recasting students' language into more technical, academic language; 2) by talking about the features of the new register, with an emphasis on appropriateness rather than linguistic correctness; 3) by reminding students to use the new language as they engaged in communicative language use; and 4) by showing students how concepts are presented in written language in science. Gibbons suggests that these strategies make language comprehensible without simplifying it, giving students access to challenging content and supporting their participation.

After this work, Julianne wrote a report on magnetism:

All magnets have a side which repels and a side which attracts. Magnets don't stick if you put north with a north or south and a south but if you put a south with a north they stick. (pp. 166-167)

This text shows Julianne's movement toward the kind of scientific report she will need to learn to write to be successful in later science learning. The text is generic, telling about how all magnets behave, rather than a specific retelling of one experience with magnets, and it uses more technical language. Both the generic stance toward the information reported and the technicality of the terminology are important parts of academic language development.

Students need to develop facility with new registers at the same time that they develop disciplinary knowledge, using the new register while learning the register. This means that teachers need to understand the concepts they are teaching well enough to be able to talk about them in both less and more technical ways, unpacking the compressed conceptions and formal definitions of the technical language into more informal, everyday language for student learning, but then compressing and repackaging it again in technical ways in order for the learning to build more complex concepts and move into new, more abstract domains. The movement back and forth allows students to make connections across topics and allows teachers to build links and establish coherence as learning develops, giving oral language an important role in teaching.

A key challenge in teaching is developing in students a sense of the intellectual significance of what they are learning, helping them go beyond seeing learning as a set of procedures and engage with new knowledge as a thinking process. Experience with language is crucial to accomplishing this goal. Teachers' language models for students the kind of thinking

that they need to engage in as they work in different subjects and shows them how to be effective participants in disciplinary discourse. Engaging students in reasoning with oral language enables them to adopt ways of talking and thinking that are valued by and important to the disciplinary communities into whose ways of talking and thinking they are being apprenticed.

Explicit teaching about language form-meaning connections

Many recent reports have called for explicit and systematic instruction in language for ELLs, so it is important to understand what this kind of instruction needs to look like to support the development of academic registers. Instruction in language that is separate from content learning is unlikely to be widely successful, and teaching discrete features of language or labeling of language structures apart from the texts and tasks students engage in is unlikely to effectively support academic language development. Work on academic registers needs to support content learning and take place in the context of content learning. The research of Gibbons and others shows that teachers can explicitly focus on language form-meaning connections with ELLs in the context of doing disciplinary teaching. If academic language development is not approached in this way, it risks becoming decontextualized instruction in discrete language skills that will contribute little to students' ability to engage with grade-level learning across content areas.

Recent professional development projects provide support for the notion that a functional focus on language, in the context of teachers' engagement in grade-level, cognitively demanding work, enables a simultaneous focus on language and content. One example is ongoing work with middle- and secondary-school history teachers in California (Achugar et al., 2007; Schleppegrell & Achugar 2003; Schleppegrell et al., 2004; 2008; Schleppegrell & de Oliveira, 2006). Using a metalanguage that includes constructs from functional grammar such as *agency, nominalization, reference chains,* and *logical connection,* teachers learned strategies for exploring the ways language presents meaning in history with their students. The teachers work with students to deconstruct written texts and focus on the language used to construe time and cause and the author's interpretative perspective. Through interaction about text and classroom discussion focused on the choices an author has made in presenting historical content, students are developing literacy in history (Gargani, 2006).

Another example comes from Aguirre-Muñoz et al. (2008), who studied the effectiveness of professional development designed to increase language arts teachers' understanding of

academic language, drawing on the framework in Schleppegrell (2001). In a study of 21 mainstream middle school teachers in southern California, they show how teachers adopted new ways of responding to students' writing based on functional grammar strategies. The training focused on how language is used to describe protagonists/antagonists, to ascribe qualities and evaluate characters, and to achieve cohesion. The goal was "to provide teachers with a framework for understanding specific language expectations of complex written tasks in a manner that … provides them with linguistic tools for examining text (and content) that involve structures that are less familiar to ELLs" (p. 6). The study looked at how the training in linguistic features influenced teachers' evaluation of student work and its impact on instructional practices. Their results indicate that the training helped teachers focus on meaning in ELL writing and provide feedback and instruction centered on developing students' linguistic resources for improving clarity. For example, teachers used knowledge about how to expand the noun phrase to help students be clear and precise, and helped them use noun phrases to create cohesion. Teachers also taught about conjunctions and transitional phrases and use of different kinds of verbs to create more interesting texts. Two-thirds of the teachers in the study implemented the training to a moderate or high degree, and many asked for ongoing support for such work through further training or coach mentoring.

Gebhard et al. (2007; 2008) also report on research indicating that giving teachers a metalanguage for talking about form-meaning connections in the context of grade-level subject matter learning offers promise in supporting ELLs' academic language and content knowledge development. They designed coursework to help teachers make connections between the texts and tasks they assign and the language resources students need for success with those texts and tasks. They focused on the features of different genres, providing teachers with deeper insights into how English works and what challenges students in learning academic English. They helped teachers design materials and activities that support classroom discussion of the demands and features of the genre and provide multiple models of the genre and explicit instruction in its features. They report that reflection with students on the process of using academic language is an important aspect of this work, and they track changes in students' use of genre-specific academic language practices as students draft, revise, and edit.

These studies show that explicit attention to form-meaning connections in the context of doing the tasks expected in school supports students' academic language development by raising

their awareness about the language choices that enable highly-valued ways of presenting the knowledge they are learning. We have few studies that describe expectations for oral academic language tasks and their explicit modeling and development (see Bunch, 2009, for discussion of oral presentations in 7th grade social studies classrooms), but it is likely that talking explicitly about how to talk academically, in the context of authentic activities, will support the development of oral academic registers.

Summary

Learning the language of a new discipline is part of learning the new discipline; the content learning is not separate from the development of the language that constructs the new knowledge. Since students come to school with everyday language with which they have constructed their knowledge of the world, the school can build on that knowledge and language to move students toward new, more technical understandings through consciousness about and attention to the linguistic challenges that accompany the conceptual challenges of learning. In classroom activities, teachers can move between everyday, informal ways of construing knowledge and the technical and academic ways that are necessary for advanced learning. They can make visible the ways of reasoning that are valued in their subjects, modeling for students how to talk about what they are learning. In addition, making form-meaning connections by focusing explicit attention on the forms language takes and the meanings presented in different structures, using an explicit, meaning-based metalanguage, supports students' development of academic registers and content knowledge.

Academic language across school subjects

Learning academic language is not just a question of learning particular lexical and grammatical forms. Students encounter vocabulary and grammatical patterns in the registers of content areas, in the language of the tasks, texts, and tests of different subjects. And yet language-content connections are not well understood by many of those who create curriculum materials and develop standards and assessments. Bailey et al. (2007), for example, analyzed the oral academic language used in 4th and 5th grade science classrooms and the textbook language of 5th grade mathematics, science, and social studies, as well as the curriculum standards for those subjects. While they found distinctive discipline-specific linguistic features in classroom talk and texts, they did not find linguistic knowledge relevant to learning in different subject areas systematically incorporated into the standards. Instead, the standards presented content

knowledge as an abstraction, disassociated from the language forms and resources in which it is presented and demonstrated.

Nowhere is the gap between the language demands and content standards more stark than in the assessment and teaching of ELLs and other students identified as remedial. When they compared California's English Language Development (ELD) standards with science content standards, Bailey et al (2005) concluded that the language demands of the science standards were not represented in the ELD standards at the level of complexity required by the demands of the science curriculum. Schleppegrell (2003) compared the California Reading and Language Arts standards with ELD standards and also found gaps between the expectations for ELLs and expectations for grade-level performance. This meant that even the ELL who achieved at the highest level of ELD standards would not be prepared for engagement with grade-level academic language tasks. All students need opportunities to learn cognitively challenging content and work at grade level even as they develop academic language, and yet the documents their teachers use to prepare their instruction do not offer ways to do this. We need to enhance attention to language and provide students with opportunities to focus explicitly on the features of academic registers in meaningful and interactive contexts as they develop new disciplinary knowledge.

Language is used in different ways related to the different kinds of things that go on in classrooms in different grades and subjects, and understanding variation in disciplinary use of language is key to preparing teachers to support students' learning across school subjects. We need to understand the kinds of activities associated with each discipline in order to understand the demands and challenges of that subject, and we need to understand the different texts and tasks students face as they move from subject to subject in order to understand academic language. To become proficient in the academic registers of the different content areas, students need to follow a developmental progression in language use as well as a developmental progression in the knowledge to be learned. Functional linguists have developed descriptions of pathways into academic language that identify key written genres of different disciplines and show how their register features evolve over the years of schooling. While this work is too extensive to fully review here, this section briefly summarizes what it says about the linguistic challenges of language arts, history, mathematics, and science, drawing in particular on Christie and Derewianka's (2008) extensive and detailed description of the developmental trajectory for control of written language in English, history, and science. They draw on a database of 2000

texts from studies over the past 20 years to describe the grammatical resources through which abstraction, generalization, value judgment and opinion come to be expressed as students' writing matures. (Unfortunately, no such resource exists for describing the development of oral language registers in academic subjects; research is needed in this area.)

Language differs in the discourses of different subject areas due to differences in the epistemologies of the disciplines as well as differences in methodologies and pedagogies. Each subject area has its own expectations for the genres students read and write, and each genre is constructed in grammatical resources that construe the disciplinary meanings. Developing facility with new genres involves learning new lexical and grammatical strategies to fit new tasks and contexts. While each genre has its own characteristic register features, each discipline as a whole can also be characterized in terms of the ways of using language that are typical and pervasive. This section presents some general points about the registers of language arts, history, science, and mathematics. Discussion about supporting students' reading in these subjects through a focus on language form-meaning relationships is developed in Fang & Schleppegrell (2008).

Language Arts

Language arts is perhaps the subject where it is least necessary to convince teachers of the important role language plays in schooling, as the English language arts classroom is a place where language development is expected and explicitly in focus. At the same time, few language arts teachers have been introduced to systematic, meaning-based ways of talking about the forms language takes. Language arts is an important site for making connections between home and school language and helping students gain conscious awareness about language variation in all its forms, because in the language arts classroom, students can engage with texts that present a range of registers and language varieties, including the varieties and informal registers found in the homes and communities that students come from.

A wide range of text types is read in the language arts classroom, and students are expected to learn to write narrative and expository texts that become increasingly more complex and highly structured. Christie and Derewianka (2008) describe the features of six genres of language arts: the 'story' genres, *recounts* and *narratives;* and the 'respond and evaluate' genres, *personal response, review, character analysis,* and *thematic interpretation.* This last, the *thematic interpretation,* is a key genre that often figures in assessment of students' writing

proficiency in secondary school, calling on students to identify a main theme of a literary work and provide evidence for the theme, sometimes addressing the themes of more than one text.

Christie and Macken-Horarik (2007) have provided evidence that students' success on standardized tests of academic writing proficiency depends on their control of academic language. They examined the linguistic features of exemplars of thematic interpretations used to illustrate the set of performance criteria by which secondary student writing was assessed in the *National Curriculum* in England and in the *School Certificate* examination taken by 16 year olds in New South Wales in Australia. They found that papers that earned high scores drew on linguistic features that enabled the writers to do particular things. For example, high-scoring writers expanded noun phrases with embedded clauses to elaborate information (e.g., *she eased past the leafy tendrils of the branches that beckoned her; beside the pool was the rock her mother had always sat on*. They used non-finite clauses at the beginning of sentences to build affect and judgment (e.g., *Gripping the box tightly, she continued…; Closing her eyes now, she felt giddy with happiness*), and they used lexical and grammatical metaphors. The successful writing drew on features of academic language to much greater extent than the writing of unsuccessful students. Christie's research has been instrumental in raising awareness about the language demands of what she calls "subject English" (e.g., Christie, 1999; 2002; 2004; Christie & Macken-Horarik, 2007) and others have also contributed to this agenda (Davison, 2005; Hammond, 2006; Macken-Horarik, 1996; 2006).

History

Like language arts, history is a subject that is presented to students almost entirely through language. In history, two key areas of challenge for students are recognizing the interpretation that is always present in history texts and recognizing how time and cause interact as the historian presents a reconstruction of events. Students are often asked to identify causes and effects in history, to recognize how particular events and actors influenced other events and actors, and to recognize the implicit points of view that are infused into a text. Students need to be able to recognize the subtle ways that causality is often presented in history, as the implicit ways this is done often position readers to align with certain interpretations. Recognizing the interpretation built into history texts is central to learning and knowing history.

Christie and Derewianka (2008) describe the features of eleven genres students are asked to write in history: those that record and describe historical events, including *recounts,*

autobiographies and *biographies, historical accounts, site studies* and *period studies;* and those that interpret and explain the past, including *site interpretations, factorial explanations, consequential explanations, exposition,* and *discussion.* Coffin (1997) shows how history genres move from constructing the past as story, with a focus on particular, concrete events unfolding through time, to constructing it as argument, with a focus on abstract theses organized in text time. This move from narrative to expository genres in reading about history draws on the abstract language that is necessary for shifting from a temporal organization of text (recount, account) to rhetorically organized texts (explanation, argument) that draw on the resources of academic registers to construct interpretation.

Research on the language of history has been greatly informed by functional linguistics studies of the genres and text features of history pedagogical texts in Australia (e.g., Martin, 2002; Coffin, 2006). Recent research describing pedagogical approaches to academic language development in history include Coffin (2004), Duff (2001), Kramer-Dahl et al. (2007), Moje & Speyer (2008), Schleppegrell et al. (2004; 2008), Schleppegrell & de Oliveira (2006).

Science

Learning science means developing new ways of thinking about the world through investigations that describe, model, predict and control natural phenonomena. Lemke (1990) points out that "the language of science teaching is 'expository' or 'analytical' most of the time...used to express relationships of classification, taxonomy, and logical connection among abstract, or generalized, terms and processes. The language of other subjects, notably literature and history, tends to be more 'narrative' in character,...used to express relationships of time, place, manner, and action among specific, real or fictional, persons and events" (Lemke 1990:158). In the 1990s, the work of Lemke (1990) and Halliday and Martin (1993) stimulated much investigation of science registers, suggesting that controlling the discourse of science requires mastering the grammatical features of the language that construes science knowledge. Halliday (1993b) illustrates how science registers evolved historically, comparing the language used by Chaucer, Newton, and Darwin, and showing how grammatical metaphor has become a major resource used by scientists to present and re-package information as they develop new theories.

Science is a field where the issue of learning technical vocabulary is often foregrounded. But to understand new technical vocabulary and use it appropriately, students need to develop the scientific knowledge that supports understanding new words (Bruna et al., 2007). Lemke

(1990) points out that "In teaching science, or any subject, we do not want students to simply parrot back the *words*. We want them to be able to construct the essential *meaning*s in their own words, and in slightly different words as the situation may require…. This is what we mean when we say we want students to 'understand concepts'" (p. 91). Lemke recommends bridging between colloquial and scientific language, teaching students to talk science through group work and oral discussion followed by writing, with explicit attention to the linguistic patterns of science knowledge at the sentence and text levels.

The tasks and text types that students are expected to engage with in science include reports on experiments, development of hypotheses, and reading and writing descriptions of natural phenomena and explanations of natural processes. Christie and Derewianka (2008) describe the features of seven genres that students are expected to write in science classes: genres that *record* students' observations such as *procedural recounts, demonstrations, research articles,* and *field studies;* and genres that *intepret* natural phenomena, such as *reports, explanations,* and *discussion.* Engaging in these tasks and reading and writing these texts calls for new ways of using language and structuring texts (Fang, 2006).

Recent work on the language of science includes Bruna & Gomez (2009), Fang (2006), Huang (2004), Huang & Morgan (2003), Lemke (2002), Mohan & Slater (2005; 2006), Schleppegrell (2002), Spycher (2009), Unsworth (2001); Young & Nguyen (2002).

Mathematics

Current practice in mathematics encourages an emphasis on discourse and on making mathematics meaningful, as teachers are encouraged to ask students to explain and justify answers. Interest in issues of language in mathematics has been prominent since Pimm's (1987) widely-cited study, in which he draws on Halliday's (1978) discussion of the mathematics register. While common wisdom may suggest that mathematics is the least language-dependent discipline, recent research shows that students face real difficulties in learning mathematics, and that some of the challenges are linguistic (e.g., Lemke, 2003; Schleppegrell, 2007; forthcoming). Abedi & Lord (2001, p. 219) find, for example, that "nationally, children perform 10% to 30% worse on arithmetic word problems than on comparable problems presented in numeric format," pointing clearly to factors other than mathematical skill. Mathematics has a highly technical language that is also made more challenging by the nature of mathematics discourse. The grammatical patterning of mathematics brings together long, dense noun phrases in clauses and

sentences constructed with *being* and *having* verbs that present a variety of meaning relationships. In addition, mathematics problems often use conjunctions with meanings different from their everyday uses, or include implicit logical relationships that are not spelled out.

In addition to natural language, mathematics has a mathematics symbolic language and also draws on visual display of diagrams and equations. These three forms of meaning-making are always in interaction with each other in mathematics classrooms, and math understanding is constructed in large part as the teacher talks about mathematical expressions using spoken language. The challenge for students is to make the connections between the math symbolic language and the teacher's oral explanations. This makes oral language and spoken interaction of crucial importance in learning mathematics. Moschkovich (1999) analyzes teacher-student interaction in classroom episodes with Latino students in California and shows shows how these students use gesture and other modalities in bilingual conversations to participate in mathematical discourses. She critiques the use of generic ESL strategies that have no mathematics content, pointing out that manipulatives and pictures cannot be used without language. She addresses the issue of movement between informal and technical language, suggesting 'revoicing' students' contributions to make them more mathematical, without focusing on students' language errors (Moschkovich, 1999). Barwell (2005) has studied students' small group interaction in mathematics classrooms, with a particular focus on ELLs. He reports that they successfully share meaning about mathematics even as they develop their linguistic resources, and that their focus as they work together is similar to what native speakers focus on. They consider the expectations for the tasks they are engaged in, the mathematical structures they need to use, and the form the work needs to take, and they share their real-world experiences relevant to the problem-solving.

Written genres also figure in mathematics learning, as written proofs and word problems pose linguistic challenges (Abedi & Lord, 2001; Lager, 2006; see also Huang & Normandia in Fang & Schleppegrell, 2008). Chapman (1995) tracks students' developing understanding of a concept over several lessons, showing how it is built up in teacher talk, whole-class teacher-student interaction, interaction between students, and reading of the textbook. The teacher focuses students on using appropriate language to construct the concept and contextualizes the textbook language through spoken language to help students understand the relationships in the textbook definitions. Chapman also shows that when the students work out a problem together in

groups, they construct the concepts in ways that are different from the teacher or the textbook. This underscores the need for teachers to continually make explicit reference to the technical language through which the mathematics knowledge is built up, helping the students learn by making connections with other texts and other contexts.

Recent work that analyzes the linguistic demands of the mathematics classroom includes Chapman (2003), Morgan (2003), Moschkovich (forthcoming), O'Halloran (2005), Schleppegrell (2007), Wagner & Herbel-Eisenmann (2007), and Zolkower (2007).

Summary

The register variation characteristic of different academic disciplines is another aspect of the richness and challenge of academic language. Each subject area requires learning content that is presented and assessed through language and each has its own distinctive tasks and text types which become more complex as students move through schooling and into higher learning. It is the tasks and texts that present to students the values and practices of the different disciplines: critique of literature in language arts, interpretation of artifacts and documents in history, theorizing, modeling, and reporting on experiments in science, and problems and proofs in mathematics, for example. Academic language becomes salient to students as they engage in these tasks and with these text types, and it is in the context of doing these disciplinary tasks that academic registers need to be taught. Students need to comprehend and produce academic registers in order to learn and as evidence of learning, and teachers need to recognize the support students will need to engage in these disciplinary practices and to produce the spoken and written texts that represent their learning in each subject. Students need to develop flexibility of expression and competence with language across subject areas, and they need explicit focus on the forms language takes to develop consciousness of the disciplinary expectations. As most of our knowledge of the challenges of the disciplines comes through research on written language, and since spoken language plays such a key role in learning, more investigations of the oral language genres relevant to different disciplines are needed.

Implications and conclusions

Academic language is a set of registers used to engage with learning across school subjects, and being able to engage with these registers is crucial for success at school. These registers have lexical and grammatical features that enable the presentation of knowledge in ways that are typically highly structured and that enable perspectives and points of view to be

infused in ways that are often implicit. They draw on forms of expression that are unlike those used in informal and everyday interaction because they are enabling communication about knowledge that is specialized. Academic language has developed over time along with the knowledge it construes, so learning the knowledge and engaging with the language are integrally related. Students confront academic registers from the early years of schooling and as they learn school subjects, they also learn to comprehend and use ever more challenging language.

Research that has analyzed the language produced by students and teachers in classrooms and the language of the texts students work with has identified what is distinctive in the ways language is used to construct content knowledge, contextualize that knowledge, and facilitate students' interaction with it. The key issue in academic language development is students' ability to draw on different registers in the contexts of doing the things that they are expected to do in school. The notion of register offers us ways of recognizing how the challenges of academic language are relevant to all students, and how they challenge English language learners and speakers of socially marginalized varieties of English in particular ways. It also shows us that the challenges of academic language begin in the early years of schooling and then grow as students move into disciplinary learning and the specialized knowledge of secondary schooling. Since advanced language development (Schleppegrell & Colombi, 2002) is an ongoing project in school, attention to this development is crucial to progress in addressing the achievement gap and other important educational issues.

Most of the language we learn comes through participation in the world around us, without explicit attention to form. For most children, school may be the only place where matters related to language are explicitly discussed; where learning about language is an explicit concern. Unfortunately, such attention to and learning about language has often been operationalized as learning vocabulary or learning to label parts of speech or learning the grammatical rules for correctness in standard English. Attention to language in school needs to go beyond this to address explicitly how content knowledge is expressed in and assessed through language. It is in school that questions that get at content through language analysis can be directly addressed, including ones like: *Who is doing this action? What is the relationship between the ideas in these sentences? What words does the author use to refer to the main character, and how does that change during the story? What language gives us clues about the author's point of view on this topic?* Students can learn to answer such questions by recognizing

the language resources for introducing or eliding agency, for making logical connections and developing chains of reference, and for infusing a point of view in implicit ways. Many other questions about "content" can also be answered through through analysis of language.

Language and content learning do not exist in the classroom separate from each other, and they cannot be effectively taught in isolation from each other. Unpacking dense academic registers exposes the content meaning and implicit interpretation in challenging language forms. Teachers and students can explore the 'voices' in a text, and can examine how a theory or explanation develops clause by clause, how a point can be conceded, and how to argue with authority. These are content-based concerns that exploration of language can help students address, and the exploration also illustrates to students that content is presented in language and that by analyzing the language, they can uncover the nature of the content. To produce language that does more than just recount what they have done and instead 'repackages' new knowledge in ways that present it as general rather than specific; as abstract rather than concrete; students need language resources for presenting generic and abstract knowledge. This paper has described some of those language resources–grammatical metaphor expressed in nominalization and reasoning within the clause instead of with conjunctions, long reference chains, and diverse ways of organizing a clause and text–and functional linguists have provided many other, richer descriptions that can inform and naturalize language-oriented pedagogies.

Students need many opportunities to practice speaking and writing about what they have learned in ways that enable them to present themselves as knowledgeable. By focusing on register variation as the key issue in language development at school, teachers can address the demands of the contexts of learning and enable students to participate in disciplinary discourses that call for authoritative presentation of knowledge in the tasks and genres of the subject area. But many teachers do not currently have sophisticated or discipline-related understandings about the language their students need to control for academic success, and are not prepared to provide appropriate linguistic support to students as they learn across content areas. This is a key shortcoming of our educational practices and teacher preparation systems. Language teaching needs to be infused into content teaching at all levels and in all subjects, and to accomplish this, teachers need broader and deeper metalinguistic awareness, as well as pedagogies that address language issues as they accompany and amplify other pedagogies. Teaching needs to be recognized as a form of *linguistic* work where teachers foreground everyday language in some

contexts and technical or abstract language in others to negotiate the differences between the knowledge and language students bring and the knowledge and language they need to develop, related to the task at hand and their current level of knowledge. Enriching educational pedagogies and practices in these ways calls for good understanding of academic language and of the challenges of learning language and learning through language, and it calls for tools for talking explicitly about language in academic subjects.

Researchers also need to focus on academic register variation and learn more about how students appropriate new registers. Oral language use is a crucial factor in academic language development, as it models the reasoning typical of different subject areas and can be used by teachers to connect with more everyday registers and help students develop proficiency in academic registers. But much more work has been done to identify the features of the texts students read and are asked to write than of spoken language or demands for oral language in schooling, so the investigation of oral language genres and registers remains an important focus for research. Oral academic language development interacts with written language development, and we need more studies of the demands of schooling in terms of the mode continuum and movement between oral and written language. Tasks, texts, and tests interact with each other in student learning, and both oral and written language are important for developing students' confidence with and proficiency in the language needed to present new knowledge.

Recommendations for research

An agenda that enhances support for the academic language development of English language learners and speakers of socially marginalized dialects can draw on research already available as well as call for new research. The work of functional linguists on academic register features of disciplinary language and genres at different levels and in different subjects can inform a research agenda that explores further the role oral language can play in supporting students' development of academic language.

Some key questions for further study include:

- What are the genres of oral and written academic language that students typically engage with at different grade levels? What are the language and discourse features that teachers attend to as their students engage in these genres?

- What are the pathways into oral and written academic registers in different subjects? How does proficiency with academic registers develop?

- How is academic oral and written language used in different kinds of classrooms, situated in different social formations? How does student engagement in classroom discourse and teacher-student interaction vary across settings? What are the implications of this variation for teaching and learning?

- Where have teachers been successful in supporting talk that connects language and disciplinary knowledge? What are the ways teachers build on students' everyday language as they support academic language development through classroom talk?

- What are the key register features to focus on in teaching at each grade level and in each subject area, and what are the features of a linguistic metalanguage that enables connections to be made between language and content meanings to support students' learning?

- What are the similarities and differences between native speakers and English language learners and speakers of socially marginalized dialects in the way increased metalinguistic awareness is most effectively implemented in classroom practices and pedagogies?

- How can we effectively introduce greater language awareness in educational research and practice to improve teachers' ability to engage students in talk about content-meaning connections?

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