

**Comprehending in the Subject Areas:
The Challenges of Comprehension, Grades 7-12, and What to Do About Them**

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Comprehend This: Introducing the Problem

Day in and day out, most people comprehend texts of one kind or another. Despite, or perhaps because of, the omnipresence of comprehension tasks in daily life, very few people can offer a clear definition of just what it means to comprehend something. Even people who have studied comprehension for years find it difficult. The question becomes even more complicated when we consider the many different forms of representation to be comprehended, including print texts, oral texts, images, and chart or other graphics. Even more complex: The integration of all of them. And just to put the final bit of icing on the case, consider what is required to comprehend texts of different domains. Is there a difference, for example, between the comprehension of a mathematics word problem and the comprehension of a newspaper article? A journal entry from the 17th century? A lab report? An excerpt of a novel?

Conversely, think about the act of comprehension required across different types of texts all within one domain of learning. For example, different reading practices and skills may be required to read a science textbook compared to a report written by a scientist, even when the concepts of study are at the same conceptual level. More to point, do experts read differently from novices precisely because they are experts (i.e., they have the knowledge, skills, and strategies they need to read proficiently in their domains)? If so, then why would anyone imagine that secondary school students could or should read subject-area domain texts in order to learn the knowledge, skills, and strategies of the domain?

Although we have a strong research base around a number of these questions, many remain largely unanswered in specific ways. In particular, questions of reading in the subject-matter domains have been largely unattended in research on middle and high school literacy until recently¹. Even more critical, there is little research or practical experience with how to *teach* within and across those differences in ways that support a novice's developing competence with more and more sophisticated texts of different domains. And yet educators in a range of contexts ask young people to comprehend print texts in multiple domains of secondary school learning on a regular basis. Add to this demand the fact that as young people move through schooling, they experience more and more complex texts. Moreover, it is often the case that very little instruction in how to read text is offered beyond the upper elementary grades even as texts become more complex. Finally, the possibilities for engagement in non-school texts and experiences increases as children move into adolescence because they are more independent (Eccles, et al., 1993; Moje, 2002).

This is the challenge I address in this chapter. *Answering* these questions is beyond the scope of this chapter (or even my life's research and teaching agenda), but the chapter will touch on a number of these issues. To begin, I provide a working definition of comprehension. Next, an example drawn from a real-world science text helps to distinguish comprehension at the elementary level from what we ask young people to do at the secondary level. To conclude the chapter, I offer planning and teaching practices that can support young people not only in comprehending sophisticated texts of different domains, but also in *learning to comprehend* texts that challenge their working knowledge and, at times, their interest and engagement.

Working Definition of Comprehension

¹ Patricia Alexander and colleagues have done groundbreaking work in domain-specific reading, but primarily focused on college-age students. Still, this work has been and will continue to be extremely useful in applications of comprehension teaching practices for older youth.

Comprehension—whether of oral or written text—is at its core about understanding what a speaker or author is trying to say. Even this simple definition, however, could easily inspire controversy. Is comprehension a matter of figuring out what an author is trying to say or about making meaning of concepts for one’s own purposes? Should one try to get at the author’s intentions or is that impossible? Does all meaning reside in the text or in an interaction between text and reader? Is comprehension about determining the main or primary idea(s) being expressed or communicated in the text and understanding the relationship of supporting details to the main idea? Or is comprehension the full range of processes of information extraction, critique, summarization, synthesis, and application? A full review of the many ways of thinking about this complex phenomenon cannot be offered here (but see Pearson, this volume, for more detailed analyses of comprehension research). However, I do offer a brief survey of a few definitions and components of comprehension.

In this chapter, I work from a well-established theoretical and empirical model of comprehension as the interaction of a reader and text (Rumelhart, 1994) immersed in particular activities, situated in specific and broad contexts, reading for particular purposes (Moje, Dillon, & O’Brien, 2000; Tierney & Pearson, 1981, 1992; Scribner & Cole, 1981; Snow, 2002). The elements that a *reader* brings to a text include word recognition knowledge, vocabulary knowledge, background knowledge, linguistic and textual knowledge, ability to infer meanings, the ability to use strategies to make sense when comprehension is challenged, and motivation and interest to engage with a given text (Guthrie & Wigfield, 2000; C. B. Snow, 2002; Tierney & Pearson, 1981, 1992).

Readers read for particular purposes in particular activities, as well (Scribner & Cole, 1981). After conducting a long-term, large-scale ethnographic and experimental study of readers

and writers in Western Liberia, for example, Scribner and Cole concluded that literacy was not just a set of skills that people learned, but regular, everyday practices situated in the tasks people needed to accomplish on a daily basis. This point can be extended to comprehension:

Understanding a text does not occur outside the purpose for which one is reading it. Think about the difference in your comprehension were you to read this chapter to guide your own teaching, versus reading it because you have to lead a discussion on it in a literacy course, versus reading it to present to colleagues across the subject-matter areas at your school. You might draw on the same concepts from the chapter, but your different purposes and applications would shape the sense you might make of the concepts, as well as how you represent them to others. Similarly, think back over times when you have read something at one point in your life and then read it again several years later. Both changes in knowledge and purpose for reading may intervene on the example, reinforcing the idea that not only does purpose matter, but the specific context (whether time or space) of the act of reading may be crucial to comprehension.

The possible *contexts* that can shape a reader's meaning making are vast. For secondary school students, the contexts are potentially more vast than for young children, simply by virtue of the nature of secondary schools and of adolescence. Contexts for an adolescent can include the academic subject area in which one is reading (e.g. science), a context that changes from hour to hour throughout the adolescent's day; one's ethnic background; the social situation in which one is reading; a broad, sociopolitical context; a family situation; peer groups; extracurricular activities; and even variations in environmental factors such as temperature or noise around a person when she reads (Moje, Dillon, & O'Brien, 2000).

Finally, the *text* contributes to the reading process because texts are written in a variety of ways. Texts can tell stories (i.e., narrative) or explain information (i.e., exposition) and some

texts do both. Texts can pose problems to be solved, or can lecture readers on methods to solve problems. Texts can be written in many different styles, relying heavily on technical language and particular ways of phrasing ideas, or they can be written to appeal to more general audiences.

How Comprehension Demands Differ in Elementary and Secondary School

What makes comprehension a different task in middle and high school learning activities from the task of reading in elementary school activities? Many of the questions raised in the introduction of this chapter foreshadowed the answer to this question: In short, reading at the secondary school level is more demanding, in part because the texts are longer and more complex, in part because the expectations for prior knowledge are so high, in part because the concepts become more abstract and complex. Complexity increases as a function of domain specificity, of the nature of concepts addressed in the upper levels of schooling, and as a function of the length and quality of texts (Alexander & Jetton, 2001; Alexander, Kulikowich, & Jetton, 1994; C. Snow, 2009).

These points are coupled with two other extremely important observations. One is that we know that regular and explicit literacy instruction tends to diminish around grade six. Students may pick up “tips” on how to read certain kinds of texts on an occasional basis, but sustained instruction in literate processes and practices is rare (Biancarosa & Snow, 2004).

Equally important, many claim that students’ interest in “voluntary reading” also diminishes at about the same time period, arguing that as students go through school from upper elementary through high school, they become less intrinsically motivated to read or have less curiosity about new books and topics, and they spend less time immersed in reading longer and more complicated texts (Guthrie, Hoa, Wigfield, Tonks, & Perencevich, 2006).² Non-school texts and experiences are often more engaging than the texts youth are asked to read in school

² It should be noted that these findings refer largely to “school-like” reading.

(Alvermann, Young, Green, & Wisenbaker, 1999; Leander & Lovvorn, 2006; Moje, Overby, Tysvaer, & Morris, 2008). Simultaneously, these same researchers argue, students become more extrinsically motivated to read school-based texts because they become more grade-oriented, competitive, and driven by conceptions of their abilities as readers (Guthrie & Davis, 2003). Although all students lose some of their intrinsic motivation for reading between grades four and seven, proficient readers tend to maintain more of a balance between intrinsic and extrinsic motivation (Guthrie & Davis, 2003).

Another way to think about what some label, “lack of motivation to read,” is that as young people age, they meet competing demands on their time. They are often expected to complete more school homework, extracurricular activities increase, domestic responsibilities (i.e., caretaking of young siblings or working outside the home) increase, and they have more access to peers. In fact, among the most common reasons given by adolescents for *not reading* outside of school are time, noise and other distractions, and too much homework (Moje, et al., 2008).

In a digital age, young people also have access to a global network of peers, texts, and activities (e.g., massive, multi-user computer games) that are often more compelling or engaging than are the texts of schools. When one considers each of these changes, together with the probable lack of change in young people’s overall literacy skill (due to lack of continued, sustained literacy instruction), it should be clear that secondary school comprehension is a difficult task. Indeed, attending to these issues puts a different spin on recent test results: Perhaps we should be surprised that so many secondary-school-age youth read at even basic levels.

The argument that youth, who are increasingly disengaged in school increasingly complex texts with little instructional support suggests that we need to tackle the problem of text (all kinds, from print-based to image-based) in subject-matter instruction at the secondary level. Tackling that problem requires some insight into what makes the texts of secondary school more challenging. As noted previously, secondary school texts are usually longer than elementary school texts and are typically written in a smaller font than children are accustomed to reading in elementary school. The change even in format can be dramatic and abrupt. More challenging, however, are assumptions about the knowledge young people bring to the reading task, from world knowledge to subject-matter domain knowledge, discursive knowledge, semantic knowledge, and pragmatic knowledge, to name just a few (Moje & Speyer, 2008).

Consider, for example, a text titled, *Top U.S. Warship delivers aid to Georgia* (CNN.com, September, 2008)³, distributed in a sixth-grade social studies class in the first week of school. Students were asked to write a summary of the article, using the categories of Who, What, Where, Where, and How as guides. The text consisted of 21 “paragraphs,” each 1-3 lines long, with none more than one sentence in length. Here, for example, are just the first three paragraphs:

(CNN) – A U.S. Navy command ship arrived in the Georgian port of Poti on Friday to deliver humanitarian supplies following the republic’s war with Russia last month.

The USS Mount Whitney will also coordinate the work of a group of NATO ships currently in the Black Sea, the Russian news agency Interfax reported.

Two other U.S. vessels have already arrived in the Georgian port of Batumi, south of Poti, delivering humanitarian supplies, the U. S. Navy said.

³ The exact story is no longer retrievable on www.CNN.com. It should also be noted that no specific date was given on the text distributed in class, which could be considered antithetical to the work of reporting on “current events,” particularly because references are made in the text to “Friday,” etc. As Wineburg (1998) has noted, one of the key reading tasks of social scientists, particularly historians and political scientists is to contextualize the sources of information they read. Without access to temporal information, the youth in this sixth-grade class would be unable to engage in historical or civic reading strategies.

One sixth-grader who read the article proclaimed it to be “the worst writing” she had ever read because it was “just a list of random statements.” Then she asked, “And which *who* am I supposed to name? Russia? Georgia? The U.S.? Dick Cheney?”

This young person’s legitimate questions reveal her lack of prior knowledge about the Russian-Georgian conflict (knowledge of which *might* have simplified the task of deciding on a particular subject—or *who*—for the summary), but also her lack of knowledge about how to handle complex *who/what/where/when/how* tasks. This particular young person had experience with such tasks in elementary school, but they were tightly constrained reading tasks, with clear subjects, foci, locations, time periods, and processes controlled by the teacher and text made available (e.g., there was usually only one *who* in a text). The jump from relatively simple texts and tasks to relatively complex texts and tasks was massive, abrupt, and unscaffolded in this instance, emphasizing the need for teachers to acknowledge and mediate several factors, including the demands of secondary level texts, the demands of secondary level tasks, and the legitimate lack of preparation young people might have for such texts. I use the word *legitimate* to refer to lack of preparation because I do not wish to play into the popular assumption that when young people come to middle or high school without the skills necessary to handle advanced texts and tasks it is somehow the fault of prior teaching. In some situations that may certainly be the case, but more often than not, it is the task or text that is new and demanding. This newness requires instruction by the people who assign the texts and tasks, that is, by the secondary school teachers in the subject matter domains. Secondary school subject-area teachers are the people who know their subject areas best, and thus, we are best equipped to teach our students how to read and write in the accepted ways of our domains of specialization. But what will that take?

First, the field needs a better understanding of the knowledge and skills demanded in subject-area domains. Second, it would be helpful for teachers to consider how to select, analyze, and use the texts of respective domains, rather than simply using the assigned textbook or locating isolated pieces and assigning them with little to no instruction. Finally, teachers and researchers alike could advance work in this area by thinking in terms of regular teaching *practices* (Moje & Speyer, 2008) or *routines* (Deshler & Schumaker, 2005; Schoenbach, Greenleaf, Cziko, & Hurwitz, 1999) and accompanying subject-area literacy strategies (Buehl, 2002; Vacca & Vacca, 2004).

Types of Knowledge and Skill Necessary for Comprehension

A previous analysis I conducted with a colleague in a high-school classroom indicated that at least four types of knowledge and/or skill are necessary to comprehend advanced texts of the secondary school subject areas (Moje & Speyer, 2008). These knowledge types include: (a) semantic, (b) disciplinary (i.e., historical, scientific, mathematical, literary, geographical, etc.), (c) discursive, and (d) pragmatic. We further illustrated that at times the working knowledge and skill from one subject areas are required for comprehension within a different subject area. Reading statistics germane to the social studies or natural sciences, for example, requires mathematical knowledge and skill. Understanding the import of a particular mathematical concept may require historical knowledge, and so on. Indeed, the more advanced the subject matter concepts, the more likely it is that disciplinary knowledge and skill from multiple areas will be required to make sense of texts (see Moje & Speyer, 2008, for a simple example).

I refer readers to that analysis for social studies knowledge and skill demands; in this chapter, I examine an excerpt of a text that a student might encounter in a typical high school science classroom to demonstrate how different knowledge and skills are demanded for the

comprehension and interpretation of text. Assume, for example, that a teacher is interested in teaching a unit on genetics to high school students in a biology class, and decides to use the following article from a popular science website (www.scienceagogo.com, October 27, 2008) to demonstrate the application of content concepts, reinforce vocabulary the students are learning, and to show students that the classroom concepts have meaning in the real-world (only a brief excerpt is provided here).

Immune system overdrive responsible for cold symptoms

by Kate Melville

The human rhinovirus (HRV) cops most of the blame for the sneezing and runny nose that we associate with the common cold, but in reality, it's not the virus but its ability to manipulate our genes that causes the most annoying cold symptoms. Now, for the first time, researchers have revealed how HRV hijacks our genes to trigger this overblown immune response, possibly opening the door for new therapeutic treatments for the common cold. "The study's findings are a major step toward more targeted cold prevention and treatment strategies while also serving as a valuable roadmap for the broader respiratory science community," the University of Calgary's David Proud, lead author of the study, told the American Journal of Respiratory and Critical Care Medicine.

Source: American Thoracic Society, Procter & Gamble

Semantic Knowledge

That semantic—or word—knowledge is needed to make sense of this passage may seem rather obvious and is often the first factor considered by teachers and reading theorists alike. In the first paragraph alone, the passage is ripe with technical language including: *human rhinovirus (HRV)*, *genes*, and *lead author*. The piece goes on to include language about *inoculations*, *immune response*, *nasal mucosa*, *antiviral proteins*, *viperin*, and “*pro-inflammatory cytokines*.”

These technical terms are important because we quickly home in on them as educators, worrying that youth readers will be tripped up by such terms. What is interesting, however, is that although these technical terms are often daunting to

adolescent readers, they are not usually the most problematic in terms of comprehension because readers are aware that they do not know the meaning of these terms, and they recognize that one point of the passage or larger unit of study is to be introduced to such terms. There is, then, no shame in not knowing the terms.

Technical terms are important, but equally problematic are everyday terms that readers think they know, but whose meanings are specialized in the context of the passage and domain. *Subjects* is such a term. In most cases, the average adolescent will be able to decode and/or quickly recognize the word *subjects* but may not understand that it functions as a reference to research participants studied under particular conditions in the context of science and of this passage. *Therapeutic* is another example of an everyday word that many young people may have read or heard, but perhaps not in the context of a drug regimen. More interesting is the fact that the word *genes* may actually seem to be an everyday word to youth readers, given its everyday parlance on popular crime shows or in the news media. But the likelihood that readers really know the scientific meaning of *gene* is slim.

Finally, the passage also includes *everyday* terms that might be especially challenging to adolescent readers due to their unusual syntactical use in this passage. The phrase, “*human rhinovirus (HRV) cops*,” for example, may demand a second look even of adult readers, especially with *cops* following a technical term that may throw off readers. These terms are not words that will pose decoding or word recognition challenges, but their syntactic use changes semantics, implicating the role of syntactic knowledge intertwined with semantic knowledge in passages of this complexity. Many of these

terms are ones that most youth will have been likely to have heard before; however, the difference between their casual use and their meaning in this passage may be critical.

It is also worth noting that the author of this piece has used a number of verbs (e.g., *cops*, *hijacks*, *manipulates*) that suggest a strategic orientation on the part of the *HRV*. Is this move intentional on the part of the journalist, signaling the active debate in biological science communities over whether viruses are intelligent life forms, or is it simply a matter of rhetorical device on the part of the journalist? Such a question reveals the way that deep comprehension is dependent on the intersection of semantic knowledge (recognizing that such words signal a strategic—and perhaps even *sly*—orientation), rhetorical and discursive knowledge (the understanding that authors write with audience in mind and that writing conventions differ from one discourse community to another—i.e., the news media to the scientific community), and disciplinary knowledge (the knowledge of the contested status of the virus in biological science).

The mention of disciplinary knowledge takes us from the discussion of semantic knowledge, or knowledge of words and word phrases, to that broader of category of disciplinary knowledge: What does it mean to *know* something from a disciplinary standpoint, and how does that knowledge shape one's comprehension?

Disciplinary Knowledge

One dilemma of reading comprehension at the secondary school level is that although the relationship between comprehension and prior knowledge is extraordinarily well documented (e.g., Alexander, et al., 1994, among many others; R. C. Anderson & David, 1984; Kintsch & Van Dijk, 1978), most teachers expect young people to read and *learn from* texts on subjects they have not yet encountered. The idea that anyone could really *learn from* the text above with

only a lay person's knowledge of genetics and epidemiology is rather far-fetched. And yet, we expect that of young people on a daily basis because they are assigned texts to read regularly, whether textbooks or other kinds of text materials.

For example, in the HRV passage shown previously, the reader must know something about how viruses work, both to understand the content of the text and to be able to question the author's use of language that makes a virus seem like a sentient life form. Moreover, the many technical terms and phrases used in the passage require disciplinary knowledge. What, for example, does it mean when the author refers to an "immune response"? How are "therapeutic treatments" unique from other kinds of treatments? As the text progresses (not included here), it becomes equally important to understand how scientific experiments are conducted as the text refers to "sham inoculation," obtaining "cell scrapings from the nasal passages," the passage of time (a key ingredient in growing bacteria), and "control" and "HRV-inoculated" groups. The text becomes more and more dependent on scientific domain knowledge, in fact, as one continues reading, a fact that might be missed by a teacher searching for a real-world piece to exemplify concepts about viruses. Of note is the fact that the passage becomes more domain-specific not only because of the increasing use of technical vocabulary (e.g., "antiviral proteins," "viperin," "pro-inflammatory cytokines" and "chemotaxis"), but also because it assumes an understanding of the cause-effect relationships assumed in scientific experimentation, of inquiry processes, and of ways of communicating ideas (more on that to come). These are all aspects of disciplinary knowledge that need to be taught even as we engage students in reading about these concepts. In short, we cannot expect young people to learn independently from these disciplinary texts, because these texts are written inside the discourse community of science and

thus depend on readers already possessing some working knowledge of the domains, their epistemological assumptions, and the resulting discourse and terminology.

Some readers might appropriately wonder at this juncture whether, in fact, this knowledge dependence claim is really true of *textbooks*. Textbooks are, after all, written to be readable for the learner and thus should not require extensive disciplinary knowledge, at least in theory. They are meant to impart disciplinary knowledge, are they not? This is a reasonable question, but research on textbooks demonstrates that, in fact, textbooks suffer from two problems: They are often poorly organized, and they make extensive prior domain knowledge demands on readers (T. H. Anderson & Armbruster, 1984; Armbruster & Anderson, 1985; Chambliss & Calfee, 1998). Even introductory textbooks make domain knowledge demands; indeed introductory texts in their attempt to only survey the domain landscape may make even more domain knowledge demands than more subject-specific texts. It is often the case that in the attempt to provide a scan of basic facts about a topic, introductory textbooks leave out key ideas that would help the reader understand relationships between key concepts. Consider, for example, this passage on the 1920s drawn from an eighth-grade history textbook (Davidson, 2005):

The Prosperous Twenties

The auto industry was important in the booming economy. Factories turned out new consumer goods such as radios, vacuum cleaners, and refrigerators. Many people also invested in the stock market for the first time. Stock prices rose steadily. Women could now vote. More women also joined the workforce. Young women known as flappers shocked older Americans with their short skirts and reckless behavior (p. 553)

Much could be said about this particular passage, but in this case I use it simply to illustrate how much making an inference about prosperity in the 1920s depends on having some knowledge about the 1920s. Adult readers with extensive background knowledge can, with some effort,

make connections among these ideas (although in my professional development work with groups of teachers I have noted that most adults come up with variations on what they consider to be the main idea of this passage). The typical eighth-grade student, however, reads this text as a series of disconnected or tenuously connected statements (Moje, 2007).

Consequently, secondary school content teachers find themselves in a bit of a bind: They cannot rely on textbooks alone because textbooks often contribute to the reading challenge for young people and because many youth find textbooks less than stimulating (Stockdill & Moje, 2007), but real-world and primary source texts also present reading challenges for young people because these texts also make disciplinary knowledge demands. The *Scienceagogo* site, for example, can assume that its readers know and care about science concepts; why would anyone who did not know or care at all about science search a popular science website?

Discursive Knowledge

Discursive knowledge refers to an understanding of the ways texts are constructed in the domain in which they are written and how they are tied to the purposes for which they were originally written. Secondary school students need both the general knowledge that domains have different discursive demands, which the New London Group (1996) referred to as *metadiscursivity*, and the specific knowledge of particular domain discourses. For example, as many analysts of scientific text and discourse have noted (e.g., Gee, 2001; Hand, Wallace, & Yang, 2004; Hicks, 1995/1996; Lemke, 1990), scientific writing typically removes the subject from an action, turning actions or processes into things and phenomena (e.g. “we studied three processes” becomes “the study of three processes”). Scientific writing also requires precision in language use, thus proliferating technical terms that capture as closely as possible the precise meaning of a phenomenon. Scientific writing also uses what might seem to be common,

everyday words in particular ways (e.g., “significant” has a statistical meaning in science and would not be used to mean “important” or “noteworthy,” although statistically significant findings are both important and noteworthy). Finally, as Lemke (1990) noted, scientific writing is based on certain assumptions about the world, which he referred to as “thematic formations.” In particular, scientific experimentation rests on the idea that phenomena can be identified, studied, and known; that correlations between phenomena do not equal causation, and that variation can and must be controlled in order to determine causation. Thematic formations of science as a discipline and profession, for example, revolve around deepening, and often challenging, everyday knowledge. Scientific themes also focus on controlling the natural world in the attempt to produce innovations, tools, or solutions that improve human life. Thematic formations differ for each discipline or domain of study, thus producing different ways of talking, reading, and writing in the different subject-matter areas.

With these discursive points in mind, the HRV text illustrated in this chapter poses an additional challenge to adolescent readers because it actually represents a kind of hybrid between scientific and everyday discourses. The conflicting uses of terms discussed previously underscore this hybrid by illustrating that viruses are represented as agents that can manipulate, when in actual practice, scientists cannot determine whether viruses “think” or simply “act.” What’s more, the discourse of the piece, written in a somewhat friendly or everyday language, might send mixed messages to young readers about the quality of the science therein or about conventions for writing scientific findings. Furthermore, as noted previously, the piece becomes more and more “scientific” as it progresses, demanding that the reader navigate the discourse community of everyday or news articles and the discourse of science.

Pragmatic Knowledge

Making sense of this text also requires another kind of knowledge that is tied to the question of purpose. In short, why has this text been written, and why is the reader reading it? Pragmatic knowledge involves the reader's recognition that one should get information, ideas, or perspectives from texts. The question, however, is which information, ideas, or perspectives are to be taken away from the text, and once one has them, what is to be done with them? Studies of expert readers (Leinhardt, 1989; Wineburg, 1998) have demonstrated that expert readers either ask for, articulate, or have in their minds an explicit purpose when approaching a text. How many high-school-aged readers approach texts such as the human rhinovirus newspaper article with a specific purpose in mind? How many high school teachers help readers set a purpose for the various texts they read? And when we do set purposes for student readers, how clear and specific are they? Equally important, are the purposes ones that match the purposes of the discipline? A scientific researcher who studies HRV would be likely to read the HRV text with her own investigations in mind. How often do we use texts in secondary school classrooms as ways of launching investigations, framing problems, or expanding on findings? More often than not, we assign texts to be read and ask students to answer "comprehension questions" about the text or to have a class discussion of them. How might comprehension of the text change if students were asked to read domain-specific texts for domain-specific purposes?

The mention of "questions" leads to yet another type of pragmatic knowledge useful for comprehension: the recognition that texts can be questioned. Many of the youth with whom I work on a regular basis seem to struggle with asking and answering analytic and critical questions. My analysis of their discussion practices does not suggest a lack of cognitive skill or even of understanding of the text's main ideas, but rather I have observed a lack of movement to higher or deeper levels of comprehension, meaning making, or understanding. As illustrated in a

previous analysis of young people reading the Emergency Quota Act of 1921, not one student questioned what the “emergency” was or why the law used U.S. Census data from 1910, rather than from 1920, the Census closest to the enactment of the law (Moje and Speyer, 2008). When prompted to question these things, they were able to generate reasonable hypotheses, but they did not ask those questions of the texts themselves.

In addition, readers need to be able to recognize when they need more information than is available in a text. In order to obtain that information, however, readers need additional knowledge or skill, specifically, search and analytical skills and knowledge. Let us assume that all of our high school readers possess all the different kinds of knowledge described above. They still need to build relevant knowledge or information (we can assume that they do not possess it in depth, or we would not be teaching them biology). Thus, they either need the information handed to them (say, in the form of a lecture), or they require knowledge of how to access relevant information. Once they have access to the information, they must be able to make sense of relevant information. The demand for additional knowledge directs attention to the kind of search skills needed in a digital age, where obtaining information is a relatively simple task, but sorting through it, analyzing its validity, and making sense of the information and its relationship to the topic and texts under study is challenging. Not all texts are equally valid; learning how to analyze the validity of a text has always been central to good teaching, but is even more imperative in a digital world (Coiro, 2003).

The brief analysis just presented of the types of knowledge and skill necessary for reading even a short piece of text should reveal the complexity of what it means to comprehend something at the secondary school level. Indeed, this list is quite probably incomplete, particularly as one considers all the different types of text that secondary school teachers and

students encounter (or should be encountering) on a daily basis. The analysis may make the task of teaching students to understand and use complex texts in complex ways seem daunting, even impossible. Many subject-area teachers recognize how much young people struggle with the texts of the discipline, and in frustration, they simply avoid using texts in their classrooms.

Avoiding texts, however, just sidesteps the challenges and potentially disenfranchises young people, especially those who do not have access to disciplinary text knowledge and skills in other contexts of their lives. National test scores seem to bear out this concern: Data from the National Assessment of Educational Progress (J. Lee, Grigg, & Donahue, 2007) show that although a reasonable number of youth can read at “basic” levels, few can read with proficiency or at advanced levels. Similarly, a recent report of the American College Testing service (ACT, 2006) posited that 51% of youth who took the ACT test were not prepared to deal with the reading demands of the college or university. These statistics, together with the analysis provided here, suggest that secondary school teachers need to mediate text reading for their students. Reading in specialized domains requires that people be taught to read in those domains. Reading in the domains *is* reading to learn, but it nevertheless requires that young people also learn to read these specialized texts. Subject-matter teachers are the best people to teach youth how to make sense of the texts of those domains. But where does one begin?

Implications for Teaching

In this section I focus on two aspects of teaching demanded by the recognition that comprehension is a complex process and that the texts of the upper-level subject areas are challenging to all adolescent readers. One is the importance of thinking about how texts are chosen for use in the classroom. The second addresses the teaching practices used to support students in working with those texts.

Selecting and Analyzing Texts of Instruction

Too often, middle and high school teachers assume that the course textbook should serve as the unquestioned textual resource for classroom instruction. Not only do I want to provide ideas for analyzing classroom texts, but I want also to encourage teachers to seek out other kinds of texts (cf. Bain, 2005; Lee & Spratley, 2006; Snow, 2009). Students across the different subject areas can benefit from encountering many different types of texts that cast subject-area concepts in different ways (C. D. Lee & Spratley, 2006; Solomon, van Der Kerkhof, & Moje, in press). Using both the textbook and many other types of texts, however, requires that teachers analyze the texts so that they know where and when they will need to scaffold students' comprehension of the texts, where they work in particular kinds of literacy strategy instruction, and where and when they can assign texts to be read independently. The questions shown in Figure 1 could be useful in such an analysis, although they are just a starting place for analysis.

[Insert Textbox about here.]

Once one analyzes possible texts, then one must make decisions about which texts will be used to do what and about how the texts will be used. It is particularly important to decide whether texts need to be scaffolded in terms of vocabulary, prior knowledge, and discourse. At times, however, one text can scaffold another.

Bain (2005) provides a helpful illustration of the process of text scaffolding in an analysis of his teaching of Columbus's exploration of the world in a high school history class. His first step was to determine the historical problem of how explorers viewed the world as flat or spherical in the late 1400s; Bain—a historian and 25-year veteran of teaching high school history—knew that many people of Columbus's time actually believed the world to be round, not flat, as the popular myth suggests. The problem he wanted students to investigate then was

whether Columbus was, indeed, the only brilliant fellow to posit that the world was round, a point that might lead students to question other taken-for-granted historical “truths.” He thus selected texts by historians to support students’ speculations that everyone but Columbus thought the world was flat in 1492. He presented these texts to students, followed by a text with a radically different message: a picture of Greek Titan Atlas holding a globe. This image-based text served to contest the other sources, given that the Greek civilization existed just a few centuries before Columbus, and so confounded the students. In creating that confound, Bain produced cognitive dissonance, which opened a space for new learning to occur (i.e., it sets a purpose for examining other texts), all by simply offering multiple print- and image-based texts.

Bain then provided his students with more texts to support, extend, or challenge their thinking and comprehension, supporting their comprehension of individual texts when necessary, based on his analysis of whether and how the students could read them. Bain’s example demonstrates that selection and use of texts to support content learning and reading comprehension has to be done in the service of particular cognitive and pedagogical functions and most definitely in the service of subject-area learning. He also illustrated that the question of selecting texts is less about the length or density of text (although he edited text length as he judged necessary), and is instead more about the juxtaposition of one text to others and to what he knew about his students’ thinking and prior experiences.

Teaching Practices for Enhancing Comprehension in the Secondary School Subject Areas

The usual answer for addressing the challenges of comprehension at the secondary school level has been to offer content-area literacy teaching “strategies” that build on what we know good readers do when they read. These strategies are intended to teach readers both the skills they need for making sense of content texts and the strategies they can use when their

comprehension breaks down. The idea of using strategies is critical for secondary school students because regardless of how proficient a reader is, the possibility for comprehension skills to be challenged in secondary school is high simply because the content and accompanying texts become more and more domain-specific and thus less and less likely to have been encountered previously. In other words, if we know that proficient comprehension is dependent in large part on one's prior knowledge, then we have to acknowledge that the more obscure or specialized the topic or concept being read, the less likely the reader will have extensive prior knowledge. Thus, the reader needs to be equipped with the ability to recognize her own comprehension challenges and then strategize about how to address those challenges. Enter the teaching of content literacy comprehension strategies. The problem that arises, of course, is one that has already been mentioned: Even strategy use is dependent on knowledge. Thus, if the reader is already struggling with a piece of text because prior knowledge is minimal, then how does he know what strategies will work best?

Another problem in considering the teaching of content-literacy strategies as a solution to the challenges of comprehension is that historically these strategies have been taught in generic ways, as if previewing a text, for example, is done in the same way regardless of the text itself, the needs of the learners, or the purpose of the activity for which the text is being read.

Content-area literacy teaching strategies provide a framework for thinking and an organization for instruction, but they may not address the greatest challenges presented by advanced content area texts being read by a wide variety of youth (i.e., who may or may not care). We need to continue to use literacy teaching strategies, but those strategies appear to work best if embedded in content teaching *practices* that make working with texts central to the work of content learning (Greenleaf, Schoenbach, Cziko, & Mueller, 2001; Sutherland, Moje,

Cleveland, & Heitzman, 2006). In what follows, I recommend teaching *practices* and related literacy teaching and learning strategies. The *practices* are activities that should frame subject-area pedagogy on a daily basis, with literacy teaching and learning strategies inserted as tools for engaging in the practices.

Knowledge building and purpose setting. To address the quite reasonable lack of prior domain-specific knowledge that young people bring into subject-matter classrooms, it is crucial to engage in knowledge building. However, it is also crucial that this knowledge building does not take only the form of lecturing to students. The practices suggested in what follows are ways to engage students in constructing the knowledge they need to make sense of texts. These activities also serve to set purposes or frame problems for reading, thus enhancing the possibility that students will be motivated to read and will be able to locate and analyze information and concepts offered in texts.

- Preview texts with strategies such as K-W-L, anticipation guides, preview guides, and advanced organizers. When previewing, keep in mind the purpose you have set for the reading. It is easy to lose focus when previewing, especially if students have a great deal to say about the topic. Equally important, staying focused on your purpose will allow you to make decisions about how much to preview, how long to continue the previewing activity, and what aspects to take up in later phases of instruction. Too often, previewing activities take up the bulk of instructional time, and we fail to revisit the previewing to assess what was learned. In addition, make explicit what you expect your students to do with the text (whether to ask questions, to use it in an essay, to link it to another text, and/or to critique or question its purpose in history).

- Contextualize texts. Discuss with students the purpose of the text for the context in which it was written. Who was its author? What did the author intend? To whom was the author writing? Although these are questions that historians routinely ask of texts in their work (Wineburg, 1991; Bain, 2006), these questions are relevant for students reading texts in any content area, because no matter what the text is, they are reading it outside of the context in which it was written. Often mathematics and science teachers will argue that context does not matter for the texts of mathematics and science, but all texts are produced in and for particular contexts and purposes, and students benefit from knowing what those are or knowing how to ask what they are and how to find out and assess those contexts and purposes.
- Talk about the texts using text discussion strategies such as close reading, dictionary searches, concept mapping of ideas in texts, and text-self/community/world connections. As you talk about texts, define words together and talk about nuances in meaning. Model for students how to ask questions even at the word level.
- Make texts visible. Too often we introduce new concepts, using new words that our secondary school students have never seen written. They hear the word and make it part of their oral vocabulary, but they do not get to connect the written form with the word they heard pronounced. Project sections of text on an overhead screen so that students can see and hear words read and so that you can point to words as you read. Look up important words together in the dictionary while also pointing to them on a common text. Similarly, we talk about places and concrete things, but rarely make them visible for an entire class to see, critique, and discuss. One of my teaching colleagues, Mr. Tom Hoetger at Western International High School in Detroit, Michigan, uses political

cartoons and other images in all of his lectures to ensure that young people are not only reading words, but also reading images. He does not just flash the images at his students, but asks them to analyze the images, as a whole group.

- Read charts and tables. Mr. Hoetger makes the same move with charts and tables that students often encounter in texts. Rather than simply ignoring the charts and tables—many of which are often central to meaning making around certain concepts (see Moje & Speyer, 2008), he engages students in analyzing the trends or patterns represented in the charts and tables. At times this work requires teaching students how to read the charts and tables, a skill that is absolutely necessary in social sciences, natural sciences, and mathematics, but that is not typically taught in explicit ways.

Questioning. In the tradition of Palincsar's teaching practice of Reciprocal Teaching (Palincsar & Brown, 1984), I suggest that secondary school teachers model good questions about texts and subject-area concepts for their students in whole-group, small-group, and individual activities. This requires more than posing questions on a study guide, but instead involves showing students how to question texts. A model for this kind of work at the secondary level lies in Bain's (2005; 2006; 2008) work in history classrooms. Bain models questioning from the very first stages of a unit by framing problems for students to tackle. He also helps to maintain motivation to continue questioning by selecting texts that challenge previously held notions of the concepts.

Visualization. Visualization is often suggested as a literacy teaching strategy in supporting students as they read literature (see for example the chapter by Roberts and Duke). In the case of social science, natural science, and mathematics, visualization teaching practices may take a different form. For example, Speyer and I (Moje & Speyer, 2008) found that we had to

provide images of immigrants from the late 1800s/early 1900s to help students understand the role of racist and classist ideologies in the immigration laws that were passed during the time period. We read together, we discussed, we look at tables of immigration statistics, but it was not until our students saw images of Italians, Poles, and Romanians that they began to understand the assumptions being made about these groups in that period. In a different way, seeing an image of a bacteria colony can help science students learning to investigate and understand the spread of communicable disease. Seeing a graphic representation of the slopes of two lines may help mathematics students understand how the intercept functions to signal key mathematical information to both the mathematician and to someone applying mathematic concepts (e.g., an economist or business person). In short, visualization may be about encouraging students to imagine and visualize scenes or interactions, but it may also be about providing visual images *and linking those with print and numerical information* in a way that furthers conceptual understanding.

Summarization and synthesis. In my own teaching, I sometimes use a lot of time previewing texts or activities of a unit and, quite simply, I run out of time for summarizing what has been learned. Summarization, however, is a key teaching practice for helping adolescent readers learn to integrate ideas across texts. National test data (i.e., the NAEP) suggest that adolescent readers can generally extract main ideas from single texts, but are less proficient synthesizing ideas across texts (J. Lee, et al., 2007). Consequently, it is critical that we engage in instruction that not only encourages summarization within and synthesis across texts and ideas, but that teaches students how to summarize and synthesize. Phyllis Blumenfeld (Blumenfeld, Kempler, & Krajcik, 2006) has written extensively on the importance of what she refers to as “coming back around” on concepts and ideas. Teachers can help students weave connections to

other texts and to broader unit concepts throughout each unit. More important in relation to text comprehension, we need to “come back around” by referring back to texts in both general and highly specific ways. Comparing words used across texts, examining different kinds of sentence structures and language used (i.e., “discourse”) in various text types, and highlighting points of similarity and contradiction can model for students how to look strategically across texts while also helping to develop metadiscursive skills. With regular opportunities to engage in intertextual analyses, summarization, and synthesis of texts, young people can learn to engage in such practices independently and regularly, anytime they read any type of text. In other words, although making intertextual connections may be an automatic, taken-for-granted practice for those of us who are proficient readers, we must recognize that making intertextual connections may not be the norm for our students, especially if they do not typically see how texts connect to each other in the study of a given concept. We have to teach them, both by modeling and by explicitly pointing out points of overlap and difference between and among texts of instruction. And, as Bain’s (2005) work on teaching students to question commonly held historical assumptions demonstrates, we need to consider these intertextual connections *as we plan* for instruction, in order to choose the texts that will provide the most generative opportunities for dissonance and synthesis.

What Does Secondary School Comprehension Instruction Require of Teachers?

The short answer is “a lot.” Teaching young people the central concepts and practices of the subject areas is extremely challenging work. Just as comprehending the complex texts of high school classrooms makes many knowledge and skill demands on adolescent students, comprehension instruction at the high school level makes comparable knowledge and skill demands of teachers. The first kind of knowledge teachers need is of students’ interests,

knowledge, and skills. Such knowledge requires that teachers develop relationships with students that allow them to build knowledge of students and their community.

A second, and related, kind of knowledge is the knowledge of how to maintain student engagement in concept learning and text reading once the initial, situated interest (Renninger, Hidi, & Krapp, 1992) starts to wane. The example drawn from Bain (2005) provides one example of how such work can be done, but it also emphasizes how much careful forethought this kind of instruction takes. In addition, teachers who seek to build on students' interests as a way of engaging them must then possess skill in how one helps students learn to examine their own beliefs and to develop strong arguments for or against issues. Learning to look carefully at data and assess the validity of one's own beliefs is hard work even for adults who have honed their research and analysis skills; teaching 16-year-olds to do it when they do not possess the range of experience adults possess is even harder.

The third and rather obvious kind of knowledge and skills teachers must develop to do this work is deep disciplinary knowledge and skill. Teachers need not only to know the information and concepts of the subject areas they teach in order to choose texts, analyze them, and teach them, but they need also to have a sense of how members of the discipline engage in reading and writing as an aspect of knowledge production. As Brian Hand and colleagues (Hand, Hohenshell, & Prain, 2004; Hand, Prain, & Yore, 2001; Hand, Wallace, & Yang, 2004) have demonstrated in multiple studies, when teachers engage students in the discourse practices of the discipline, young people learn the concepts and the writing and reading skills to a greater degree of proficiency than when taught concepts apart from disciplinary practices.

A fourth kind of knowledge is knowledge of how to support adolescents of varying skill and interest levels in building relevant knowledge or in developing skills for finding and

interpreting information. Teachers also need to know not only how to develop reasoned critiques of issues, but how to teach novices to do so. For example, simply knowing that young people may never think to ask questions such as, “Who lived in the U.S. in 1910?” is key to knowing that the question must be posed and methods for answering the question modeled. Teachers may likewise need to model how to make sense of the data they find. Teachers in the 21st century further need to hone their skills of searching and critiquing texts available on the Internet. Learning how to support young people in navigating and comprehending Internet texts (Afflerbach & Cho, 2008; Coiro, 2003; Coiro, Knobel, Lankshear, & Leu, 2008) will be increasingly important as more and more schools and homes achieve real access to digital sources.

It may be that subject-area teachers will read this and say, “Wait a minute; isn’t it enough that I have to teach all of this content? Now you want me to teach comprehension of text as well?” This is a common question in secondary school literacy work. However, if I have performed my task well in this chapter, then it should be clear that comprehension of text is part and parcel of learning in the subject areas of the secondary school. Proficient learning in the upper-levels of schooling becomes increasingly dependent on being able to access, navigate, and comprehend many different kinds of text. Thus, to teach young people how to navigate texts in secondary school should be everyone’s task because it is really the process of teaching the key concepts of the subject areas.

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Textbox

Questions to Guide Analyses of Disciplinary Texts and Textbooks

1. For what purposes am I using the text?
2. How will I set a purpose for the students? What kind of purpose will help them learn the content best?
3. What can I assume students already know or believe about the concept I want them to learn from this text?
4. What seems to be the main idea the author wants to put forward? What other ideas in the text might get in the way of the main idea?
5. What are the key ideas or concepts in the text that support the author's intention?
6. Is any key information missing? If so, how might the missing pieces interfere with students' comprehension?
7. Is any of the information extraneous? How could I address the extra information? Why might the author have included it?
8. What challenges does the text pose for me, as an adult reader with relatively deep knowledge of this subject?
9. What challenges might the text pose for adolescent readers of this text?
10. What knowledge does the author seem to assume a reader will bring to this text?
11. What aspects of the text would my students find most interesting?
12. What aspects of the text would my students find most difficult?
13. What cultural, racial/ethnic, or gendered connections might my students make to this text?
14. How would I describe the structure and tone of this text?
15. What are the key words or technical terms in the text?
16. How do I assess the organization and flow of ideas within this passage?
17. What, if any, texts are embedded within this text?
18. What other texts could accompany and expand on this one?