BRINGING LITERACY STRATEGIES INTO CONTENT INSTRUCTION

Professional Learning for Secondary-Level Teachers

CENTER ON INSTRUCTION

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INTRODUCTION

This document provides research-based guidance on academic literacy instruction in the content areas. It is intended for use by literacy specialists and other technical assistance providers in their work with states to improve educational policy and practice in adolescent literacy. Specifically, this document focuses on the effective use of text in content areas. It expands upon two documents previously published by the Center on Instruction's reading strand: *Academic Literacy Instruction for Adolescents: A Guidance Document from the Center on Instruction* and *Adolescent Literacy Walk-Through for Principals: A Guide for Instructional Leaders*.

The three documents share the same goals:

- to increase all students' overall levels of reading proficiency,
- to ensure that students who have achieved grade-level reading standards will continue to meet increasingly difficult standards, and
- to help students who are reading below grade-level standards acquire the skills and knowledge required to meet those standards.

It is also important to note that this document is not intended to provide information specific to addressing the needs of students who are English language learners or identified as struggling readers in need of special education services. We use the same definition for academic literacy across the three documents (Torgesen et al., 2007):

> *Academic literacy is usually defined as the kind of reading proficiency required to construct the meaning of content-area texts and literature encountered in school. It also encompasses the kind of reading proficiencies typically assessed on state-level accountability measures, such as the ability to make inferences from text, to learn new vocabulary from context, to link ideas across texts, and to identify and summarize the most important ideas or content within a text. Notice that the definition of academic literacy includes not only the ability to read text for initial understanding but also the ability to think about its meaning in order to answer questions that may require the student to make inferences or draw conclusions. Our definition of academic literacy also includes the ability to learn from text, in the*

sense that full comprehension of text meaning usually results in new understandings or new learning. (p. 3)

In 2007, 33% of fourth-graders and 26% of eighth-graders performed below the *Basic* level on the National Assessment of Educational Progress (NAEP) reading assessment, which means that they lacked the skills to access grade-level text (National Center for Education Statistics, 2007). Even though the average reading score for eighth-graders was up one point since 2005 and three points since 1992, the trend of increasing scores was not consistent across all assessment years. In comparison to both 1992 and 2005, the percentage of students performing at or above the *basic* level increased in 2007, but there was no significant change in the percentage of students at or above the *proficient* level. Furthermore, results from the NAEP showed that the percentage of twelfth-graders performing at or above grade level (*proficient*) fell from 40% to 35% between 1992 and 2005. On the other hand, those who scored *below* the *basic* level (partial mastery of prerequisite knowledge and skills that are fundamental for proficient work at grade level) rose from 20% to 27% (Grigg, Donahue, & Dion, 2007).

A coordinated effort is needed to improve the reading performance of students in grades 4-12, who spend the majority of their days in content-area classes. As students advance in school, researchers suggest reading instruction should become more disciplinary, reinforcing and supporting students' academic performance (Shanahan & Shanahan, 2008). All content-area instruction (English language arts, mathematics, science, and social studies) utilizes literary or informational text in some manner, so students must comprehend specific texts and grasp the concepts being communicated in them. This is a particular concern as the texts students are asked to read become increasingly complex with unique linguistic and cognitive features that are not necessarily shared across disciplines. This document provides guidance regarding how content-area teachers can use such texts in their classrooms to help students learn and understand subject matter concepts while meeting school, district, and state standards.

We review evidence from research about effective content-area literacy instruction for adolescents and suggest ways teachers can effectively use content-area texts to enable students to understand the vocabulary and concepts they contain. Because professional development is essential to

supporting teachers in making these types of instructional changes, this document provides a brief synopsis of working with adult learners and the most promising professional development practices identified in research. Finally, we describe ways to assist states, districts, and schools in helping teachers develop the kinds of pedagogical skills needed to implement instructional practices that have been shown to improve student literacy outcomes.

Organization

This document is organized in six sections with the focus on effective use of text in content areas.

- Section 1: Description of the NAEP and its reading framework
- Section 2: Review of the five recommendations of instructional improvement identified in *Academic Literacy Instruction for Adolescents: A Guidance Document from the Center on Instruction*
- Section 3: Overview of the research to support vocabulary instruction in the content areas, with vignettes across the content areas
- Section 4: Overview of the research to support comprehension instruction in the content areas, with vignettes across the content areas
- Section 5: Synopsis and discussion of the research base for professional development
- Section 6: The design of professional development for supporting content-area teachers in their vocabulary and comprehension instruction (including a case study of a school-based professional development program)

SECTION 1

THE NATIONAL ASSESSMENT OF EDUCATIONAL PROGRESS (NAEP) READING FRAMEWORK

The NAEP, also known as the "Nation's Report Card," is considered the national indicator of what American students know and can do. The student achievement information provided by the NAEP assists the public, educators, and policymakers in understanding student performance and making informed decisions regarding education. Likewise, the Program for International Student Assessment (PISA) provides data regarding the reading literacy, mathematics literacy, and science literacy of 15-year-olds and compares the performance of American students to students in other nations. For more information about the PISA see the Appendix.

The NAEP regularly assesses fourth-, eighth-, and twelfth-grade students' achievement in reading. It gauges how well students respond to reading various texts with multiple choice and constructed-response questions (National Assessment Governing Board, 2006). For the purposes of the NAEP, reading is defined as "an active and complex process that involves understanding written text, developing and interpreting meaning, and using meaning as appropriate to type of text, purpose, and situation" (National Assessment Governing Board, 2006, p. iv).

Reading behaviors (such as recognizing and using text structure, understanding vocabulary, and making sense of sentences and paragraphs) can vary depending on the type of text encountered by the reader. Therefore, the 2009 NAEP reading framework calls for two types of text on the assessment: literary texts (e.g., fiction, literary nonfiction, and poetry) and informational text (e.g., exposition, argumentation and persuasive text, and procedural text and documents). Vocabulary is assessed within these two types of texts. The 2009 reading framework is the conceptual base for and illustrates the content of, the NAEP. It focuses on important, measurable indicators of student achievement. However, the reading framework does not endorse or advocate particular pedagogical approaches (National Assessment Governing Board, 2006).

The 2009 NAEP reading framework provides guidance for a robust and accurate measure of the reading comprehension and analytical skills that students need for success in academics and in life. The NAEP revision is intended to provide a significant national measure of how students are doing in reading and serve as a catalyst for improving overall reading achievement. The 2009 NAEP reading framework differs from the 1992 framework in three significant ways (Foorman, 2009):

- Vocabulary is reported apart from comprehension. Items measure word meanings in context using academically challenging words.
- New and different types of passages are used for literary and informational text and vary across grade levels to reflect text type encountered (Salinger, Kamil, Kapinus, & Afflerbach, 2005).
- Separate scores are reported for literary and informational text to address the research on text structure which indicates that literary and informational text vary in organizational patterns that contribute to meaning (e.g., Goldman & Rakestraw, 2000; Pearson & Camperell, 1994).

The NAEP framework specifies that the texts used in the assessment represent the text that students encounter at different levels. As mentioned above, the text types on the NAEP are the same as those used in content-area classrooms: literary and informational. Each content area (i.e., English language arts, math, science, and social studies) uses a text type that contains certain elements of *text structure*. For example, informational text may be structured sequentially or with cause and effect relationships among the ideas, while literary text may be structured to build a plot or rhyme scheme. In addition to the organizational pattern of the text, each piece reflects the *author's craft*: the techniques used by the author to relay an intended message. An example of author's craft in a literary text may be the use of imagery, whereas the author's craft in a science passage may be a type of rhetorical structure. A combination of text type, text structure, and author's craft may be, for example, a history passage where the text type is informational with a persuasive text structure that includes supporting ideas and evidence, and the author's craft of parallelism. Another example may be the type of text that students may encounter in a math class where the text type is symbolic with a text structure of graphical features and the author's craft of using examples.

The NAEP framework refers to *cognitive targets* to describe the mental processes or kinds of thinking that underlie reading comprehension. These cognitive targets guide item development for the NAEP and are used to assess students' comprehension of literary and informational text. The cognitive targets are the same across all three grade levels on the NAEP; however, the passages around which the items are developed will increase in complexity at each grade level. The cognitive targets assessed include locate/recall, integrate/interpret, and critique/evaluate. For locate and recall, students may be asked to use literary text to identify explicitly stated information within and across texts, such as details about the characters or setting. Students need to *integrate* new information from a text into their background knowledge and *interpret* what they read. For example, students may be asked to apply information from a manual to determine how to properly complete a college application. Critiquing and evaluating text requires the reader to view the text objectively—for example, analyzing the presentation of information or evaluating a character's motivations and decisions (National Assessment Governing Board, 2006).

The features and cognitive targets of the NAEP make it apparent that its texts, text structures, and author's craft are similar to those students read, and are asked to understand, in their content-area classes. Developing the skills in the reading framework is the responsibility of all content-area teachers, not only specialized reading teachers. (In fact, for several decades, middle and high school teachers have been called on to provide instruction and support for day-to-day textbook assignments and related writing activities [Romine, McKenna, & Robinson, 1996]). Because understanding depends upon the reader's grasp of the knowledge, ideas, language, and reading skill the text requires, teachers must provide texts for which students possess sufficient language ability and knowledge to access the meaning, or they must provide adequate assistance to students as they read (Adams, 2009). Given the high demand of literacy in our society, providing text with more simplified language may help students in the short run with understanding a particular lesson or concept. However, will it help in the long-run with meeting accountability measures and post-secondary reading requirements that incorporate higher level text?

The 2009 NAEP framework separated the subscales for literary and informational text, emphasizing that a reader must construct different mental models for different genres and discourse patterns (Foorman, 2009; Kintsch & Rawson, 2005). This is consistent with our definition of academic literacy (Torgesen et al., 2007) and acknowledges the role of inferential thinking in the comprehension of content-area texts and literature. Attempting to support literal understanding by manipulating superficial features such as the difficulty of the vocabulary or the length of sentences (Rudman, 1998) may make it more difficult to understand text that draws upon different ideas (both stated and implied) and uses different styles to convey the relationships among those ideas. Shortening sentences or removing longer words, in some cases, can obscure the relationships among the ideas, placing *higher* demands on students' inference abilities (McNamara, 2001).

Research on predicting comprehension has consistently relied upon five influential reader characteristics: vocabulary, background knowledge, inference ability, word reading, and strategy use (Cromley & Azevedo, 2007; Kintsch, 1988; Perfetti, 1985). However, students' literal comprehension can be distinguished from their inferential comprehension by how well they are able to make inferences in support of their vocabulary, background knowledge, and strategy use when processing the information in a given text (Cromley & Azevedo, 2007).

Comprehension (as assessed on the NAEP and expected in content courses) involves an interplay among the reader's background knowledge and abilities, the features and style of the text, the purpose(s) of the reading, and the context in which it takes place (Sweet & Snow, 2003). Content-area teachers, who expect students to read text and understand assignments, need support in selecting strategies and adapting them to fit the specific needs of their discipline. This turns our attention to five academic literacy recommendations previously described in *Academic Literacy Instruction for Adolescents: A Guidance Document from the Center on Instruction* (Torgesen, et al., 2007).

SECTION 2

FIVE ACADEMIC LITERACY RECOMMENDATIONS

This section summarizes the five areas of instructional focus and improvement recommended in *Academic Literacy Instruction for Adolescents: A Guidance Document from the Center on Instruction* (Torgesen et al., 2007). Considered pivotal to improving adolescent literacy, these five recommendations are scientifically based. They succinctly delineate the instructional focus and improvements that content-area teachers can make to improve reading comprehension for adolescents. Implemented widely and effectively, they would likely lead to significant long-term improvement in adolescents' literacy abilities:

- strategy instruction,
- discussion-oriented instruction,
- high standards,
- motivational context, and
- strategies to teach essential content.

Recommendation 1: All teachers should provide explicit instruction and supportive practice in effective comprehension strategies throughout the school day.

Students engage in comprehension strategies to improve their understanding of the text or repair comprehension when it breaks down (National Institute of Child Health and Human Development, 2000). Comprehension strategies can include mental activities, conversations with others, or use of outside references. A few reading comprehension strategies applicable across content areas and genres have been studied broadly, such as graphic organizers and question generation (National Institute of Child Health and Human Development, 2000). However, recent evidence suggests that some comprehension strategies are specific to a content area, and some are even course specific because they involve interpreting text, documenting evidence, or framing arguments unique to a given discipline (Shanahan & Shanahan, 2008). For example, comprehension research in science (Norris & Phillips, 1994), social studies (Mosborg, 2002; Perfetti, Britt, & Georgi, 1995),

and math (Leong & Jerred, 2001) shows that these areas demand distinctive reading and writing skills that foster comprehension and learning.

Common features critical to successful strategy instruction for adolescent readers include:

- discussions to help students become more aware of their own cognitive processes and set a purpose for using strategies;
- teacher modeling of explanations for why, how, and when to use a strategy;
- many meaningful opportunities for students to use strategies with feedback from the teacher, and;
- a gradual transfer of responsibility for implementing literacy strategies from teacher to student. (Dole, Brown, & Trathen, 1996; Klingner, Vaughn, & Schumm, 1998; Block, 1993; Lysynchuk, Pressley, & Vye, 1990; National Institute of Child Health and Human Development, 2000, Alfassi, 2004)

Recommendation 2: Increase the amount and quality of open, sustained discussion of reading content.

Research establishes this important finding: rich discussions among small groups of students, or led by the teacher, can increase students' ability to think about and learn from text (Beck & McKeown, 2006). Increased, high quality discussion has also been cited as a way to increase student engagement in reading (Guthrie & Humenick, 2004). When students engage in extended discussions of what they read, they improve their understanding and learning and, over time, improve reading comprehension (Applebee, Langer, Nystrand, & Gamoran, 2003; Fall, Webb, & Chudowsky, 2000). Text discussions promote "the interaction and involvement with written language" that is essential to more sophisticated comprehension of complex material (Snow, 2002, p. 11). It capitalizes on the shared knowledge of the class while supporting students as they make inferences combining textual information with relevant background knowledge and experiences to form coherent mental representations of the text's overall meaning (Verhoeven & Perfetti, 2008).

Implementing these instructional approaches for adolescents in middle and high school will likely require significant changes to the schedule and curriculum; time must be allotted for effective discussions to take place. Although the breadth of content may be affected, rich discussions about text

lead students to analyze what they read, think critically, and build conceptual understanding. The impact of these experiences extends beyond one lesson, ultimately supporting comprehension when students read text independently.

Recommendation 3: Set and maintain high standards for text, conversation, questions, and vocabulary.

Observational studies of high-achieving classrooms and teachers consistently support this recommendation (Good, 1987; Good & Brophy, 2002; Langer, 2001). State-level literacy leaders must identify accountability measures for literacy outcomes, and school-level literacy leaders must understand and implement these measures. Also, classroom teachers need to use instructional methods that support student growth toward meeting the literacy standards of the state, and of the NAEP. Without teacher acceptance, the state literacy standards will have minimal impact. To achieve these high literacy standards, evidenced-based instructional techniques, such as those recommended here, will be required.

Recommendation 4: Increase students' motivation and engagement with reading.

Students who are motivated to engage with and understand text will be more successful (Guthrie, et al., 2004; Snow, 2002; Wigfield, et al., 2008). Although research does not identify specific motivational techniques for particular types of students, the theoretical and empirical supports for increasing motivation are persuasive (Guthrie, Wigfield, & VonSecker, 2000; Guthrie et al., 2004; Reeve, Jang, Carrell, Jeon, & Barch, 2004). Guthrie et al., (2004) recommend that teachers use the following techniques in concert:

- give students more choices of text and assignments to build their autonomy,
- create opportunities for students to interact with a focus on understanding text,
- provide a variety of interesting texts for students, and
- focus students on important and interesting learning goals.

Recommendation 5: Teach essential content knowledge so that all students master critical concepts.

Background knowledge plays an important part in reading comprehension and understanding content concepts (Anderson & Pearson, 1984; Donovan & Bransford, 2005; National Assessment Governing Board, 2006; Hirsch, 2006). As students improve their knowledge in a specific area, their ability to understand the associated reading material also improves. Students' prior knowledge highly influences their ability to comprehend, think about, and learn new information from a newly-presented text. After all, readers create meaning from a text by integrating the new information with prior knowledge: in other words, they "construct new knowledge that is relevant to their individual experiences and situations" (Verhoeven & Perfetti, 2008, p. 295). Therefore content-area teachers who use instructional routines that support students' understanding of content-area vocabulary, concepts, and facts will greatly improve students' ability to independently comprehend the reading material.

A final note. These five recommendations for content-area teachers are not meant to be considered as self-standing, fragmented, or appropriate for piece-meal implementation; rather, they should be used in a thoughtful, planned, systematic manner. This will require support for teachers through high-quality professional development.

SECTION 3

THE RESEARCH BASE FOR EFFECTIVE VOCABULARY INSTRUCTION FOR ADOLESCENTS

This section provides a general overview of vocabulary instruction as a critical component in content-area classes. It defines the word *vocabulary*, describes the goal and purposes for teaching it, and reviews the research that supports the importance of vocabulary instruction. We then discuss vocabulary instruction as it applies to the core academic subjects.

There are two types of vocabulary: *oral* (listening and speaking) and *print* (reading and writing). Vocabulary knowledge includes *recognizing words* and their meanings, but also *pronouncing, understanding, and using words* effectively and appropriately to foster communication and comprehension. Vocabulary instruction is considered critical, especially in content-area classrooms (National Institute of Child Health and Human Development, 2000; Snow, 2002; Snow, Burns, & Griffin, 1998), because vocabulary knowledge has shown a strong relationship to comprehension and students' academic success (Baumann, Kame'enui, & Ash, 2003; Beck, McKeown, & Kucan, 2002). This aligns with the 2009 NAEP framework, which measures students' ability to (a) infer an author's intended meaning of a word in context and (b) apply knowledge of academically challenging words to understand literacy and informational passages (National Assessment Governing Board, 2006).

Unfortunately, not all students are equipped with the vocabulary necessary to do well in their content area classes or perform at acceptable levels on state and national tests. For nearly 70 years, researchers have reported a disparity among students' lexicons. High-knowledge third graders have vocabularies about equal to the lowest-performing twelfth graders (Smith, 1941). High achieving high school seniors know about four times as many words as their classmates (Smith, 1941). The reason: higher achieving students read more than their classmates with relatively limited vocabularies. Stanovich (1986) refers to this as the Matthew Effect—the rich get richer and the poor get poorer. In other words, the more one reads, the better the vocabulary and the ability to read increasingly complex text. Over time, the knowledge gap between these two types of readers widens.

Students may struggle with vocabulary for many reasons such as lack of exposure to words (through reading, speaking, and listening), lack of background knowledge related to words, and lack of explicit vocabulary instruction. However, the vocabulary knowledge of adolescents can be improved with appropriate instruction (Scamacca et al., 2007). The goal of vocabulary instruction is to provide students with the understanding of the meaning and use of words so they can comprehend what they read and communicate effectively. According to Graves (2006), vocabulary instruction that benefits all students at every level includes the following four elements, which we will examine independently:

- rich and varied **oral and print language experiences**,
- **instruction in individual words** with multiple exposures to the words in a variety of forms,
- **instruction in word learning strategies**, and
- **fostering word consciousness** (i.e., promoting an interest in learning words and their meanings).

Rich and varied oral and print language experiences

Students can learn many words indirectly through being read to, independent wide reading, and discussions. Structured read-aloud sessions and independent wide reading experiences outside of school (Cunningham, 2005) give students repeated and multiple exposures to words. They also provide a way to see vocabulary in rich contexts (Kamil & Hiebert, 2005). Students have more opportunities to think about and learn from text when they participate in teacher-guided and small group discussions about vocabulary words in content area text (Beck & McKeown, 2006). Moderate evidence suggests that vocabulary can be built through discussion, but some of the recommendations discussed here are limited by the varying rigor of research on which they are established (Kamil et al., 2008).

One effective way to use discussion in content-area classes is to elicit students' prior knowledge of concepts and words and then relate that knowledge to the new vocabulary words (Kamil, 2003). Such discussion should also emphasize the important similarities and differences between the new and familiar words (Stahl & Fairbanks, 1986). In one instructional strategy, the teacher presents a central concept (or vocabulary term) and guides students to

brainstorm related words, which are then included in a web-like graphic organizer. Teachers can use this technique across content-area classes in whole- or small-group instruction (Pittelman, Levin, & Johnson, 1985). It improves students' recall of previously taught words as well as their understanding of text containing taught words in a variety of different circumstances (Johnson, Toms-Bronowski, & Pittelman, 1982; Johnson, Pittelman, Toms-Bronowski, & Levin, 1984; Margosein, Pascarella, & Pflaum, 1982). Discussion is a critical aspect of the effectiveness of this strategy (Stahl & Clark, 1987; Stahl & Vancil, 1986). Researchers found that students who participate in discussion understood the concepts better than students who studied the graphic organizer independently, without discussion.

Another strategy for vocabulary development, possible sentences (Moore & Moore, 1986), has students develop sentences that predict the use of target vocabulary words. The teacher chooses six to eight potentially difficult key concept words and another four to six related words that are more familiar to students. Students and the teacher discuss the basic meanings of all 10-12 words, then write sentences that predict how the author will use the words in the text. Each sentence must contain at least two words from the list, and all words must be used at least once. The teacher and students do not discuss the accuracy of the word use in the sentences they generate until after they read the text. Then, the class evaluates whether each sentence is accurate based on what they have read. The class discusses how to modify the inaccurate sentences, based on what they now know from the text. Research indicates that this strategy significantly improves students' recall of word meanings and their comprehension of text containing those words (Stahl & Kapinus, 1991). This strategy may not be as easy to integrate into a mathematics lesson, compared to the graphic organizer discussed earlier. But content-area classes that use long passages of connected text will find the sentence-generation strategy useful for introducing vocabulary before reading and revisiting the terms after reading.

Rich, varied discussions about the use and meaning of words in context can directly increase students' ability to think about and learn from text (Beck & McKeown, 2006). Students also benefit by building on the cumulative knowledge of their peers (Stahl & Kapinus, 1991) and hearing thoughtful ways to analyze text to support comprehension (Torgesen et al., 2007).

Instruction in and multiple exposures to individual words

Adolescents will encounter 10,000 or more new words each year, most of which are multisyllabic and unique to content-area texts (Nagy, Berninger, & Abbott, 2006). As previously mentioned, there is a strong relationship between vocabulary and the comprehension of complex text (Carlo et al., 2004; Cunningham & Stanovich, 1997; Hirsch, 2006; Nagy, Berninger, Abbott, Vaughn, & Vermeulen, 2003) that increases as students advance through grade levels (Snow, 2002). Given the breadth of vocabulary needed for academic success in grades 4-12, incidental exposure through wide reading and discussion is critical. However, not all vocabulary essential to academic success can be learned through incidental exposure. Some words and their meanings should be directly taught (National Institute of Child Health and Human Development, 2000).

Because each content area has its own specialized vocabulary, domain-specific words should be carefully selected and taught explicitly and systematically (Stahl & Fairbanks, 1986). Instruction must be well-planned and purposeful because most students need to encounter a word about 12 times before they know it well enough to improve their comprehension (McKeown, Beck, Omanson, & Pople, 1985). Students with learning disabilities or those who are still learning English may require even more exposures to a word. Also, students should not only hear the words and copy their definitions; they should practice using the words in different forms and contexts (August, Carlo, Dressler, & Snow, 2005; Biemiller, 2001; Nagy & Anderson, 1984). Peer activities two or three times a week appear to be an effective way to provide these varied practice opportunities in all content-area classes.

Many math and science teachers agree that the unique vocabulary of their domains constitutes a special "language" that is critical to learning. Math definitions, for example, are much more exact and are not easily restated accurately. Fortunately, most research-based strategies for teaching vocabulary (e.g., Beck & McKeown, 2006; Biemiller 2001; Blachowicz & Fisher, 2000; Graves, 2006) are appropriate for math, with adjustments (Gersten, 2007). Although learning technical math vocabulary may require more verbatim instruction than other types of vocabulary, students learn these terms primarily through exploration of the ideas. Essential math terms should be taught over several days and in various contexts, such as problem solving, discussions, and writing.

The review needed to acquire math or science terms is likely to be longer than review in other areas, such as English or history, because of their complexity and rare use in everyday language (Gersten, 2007; Fang, 2006). Students need to understand the terminology associated with each concept in order to read the textbook directions and refer back to sections previously reviewed. (The ability to understand vocabulary within a task context will also be measured on the NAEP, as described earlier.) Students who are intimidated by math word problems can benefit from explicit teaching of operational terminology. When selecting words to teach directly, content teachers should emphasize vocabulary that students will (a) encounter often, (b) see in directions, and (c) use to build conceptual knowledge.

As with any content area, students should be taught concepts that anchor their learning. Unknown concepts that define an area of study (e.g., definitions, models, representations, examples, and non-examples) deserve thoughtful instruction. Unfortunately, two features of history textbooks typically prevent students from accessing a deep understanding of the vocabulary and concepts: they often assume too much prior knowledge and provide shallow coverage of the content (Schug & Western, 1997). A study of eighth grade history students investigated the effects of explicit instruction (directly teaching vocabulary words) with traditional instruction (lectures and readings; Twyman, McCleery, & Tindal, 2006). Significant differences, favoring the explicit instruction group, were found on the vocabulary and problem-solving essays. Researchers found that direct instruction promoted relational thinking and problem-solving with explicit reference to concepts and attributes. Also, the organizational structure of the concept-based instruction allowed teachers more productive time to introduce and define new words and put them into context, and to offer numerous exposures to the terms. Although not researched in every content area, explicit and systematic instruction is considered effective for improving the access of all students to the general education curriculum (Swanson, 1999; Vaughn, Gersten, & Chard, 2000).

Instruction in word learning strategies

Teachers cannot possibly teach the meanings of all new, unfamiliar words, so they need to help students learn word meanings independently (National Institute of Child Health and Human Development, 2000). Teaching independent word learning strategies along with explicit word instruction can greatly

increase students' vocabularies and help them become independent word learners (Baumann, Edwards, Boland, & Olejnik, 2003). The National Reading Panel (National Institute of Child Health and Human Development, 2000) identified examples of effective word learning strategies:

- using **dictionaries** to *confirm and deepen* knowledge of word meanings;
- using **morphemic analysis** (or, analysis of word parts) to *derive* word meanings;
- using **contextual analysis** to *infer* word meanings.

Dictionaries. Traditionally, students are assigned to copy definitions from dictionaries, but this doesn't allow students to discover how to use the dictionary efficiently and independently (Beck, McKeown, & Kucan, 2002; Scott & Nagy, 1997). Teachers should model how to analyze a dictionary definition to see how, or if, it fits a particular context and help students apply this critical thinking skill while they are reading (Stahl, 2005). Further, students should be taught to use the dictionary to increase their knowledge of a word and its many meanings.

Morphemic analysis. Learning morphemes (prefixes, suffixes, and roots), offers students another way to understand the meanings of words beyond the dictionary (Diamond & Gutlohn, 2006; Stahl, 1999). Decomposing words into these parts is referred to as morphemic analysis, a particularly useful strategy for content-area texts, which contain words with recognizable parts. Based on word frequency data, researchers recommend that instruction in morphemic analysis be provided to students in fourth grade and above where texts commonly contain rarely used, derivational words (Nagy, Diakidoy, & Anderson, 1993; White, Power, & White, 1989).

A study of fifth-graders who participated in lessons on how to use morphemic analysis and contextual analysis revealed that morphemic knowledge enabled students to infer meanings of untaught words immediately following instruction (Baumann et al., 2002). The study also showed that students of all ability levels benefited equally from the instruction. Another study conducted with fifth-grade social studies students revealed positive effects for both morphemic analysis (as an additional tool for word learning and making inferences) and direct instruction in content-area words from the text (Baumann, Edwards et al., 2003). The study found that 25 days of morphemic analysis instruction was beneficial for deriving meanings of novel words in

subject-matter texts without impeding students' content learning. This research has not been replicated with other content areas, but a synthesis of morphology interventions suggests that students' morphological knowledge can generalize to other contexts (Reed, 2008).

Contextual analysis. Beyond morphemic analysis, skilled word learners use contextual analysis to understand unfamiliar words (Nagy, 1988; Nagy & Scott, 2000; Swanborn & de Glopper, 1999). Using contextual analysis, a reader infers the meaning of a word by examining the words or phrases surrounding it for clues to its meaning. Context clues include embedded definitions, synonyms, antonyms, noted examples, and general clues often extended across several sentences (Baumann et al., 2002; Baumann, Edwards et al., 2003; Baumann, Font, Edwards, & Boland, 2005). Researchers caution, however, that contextual analysis cannot be effective when the text surrounding the unfamiliar word does not offer additional information (Beck et al., 2002; Edwards, Font, Baumann, & Boland, 2004). Baumann, Edwards et al., (2002) found that combining morphemic and contextual analysis produced equally powerful effects as using the two strategies alone. In fact, the researchers suggest teaching a multi-part vocabulary strategy that includes contextual analysis (to infer a word's meaning), morphemic analysis (to derive a word's meaning), and the dictionary (to confirm a word's meaning).

Other strategies. Studies also indicate that students can increase their understanding of new, multisyllabic words found in isolation when they use syllabication strategies (Shippen, Houchins, Steventon, & Sarton, 2005; Moats, 2004; Bhattacharya & Ehri, 2004). Bhattacharya (2006) suggests that syllabication strategies can apply to reading words in context, which would assist in the mastery of content-area information in textbooks and supplementary literature. For example, when reading a science textbook, middle school students can be taught to follow the steps of: "reading the word (e.g., carbohydrate), explaining the meaning (e.g., an organic compound made of carbon, hydrogen, and oxygen), dividing the word (e.g., car/bo/hy/drate), and saying the word (e.g., carbohydrate)" (Bhattacharya, 2006, p. 121) to understand the vocabulary and the content of the passage. When taught to use analytical tools to learn new words, students can use the same strategies as they read and write in their content-area classes (Henry 1988, 1989).

One quasi-experimental study of the implementation of a vocabulary intervention program for use across content areas (English language arts,

math, science, and social studies) showed that schools had significantly greater growth in sixth- through eighth-grade students' vocabulary than schools choosing not to implement the program (Snow, Lawrence, & White, 2009). The intervention combined explicit instruction with multiple exposures to important content-area words. It also included other features linked to improving students' vocabulary (e.g., opportunities to use the words orally and in writing and motivating texts that include the target words) as well as word-learning strategies.

Other recent studies have focused on improving outcomes for English language learners (ELLs) by targeting vocabulary in connection to content knowledge. Research on an intervention program gave teachers instructional materials and professional development specific to promoting vocabulary learning in science classes (August, Branum-Martin, Cardenas-Hagan, E., & Francis, 2009). The quality of teachers' science instruction improved. Also, English proficient and ELL students both demonstrated significant increases in science knowledge and vocabulary compared to students taught with the traditional science curriculum. Similarly, Vaughn and her colleagues (2009) conducted two studies that gave seventh-grade social studies teachers structured instructional routines related to vocabulary and content knowledge improvement. The treatment group teachers learned to engage students in explicit vocabulary instruction and purposeful discussion and to use brief videos, graphic organizers, and structured paired grouping. In both studies, students significantly improved their word knowledge and their comprehension related to social studies compared to students of teacher who did not participate in the professional development.

Fostering word consciousness

Students who have developed word consciousness are interested in words, enjoy learning the meanings of new words, and understand that a word can have multiple meanings depending on how it is used (Scott & Nagy, 2004). To become word conscious, students must receive quality vocabulary instruction through a variety of approaches, including instruction that promotes word knowledge and word meaning. Research on word consciousness often relies on correlation methods. These studies indicate that a relationship exists between vocabulary knowledge and word consciousness, especially awareness of word formation through roots and affixes (e.g., Carlisle, 2000; Ku &

Anderson, 2003; Nagy, 2007; Nagy et al., 2006). However, correlation does not guarantee causation; it is not given that greater consciousness of word parts results in increased vocabulary knowledge.

Nevertheless, qualitative studies have demonstrated that a word-rich environment can foster word consciousness (Blachowicz & Fisher, 2000) which, in turn, may aid comprehension. Teachers in all disciplines can incorporate simple activities to promote word consciousness (Graves & Watts-Taffe, 2002). Content teachers can support the use of adept diction, or the skillful use of words in speech and writing (Graves, 2000), a critical aspect of vocabulary growth (Scott & Nagy, 2004). It can be modeled easily through attention to word choice in the classroom. For example, an English teacher might direct her students to make their writing "parsimonious" rather than "short and to the point." Other ways to promote word consciousness include highlighting skillful word use in content-area texts and encouraging students to expand their range of word choices when they discuss and write (Graves, 2000; Beck et al., 2002; Graves & Watts-Taffe, 2002; Scott & Nagy, 2004).

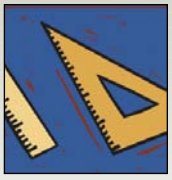
For many students, the greatest challenge to learning science, for example, is learning the language of science (Wellington & Osborne, 2001). Science textbooks contain technical words that seldom occur in everyday conversation; however, they are essential for conveying specialized science knowledge (Holliday, 2004). Even more challenging, words used in science and mathematics have different technical meanings than their common meanings. For example, *rational* has different meanings when used generally and in mathematics. Therefore, teachers should raise students' word consciousness about the specific and unique language demands of science (Fang, 2006) and mathematics texts. (In addition, they should encourage students to reflect on their ability to use and understand mathematical and science terms.)

For example, in science, paraphrasing can promote word consciousness and break down the barrier between students' everyday language and the language of the discipline (Fang, 2006; Nagy, 2007). When they paraphrase, students translate what they read to everyday language. Conversely, students use their writing from science class assignments to translate their informal writing into the language of science. This comfortable movement between familiar, everyday language and the language of science helps students understand and appreciate the similarities and differences between the domains of science and life (Fang, 2006).

Similar points apply to the other content areas. For example, Kinder, Bursuck, & Epstein (1992) note the difficulty of determining the readability of history textbooks. Complex text requires more than a standard readability formula (Foorman, 2009). Analysis requires other aspects than word and sentence length, such as the structure of the text and the interaction of the material with the reader (e.g., background knowledge, motivation, and interest). Similarly, Borasi, Siegel, Fonzi, and Smith (1998) state that research on reading mathematics has concentrated on creating strategies that teach the "language of mathematics" and ways to interpret word problems, because students often have trouble understanding math textbooks (see Siegel, Borasi, & Smith, 1989 for a review of this literature). The vocabulary of academic subjects, including English language arts, seems unfamiliar and alienating compared to everyday language (Fang, 2005; Schleppegrell, 2004; Unsworth, 1997). Content teachers can bridge the gap between students and text by explicitly addressing the language demands of their teaching and learning material. Otherwise, students will reach only a surface understanding, not the ability to use the information effectively (Reif & Larkin, 1991).

Note: The word consciousness activities described here do not need to be implemented as isolated, worksheet-type activities. They can be embedded within the connected texts and authentic reading and writing that already take place in classrooms.

Summary—vocabulary research. Research indicates that content-area teachers first need to understand the importance of vocabulary instruction in facilitating student learning and the application of information. Rich and varied oral and print language experiences, instruction in individual words and word learning strategies, and word consciousness are all skills teachers can help students develop to understand the vocabulary and concepts in content texts. As discussed in Section 1, background knowledge plays an important role in mediating vocabulary knowledge and fostering comprehension (Cromley and Azevedo, 2007). When students cannot figure out a word's meaning, teachers may need to provide the vocabulary in combination with hands-on experiences to link the term to students' background knowledge.



THE VOCABULARY VIGNETTES

The vignettes that follow show vocabulary instructional strategies "in action" in the four core academic subjects: English language arts, mathematics, science, and social studies. These illustrations do not attempt to describe everything the teacher would address in an extended lesson or unit of instruction; they highlight features of vocabulary instruction to illustrate how a lesson can meet the dual goals of improving literacy and content knowledge simultaneously. Additional support for vocabulary might be needed for other components of the lesson or unit, as well as to scaffold students' development toward more sophisticated word usage and text understanding.

The vignettes offer a starting point. Extended support through professional development will be necessary to help teachers work through the roadblocks to adapting instruction to support the unique literacy demands of each content area. This is particularly true at higher grade levels where coursework becomes more complex and places greater demands on students' abilities to understand technical terms, sophisticated non-technical language, and discipline-specific means of communicating information (Shanahan & Shanahan, 2008). The vignettes offer some explanation of how words were selected for instruction and how strategies were adapted to the needs and purposes of specific content. However, the narrative style and concise nature of the scenarios tend to oversimplify the very difficult task of specializing vocabulary instruction to support students who are above-, on-, and below- average ability in the same content-area class. To help consider the elements of vocabulary instruction being featured, we provide a set of guiding questions:

- How did the teacher determine which words needed direct instruction?
- How did the teacher create opportunities for students to return to important vocabulary throughout the lesson?
- How did the teacher foster discussion throughout the vocabulary instruction?

- How did the teacher help activate or build background knowledge in the vocabulary instruction?
- How were the vocabulary strategies tailored to meet the needs of the content area?
- How did the teacher maintain the importance of the content knowledge students needed to build?
- How were students prepared to use vocabulary strategies independently to support their learning?

These vignettes provide examples of strategies that fit the nature of the reading demands for the lessons described. As courses become more specialized, teachers need expert guidance in and collaborative support for selecting and adapting strategies to help students meet the very specific reading demands of each discipline. The section on professional development (see page 83) addresses research that suggests teachers will be resistant to implementing practices which seem to neglect their content or fail to meet the needs of a majority of their students (Siebert & Draper, 2008). Therefore, consider the following questions for reflecting on the vignettes and connecting them with the necessary professional development for content-area teachers:

- How can the vignettes be used to start discussions with teachers about meeting the literacy demands of their specific disciplines?
- What are the differences among content areas in the kinds of vocabulary and the ways terms are used that will need to be addressed in professional development?
- What would help make vocabulary strategies useful for the majority of the students in a particular course?
- What would be necessary to prepare teachers in your state/district/school to use the types of strategies featured here?
- What is your current level of confidence and skill at incorporating vocabulary strategies in content lessons? How can you build upon that?

ENGLISH LANGUAGE ARTS

VOCABULARY VIGNETTE / ENGLISH/LANGUAGE ARTS

Mrs. Takakawa was preparing to start a new novel, *Pudd'nhead Wilson* by Mark Twain, in her junior American Literature class. From the state standards and district scope and sequence, she knew she needed to teach eight new literary terms in conjunction with the novel. Additionally, Mrs. Takakawa identified, on average, four words per page of text that she anticipated would be unfamiliar and challenging to her students. Although this indicated the novel was at an appropriate level of difficulty, the 248 total pages of text meant there would be approximately 992 new vocabulary words for students to learn plus the eight literary terms. She consulted with her colleagues in the English department as well as the literacy coach on the best ways to handle such a large number of words in only three weeks' time.

The collaborative team suggested that Mrs. Takakawa teach her students two independent word learning strategies to support themselves while reading the novel: 1) a combination of morphemic and contextual analysis, and 2) the appropriate use of a dictionary. However, they felt the literary terms should be more explicitly taught and extensively practiced because students would be expected to apply them to other reading material in the English classes as well as on state and national exams.

Before beginning the novel, Mrs. Takakawa devoted instructional time to reviewing what morphemes are and how they could be used in conjunction with context clues to infer the meaning of a word. Although her colleagues indicated students would have studied morphemes and their application in the prerequisite English courses, Mrs. Takakawa wanted to activate students' prior knowledge and ensure everyone was sufficiently prepared for the independent word learning strategies. She distributed an alphabetical list of prefixes, roots, and suffixes that students could use as a quick reference while reading. She also taught her students to use a dictionary as a reference tool whenever the morphemic and contextual analysis was insufficient to understand the author's terminology. The class reviewed basic dictionary skills such as the pronunciation guide, information on etymology or word origin, and the selection of the correct definition to fit the context.

When they began the novel, Mrs. Takakawa told the class that they would be building their own dictionaries as they read. "On each page, you will

probably come across a few words that are not familiar to you or that you may have heard before, but aren't really sure what they mean. Whenever that interferes with your ability to understand the story, you need to stop and use our strategies to help yourself determine the meaning of the word as it pertains to the novel. For some words, you will be able to do this in a matter of seconds. For other words, it may take you a little longer. In every chapter, I want you to record at least five words that you did not know and on which you applied the strategies. In your notebooks, you need to keep the list of words and the meanings you figured out. You will talk about these words during some of the activities we will do and use them in completing written assignments on the novel."

Mrs. Takakawa then modeled the independent word learning strategies with a sentence from the first page of the book. "Let's see how this is done. If I were reading this page, I might stop after this sentence:

Percy Northumberland Driscoll, brother to the judge, and younger than he by five years, was a married man, and had had children around his hearthstone; but they were attacked in detail by measles, croup, and scarlet fever, and this had given the doctor a chance with his effective antediluvian methods; so the cradles were empty.

"I don't know what *antediluvian* means, but the word seems important to understanding the character and the events that followed. The first step in our process is to divide the word into its parts. I can see the prefix *ante-* and the suffix *–an*. I think the root must be *diluvi*. The next step is to determine the meanings of the parts. The prefix is somewhat familiar to me. I have seen it on words like *anteroom* and *antecedent*. If I think about what meaning the prefix might be contributing to those words, I could guess it means *before*. The anteroom is a type of waiting room or entry room before the main room. It's before the main room. And we talked about antecedents when we were revising our sentences to make sure the pronouns agreed with the noun that came before it."

"I don't think I know what *diluvi* means, but if I check our list of morphemes, I see it means flood or deluge. The third step of our process is to put the meanings of the parts together. So far, I have 'before the flood' as the meaning of *antediluvian*. However, that doesn't make much sense in the sentence: 'this had given the doctor a chance with his effective 'before the flood' methods.' The fourth step is to check the combined meaning with the

context in which we found the word. I'm not sure what a flood has to do with methods for treating sick babies, so I need to use our other strategy and check the dictionary."

Mrs. Takakawa modeled using an online dictionary that had two entries for antediluvian:

1. of or belonging to the period before the Flood. Gen. 7, 8.
2. very old, old-fashioned, or out of date; antiquated; primitive

"I see that the morphemic analysis I did was correct because that is the first definition, but it also gives me a little more information. It's not just any flood, but Flood with a capital *F*. The novel does not make reference to a religion or religious events, so I don't think that helps me. The second definition makes sense, however. The doctor could have been using very old-fashioned or primitive methods to treat the sick babies. That would explain why all the cradles were empty. His out of date methods could not cure the illnesses, so the babies died. *Antediluvian* is a kind of insult Mark Twain is making, and it tells me a lot about Percy Driscoll and what I'm supposed to think of this character in the story. I'm going to record that word and definition as one of my five for the first chapter."

Mrs. Takakawa then had the class work with her to apply the independent word learning strategies to four other terms of the students' choosing in the first chapter. Following the guided practice, Mrs. Takakawa reminded the students that they needed to add five words from each chapter to the list they were keeping in their notebooks. Throughout the time the class was reading the novel, Mrs. Takakawa provided opportunities for students to share the words they were identifying as a part of their small group discussions about the author's craft, particularly his use of language and imagery. She also created opportunities for the students to use their self-selected words in their writing activities.

The other part of her vocabulary instruction concerned the eight new literary terms: *satirical novel*, *overstatement*, *understatement*, *verisimilitude, irony, parody, vernacular*, and *local color writing*. As part of her pre-reading instruction, Mrs. Takakawa briefly introduced the terms in relation to the novel *Pudd'nhead Wilson*. "Mark Twain wrote this novel as a type of social statement. He was trying to be humorous to mask the criticisms he was making of social practices, personal beliefs, and mannerisms of some people in the time period. You will

ENGLISH LANGUAGE ARTS

notice that the dialogue looks very strange because he spelled words phonetically. You almost have to read it out loud so that you can hear how Twain is trying to portray the characters. And, you will have to look for his sneaky ways of poking fun and criticizing. Think, for a moment, about a very funny comedian you have heard or comedy movie you have seen. How did the comedian or actor tell the jokes in a way that made you laugh? What was the comedian making fun of? How did you know when the comedian was kidding? How much of the joke do you think was true? Are all comedians 'over the top,' or do you know some who are funny because they are almost too calm?"

She had the class discuss responses to her questions and, when appropriate, she recast students' comments using one of the literary terms. For example, one student said that some comedies are made by putting together parts of other movies in a slapstick kind of way. "They're only funny if you know all the original movies and what happened in them."

Mrs. Takakawa replied, "Those kinds of comedies are called *parodies*. They are imitating the original in a humorous and exaggerated way."

Then, she divided the class into eight groups and assigned each small group one of the literary terms. As a team, they researched more information on the term and created a five to seven slide presentation for their classmates on the meaning of the term, what it is or includes (examples), and what it is not or does not include (non-examples).

During class and small group discussions throughout the unit, Mrs. Takakawa had students locate and discuss particular excerpts that exemplified the eight new literary terms as well as terms previously studied such as *foreshadowing* and *juxtaposition*.

MATHEMATICS

VOCABULARY VIGNETTE / MATHEMATICS

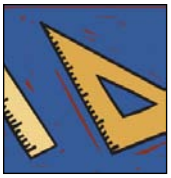
Mr. Molina is planning to start a unit on data analysis with his eighth-grade class. In reviewing the state standards and district scope and sequence, he identified several terms that would be critical for his students to understand: *mean, median, mode,* and *range*. These terms are ways of analyzing data that students will need to know and apply in order to read word problems and perform the necessary mathematical operations successfully. In addition, the words are ones that students might use for different meanings in their everyday lives or in other classes. Mr. Molina knows he should pre-teach these terms, prior to the students encountering them in text, in order to prevent confusion and to provide an entry point upon which to build conceptual knowledge about data analysis.

After reviewing his curricular materials and consulting with colleagues on his interdisciplinary team, Mr. Molina decided to implement two vocabulary instructional practices to support his students' learning. First, he plans to briefly introduce the terms and draw out the more common meanings with which students might already be familiar. After clarifying that the words would take on a different meaning in the math class, Mr. Molina plans to use a concept map to organize definitional information and examples of the terms in a way that depicts their relationships to the concept of data analysis.

On the day he began the unit, Mr. Molina wrote the terms *mean, median, mode*, and *range* on the board. He read the words out loud and, then, asked his students, "Have any of you used these words before? If so, tell me when and how you have used them."

As students offered the ways in which they have used the four terms, Mr. Molina recorded those meanings as follows:

Mean	• Not nice • Intend to • Defined as	
Median	• Roadway divider	
Mode	• Type of functioning for electronic devices • Method	
Range	• Area for grazing farm animals • Area for practice firing weaponry	



Mr. Molina then told his students, "You know a lot of ways that these words can be used. You also know that the same word can have a different meaning when it is used in a different context or for a different purpose. Let's call all of these meanings the *common meanings* because they are already familiar to you."

	Common meaning	
Mean	• Not nice • Intend to • Defined as	
Median	• Roadway divider	
Mode	• Type of functioning for electronic devices • Method	
Range	• Area for grazing farm animals • Area for practice firing weaponry	

Mr. Molina labeled the definitions the students offered and then began to introduce the definitions of the words as they pertained to the unit on data analysis. "For our next unit, you are going to learn another way that each of these terms can be used. We are going to be talking about data analysis, or how to organize and explain information. *Mean, median, mode*, and *range* are all ways of organizing and explaining data. To help you explore what these terms might have to do with data analysis, we are going to engage in a short activity."

He distributed a few pennies to every student. Some students had the same number of pennies, but most students had a different amount. Mr. Molina then instructed the students to arrange themselves in a line so that the person with the fewest pennies was at the end on the left side of the room, and the person with the greatest number of pennies was at the right side of the room.

When they were in order, Mr. Molina asked the students a series of questions that guided them in talking about the mean, median, mode, and range of their data on the frequency distribution of pennies. As the students explained the penny data in a way that was appropriate to one of the target words, Mr. Molina wrote the new definition for the word on the board. After all

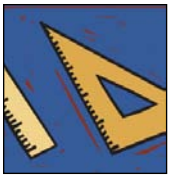
the terms were defined, he suggested, "Let's call each of these the *mathematical meaning* so that we know they are the definitions we need to apply when we are talking about data analysis."

	Common meaning	Mathematical meaning
Mean	• Not nice • Intend to • Defined as	Average
Median	• Roadway divider	Middle most value
Mode	• Type of functioning for electronic devices • Method	Most frequently occurring value
Range	• Area for grazing farm animals • Area for practice firing weaponry	The difference between the highest and lowest values

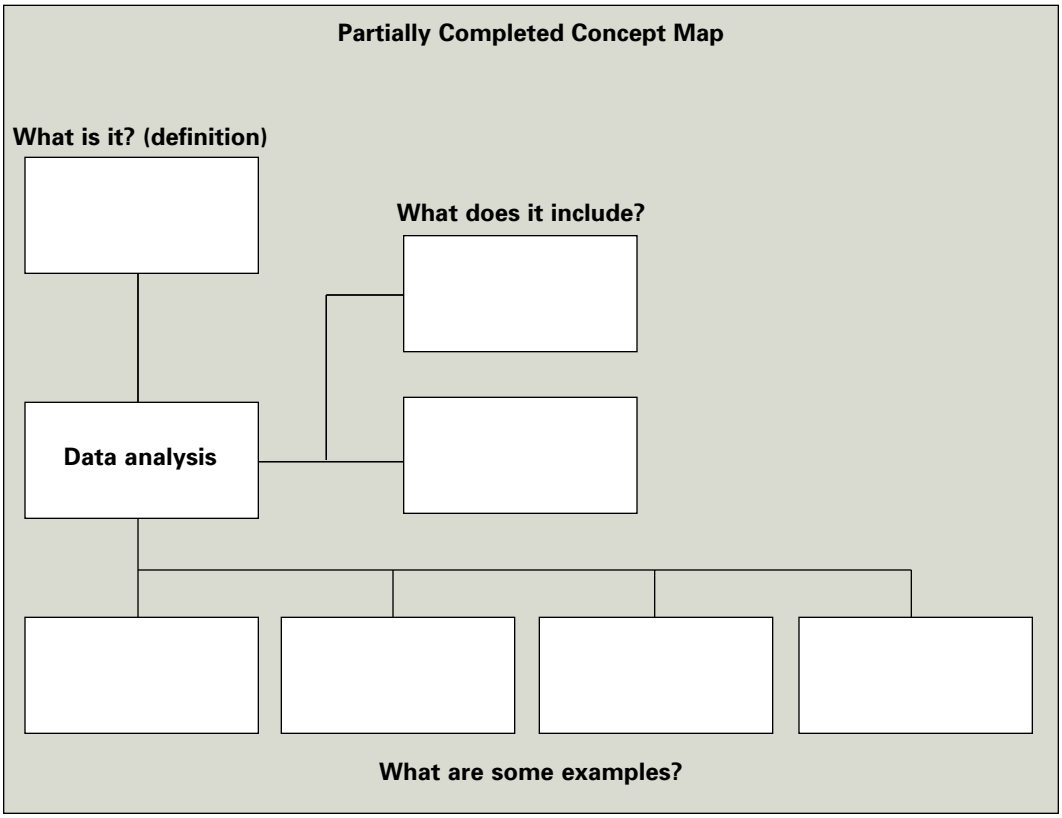
Mr. Molina closed the activity that day by reviewing the terms with students through a series of questions, such as:

- Sandra wants everyone to have the same amount of pennies so she needs to know what?
- Mark wants two things to be equal: the number of people who have *fewer* pennies than he has, and the number of people who have *more* pennies than he has. So, what does he need to know?
- Terrell doesn't care if he has only a couple pennies as long as he is part of the group with the most people in it, so he needs to know what?
- Diana has the least amount of pennies. She wants to know how far her place in the frequency distribution is from the top, so she needs to know what?

The next day, Mr. Molina had pairs of students read aloud to each other the introduction for the data analysis chapter. As was typical with the math textbook, the introduction was one of the few areas of connected text, so he wanted to hear how the students were handling the content. As they read, he circulated throughout the room and provided assistance as necessary. When the partners were finished with the page and a half of text, Mr. Molina



distributed the concept map with the term data analysis on it. He said, "In our activity yesterday and the reading today, you learned that data analysis was organizing and explaining information. Let's record that on our concept map."

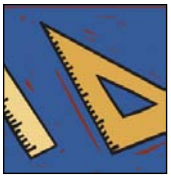


He then explained that the rest of the concept map would help the students see how the terms they were learning related to each other within the concept of data analysis. Mr. Molina focused this lesson on categorizing *mean, median, mode*, and *range* as measures of center and measures of spread. After helping students distinguish which terms described the central tendency of the frequency distribution and which described the spread, he had students work in pairs to generate examples for the concept map. He encouraged students to refer back to the chapter introduction and to use the engagement activity from the previous day in order to create meaningful and accurate examples. However, he asked them not to copy something already provided but, rather, to generate a new example that was similar to what they had read and experienced. "That way," he said, "all your concept maps will provide us different ways to review the key terms and apply our knowledge."

As Mr. Molina monitored the partners, he saw some students creating examples with athletic teams' scores printed in the newspaper and others that were counting the number of bolded vocabulary words or word problems in each chapter of the textbook. One pair asked if they could conduct an Internet search for prices on digital games. Mr. Molina briefly conferred with these students to ensure they were prepared to handle decimal values and then sent them to the class computer with their concept maps.

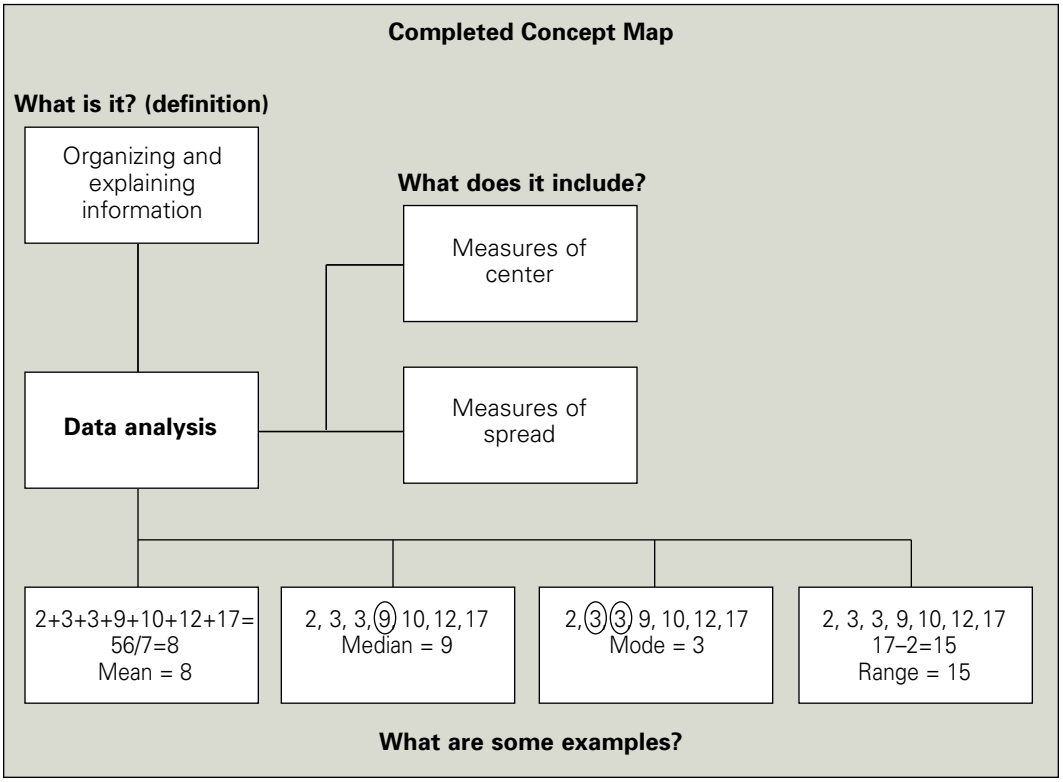
Another pair was not talking to each other, so Mr. Molina asked how they were generating their examples. The students explained that they had just changed the numbers from the examples in the textbook. Mr. Molina noticed that the students had incorrectly identified the median and mode in their new set of numbers and asked the students to explain how they had determined those measures of center. "We counted over the same number of digits as the examples in the book," one student responded.

Mr. Molina suggested that a more meaningful example might help them better understand the concepts. He worked with the pair to gather data on the number of text messages one of the students had sent over the past week. Mr. Molina had the partner record the numbers on adhesive notes while the other student looked up the history in her phone. Then, Mr. Molina had the students organize their data by placing the adhesive notes in numerical order across their desks. He referred them to the definitions they had developed the previous day and helped them apply that knowledge to determining the mean, median, mode, and range of their text message data.



MATHEMATICS

To reinforce their learning, Mr. Molina asked to use the pair's completed concept map to close the class for the day. Using a document camera, he projected the concept map with text message data examples on the screen.



Mr. Molina asked different pairs of students to explain how the mean, median, mode, and range were determined as well as what that information told us about the student's text messaging over the past week. After each response, he asked the original pair, "Do you think that's right? Why or why not?"

Before dismissing the class, Mr. Molina collected all the concept maps. "I will look these over and return them to you tomorrow. You will be able to use them as a reference when we begin to work on data analysis word problems, and we might even try turning your data into word problems to quiz each other!"

SCIENCE

VOCABULARY VIGNETTE / SCIENCE

Mrs. Shankle is teaching a unit on force and motion to her tenth grade science class. In reviewing the state standards and her instructional materials, she initially identified 21 technical terms that were unique to the topic and necessary for students to understand the text. In addition, she identified 11 non-technical, academic terms she anticipated would be unfamiliar to her students and challenging for them to read independently. This was an average amount of vocabulary for a science chapter, but Mrs. Shankle knew that her students would be overwhelmed by a list of 32 terms. Therefore, she worked with the science teachers from the adjacent grade levels (ninth and eleventh) as well as a special education teacher to determine for which words she should simply provide definitions and for which she should engage the students in more extended instruction.

As a collaborative team, Mrs. Shankle and her colleagues examined the students' text and saw that several terms had sufficient contextual support in the form of embedded definitions, figures and illustrations, or supplementary text boxes of information. Therefore, Mrs. Shankle planned to provide brief instruction that would draw her students' attention to these forms of support and ensure the students used the context appropriately to support their comprehension of the text and understanding of the scientific concepts. Several other terms had a rather limited usage or a multiple meaning that might confuse students in the given context only. Mrs. Shankle planned to explain these vocabulary words as they were encountered so that students were able to carry on with the reading or work of the unit.

After separating the words with contextual support and those that only needed a simplified definition, 13 terms remained from the original list of 32 she had identified as important to students' understanding. These 13 were the key concepts and important academic terms that would be encountered and used frequently when reading, completing activities, engaging in discussion, and making connections to other units of instruction. Mrs. Shankle and her colleagues planned several methods of building students' knowledge of these terms recursively throughout the unit.

The first involved an investigative activity designed to build background knowledge by providing a concrete example of force and motion. Mrs. Shankle

SCIENCE

introduced this to her students by saying, "We are going to be studying about motion, or a physical change in the position or location of an object. To help you explore what happens when an object begins or ends its motion, we are going to engage in a short activity."

Mrs. Shankle then distributed a tennis ball and a medicine ball to each pair of students assigned as lab partners. She asked the partners to perform a series of actions that involved tapping, rolling, and stopping the balls on the floor. After each experiment, Mrs. Shankle asked the students a series of questions that guided them in talking informally about Newton's laws of motion. As the students explained target vocabulary in their own words, based on their experiments with the tennis and medicine balls, Mrs. Shankle provided the scientific term(s) for what was being described. For example, when one student said that it was harder to make the heavy medicine ball roll than the light tennis ball, Mrs. Shankle recast the response, "So, it took more force for you to accelerate the object with a greater *mass*?"

Each time a term was introduced, Mrs. Shankle wrote it on the board and had students record the term in their notebooks or on their laptops along with their observations of the tennis and medicine balls that demonstrated that concept. For the force example, the lab partners recorded the following:

Observations

Force: Had to push harder on the medicine ball than on the tennis ball

Mrs. Shankle also encouraged her students to draw a diagram or picture to accompany the written observation.

At the end of the period, Mrs. Shankle distributed a page with the terms and their basic definitions. "Tomorrow, we are going to use these definitions and your observations from today's activity as reference tools when we read a passage explaining Newton's first law of motion. Our goal is to understand the principles of force and motion that can be applied to a variety of examples."

The next day, after reading from the text and an interactive Website on Newton's first law of motion, several students commented on how they were trying to keep track of the different forces. Mrs. Shankle asked the class to name the forces they had identified in their reading. She wrote these down the far left side of the board: *weight, normal force*, *static friction, kinetic friction*,

and *tension*. "For tomorrow," she told her students, "I want you to think about how these types of force are alike and how they are different. Write down some of the features or characteristics you read that you think would help you identify these as forces and sort out which force was which."

Mrs. Shankle wanted to discover the particular features that were confusing to her students so that she could plan follow-up instruction to improve their understanding. Because there was a combination of technical and non-technical vocabulary used to explain the forces, she also wanted a way to review the terms and concepts that would help depict how they were related. She knew her students were familiar with Venn diagrams for comparing and contrasting items, but she felt that populating a diagram with five overlapping circles would be difficult for students to manage, particularly if they added additional types of force in subsequent lessons. In addition, she did not think they had learned enough of the characteristics yet to make the Venn diagram a useful way to visually display the similarities and differences.

That afternoon, her collaborative team suggested Mrs. Shankle try using a semantic feature analysis because it would depict the relationships among the terms and concepts included in the types of force as well as the features and would enable the students to add information as they learned more. Mrs. Shankle prepared a "key" or teacher's version of the semantic feature analysis to be sure it would work for the information the class had read on force and to determine how she would help students complete the grid.

She began the lesson by distributing the semantic feature analysis template and projecting an electronic document of it onto the screen. She already had the types of force students identified the day before recorded down the left side and the title at the top.

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Title: Types of Force

Features / Examples											
Weight											
Normal Force											
Static Friction											
Kinetic Friction											
Tension											

"Today we are going to review the information on force that you learned from yesterday's readings. Many of you commented about the number of different forces that were referenced in the chapter and interactive website. I have listed those down the left side of this semantic feature analysis under the label 'Examples.' We are going to use this grid to help give us a kind of quick picture of the similarities and differences among the types of force and to review the relationships among the important terms associated with *force*.

"We are going to fill-in the top row of the semantic feature analysis, labeled 'Features,' with some of the features or characteristics of the forces that you found in the readings and recorded for your homework. Before we start writing or typing, however, I want to take a moment to discuss those features and how we might word them to be helpful on our grid. We want them to help us identify the forces and how they are alike or different from each other."

Mrs. Shankle put the students in groups of three or four to talk about the features they found for their homework assignment and decide how best to combine and word the features for the Semantic Feature Analysis. As she monitored their work, she noticed one group was wording their features to be very specific to a particular example that was animated on the interactive Website. Therefore, Mrs. Shankle worked with the group on making the language more abstract so that they could be applied to other situations or examples.

After each group had generated at least 4 features, Mrs. Shankle reconvened the whole class. She asked a few groups to share one feature each while the others checked for something similar in their own work. Mrs. Shankle recorded the features on the projected Semantic Feature Analysis and added a couple the students had not generated, but that she felt were important to helping them understand the forces and prepare for the next lesson. She had the students reword and add features to their grids as necessary.

Title: Types of Force

Features / Examples	Vector quantity	Opposite the force of a push	Perpendicular to the surface of contact	Parallel to the plane of contact	Net force must be zero	Requires contact with the object					
Weight											
Normal Force											
Static Friction											
Kinetic Friction											
Tension											

Next, Mrs. Shankle explained how the rest of the grid would be completed before guiding her students through filling-in the first row of the semantic feature analysis. "Think for a moment about weight and how weight is different from mass. Is weight a vector quantity? *[Yes.]* How do you know? *[It's a measure of the gravitational force.]* So, I will put a plus symbol in this cell."

She proceeded in this way across the row, asking students to justify each response. She placed a plus symbol in each cell to represent a feature that was present or true for *weight* and a minus symbol in each cell to represent a feature that was not present or true for *weight*. Mrs. Shankle encouraged discussion when students disagreed on how to mark the cell for "perpendicular to the surface of contact." Some students felt this was true, but others pointed out that it was only true when the surface of contact was horizontal. This afforded an opportunity for students to return to their textbooks and review

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how the force of weight is modeled on horizontal as opposed to inclined planes. Mrs. Shankle reminded the class, "Remember that we learned how the force of weight or gravity is always directed toward the center of the earth. When the surface of contact is not horizontal, how would the force of weight be modeled in a diagram? Would it still be perpendicular?"

The students requested to record both a "+" and a "–" symbol in the cell for this feature of the example *weight*. Given their ability to articulate the reasoning behind the marks, Mrs. Shankle recorded that on the projected semantic feature analysis and continued prompting them to justify responses for the remaining features. Then, she asked the small groups to complete the next row together. After completing each row, Mrs. Shankle called on various students to share with the class how they decided to put the plus or minus symbols in the cells. She used that as an opportunity for students to learn from each other's reasoning process as well as to correct any misunderstandings.

Types of force

Features / Examples	Vector quantity	Opposite the force of a push	Perpendicular to the surface of contact	Parallel to the plane of contact	Net force must be zero	Requires contact with the object					
Weight	+	–	+/–	–	–	–					
Normal Force	+	+	+	–	–	+					
Static Friction	+	+	–	+	+	+					
Kinetic Friction	+	+	–	+	–	+					
Tension	+	–	–	–	–	+					

When all rows were complete, Mrs. Shankle told her students, "We will be adding to this grid as we learn more about force and motion, so pay attention as we continue to read information in this unit. Any time that you come across another type of force or another distinguishing feature, you need to alert us to it. That is why we have blank rows and columns on our grid—for the new information. We want to continually improve our understanding of how the

types of force are related and how they connect to other concepts such as acceleration. We will be studying that next."

In subsequent lessons, students added *rolling friction* and *magnetic force* to the semantic feature analysis. Each time a student identified new information Mrs. Shankle asked everyone to locate it in their text and explain how the cells on the grid should be completed. Before the unit test, students used the semantic feature analysis as part of their review.

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VOCABULARY VIGNETTE / SOCIAL STUDIES

Mr. Banerjee is preparing to teach a unit on the Fourteenth Amendment to his senior government class. From the state standards and district scope and sequence, he knew he needed to teach 12 terms for the Constitutional and judicial concepts associated with the Fourteenth Amendment: *equal protection clause, incorporation doctrine, judicial activism, judicial independence, judicial restraint, originalism, precedent, privileges or immunities clause, procedural due process, social contract theory, substantive due process, unenumerated rights*. Additionally, Mr. Banerjee identified, on average, nine words per primary source document that he anticipated would be unfamiliar and challenging to his students. Therefore, he consulted with his colleagues to determine the best approaches to supporting the different types of vocabulary students would encounter in the unit.

Mr. Banerjee is the only twelfth grade social studies teacher at his campus, and he teaches economics and a section of world history in addition to government. However, the principal has created professional collaboration periods in which teachers of related courses share common planning time to support each other in implementing literacy strategies. Mr. Banerjee is grouped with the two American and world history teachers as well as the two English teachers for American and world literature.

The collaborative team examined the reading materials and decided that the 12 conceptual terms warranted the most extensive instruction because they were discussed in the textbook and referenced in the primary source documents. Also, students would be expected to apply those terms to other contexts in the government and history classes as well as on state and national exams. The more general vocabulary from the primary source documents, however, was often specific to a particular reading. Mr. Banerjee and his colleagues felt that placing too much emphasis on those words would distract time and attention away from the lesson objectives. Rather, the words were probably best handled by just providing definitions to students, as needed, to grasp the meaning of the document.

On the day he began the unit, Mr. Banerjee began by asking students to recall what they already knew about the civil rights movement in the United

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States. "In your social studies classes and in your American history class, you studied some of the important events related to ending segregation and protecting the rights of minority groups and women. What do you remember about those events? Who were some of the influential people in advancing civil rights? Did you study any of the changes in our government or laws?"

As students offered what they remembered, Mr. Banerjee recorded their ideas on the board. After a few minutes, he introduced the new unit on the Fourteenth Amendment and told the class, "We will be learning about the significance of the Fourteenth Amendment and the impact it had on Supreme Court decisions. We will be revisiting many of these ideas with which you told me you are already familiar. This time, however, we want to go a little bit deeper to examine how the interpretation of the Fourteenth Amendment shaped many of the events. We don't want to know only what happened, but also how and why from a judicial and legal standpoint. To help prepare you for that more critical analysis, I want to review a few important terms with you."

Mr. Banerjee than divided the class into small groups of three or four students and gave each team a laminated set of 5 x 7 note cards. One of the 12 conceptual terms was printed on each card along with a simplified definition of the term and a sentence using the term in a way that would be familiar to students.

Sample vocabulary card

> *Unenumerated Rights: individual freedoms that are not directly listed in the Constitution, but that have been inferred from the language of the Constitution and court cases interpreting it.*
>
> *Although not written in the First Amendment, the courts have treated flag burning as an unenumerated right associated with free speech.*

"As a team, I want you to read each of the 12 cards and think about how those terms might apply to the Fourteenth Amendment, which in 1868 granted citizenship to all persons born or naturalized in the United States. After you have read the information on all 12 cards, I want you to decide how you might group the words together. These are not isolated terms. They are, in some way, connected or related to each and the Fourteenth Amendment. Each group

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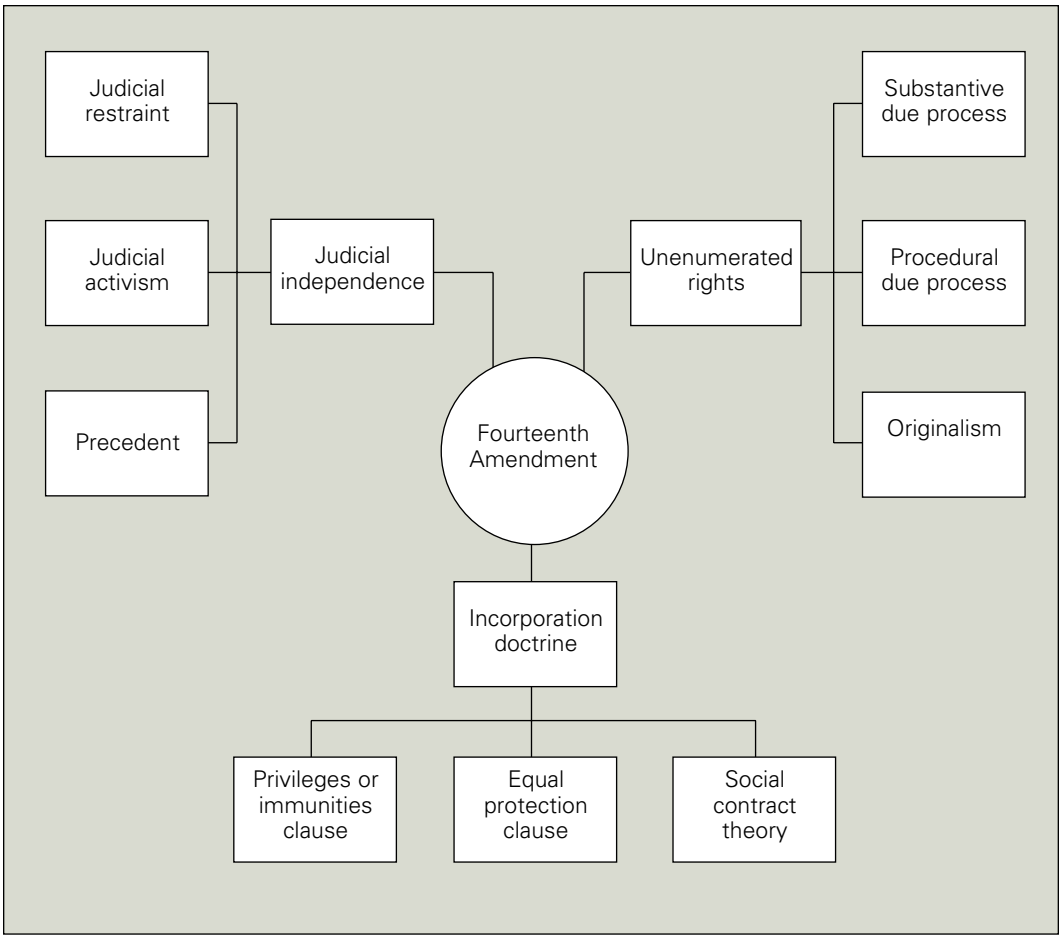
needs to decide how they will group the terms, and every member of that group needs to be able to explain why the terms are grouped in that way."

Mr. Banerjee answered any clarifying questions before having the teams work on categorizing the 12 terms. He circulated throughout the room as the students worked so that he could hear how they were discussing the information and ensure that all students were participating. When the teams had settled on an organizational scheme, he reconvened the class to share their work.

Sample grouping of terms



"After you learn more about the Fourteenth Amendment, you will have an opportunity to return to these terms and decide if you need to reorganize them in a different way. When we read and talk about the material in this unit, we will use these terms and analyze how certain events or aspects of court rulings

exemplify one or more of the terms. You will be very familiar with all 12 by the time we finish the unit."

He closed the lesson that day by introducing the first primary source document they would be reading for tomorrow's lesson. Mr. Banerjee had his students glance over the text and asked, "Are there any words that jump out at you that seem unfamiliar?"

As students identified words, he typed them into an email message he projected on the screen and provided a basic definition appropriate for the context. After the students had looked quickly over the eight pages of text, Mr. Banerjee sent the email with all the new words and their definitions to the students. "As you read your homework, you can refer back to this message if you get stuck on a word." He also reminded the students that they could look up any other words they did not know on the online dictionary that was linked through the class web page. He then reviewed the purpose for reading the primary source document before dismissing class.

SECTION 4

THE RESEARCH BASE FOR EFFECTIVE COMPREHENSION INSTRUCTION FOR ADOLESCENTS

This section provides a general overview of comprehension instruction, a critical component in content-area classes. It defines *comprehension*, describes the goal and purposes for teaching this domain, and reviews the research to support the importance of comprehension in all content areas. We then discuss comprehension instruction as it applies to the core academic subjects.

Comprehension is the process of extracting and constructing meaning, simultaneously, through interaction and involvement with written language (Snow, 2002). The goal of comprehension instruction is to help students understand written language. Students who comprehend well monitor their understanding as they read and use fix-up strategies, such as re-reading or summarizing, when understanding breaks down. Self-monitoring also helps students relate new information to their prior knowledge, fostering better understanding. However, many adolescents struggle to self-monitor and repair their comprehension due to a lack of prior knowledge, an inability to relate content to prior knowledge, an inability to read text fluently, difficulty decoding words, an inability to attend to meaning while reading, an inability to use comprehension strategies, or difficulty understanding the meanings of words (Boardman et al., 2008; Pressley, 2006; Reed & Vaughn, 2010).

We teach comprehension so that all students "can read a variety of materials with ease and interest, can read for varying purposes, and can read with comprehension even when the material is neither easy to understand nor intrinsically interesting" (Snow, 2002, p. xiii). This is particularly true for adolescent readers who increasingly need to gain meaning from conceptually-dense texts, as well as remember and use the information (Biancarosa & Snow, 2004; Perfetti, Landi, & Oakhill, 2005). Fortunately, most students demonstrate improved reading achievement when their teachers incorporate the following components of effective comprehension instruction before, during, and after reading (Edmonds et al., 2009; Snow, 2002):

- purposeful and explicit teaching,
- classroom interactions that support the understanding of content-area texts,
- instruction in the skills and strategies used by expert readers, and
- content-area texts that are appropriately matched to students' abilities and the specific strategy being implemented.

These instructional practices usually can be implemented class-wide in any content area. In fact, comprehension strategies work best when taught and practiced in meaningful contexts, so using authentic material in core academic classes makes sense. Discipline-specific materials often require advanced skills such as understanding conventions, text structures, and content-specific ways of thinking and writing (National Adolescent Literacy Coalition, 2007). Although content teachers may feel unqualified to teach literacy skills, they are the experts in their subject matter. Their strong technical knowledge plays a powerful role in helping students become critical readers of domain-specific texts. Students will be held accountable for demonstrating these skills on the NAEP. The cognitive targets on the NAEP (e.g.,, locate/recall, integrate/interpret, and critique/evaluate) are assessed with content-related texts and draw upon students' understanding of structures and authors' crafts specific to text types (National Assessment Governing Board, 2006).

Content teachers can improve their students' learning of key concepts and facts by explicitly teaching a few, specific instructional routines for reading strategically, considering the unique ways that information can be presented, and making connections to that information (Bulgren, Schumaker, & Deshler, 1994; Jacobs, 2008). Strategy instruction should be embedded within content-focused texts and not practiced out of context. Teaching only generic strategies might suggest to students that all texts are similar in structure, and that skills can transfer from one text to another without considering different discourse patterns or discipline-specific ways of communicating (Heller & Greenleaf, 2007).

Remember that the goal of teaching comprehension strategies is to help students become active readers who control their own comprehension (Pressley, El-Dinary, et al., 1992). The following comprehension strategies, which we will examine individually, can benefit all students (National Institute of Child Health and Human Development, 2000; Duke & Pearson, 2002; Pressley, 2002):

- **activate** and **build** prior knowledge,
- **ask** questions,
- **answer** questions,
- **monitor** comprehension, and
- **summarize** and use graphic organizers.

Activate and build prior knowledge

Students better understand, think about, and retain new information when they are familiar with or taught background knowledge of a topic before reading. One study conducted with seventh and eighth grade English language arts students demonstrated the relationship of prior knowledge to short-term nonverbal and verbal memory as well as long-term information retention (Recht & Leslie, 1988). Students' performance on these measures varied based on their prior knowledge, regardless of their reading comprehension ability. The researchers concluded that readers with greater prior knowledge of a topic better recognized important ideas and had an ability to summarize those ideas. Further, building background knowledge can mitigate the influence of students' limited verbal ability on comprehension. If they have equal knowledge about the concepts in the text, students with lower general verbal ability can comprehend text as well as students of higher general verbal ability (Schneider, Korkel, & Weinert, 1989).

Despite the consensus on the value of pre-reading instruction that addresses the ideas discussed in texts (Graves, Cooke & Laberge, 1983; Langer, 1981, 1984; Neuman, 1988), little evidence exists on the best methods for doing so in each discipline. Research conducted with fifth grade English language arts students indicated that teacher-directed instruction was more effective than an interactive approach to activating and building background knowledge (Dole, Valencia, Greer, & Wardrop, 1991). When given carefully structured information about the ideas in a passage they were about to read, students understood narrative and expository texts better than when they engaged in activating, discussing, and integrating their prior knowledge in less focused or purposeful ways. Similar results were found in other studies (Graves & Cooke, 1980; Graves et al., 1983; Graves & Palmer, 1981).

Despite a lack of extensive research replication, strong support exists for structured, teacher-directed background knowledge instruction with adolescents. Barton (1997) notes that prior knowledge helps students filter

content, make sense of what they read, and assimilate new information. To draw on experience and prior knowledge content teachers should ask students to justify their responses to prompts that target important ideas (Pressley, Wood et al., 1992). Teachers might consider creating an *anticipation-reaction guide* by reviewing the unit or lesson material and then identifying four or five key concepts that lend themselves to forming opinion statements (Vaughn Gross Center for Reading and Language Arts at The University of Texas at Austin [VGC], 2009). Students are asked to agree or disagree with each statement before, and again after, reading the text. Discussion before and after reading can expose any inaccuracies, incomplete understanding, and conflicting beliefs. This instructional tool can also activate students' interest and curiosity for the topic and help students link new and prior knowledge.

Answer questions

Asking and answering questions about texts may not be intuitive for many adolescents. But students can be taught ways to answer teachers' questions that improve the quality of their answers and the amount of information they learn as they read (Armbruster, Lehr, & Osborn, 2001). One research-based strategy that can be used across all content-area classes is the Question-Answer Relationship (QAR) developed by Taffy Raphael (1986). QAR helps students connect the salient parts of a question with a text and the reader's prior knowledge (Pearson & Johnson, 1978). Students learn four categories of relationships expressed within questions: *right there, think and search, on my own*, and *author and me*. Those categories can serve as a shared language for students and teachers to talk about questioning practices and, when necessary, make explicit the processes underlying reading and listening comprehension (Raphael & Au, 2005).

QAR and similar strategies emphasize that different questions require the reader to locate answers in different sources such as the text itself, other reference materials, or students' own prior knowledge. Some question types are considered higher-level because they require students to synthesize information to produce an answer or make complex inferences. Higher-level questions relate to higher levels of student growth (Taylor, Pearson, Peterson, & Rodriguez, 2005), as emphasized in the cognitive targets in the 2009 NAEP framework (National Assessment Governing Board, 2006). Teachers must include opportunities for students to deeply process information and relate it to

their prior knowledge (Pressley, Wood et al., 1992). In addition, all questioning techniques require that students first understand the concepts inherent in the question.

A study with seventh grade science teachers explored how teacher-generated questions in classroom discourse provided scaffolds for student thinking and the construction of scientific knowledge (Chin, 2007). Findings indicated that skilled teachers use questioning techniques to shape classroom discourse and build progressively on students' responses. When students are less inclined to verbalize their ideas publicly, teachers can apply "responsive questioning and feedback" skills, including how to elicit responses, probe for clarification or more information, and extend students' thinking. These linguistic and cognitive scaffolds guide students toward successively higher levels of thought. Although this study focused on discourse, the same principles apply to building student understanding of subject matter text. That is, the discussion would focus on the content of the featured text.

Ask questions

To monitor their comprehension more independently, students need help determining what types of questions to ask themselves while they read. Generating questions about the text engages readers because it motivates them to persist for more than just the teacher's purposes (National Institute of Child Health and Human Development, 2000). It also serves as a form of self-assessment (Ciardiello, 1998). Students can be taught to generate questions based on new information they read and, then, determine if they can answer their own questions by applying that information or relating it other things they have read. Like the higher-level questions promoted in the NAEP, self-generated questions have more instructional value when they require an examination of similarities and differences, causes and consequences, or alternative solutions compared to students merely checking their own recall of facts from the text.

Content teachers can teach students how to generate questions before, during, and after reading. In one study, fifth grade science students improved their factual comprehension when they worked in small groups to generate questions on self-selected trade books using a three-step process (Anderson, West, Beck, MacDonell & Frisbie, 1997). The process required the students to ask questions about the content of the book, search for answers within the text and other resources, and explain their findings to the class.

Another study in grades four through eight included generating questions as part of multiple-strategy instruction (Vaughn, Klinger, & Bryant, 2001). Students in small groups were taught to wrap up what they read by generating questions a "good teacher would ask" (Vaughn et al., 2001, p. 68). The wrap-up served to help students identify and understand the text's most important ideas. Findings from professional development, student academic progress, and discourse analysis revealed that many students made significant progress in understanding text and learning content.

The relationship between self-generated questions and comprehension also was investigated specifically in history classes (Taboada & Guthrie, 2006). General findings from this study indicated that questioning positively contributed to reading comprehension for both low and high prior knowledge students. In fact, the self-generated questions contributed to comprehension concurrently with prior knowledge.

Monitor comprehension

Monitoring one's comprehension becomes increasingly important when one reads explicitly to learn new information. Students must be aware of what they do and do not understand and how to use comprehension strategies to "repair" their confusion (Taylor & Frye, 1992). Many students, especially struggling adolescent readers, do not understand what they read and are unaware that they do not understand (Gersten, Fuchs, Williams & Baker, 2001; Brown, 2002). Content-area teachers can help improve students' comprehension by teaching students to acknowledge their lack of understanding and then determine which strategies can help them rebuild and maintain comprehension (Honig, Diamond, & Gutlohn, 2008).

Students can be taught to stop regularly and think about what has been communicated so far in the text. The reader then judges how well he or she has grasped the information. If the student does not understand, fix-up strategies such as re-reading, asking someone questions about the text, considering relevant background knowledge, or examining the graphics more carefully can be applied (Almasi, 2003). There are three challenges to teaching fix-up strategies: they take time, require modeling, and should be imbedded in authentic reading experiences. Almasi (2003), describing modeling, suggests that when a teacher presents text where modeling a comprehension strategy could be difficult, the teacher could stop and say something like, "This doesn't

make sense to me. I think I need to go back and reread a section (or study the graphics more carefully, etc.) to make sure I understand." Then, she would think aloud as she models the particular fix-up strategy.

Identifying the main idea of a paragraph, page, or passage is another useful means of monitoring comprehension during or after reading. Often, teachers assume that students already know how to find or compose the main idea, and do not explicitly teach this important skill. However, research indicates that as text becomes more complex or unfamiliar, most students need to call on a strategy for identifying main ideas (Afflerbach, 1990). When explicitly taught such strategies, adolescents have demonstrated increased reading comprehension (Jitendra, Hoppes, & Xin, 2000; Sjostrom & Hare, 1984).

Comprehension monitoring strategies need not be implemented individually. The National Reading Panel (National Institute of Child Health and Human Development, 2000) found the greatest research support for teaching more than one strategy. Multiple strategy instruction shows how to use a set of strategies flexibly and meaningfully (Armbruster et al., 2001). One approach—reciprocal teaching—gives student practice in using four comprehension strategies: questioning, clarifying, summarizing, and predicting (Brown & Palinscar, 1984). Students in small groups apply the strategies as they discuss two or three paragraphs. At first, the teacher leads the group discussion but gradually releases control to a student after the strategy has been explicitly and systematically taught.

Results of a study with ninth grade English language arts students indicated that a combination of reciprocal teaching and direct instruction yielded significant improvements in reading comprehension compared to traditional literacy instruction (Alfassi, 2004). A subsequent study by the same author revealed similar results when reciprocal teaching was implemented with tenth graders in science, social studies, and math (Alfassi, 2004). Although the second study did not include a control group, it reported a significant difference between number of correct answers before and after intervention. The author concluded that strategies are best learned and applied to actual academic tasks used across content areas and established a benefit in implementing combined strategy instruction as part of the overall high school curriculum.

Reciprocal teaching is appealing as a schoolwide comprehension strategy because it can be used in all core content areas. Moje (2007) suggests that reciprocal teaching can be useful in differentiating science instruction. Van

Garderen (2004) suggests that, with minor accommodations, it can also assist students in understanding word problems, which place greater demands on students' reading skills as they advance in grade-levels (Flick & Lederman, 2002; Miller & Mercer, 1997).

However, reciprocal teaching is not the only multi-strategy approach to comprehension monitoring that is applicable in the content areas. Another strategy showing promise involves small groups collaboratively previewing, "fixing-up" comprehension breakdowns, identifying main ideas, and summarizing (Klingner et al., 1998). Research on this strategy has demonstrated gains in students' comprehension of social studies content and the number of their interactions in learning situations (Klingner et al., 1998). The components of this strategy include the use of graphic organizers or other templates as scaffolds.

Summarization and graphic organizers

Once students can state the main ideas of several connected paragraphs, they can learn how to write a summary of a passage. Summarizing requires the reader to synthesize information extracted across a text and restate it succinctly. Students who summarize well are more aware of the text's structure and how ideas are related (National Institute of Child Health and Human Development, 2000). Attention to organizational structure of informational text, in turn, helps students locate and keep track of important information to include in the written summary (Honig et al., 2008). Explicit instruction in summarization improves student comprehension and helps them make connections among main ideas and significant details (Ambruster, Anderson, & Ostertag, 1987; Trabasso & Bouchard, 2002). Further, adolescents who work collaboratively on summarizing expository texts reach higher levels of comprehension and retention of content information (Mastropieri, Scruggs, Spencer, & Fontana, 2003; Spencer, Scruggs, & Mastropieri, 2003). For literary texts, summarization often takes the form of retelling or restating the events of the passage (Klingner, Vaughn, & Boardman, 2007), but produces the same comprehension benefits. (Based on the 2009 framework, NAEP will now measure literary and informational text separately to address the research on text structure, which indicates that literary and informational text have different organizational patterns that contribute to meaning [e.g., Goldman & Rakestraw, 2000; Pearson & Camperell, 1994].)

Graphic organizers have proven to be a useful tool for summarizing text. Instruction in how to use graphic organizers helps students identify, organize, and remember important ideas from what they read (National Institute for Child Health and Human Development, 2000). The tools derive their name from the two features that define them. They are considered "graphic" because they create a visual representation of the information. And, they are "organizers" because they provide a way for students to (Armbruster et al., 2001; Trabasso & Bouchard, 2002):

- record information about underlying text structures,
- see how concepts fit within text structures,
- focus on the most important ideas in the text,
- examine relationships among text concepts,
- recall key text information, and
- write well-organized summaries.

Authors structure informational text in specific ways to help readers identify key information and make connections among ideas (Honig et al., 2008). The most common organizational patterns of informational text are the expository structures (description, compare-contrast, cause-effect, problem-solution, time order) and the structures of procedural and persuasive text. The graphic organizer should concretely represent the structure of the text. For example, if a science passage uses compare-contrast structure, the teacher may teach how to use a Venn diagram as a way to organize ideas and compare and contrast the passage's concepts.

Several studies have focused solely on the use of graphic organizers in social studies. A study in sixth grade classrooms found that explicit instruction of graphic organizers worked regardless of whether or not it was carried out in cooperative learning groups (Darch, Carnine, & Kame'enui, 1986). However, using graphic organizers in cooperative learning activities appears to have the most pronounced effect. When compared to using the activities in a textbook's teacher edition, instruction in using a visual graphic (the representation of the important ideas in a text) resulted in greater learning (Armbruster, Anderson, & Meyer, 1991).

Recent research on text structure use in social studies has focused on teaching students to identify cause-effect and problem-solution sequences, and

to build coherent conceptual frameworks. As early as second grade, students can learn to recognize cause-effect relationships in text using graphic organizers, generic questions, and clue words without distracting from content learning (Williams et al., 2007; Williams, Stafford, Lauer, Hall, & Pollini, 2009). Another study found that fifth grade students who received direct instruction in problem-solution text structure using a graphic organizer produced better written summaries of the text (Armbruster, et al., 1987). Further, combining text structure instruction with a text reading strategy, which included the use of semantic maps, resulted in higher student scores on comprehension and reasoning assessments at immediate and delayed recall testing points (Walker, 1995).

Graphic organizers are equally appropriate for other content-area classes. Although not experimental, one study found a fifth-grade teacher reporting positive outcomes from an action research project using a graphic organizer to help students solve mathematical word problems (Braselton & Decker, 1994). During group work in any subject, teachers should model the thinking process involved in completing graphic organizers before, during, and after reading (Hennings, 1993). In addition, instruction should focus on identifying key words and important points that make the graphic organizer an efficient means of representing and reinforcing the text.

Summary—comprehension research. Instruction that activates and builds prior knowledge, asks and answers questions, monitors students' comprehension, summarizes, and uses graphic organizers fosters understanding of content texts. Content teachers seeking to provide effective comprehension strategy instruction can benefit by developing deeper knowledge and practicing with more examples than can be provided in this relatively brief document. Also, teachers will need ongoing support through professional development to implement and adapt the strategies to their instruction.

The important interaction between text difficulty and reader abilities

In addition to the use of comprehension strategies, the difficulty of text has important implications for how well students comprehend it. The demands of the 2009 NAEP framework and the expectations of content-area coursework require more than superficial comprehension. Sophisticated reading comprehension is "the process of simultaneously extracting and constructing meaning through interaction and involvement with written language" (Snow, 2002, p. 11). Some comprehension strategies help students attend to and remember what they read, but the real goal of comprehension in academic literacy is to foster students' ability to make inferences and draw conclusions that result in new knowledge (Torgesen et al., 2007). Achieving an advanced understanding depends on the interaction of the linguistic and cognitive features of text difficulty with the readers' ability to construct a mental model of the text. This requires background knowledge, inference-making skills, and consideration of the purpose for, and context in which, the reading activity is taking place (Sweet & Snow, 2003; Verhoeven & Perfetti, 2008).

Foorman's (2009) analysis of the following passage drawn from Barbara Tuchman's (1985) *The Zimmermann Telegram* exemplifies the features that make text difficult and call for the active and complex processes involved in comprehension:

> *The first message of the morning watch plopped out of the pneumatic tube into a wire basket with no more premonitory rattle than usual. The duty officer at the British Naval Intelligence twisted open the cartridge and examined the German wireless intercept it contained without noting anything of unusual significance. When a glance showed him that the message was in non-naval code, he sent it in to the Political Section in the inner room and thought no more about it. The date was January 17, 1917, past the halfway mark of a war that had already ground through thirty months of reckless carnage and no gain. (p. 3)*

Foorman's (2009) analysis reveals that the passage places demands on students' understanding of the vocabulary, the use of pronoun and noun referents (e.g., *him* to the *duty officer*), and the historical context of the telegram. As explained by Foorman:

> *Immediately one notices the demands of vocabulary and prior knowledge. Phrases such as duty officer, morning watch, non-naval code, German wireless, and Political Section require knowledge of military terminology. Words such as premonitory, carnage, and cartridge are academically challenging words. Words such as telegram, pneumatic tube, wire basket, and wireless intercept demand prior knowledge of twentieth century communications. In fact, the entire passage requires an understanding of the war that was going on in early 1917 between Britain and Germany. The author's antiwar sentiment is poignantly expressed in the phrase "past the halfway mark of a war that had already ground through thirty months of reckless carnage and no gain." But questions remain, not answered by this paragraph. Who was Zimmermann and why was the telegram in non-naval code? Answers are readily available in Barbara Tuchman's book but also on the Internet, where one can find the actual telegram. (p. 232-233)*

Students must make inferences to connect these aspects of the content with background knowledge to form a mental model of the situation (Kintsch & Rawson, 2005). This requires an understanding of the vocabulary and historical context as described above, but also places demands on students' awareness of the text type (i.e., narrative; historical non-fiction) and structure (i.e., persuasive) as well as the linguistic markers, "such as the use of anaphora (e.g., the pronoun *he* or *him* refers to the *duty officer*), co-reference (e.g., *German wireless intercept* refers to *the message*), and deixis (e.g., *in the inner room*)" (Foorman, 2009, p. 233-234). Finally, comprehension may be influenced by how well students are able to draw upon connective words and explicitly stated relationships among the ideas (also referred to as cohesive elements) to form a coherent mental representation of the text (McNamara, 2001).

THE COMPREHENSION VIGNETTES

The vignettes that follow show comprehension instructional strategies "in action" in the four core academic subjects: English language arts, mathematics, science, and social studies. These illustrations do not attempt to describe everything the teacher would address in an extended lesson or unit of instruction; they highlight features of comprehension instruction to illustrate how a lesson can meet the dual goals of improving literacy and content knowledge simultaneously. Additional support for comprehension might be needed for other components of the lesson or unit, as well as to scaffold students' development toward more sophisticated word usage and text understanding.

The vignettes offer a starting point. Extended support through professional development will help teachers work through the roadblocks to adapting instruction to support the unique literacy demands of each content area. This is particularly true at higher grade levels where coursework becomes more complex and places greater demands on students' abilities to understand technical terms, sophisticated non-technical language, and discipline-specific means of communicating information (Shanahan & Shanahan, 2008). The vignettes offer some explanation of how strategies were adapted to the needs and purposes of specific content. However, the narrative style and concise nature of the scenarios tend to oversimplify what we acknowledge is a very difficult task of specializing comprehension instruction to support students who are above-, on-, and below- average ability in the same content-area class.

To help consider the elements of comprehension instruction being featured, we provide a set of guiding questions:

- How did the teacher create opportunities for students to return to important text information throughout the lesson?
- How did the teacher foster discussion throughout the comprehension instruction?

- How did the teacher help activate or build background knowledge in the comprehension instruction?
- How were the comprehension strategies tailored to meet the needs of the content area?
- How did the teacher maintain the importance of the content knowledge students needed to build?
- How were students prepared to use comprehension strategies independently to support their learning?

These vignettes provide examples of strategies that fit the nature of the reading demands for the lessons described. As courses become more specialized, teachers need expert guidance in and collaborative support for selecting and adapting strategies to help students meet the very specific reading demands of each discipline. The section on professional development (see page 83) addresses research that suggests teachers will be resistant to implementing practices which seem to neglect their content or fail to meet the needs of a majority of their students (Siebert & Draper, 2008). Therefore, consider the following questions for reflecting on the vignettes and connecting them with the necessary professional development for content-area teachers:

- How can the vignettes be used to start discussions with teachers about meeting the literacy demands of their specific disciplines?
- How can teachers be supported in making comprehension strategies appropriate for the particular formats and approaches of different courses?
- What would help make comprehension strategies useful for the majority of the students in a particular course?
- What would be necessary to prepare teachers in your state/district/school to use the types of strategies featured here?
- What is your current level of confidence and skill at incorporating comprehension strategies in content lessons? How can you build upon that?

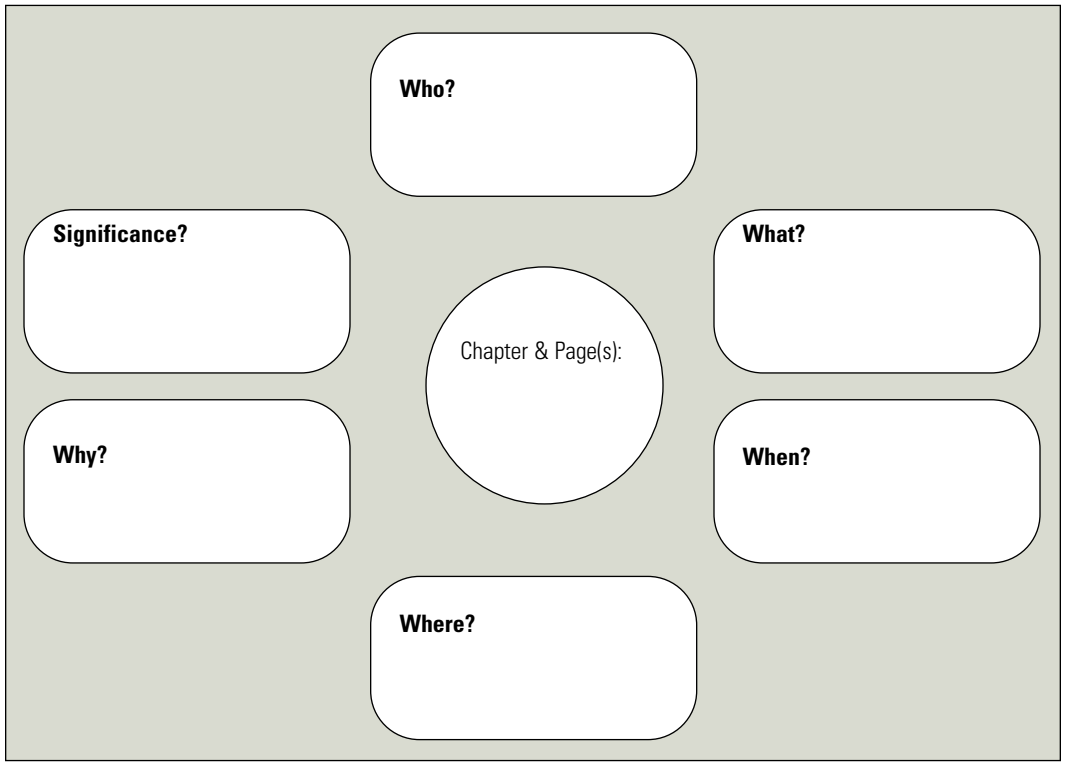
ENGLISH LANGUAGE ARTS

COMPREHENSION VIGNETTE / ENGLISH/LANGUAGE ARTS

Mrs. Takakawa has planned to teach her eleventh-grade American literature class the novel *Pudd'nhead Wilson* by Mark Twain. Although her vocabulary instruction will support students' comprehension of the text, she is concerned that the author's use of vernacular and local color writing will make the novel more challenging. After consulting her colleagues in the English department as well as the literacy coach, Mrs. Takakawa decided to implement a summarizing strategy to support her students' understanding of chapters that contained a great deal of dialogue.

She introduced her students to the procedure during the second chapter, using a graphic organizer for recording the important information.

Summarizing graphic organizer template



ENGLISH LANGUAGE ARTS

Mrs. Takakawa had pairs of students read the first few pages of the chapter to each other by alternating turns whenever Mrs. Takakawa called out: "Switch readers, please." The chapter contained the following dialogue (Twain, 1900):

> *"Say, Roxy, how does yo' baby come on?" This from the distant voice.*
>
> *"Fust-rate. How does you come on, Jasper?" This yell was from close by.*
>
> *"Oh, I's middlin'; hain't got noth'n' to complain of, I's gwine to come a-court'n you bimeby, Roxy."*
>
> *"You is, you black mud cat! Yah — yah — yah! I got somep'n' better to do den 'sociat'n' wid [folks] as black as you is. Is ole Miss Cooper's Nancy done give you de mitten?"*
>
> *Roxy followed this sally with another discharge of carefree laughter.*
>
> *"You's jealous, Roxy, dat's what's de matter wid you, you hussy — yah — yah — yah! Dat's de time I got you!"*
>
> *"Oh, yes, you got me, hain't you. 'Clah to goodness if dat conceit o' yo'n strikes in, Jasper, it gwine to kill you sho'. If you b'longed to me, I'd sell you down de river 'fo' you git too fur gone. Fust time I runs acrost yo' marster, I's gwine to tell him so."*

As the students read, Mrs. Takakawa circulated around the room, listening to how students were handling the dialogue. When necessary, she stopped to assist with pronouncing the phonetically spelled words. When all pairs had finished the first section of dialogue, she reconvened the whole group and explained the purpose for what they would be doing. "Many of you noticed how difficult the dialogue can be to read and understand because it is written in the vernacular and emphasizes the speech patterns and mannerisms peculiar to this time period and region. To make sure you are getting the important information out of these sections of text, we are going to learn to use a graphic organizer for summarizing the conversations of the characters. We will not use

this every time there is dialogue, but we will use it when there are longer sections of dialogue or when the conversation is very important."

Mrs. Takakawa projected an electronic copy of the graphic organizer onto the screen and indicated portions of it as she spoke. "You will notice that there is a place in the center of this summarizing organizer for us to record the chapter and page numbers. This will help us refer back to the dialogue later if we need a quote for text evidence in an extended response or essay. Can someone tell me what I should record in this circle?"

She typed the information into the graphic organizer before continuing. "In the box at the top of the center circle, we will record *who* was talking. We want to put all the names of the characters involved in the conversation so that we can easily track their conversations in the graphic organizers we create over the course of the novel. Who remembers the names of the characters who were involved in the first dialogue in chapter 2?"

Again, Mrs. Takakawa typed the information into the projected graphic organizer. "You can see how quickly and easily some of the information in our organizer can be completed. This next box, however, will require a little bit more. We want to be as concise as possible in describing the content of the characters' conversation so that we do not repeat everything they said. We just want the main points. The dialogue between Roxy and Jasper was fairly short, so there is less to synthesize than we might have later in the novel. Remember that they started with a basic 'How are you?' Then, they had what Twain described as a 'friendly duel.' What did the author mean by that?"

A student suggested the two characters were teasing each other, and Mrs. Takakawa asked for the types of things about which the characters were teasing each other. She recorded these ideas in the "What" box on the graphic organizer before asking where and when the conversation was taking place. "Knowing the time and place of the conversation are important for a couple reasons. First, some of the conversations will help advance the plot, so the setting can provide clues to understanding what is happening and the significance of what is being said. Second, the dialogue is an example of the vernacular of a particular cultural group in a particular geographic region and time period. Twain gave us all that information before the dialogue started, and we will need to remember it when we consider the significance of the conversation we are summarizing. Who can find when and where the conversation between Roxy and Jasper took place?"

ENGLISH LANGUAGE ARTS

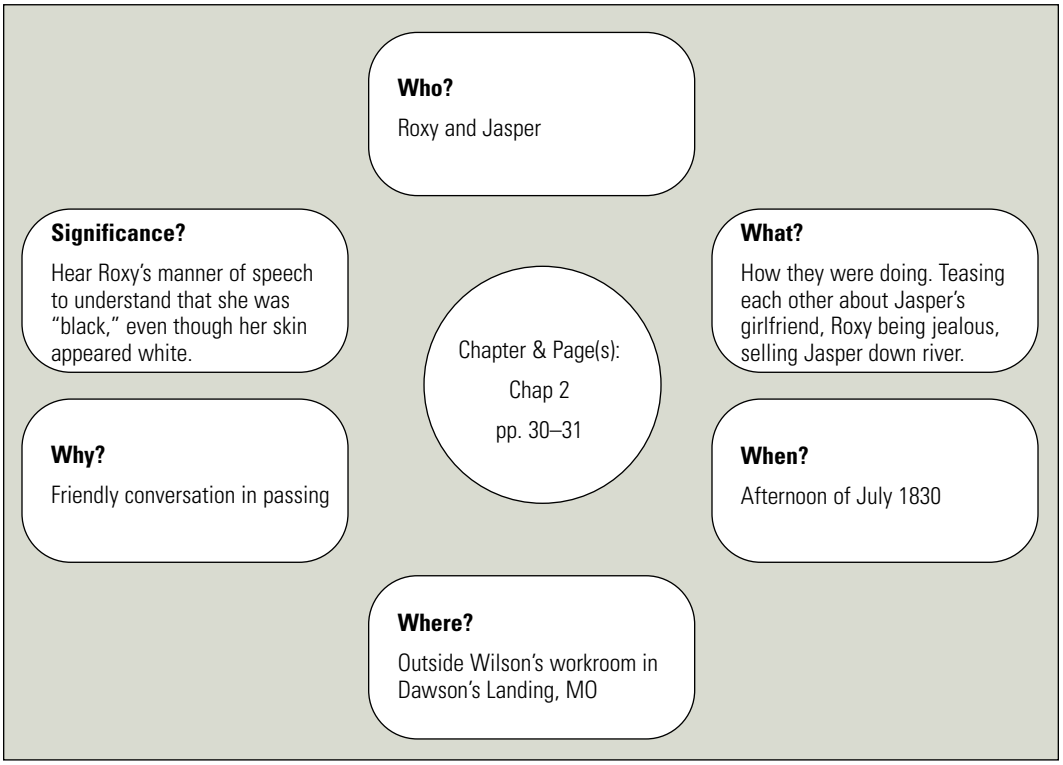
After recording the information in the "When" and "Where" boxes on the graphic organizer, Mrs. Takakawa explained the "Why" box. "We need to know the nature of the conversation between the two characters as a reminder of the tone and, possibly, the role this dialogue might have played in developing the conflict. Were the characters arguing? Were they trying to get information from each other? Was one of them trying to trick the other into doing something? Or, was one of them trying to help the other? Those are some of the possibilities for why characters have a conversation. What do you think the reason was for the conversation between Roxy and Jasper?"

Some students suggested the characters were flirting, and others thought the characters were just trading insults as a cultural practice. "Both are possibilities and show how well you are using your background knowledge to bring meaning to the text," remarked Mrs. Takakawa. "Can we agree that, whether they are flirting or trading insults, Roxy and Jasper are just having a casual conversation? They saw each other in passing and are taking advantage of the opportunity to have a friendly chat?"

The students agreed, and Mrs. Takakawa typed the information into the graphic organizer. "Good! Because the significance of this conversation is not that they ended up going out on a date or one-upped each other with insults, is it? Twain wrote about the significance of presenting this dialogue in the paragraphs that followed. Who can find the important information the language of the dialogue helped to reveal about Roxy? Why was her manner of speaking so important that Twain gave space for the trivial banter in a short chapter in a short book? What does it help us understand?"

The students discussed how Roxy's speech portrayed her as a black slave during this period, but she was actually only one-sixteenth black. She appeared white and carried herself with "sass" among the other slaves. Mrs. Takakawa modeled paraphrasing the information in the final box on the graphic organizer. Then, she had the pairs of students try completing a graphic organizer for the other important dialogue in chapter two of the novel, to ensure the students understood how to apply the summarizing strategy.

Summarizing graphic organizer: Chapter 2 dialogue



Near the end of the period, Mrs. Takakawa asked the students to keep their graphic organizers in their binders. "I will post an electronic version of the template on my class Webpage so that you have the option of using it on your own computer as you complete your assignments. You can also continue using the paper version if you prefer. For tomorrow, you will be reading chapter 3, which contains a very important soliloquy."

She reviewed the meaning of the literary term *soliloquy*, a word they had previously studied while reading Arthur Miller's *Death of a Salesman*. "I want you to complete a graphic organizer for that. In class, you will use those organizers to support your discussion in small groups about the significance of what Roxy has said and done." Mrs. Takakawa answered clarifying questions before the class was released.

MATHEMATICS

COMPREHENSION VIGNETTE / MATHEMATICS

Mr. Molina has been teaching a unit on data analysis to his eighth grade class. He has provided vocabulary instruction to ensure his students have a basic understanding of the terms *mean, median, mode,* and *range* as well as how these measures of centrality and spread are applied when organizing and explaining data. Mr. Molina wants his students to evaluate their knowledge and skills, so he has prepared a set of word problems that require the students to identify and perform the correct type of data analysis.

He knows that word problems are particularly challenging for many of his students, so he wants to support their comprehension. After consulting with his colleagues on his interdisciplinary team, Mr. Molina decides to use a modified form of reciprocal teaching to support his students' understanding of the word problems*. He knows he will need to thoroughly explain and model this strategy before he has students work in groups to carry it out. Therefore, he creates another set of word problems to use for the demonstration lesson.

The next day, Mr. Molina wrote the steps of the reciprocal teaching strategy on the board: Clarifying, Questioning, Summarizing, and Planning. He opened the lesson by explaining the purpose of the strategy to his students, "Today, we are going to learn how to work collaboratively to understand and complete word problems. We are going to use a strategy called reciprocal teaching that you may have used in your other classes when reading passages. We will be following the steps in a slightly modified way to support each other in comprehending what information the word problem contains and what measures of centrality or spread it requires us to perform in order to analyze the given data."

Mr. Molina provided a brief explanation of each step in reciprocal teaching and then proceeded to model how the group should carry out the steps. He distributed the set of sample word problems to the class and read the first one out loud to the students:

> *There are 150 teachers in our school. The teachers live in different communities around our city. Some teachers live within a few blocks of each other, and other teachers live many miles apart. At the end of*

*Modification suggested by Van Garderen, D. (2004). Reciprocal teaching as a comprehension strategy for understanding mathematical word problems. *Reading & Writing Quarterly, 20,* 225-229.

the last school year, we calculated that the 150 teachers had traveled a total of 200,000 miles while commuting between the school and their homes. One teacher, who lives the farthest away, commuted a total of 3,000 miles last year. What is the average number of miles the teachers traveled over the past year?

Mr. Molina modeled the first step in reciprocal teaching, clarifying. "If I were the clarifier in my group, I would ask my partners if there were any words or phrases they did not understand. Someone might ask me what the word 'commute' means or how the phrase 'average number of miles' related to our data analysis measures. I would clarify that a 'commute' is a trip to or from a place of work. In the word problem it talks about the teachers traveling between their homes and our school. They commute or travel from their homes around our city to their place of work at our school. I would also clarify that the phrase 'average number of miles' is related to the mean of the data. 'Average' is another way of saying 'mean,' so the phrase is asking the mean of the miles traveled."

Mr. Molina asked if the students wanted to ask him any other clarifying questions about the words or phrases in the word problem. After answering all their questions, he explained that if the clarifier in the group did not know an answer, any other group member could help. The group could also use resources such as their textbook, vocabulary graphic organizers, or a dictionary.

Next, Mr. Molina modeled the questioning step. "If I were the questioner, I would help my group understand the key parts of the problem by asking questions about the information. I might ask 'What is the data we are organizing and analyzing? Do we have all the information we need? What information do we not need?"

As he stated the questions, Mr. Molina wrote them on the board under the label for the questioning step. He guided his students through answering each question he posed and asked if there were other questions that might be important to ask. He recorded each question the students offered on the board and guided the class in using the word problem to answer them.

"Now we need to summarize the purpose of the word problem," he continued. "We need to restate what kind of data analysis we are supposed to do. When we were clarifying the words and phrases, we looked at a part of the problem that asked the average number of miles the teachers traveled. We

MATHEMATICS

know that we need to calculate the mean because the mean is the average. So, to summarize this word problem, we will be looking at a measure of center in the mileage data. We need to compute the mean distance in miles that teachers traveled while commuting last year."

Mr. Molina asked if anyone had another suggestion for how to summarize the problem that might make more sense to the class. This gave him an opportunity to discuss the different ways that mathematical operations can be expressed as well as how some changes in the language of a word problem might have a significant influence on the meaning. For example, one student suggested the problem could be summarized, "We need to figure out the mean mileage the teachers traveled every day last year." Mr. Molina had the class discuss the difference between calculating the mean mileage last year versus calculating the mean mileage traveled every day. He emphasized that the reciprocal teaching groups might all phrase their summaries of the problem a little bit differently, but that they each had to make sure they accurately restated the purpose of the problem.

"Adding the words 'every day' would change the purpose slightly because it would put an additional step in our problem solving. That brings us to the last part of reciprocal teaching. If I am in charge of planning for my group, it's my job to help plan out the steps for solving the word problem. I have to make sure we follow the steps for calculating the mean number of miles that teachers commuted."

Mr. Molina wrote on the board to demonstrate how he would devise a plan to solve the problem. He showed the difference between planning the steps and doing the actual calculations. "The point of this part of reciprocal teaching is to make sure that we list all the operations in order and check them to make sure they make sense before we plug in the numbers. This gives us one more chance to fix-up our comprehension with the help of our partners."

The class then solved the word problem together by following the steps identified in the plan. To make sure the class knew how to carry out reciprocal teaching, Mr. Molina asked for volunteers to model the process in front of the class. He had the four students pull their desks together and gave each one a role of clarifier, questioner, summarizer, or planner. He read the second sample word problem to the class, and had the group of four volunteers begin the reciprocal teaching. He told the rest of the students, "If a member of this small group gets stuck and doesn't know what to do, it's your job to help that person

out. You can explain how to clarify, question, summarize, or plan. However, you cannot do that job for them. Just explain how the job is supposed to be done."

After facilitating the peer modeling, Mr. Molina closed the lesson by having students do a quick writing exercise. He put them in the groups of four in which they would work the next day and assigned each person one of the reciprocal teaching roles. "Look at the third sample word problem on the sheet and describe how you would carry out your job for that problem. How will you help your partners? What will you need to know or do? In what ways can you use your vocabulary concept map to assist yourself and others in your group?"

Mr. Molina used the students' written responses to determine the kinds of support or re-teaching he would need to provide tomorrow when he had the class implement reciprocal teaching with data analysis word problems.

SCIENCE

COMPREHENSION VIGNETTE / SCIENCE

Mrs. Shankle has been teaching a unit on force and motion to her tenth grade science class. In addition to investigative activities and work with the important vocabulary, Mrs. Shankle had her students read from the textbook, supplemental materials, and instructional web sites that contained both technical explanations and diagrams. She knew that it was often difficult to integrate these two formats of information. Therefore, she planned to have her students generate questions to monitor their understanding. Mrs. Shankle's collaborative team agreed that this strategy would require more active involvement of students than answering teacher-generated questions and would equip them to self-regulate their learning. In addition, the kinds of questions the students produced would indicate to Mrs. Shankle whether they were being distracted by extraneous information in the text or if they were focusing on particular examples at the expense of the overarching principles.

When she first introduced the strategy, Mrs. Shankle told her students, "Today, we are going to be reading about how to determine force and acceleration. You know that scientific writing is very different from the kinds of text you might typically read in your English language arts class or for your own pleasure. This text will have procedural information to guide you in the steps of calculating force and acceleration. You will also see figures and formulas that relate to what is being described in the written portions.

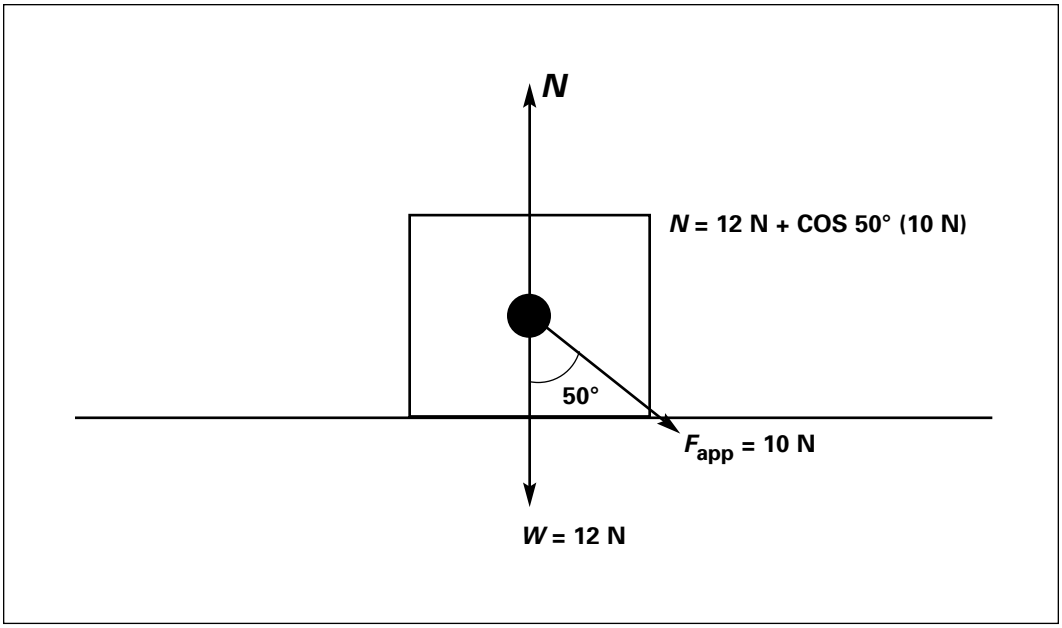
"The author communicates a lot of information in a very short space, so we're going to use a strategy to make sure we understand everything. As we read a section, we're going to write questions that connect information from the paragraph with information in the diagram or formula. I am going to model how to write these types of questions for the first section and, then, you are going to work with your lab partners on writing some of your own. Afterwards, we will check our understanding by answering the questions together."

Mrs. Shankle gave the class two minutes to read the section on calculating normal force that contained the following text and accompanying diagram:

> *To determine the magnitude of the normal force (N), start by drawing a free-body diagram depicting all the forces acting upon the object. Remember that a free-body diagram is a type of vector diagram in which the length and direction of the arrows indicates information*

about the forces. Each force arrow in the diagram is labeled to indicate the exact type of force.

Next, align the coordinate system so that as many of the forces are parallel or perpendicular to it as possible. Forces directed at an angle, such as a push on a large box, have two components: a horizontal and a vertical component. Those components are calculated using the magnitude of the applied force (F_{app}) and the angle of the force, Ø. Assuming minimal to no friction, the normal force acting upon the large box would be equivalent to the sum of the downward forces, which would include the perpendicular component of F_{app}.



Mrs. Shankle then talked through how she would form a question to connect information from the paragraphs with the diagram. "I want to make sure I am relating the written information in this section with the diagram provided here. The paragraph is describing a step in solving problems about force: drawing the free body diagram. The diagram here is just one example. I want to remember the author's points about what the free body diagram should show, not just what is shown on this particular diagram. One question I could ask is: 'The length of the arrow, or vector, is used to show what?' That would check whether I remember the important information about depicting the forces. To

SCIENCE

answer this question, I need to relate the information in the paragraph with the example provided in the diagram. The length of the arrow reflects the magnitude of the force."

Mrs. Shankle recorded that question on the board and asked the students to write it in their notebooks. Then, she had the lab partners work together to generate another question that would check their understanding of how the written paragraphs connected to the diagram. As she monitored their work, Mrs. Shankle noticed that several partners were writing questions about the normal force being drawn perpendicular to the surface of contact or the direction of the arrow showing the direction in which the force is acting. If a pair finished quickly, she asked the students to continue writing additional questions and challenged them to make the answers require someone to think critically.

However, not everyone showed this level of skill with the strategy. One pair of students was writing a question specific to the formula in the example diagram: Normal force N is equal to 12N plus what? She talked to the students about how to reword the question to apply to other situations and to remind them of the connection between drawing free body diagrams and applying equations to solve problems. With guidance, the partners rewrote the question as: *When there is a force applied at an angle to the horizontal, normal force is determined in what two components?*

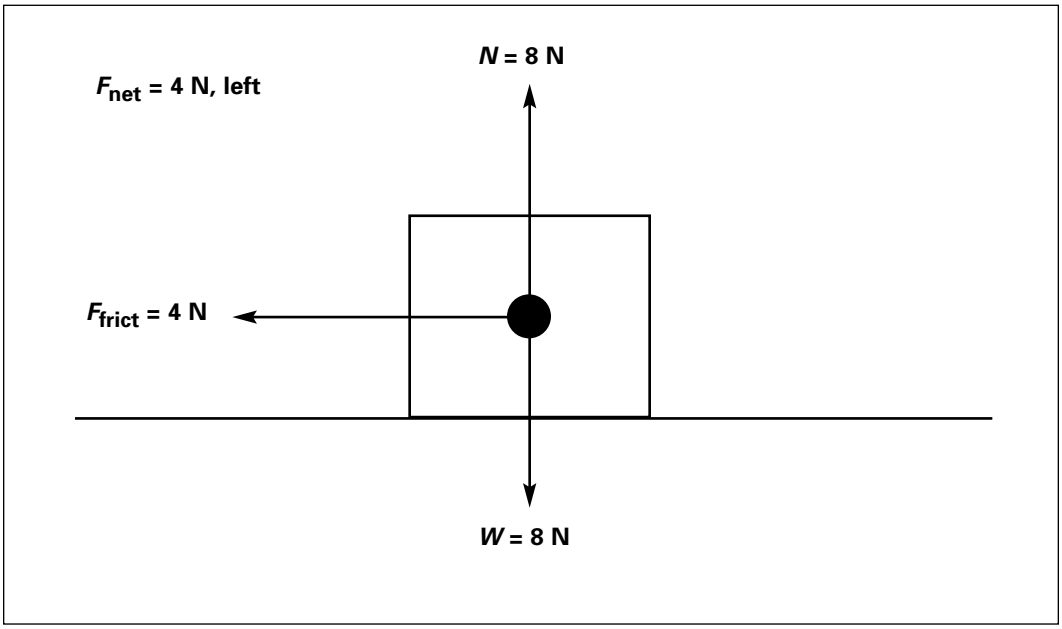
After each set of lab partners had written at least one question, Mrs. Shankle asked several students to share what they had generated. She used the students' suggested questions as peer models for different ways questions could be worded and to discuss how the questions could be evaluated by their usefulness in checking your understanding of the important points. As they were offered, Mrs. Shankle listed all the questions on the board and had students copy them in their notebooks. She then had the partners return to the text to answer each question.

Before dismissing the class, Mrs. Shankle assigned students the next section of procedural text. This portion described how to calculate net force and contained the following text and diagram:

SCIENCE

Static friction occurs when two surfaces are in contact but do not move relative to each other. Friction depends upon the nature of the two surfaces and upon the degree to which they are pressed together. The force of static friction (F_s) cancels out applied force right up to and including when static friction reaches its maximum ($F_{(s,max)}$). Therefore, a stationary object will remain at rest. If, however, the two surfaces in contact move relative to each other, there is sliding or kinetic friction (F_k). The direction of kinetic friction is independent of applied force and does not depend on the speed at which the surfaces in contact are moving relative to each other.

If either all the vertical forces (up and down) do not cancel each other and/or all the horizontal forces do not cancel each other, then an unbalanced force exists. The existence of an unbalanced force for a given situation can be quickly realized by looking at the free-body diagram for that situation.



"For homework, I want you to write two or more questions that connect information from the paragraphs of the text with information in the diagram or formula provided. Remember to make your questions about the important

SCIENCE

principles being explained and not specific to the values provided in the one example."

Mrs. Shankle answered clarifying questions about the assignment. She also reminded students that the strategy took more time than they might need in the assignments because they were just learning how to write these kinds of questions. "Eventually, you will have an easier time using this approach to monitor your own comprehension of the texts you read. We will also add other types of questions to the one we learned today so that you will be able to connect information across texts, lessons, or even subject areas such as mathematics."

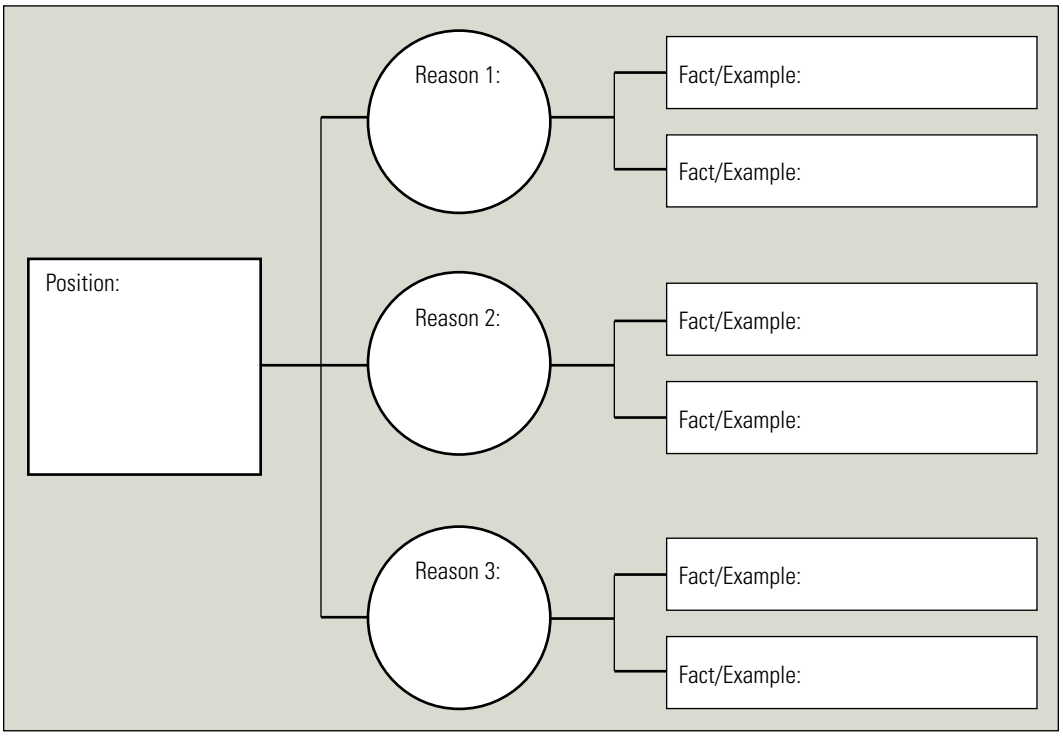
The next day, Mrs. Shankle had students exchange their questions for a warm-up activity and opportunity to revisit the text. Peers answered the questions written by another student and, where necessary, offered suggestions for improving the clarity or significance of the question(s).

SOCIAL STUDIES

COMPREHENSION VIGNETTE / SOCIAL STUDIES

Mr. Banerjee has been teaching a unit on the Fourteenth Amendment to his senior government class. Although his vocabulary instruction will support students' reading comprehension, he wants to be sure they are carefully examining the positions of the authors as well as connecting events across time. After consulting his colleagues in the collaboration group, Mr. Banerjee decided to use a graphic organizer for the position-reason text structure as a comprehension tool.

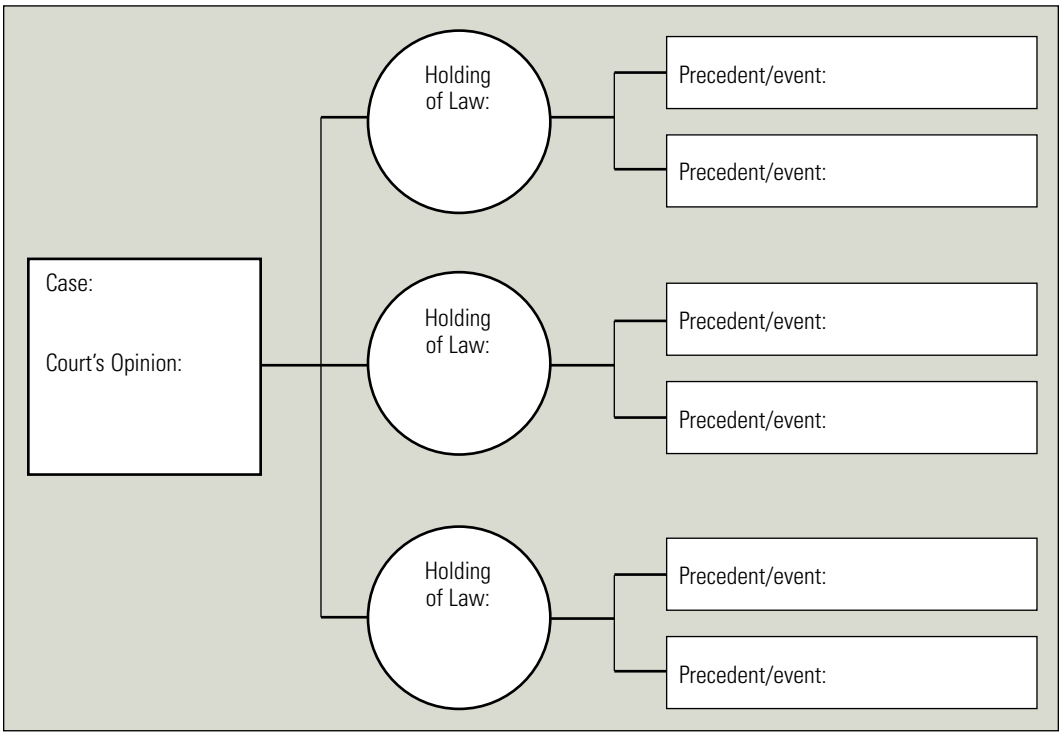
Graphic organizer for position-reason text structure



Because he planned to implement it with rulings from the Supreme Court, Mr. Banerjee adapted the graphic organizer slightly to reflect the language and components of the appropriate documents.

SOCIAL STUDIES

Position-reason graphic organizer adapted for court rulings



He taught students how to apply the tool while studying the Court's decision in *Brown v. Board of Education* (1954). "When you read the document, you probably noticed that it started by listing the dates that the case was first argued, re-argued, and decided. Why is it important for us to remember that a case is 'argued,' sometimes multiple times and in different courts?"

The students discussed how there are two sides or positions to every case, and each side has to present valid reasons why the judge or justices should agree with their position. Mr. Banerjee emphasized that part of the job of the Court was to evaluate the credibility of the arguments and examine the potential biases that each side brings to the case. "The Constitution is *interpreted*, so there is not necessarily one right answer or decision. Different justices will have different interpretations, so your job as a reader is to approach these rulings just as critically. How credible are the justices' holdings of law? How have they been influenced by precedent case law and by historical events? If you are aware of the situated context of the ruling, you will better understand how decisions and related laws change— or don't change— over time."

Mr. Banerjee projected an electronic copy of the graphic organizer onto the screen and indicated portions of it as he spoke. "We are going to use this graphic organizer as a tool for understanding the position of the Court at the time of the ruling and the reasons for the justices' decision. We will start by recording the name and date of the case. Who can tell me what that was from your reading?"

He typed the information into the graphic organizer before continuing. "The other information we need in this first box is a one-sentence version of the Court's opinion. If we give too much information here, we will just be repeating ideas that really belong elsewhere in our graphic organizer. Think for a moment about how you would phrase a sentence to tell the outcome of the case."

Mr. Banerjee encouraged the students to use the syllabus, or headnote, provided at the beginning of the document to help them form their sentence using the most important information. He thought the succinctness of the reporter's summary would reduce some of the difficulties his students might have with the vocabulary or overlapping information in the opinion.

*Syllabus (*Brown v. Board of Education*, 1954):*

Segregation of white and Negro children in the public schools of a State solely on the basis of race, pursuant to state laws permitting or requiring such segregation, denies to Negro children the equal protection of the laws guaranteed by the Fourteenth Amendment—even though the physical facilities and other "tangible" factors of white and Negro schools may be equal.

(a) The history of the Fourteenth Amendment is inconclusive as to its intended effect on public education.

(b) The question presented in these cases must be determined not on the basis of conditions existing when the Fourteenth Amendment was adopted, but in the light of the full development of public education and its present place in American life throughout the Nation.

(c) Where a State has undertaken to provide an opportunity for an education in its public schools, such an opportunity is a right which must be made available to all on equal terms.

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(d) Segregation of children in public schools solely on the basis of race deprives children of the minority group of equal educational opportunities, even though the physical facilities and other "tangible" factors may be equal.

(e) The "separate but equal" doctrine adopted in Plessy v. Ferguson, 163 U.S. 537, has no place in the field of public education.

(f) The cases are restored to the docket for further argument on specified questions relating to the forms of the decrees.

After allowing think time, Mr. Banerjee asked students to share their sentences. Although they focused on the main points, his students struggled to form a coherent representation of the relationship among the ideas in the syllabus. Therefore, the class worked together to refine a sentence with which they could all agree. Mr. Banerjee suggested they form the sentence around the connective word *because*, which is a common method of establishing a position-reason relationship. As the class formed the sentence, Mr. Banerjee typed it into the graphic organizer. "Okay: *Schools cannot be segregated because black children would be denied equal protection of laws guaranteed by the Fourteenth Amendment*. I like how you incorporated one of our important vocabulary terms into the sentence. We will be talking about more of the terms and how they apply to this case after we are sure we understand what influenced the Justices' decision. Let's look at the primary reasons for the opinion of the Court. In a court ruling, the reasons are considered 'holdings of law.' Your graphic organizer has three bubbles for holdings, but there may be more or fewer reasons provided in any given opinion. I want you to work with a partner for a moment to see if you can identify the primary holdings of law in the *Brown v. Board of Education* opinion."

Pairs of students sitting next to each other revisited the document to identify the holdings. Mr. Banerjee circulated throughout the room during this time to provide assistance as necessary and to monitor how the students were approaching the sections of the ruling. He noticed that some partners were highlighting sentences on their copies while others were numbering sections of text in the margins. One pair of students was not making any notations, so Mr. Banerjee asked them to describe their process for identifying and remembering the reasons for the opinion. When the students struggled to recall what they had identified in the text, Mr. Banerjee gave them adhesive notes on which to write the information. "You can write a few words on the note and stick it on

the document near the rest of the information. Later you can move the notes around to arrange them as you might want the ideas to fall on the graphic organizer."

When he reconvened the class to discuss the holdings, there was some disagreement as to whether the information constituted two, three, or four holdings. Those who had only two reasons had combined information about *Plessy v. Ferguson* (1896) with information about educational opportunities. Those who had four reasons had separated information about the passage of the Fourteenth Amendment from information about schooling in the South. Mr. Banerjee had students reread three paragraphs of the decision to help them determine the appropriate number of holdings to include (Brown v. Board of Education, 1954):

> *An additional reason for the inconclusive nature of the Amendment's history with respect to segregated schools is the status of public education at that time. In the South, the movement toward free common schools, supported by general taxation, had not yet taken hold. Education of white children was largely in the hands of private groups. Education of Negroes was almost nonexistent, and practically the entire race was illiterate. In fact, any education of Negroes was forbidden by law in some states. Today, in contrast, many Negroes have achieved outstanding success in the arts and sciences, as well as in the business and professional world. It is true that public school education at the time of the Amendment had advanced further in the North, but the effect of the Amendment on Northern States was generally ignored in the congressional debates. Even in the North, the conditions of public education did not approximate those existing today. The curriculum was usually rudimentary; ungraded schools were common in rural areas; the school term was but three months a year in many states, and compulsory school attendance was virtually unknown. As a consequence, it is not surprising that there should be so little in the history of the Fourteenth Amendment relating to its intended effect on public education.*
>
> *In the first cases in this Court construing the Fourteenth Amendment, decided shortly after its adoption, the Court interpreted it as proscribing all state-imposed discriminations against the Negro race. The doctrine of "separate but equal" did not make its appearance in this Court until 1896 in the case of Plessy v. Ferguson, supra,*

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involving not education but transportation. American courts have since labored with the doctrine for over half a century. In this Court, there have been six cases involving the "separate but equal" doctrine in the field of public education. In Cumming v. County Board of Education, 175 U.S. 528, and Gong Lum v. Rice, 275 U.S. 78, the validity of the doctrine itself was not challenged. In more recent cases, all on the graduate school level, inequality was found in that specific benefits enjoyed by white students were denied to Negro students of the same educational qualifications. Missouri ex rel. Gaines v. Canada, 305 U.S. 337; Sipuel v. Oklahoma, 332 U.S. 631; Sweatt v. Painter, 339 U.S. 629; McLaurin v. Oklahoma State Regents, 339 U.S. 637. In none of these cases was it necessary to reexamine the doctrine to grant relief to the Negro plaintiff. And in Sweatt v. Painter, supra, the Court expressly reserved decision on the question whether Plessy v. Ferguson should be held inapplicable to public education.

In the instant cases, that question is directly presented. Here, unlike Sweatt v. Painter, there are findings below that the Negro and white schools involved have been equalized, or are being equalized, with respect to buildings, curricula, qualifications and salaries of teachers, and other "tangible" factors. Our decision, therefore, cannot turn on merely a comparison of these tangible factors in the Negro and white schools involved in each of the cases. We must look instead to the effect of segregation itself on public education.

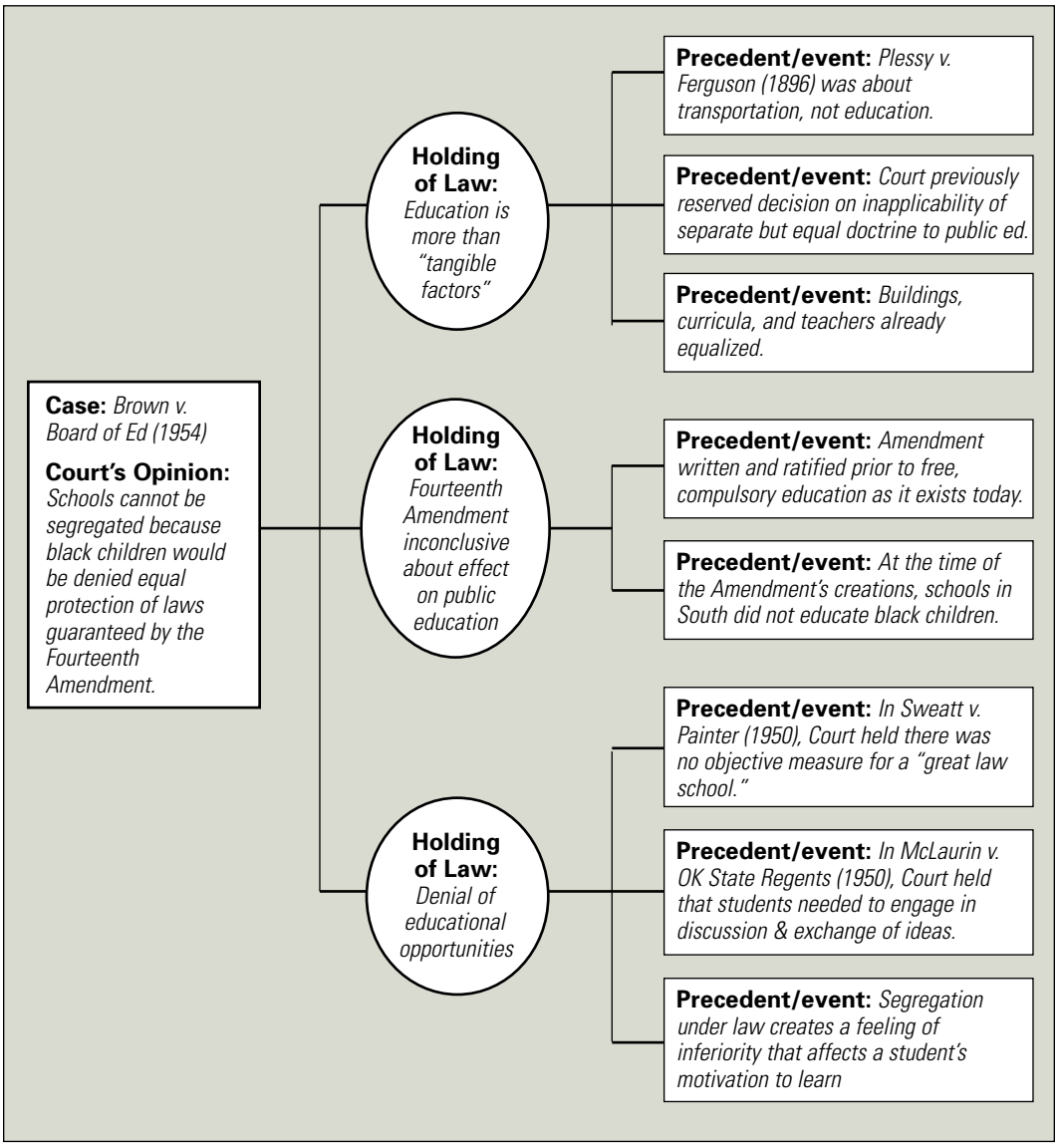
Students briefly discussed the information in these paragraphs and how the different components related to each other and the historical context. As a class, it was decided that including three holdings would ensure there was enough information to understand the Justices' interpretations without overlooking a holding that connected this case to those before and after it.

Mr. Banerjee typed the holdings into the graphic organizer projected on the screen. "Now, you are ready to return to the document one more time to find the precedent case law and other events that explain and support each holding. For example, the first holding is that education is more than 'tangible factors.' You have already mentioned that the opinion cited *Plessy v. Ferguson* (1896) and the 'separate but equal doctrine.' I would include the precedent in one of

the boxes for the first holding and the comment that the case was about transportation, not education. This is important to understanding why the opinion repeatedly uses the phrase 'tangible factors.' What else might be important to include with this holding?"

After guiding the students through recording significant events for the first holding, Mr. Banerjee had students work in pairs to complete the remainder of the graphic organizer. Again, he monitored their work and helped students either combine ideas or paraphrase information from the document. To close the lesson, Mr. Banerjee had students switch partners to share their completed graphic organizers and discuss their thinking.

Completed graphic organizer adapted for court rulings



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Near the end of the period, Mr. Banerjee asked the students to keep their graphic organizers in their binders. "I will post an electronic version of the template on my class Webpage so that you have the option of using it on your own computer when we are ready for our next Fourteenth Amendment case, *United States v. Virginia* (1996). You can also continue using the paper version if you prefer. Tomorrow, however, we will be returning to the 12 terms about the Fourteenth Amendment that you categorized in our vocabulary work prior to reading."

Mr. Banerjee asked his students to find their copies of the 12 terms. "For homework, I want you to review the text of the *Brown v. Board of Education* (1954) ruling and think about how different elements of the holdings we put on our graphic organizer today exemplify one or more of the terms. Make a list of the terms you think are applicable to this case and be prepared to discuss why you think so. We will be meeting in our small discussion groups tomorrow, so have your graphic organizers, copies of the Court ruling, and your homework notes with you."

He answered clarifying questions about the assignment before the class was released.

SECTION 5

PROFESSIONAL DEVELOPMENT

Educational reform efforts associated with No Child Left Behind legislation have required states to align curricula, teaching approaches, and assessments to content standards (what students should know and be able to do in a given subject). The goal of these reform efforts, of course, is to accelerate and increase student achievement. But to meet the high standards that states and districts have adopted, students need strong instructional support. Because it is commonly recognized that teachers are the key factor in student achievement (Carey, 2004; McCardle, Chhabra, & Kapinus, 2008; National Institute of Child Health and Human Development, 2000; Haycock, 1998; Sanders & Rivers, 1996), reform efforts have also required states to provide support for teachers. Typically, this support is in the form of high quality professional development.

High standards in the classroom (Cuban, 1990) and aligned curricula and assessments generate new expectations for teachers' instructional behaviors (Garet, Porter, Desimone, Birman, & Yoon, 2001) and, therefore, require educators to be at the heart of reform efforts. The theory underlying professional development is that by enhancing teacher knowledge and skills, classroom teaching will improve which will, in turn, improve student achievement (Yoon, Duncan, Lee, Scarloss, & Shapley, 2007). This sequence of events becomes "reform" when teachers have to change their thinking and instructional behavior in the classroom to adopt and implement the new practices with fidelity. Changing behavior is difficult for a variety of reasons, including teachers' previously held beliefs (Borko, 2004), motivation for engaging in professional development (Ottoson, 1997; Stout, 1996), background knowledge, and preexisting attitudes.

Darling-Hammond, Wei, Andree, Richardson, & Orphanos (2009) analyzed teacher and school-questionnaire data from federal Schools and Staffing Surveys of 1999-2000 and 2003-2004 (National Center for Educational Statistics) to understand the current status of professional development (also known as professional learning) in U.S. schools. Those data revealed the following conclusions:

- Most U.S. teachers participate in some form of professional development every year.

- Much professional development focuses on academic subject matter, but not with much depth.
- Nearly half of all U.S. teachers are dissatisfied with their opportunities for professional development.
- U.S. teachers tend to receive little funding or other support that might allow them to participate in additional professional development.
- Support for and participation in professional development varies widely among schools.
- Relatively few U.S. teachers engage in intensive professional collaboration around curriculum planning.
- Beginning teachers are increasingly likely to experience induction programs, but they have varying access to mentoring and other high-quality induction features.
- There is less emphasis on close teacher-to-teacher collaboration than on other forms of professional development.

Based on these findings, the status of professional development has room for improvement. However, the research base on professional development provides some ideas of what it will take to achieve this improvement.

Research base for effective professional development

Unfortunately, experimental research studies have not revealed which aspects of professional development deserve the investment of resources. Although a consensus exists in the literature on "best practices" of effective professional development, little evidence remains about the specific features that make a difference for student achievement (Blank, de las Alas, & Smith, 2008; Clewell, de Cohen, Campbell, & Perlman, 2004; Darling-Hammond et al., 2009; Kinnucan-Welsch, Rosemary, & Grogan, 2006; Wilson, 2009; National Institute of Child Health and Human Development, 2000; Snow-Renner & Lauer, 2005; Taylor et al., 2005; Wayne, Yoon, Zhu, Cronen, & Garet, 2008; Wenglinsky, 2000; Yoon et al., 2007).

In their research review, Wayne et al., (2008) found that when professional development is delivered in conducive settings, it can increase student achievement. A conducive professional development setting, as defined by Wayne and colleagues (2008), has a small number of teachers participating and is delivered by the developer of the program. Unfortunately, the positive

evidence on most professional development programs reveals only how it works when delivered by the developer, not how it works when delivered by others or in a large-scale initiative.

With budget challenges and a push toward on-line teacher professional development (oTPD), it is important to note that the effectiveness research of oTPD is limited (Whitehouse, Breit, McCloskey, Ketelhut, & Dede, 2006). Some indicators suggest that oTPD holds promise. Pianta, Mashburn, Downer, Hamre, & Justice (2008) found that Head Start teachers who watched online videos, participated in structured responses, and received online consultation with an expert made significant improvements in their student interactions, compared to teachers who participated in the video and structured responses, but did not get online consultation. The researchers were not able to use a comparison group of teachers who received more traditional, face-to-face professional development, and they did not analyze the program's effect on student achievement.

More research examining K-12 student outcomes associated with oTPD is needed (Whitehouse et al., 2006). We note that studies of the effectiveness of on-line university courses suggest that distance-delivery formats are as effective or slightly better than face-to-face learning environments for gaining content knowledge. Some studies (e.g., Warren & Holloman, 2005) have found no difference in student assessment performance or self-evaluation of their level of expertise between online and traditional on-campus courses. Other studies (e.g., Schoenfeld-Tacher, McConnell & Graham, 2001) report significant increases in class grades and the quality of interactions because, online, students actively do more with the course content. At the time of this publication, we were unable to identify existing research to support on-line or web-based professional development in vocabulary and comprehension instruction for middle and high school content-area teachers that demonstrates teacher change and subsequent increases in adolescents' reading achievement.

Even though unanswered questions remain about the effectiveness of face-to-face professional development programs when they are not presented by the developers, we still need to work toward improving student achievement by supporting teachers in developing their own professional knowledge and pedagogical skill. Fortunately, consensus exists in the literature about the characteristics of professional development that may have a positive impact on student achievement. Until research-supported guidelines emerge, these

characteristics can help guide the decisions about and the design of professional development.

Ball & Cohen (1999) assert that the field of professional development lacks consistency and a coherent design. However, several research syntheses have been conducted to identify the common characteristics of high quality professional development in schools and districts (Blank et al., 2008; Clewell et al., 2004; Darling-Hammond, et al., 2009; Kinnucan-Welsch et al., 2006; Wilson, 2009; National Institute of Child Health and Human Development, 2000; Snow-Renner & Lauer, 2005; Taylor et al., 2005; Wenglinsky, 2000; Yoon et al., 2007). The following characteristics appear to have the most support in the research literature. Professional development should be:

- intensive, connected to practice, and ongoing,
- directly connected to student learning goals and address the teaching of specific curriculum content,
- aligned with school improvement goals,
- designed to build strong, professional relationships among teachers, and
- designed to include active learning for teachers.

Teachers are more likely to implement new practices well if they receive support while trying them in the classroom. As noted in the Center on Instruction's (2006) guide to *Designing High-Quality Professional Development* (see http://www.centeroninstruction.org/files/Tip%20Sheet.pdf), ongoing support includes:

- sessions during which additional lessons and techniques are demonstrated,
- opportunities to practice techniques in role-play situations,
- time for content-area teachers to work together. Collaborating with colleagues facilitates the adaptation of vocabulary and comprehension instruction to each discipline's unique issues (e.g., selecting appropriate vocabulary words to teach, comprehending the discourse of content-area text), and
- opportunities to work with experts in literacy, such as coaches, consultants, or other instructional leaders. Effective coaches and expert consultants observe teachers' practices and offer guidance and feedback,

demonstrate lessons, help create solutions to instructional problems, and assist teachers in using assessment results to inform instruction.

Often, content-area teachers receive professional development that does not have these characteristics. Nor does it allow practice and planning for application in specific content-area concepts. These professional development experiences are less likely to change teacher practice or increase student achievement. Sufficient evidence also suggests that professional development should differ depending on the content area (Shanahan & Shanahan, 2008; Norris & Phillips, 1994; Mosborg, 2002; Perfetti et al., 1995; Leong & Jerred, 2001).

Professional development and content-area teachers

In general, teachers do not implement literacy skills as part of their content instruction. This has been attributed to content-area teachers believing it is someone else's responsibility, and little time and preparation to teach reading and writing (O'Brien, Steward, & Moje, 1995; Ratekin, Simpson, Alvermann, & Dishner, 1985; Siebert & Draper, 2008). However, research illustrates that professional development can have a positive impact on teacher change and student achievement if the professional development is tailored to participants' subject areas.

Kennedy (1998) conducted a seminal analysis of math and science professional development programs and their impact on student outcomes. The review examined the subject, content focus, skill level, form, and other features of the professional development. Professional development showed larger influences on student learning when it focused on teachers' knowledge of the subject, or on how students learn the subject. Programs that focused mainly on teacher behaviors demonstrated less impact on student outcomes. This supports the notion that high quality professional development for integrating vocabulary and comprehension strategies in content-area instruction should be planned and delivered in a content-centered context.

Similar results were found by Clewell et al. (2004), who evaluated 18 studies of professional development in science and math, using student achievement outcomes as measures of effectiveness. The major conclusions from this review were:

- The content of the professional development program should be directly tied to the curriculum, knowledge of the subject matter, and/or how

students learn the subject.

- A minimum of 80 contact hours is needed to effect changes in teachers' instructional behaviors.
- A minimum of 160 contact hours is needed to effect changes in the classroom environment.

Two more recent studies support tailoring professional development to teachers' subjects or needs and providing adequate time or other resources to support the effort. Harris and Sass (2006) analyzed third through tenth graders' math and reading scores from all public schools in Florida from 1999-2000 and 2004-2005. Florida's database allowed the researchers to match students to their teachers to estimate the impact of teacher experience, in-service professional development, and pre-service undergraduate education on teacher productivity. Professional development had a positive effect on middle and high school math student achievement. These effects were due, primarily, to teachers' content-focused professional development. The researchers suggest that more resources should be allocated to content-focused professional development for teachers in the upper grades.

Reed (2008) conducted a synthesis of four studies on professional development and the implementation of literacy strategies for middle school content teachers. Findings indicated that school-wide initiatives that were ongoing and responsive to teachers' perceived needs can increase literacy instruction and improve some students' reading skills. Important implications emerged. School and district-level administrative support is critical to the implementation of any professional development program; this includes making sure that teachers have adequate time to plan and deliver instruction, access to materials, and structured opportunities to collaborate with colleagues (Deshler et al., 2001).

Evidence also suggests that well-designed professional development in literacy encompasses more than a connection to the curriculum and sufficient resources for teachers: the ways that different subject areas are addressed must also be considered. Siebert and Draper (2008) studied how messages from professional literature (content-area methods textbooks, position statements, and research reports) about literacy impact content teachers, specifically math teachers. Math teachers seemed to believe that messages about literacy neglect, deemphasize, or misrepresent math education. If other

content-area teachers share this opinion, it follows that they resist ideas related to content-area literacy. Siebert and Draper (2008) emphasized that math teachers must teach students how to read and write the language constructs and contexts of math, such as diagrams, pictures, equations, and small group discussions. If math teachers do not hear literacy messages related to their discipline, resistance to literacy instruction is certain to follow.

It makes sense that professional development for content-area teachers will succeed when it facilitates adolescent students becoming fluent in the texts and discourse of a particular subject area. Without discipline-specific examples, content teachers will find it difficult to visualize how to incorporate literacy instruction into their daily teaching. This goes beyond surface-level methods for helping students attend to and remember what they are reading. The 2009 NAEP framework and the expectations of content-area coursework are likely to precipitate the need for professional development that helps teachers foster students' inference abilities, understanding of the unique linguistic and cognitive features of domain-specific texts, and construction of mental models of those texts.

SECTION 6

DESIGNING PROFESSIONAL DEVELOPMENT TO SUPPORT CONTENT-AREA INSTRUCTION

The goal of professional development is to encourage and support teachers to adopt and implement, with fidelity, research-based practices that accelerate and increase student achievement. The National Reading Panel (National Institute of Child Health and Human Development, 2000), in its examination of professional development effectiveness, found that when teachers learned and adopted the material presented through professional development, student achievement improved. Equally important, when teachers did not learn from professional development, students did not make academic gains. Although these studies were limited, and pertained mainly to K-6 reading teachers, applying similar principles of professional development, applied with content-area teachers should improve adolescents' reading ability (Kamil, 2003).

However, content teachers seeking to implement research-based literacy strategies probably need to use different strategies to teach content literacy from the ones they experienced as students and pre-service teachers. For example, teachers would need to help students know the meanings of terms as they related to each other and to the overarching concepts, rather than present isolated facts and procedures students may not have background knowledge to understand (Ball & Cohen, 1999). They need to be prepared to support students who have mastered basic reading skills, but have not yet learned to meet the more sophisticated demands of domain-specific texts (Carnegie Council on Advancing Adolescent Literacy, 2010; Dewitz & Dewitz, 2003; Hock et al., 2009; Snow, Martin, & Berman, 2008). Although the teachers may be approaching the reading materials as experts, their students likely have little experience with the organizational patterns, linguistic markers (e.g., connective words), or other cohesive elements of content material. Teachers may be unfamiliar with teaching students how to relate these linguistic features to content knowledge, and the purpose, or context for the reading activity (Sweet & Snow, 2003; Verhoeven & Perfetti, 2008).

In general, teachers need high-level, long-term support from instructional leaders to make major changes in their behaviors, habits, and knowledge. Hirsh and Killion (2007) recommend that this support should come in several forms:

building the capacity of individuals and teams to be leaders and learners; improving teachers' knowledge of pedagogy and student learning; and promoting collaboration among educators to build shared responsibility for student achievement. Ideally, districts will hire new faculty to infuse needed skills, but principals can improve the effectiveness of the current faculty by providing time and resources for ongoing professional development. Principals can use teacher effectiveness data to plan appropriate professional development and make teacher assignments that maximize student learning (Carey, 2004; Carnegie Council on Advancing Adolescent Literacy, 2010; Hamilton et al., 2009).

Some specific steps can support content teachers as they integrate literacy instruction into their everyday teaching. Instructional leaders can:

- Be sure that content teachers have a clear and consistent message about their roles and responsibilities as they relate to literacy instruction (Heller & Greenleaf, 2007);
- Give teachers initial and ongoing professional development in vocabulary and comprehension support (Deshler et al., 2001; Jacobs, 2008);
- Help teachers in adapting literacy strategies to meet the unique needs of their content areas (Reed, 2008; Siebert & Draper, 2008);
- Give content teachers incentives, and appropriate tools, for incorporating reading and writing instruction (Bryant, Linan-Thompson, Ugel, Hamff, & Hougen, 2001; Heller & Greenleaf, 2007).

Research suggests that changes in teacher instruction take a considerable amount of time (Snow-Renner & Lauer, 2005). One-day or half-day professional development sessions alone do not produce student achievement gains. Professional development needs to be intensive, connected to practice and ongoing. This may entail upfront professional development session(s) accompanied by on-site support throughout the school year to encourage reflection and facilitate instructional change (Snow-Renner & Lauer, 2005).

For example, when thinking about vocabulary instruction one school-wide approach would have teachers participate in an initial summer institute facilitated by a vocabulary instruction expert. This concentrated time would focus on the benefits and purposes of teaching vocabulary, and how it applies to core academic subjects. The expert would demonstrate effective strategies

applicable to all subjects and guide the teachers as they discuss and practice the strategies. Throughout the school year, a lead teacher could work with departmental or grade-level teams to select important words to teach, select instructional materials, model and/or provide feedback on lessons using the strategy, and encourage reflection and discussion among colleagues.

Professional development is more effective when part of a school reform effort, not just an isolated event in which teachers participate (Elmore & Burney, 1997; Cohen & Hill, 2001; Garet et al., 2001; Penuel, Fishman, Yamaguchi, & Gallagher, 2007; Supovitz, Mayer & Kahle, 2000). Therefore, it is important to ensure that every session is directly *connected to school improvement and student learning goals, and addresses the teaching of specific curriculum content*. In other words, professional development must align with what students are expected to know and be able to do (content standards, state standards, etc.) and focus on specific academic subject matter rather than on teaching methods taken out of context (Darling-Hammond, et al., 2009). For example, if content-area teachers have learned about collaborative strategic reading, the facilitator should model the process using text from a particular discipline rather than simply describing what would happen in each step.

Teachers are more likely to implement instructional strategies that have been modeled for them in professional development sessions (Snow-Renner & Lauer, 2005; Carpenter, Feneman, Peterson, Chiang, & Loef, 1989; Cohen & Hill, 2001; Garet et al., 2001; Desimone, Porter, Garet, Yoon, & Birman, 2002; Penuel et al.,2007; Saxe, Gearhart & Nasir, 2001; Supovitz et al., 2000). Modeling is rarely enough, however, and many school initiatives include job-embedded follow-up time. During these ongoing sessions, teachers support each other in applying the strategies in their subjects. Connections to school improvement, student learning goals, and specific curriculum content make professional development meaningful to teachers. This increases the likelihood of change in teacher practice and increased student learning.

Professional development should also *build strong working relationships among teachers*. When instructional leaders strategically create master schedules, they protect teacher's time to work with academic departments or grade levels. This can facilitate consistent instruction, a willingness to share instructional practices, and successful problem-solving in teaching practice among teachers (Hord, 1997; Louis, Marks & Kruse, 1996; McLaughlin & Talbert, 2001; Newmann & Wehlage, 1997; American Institutes for Research,

2007). Professional learning communities (PLCs) have been credited with deepening teachers' knowledge, building their skills, and improving instruction (Bryk, Camburn, & Louis, 1999; Calkins, Guenther, Belfiore, & Lash, 2007; Goddard, Goddard & Tschannen-Moran, 2007; Louis & Marks, 1998; Supovitz & Christman, 2003). Teacher observations of and constructive, structured feedback in response to their peers' teaching has proven to be a simple yet effective way to promote strong working relationships.

If a teacher were to try one of the vocabulary vignettes in this document, she could invite her colleagues to observe the lessons incorporating vocabulary and comprehension instruction. The teacher would specify, in advance, the type of feedback that would be helpful, such as word choice or the facilitation of classroom discussion. The observations would inform everyone's subsequent vocabulary and comprehension instruction and could become data that inform future professional development. Research shows that peer observations help teachers focus their instruction on student learning rather than on covering the material (Dunne, Nave, & Lewis, 2000). PLCs and teacher observations conducted under the guidance of a reading specialist or literacy coach may foster the fidelity of strategy implementation and the alignment of instruction to content-area standards (Manno & Firestone, 2007; Showers & Joyce, 1996).

Teachers are expected to meaningfully engage their students in a lesson. Professional development should be held to the same standard, and *include active learning for teachers*. Active learning might include devoting time for teachers to plan classroom implementation so they can process the ideas and link them to their own teaching contexts. Remember, the content of the professional development may have different implications across disciplines. Teachers learning the strategies featured in the vignettes would spend time selecting appropriate words or texts for their different content areas and would create tools such as vocabulary cards, graphic organizers, and semantic feature analysis grids. Teachers should leave ready to implement the new strategies in their classes and then share their reflections with their colleagues during ongoing professional development sessions.

Content teachers need ongoing support to build their confidence and skill in implementing literacy instruction and adapting it to meet the unique demands of their courses. Therefore, administrators might consider providing time for sessions *with sample lessons and demonstrations of some of the more advanced techniques*. Such sessions can remind teachers of how particular

strategies are meant to be implemented, and to consider the interplay among readers' background knowledge and abilities, the features and style of the text, the purposes behind the activities, and the contexts where they should take place (Sweet & Snow, 2003). Demonstration lessons can be delivered via video, on-line, or by master teachers (Heller & Greenleaf, 2007). Regardless of the venue, teachers need time to discuss what they observed with their colleagues.

Opportunities for content teachers to practice techniques in role-play situations can also be helpful. Teachers can give each other feedback about their developing skills without the added pressure of being in front of students. Teachers can meet departmentally to study their own content and unique challenges, or they can meet as interdisciplinary teams to provide different perspectives and improve the consistency of strategy implementation.

Finally, provide *time for teachers to work together and with experts such as district specialists, a job-embedded professional development support person, consultants, or other instructional leaders*. Using vocabulary and comprehension strategies appropriately and successfully will depend on teachers' depth of knowledge in their fields and their understanding of the structure and use of discipline-specific texts. At first, teachers may need to work with subject-area experts to learn how the experts approach reading before trying literacy strategies in their classrooms (Shanahan & Shanahan, 2008). Experts and teachers can work together to analyze the features, structure, language, and background knowledge of discipline-specific textbooks and ancillary material. Teachers will then be able to design instruction that supports student understanding of the written language, making inferences, and creating mental models of the concepts (McNamara, 2001).

Strong instructional leaders, who are willing to commit the needed time and resources, are critical to making these features of professional development possible. Additionally, the professional development design should emphasize integration of content and procedural expertise. Effective content teachers have a deep understanding of the structure and epistemology of their discipline. They combine this with the knowledge of effective instructional techniques. The interaction of pedagogy and subject knowledge counters the common misconceptions that teachers use a set of general methods, that a good teacher can teach any subject, or that content knowledge is enough to be an effective teacher (Bransford, Brown, Cocking, Donovan, & Pellegrino, 2000).

Content teachers bring the knowledge of their disciplines, but they need the support of someone, such as a coach (International Reading Association, 2006), with a deep understanding of how to incorporate effective literacy strategies into a lesson. That combination is the key to changing teacher behavior in the classroom and improving adolescents' understanding of content-area text (Manno & Firestone, 2007).

Enhancing and supporting academic literacy instruction: A professional development case study

Here is a case study that illustrates how some of the professional development concepts can be made real. This vignette about Riverside Junior/Senior High School suggests a starting point for a school implementing vocabulary and comprehension instruction. Reciprocal teaching is featured in this example, but schools may begin with other approaches. Any strategies suggested here will only begin to touch on all that teachers need to know to help their students access the meaning of written academic language and generate new knowledge. However, they represent feasible first steps and provide a foundation for building future professional development.

RIVERSIDE JUNIOR/SENIOR HIGH SCHOOL

A literacy leadership team had already been established at Riverside Junior/Senior High School and this team worked together to determine the professional development needs of the teachers for the next school year. They identified needs and resources by considering the faculty skills and expertise as documented in formal and informal faculty observation forms, previous years' experiences, transcripts, and training records. The team determined that next school year there would be four beginning teachers, three teachers who needed extra support for their teaching assignment, and five veteran teachers who could serve as mentors. In examining the results of the state reading assessment, they noted the overall comprehension scores were well below the district and state averages.

Also, the team reviewed student data from formal and informal progress monitoring and diagnostic assessments. Information from these analyses provided more detailed information on and confirmation of the state reading assessment results. Therefore, the leadership team facilitated discussions during school-wide faculty meetings to elicit from teachers their perceptions of

the kind of support and resources needed to help students improve their comprehension. After considering the perceptual, observational, assessment, and archival data, the leadership team decided to plan professional development in reciprocal teaching, a research-based approach that can be used across content areas to help students understand text. Reciprocal teaching also provides a strategy for teachers to focus on their subject area concepts while facilitating student comprehension of the text used in their classrooms.

At the last faculty meeting in the spring, the principal provided a summary of the leadership team's data analysis and previous faculty meeting discussions about student reading needs. After a brief discussion, the faculty agreed that improving comprehension was aligned with their school improvement goals and the student learning goals outlined in their state standards. Next, the principal introduced the leadership team's idea of using a comprehension strategy school-wide so that teachers could support each other in changing their instruction and promote making the strategy a habit among students. The campus reading specialist provided an overview of what the strategy entailed, as well as the benefits and possible challenges of implementation. Then, the principal explained the professional development program, including the number and type of sessions that would occur. The principal clearly communicated that content-area teachers were not expected to teach basic reading skills, but that the comprehension strategies included in reciprocal teaching were a way to help students understand and be able to use the content read in each class. The faculty discussed the proposal thoroughly. Although there was some concern over balancing content and literacy instruction, the majority of teachers were committed to learning how to implement reciprocal teaching and help students improve their reading comprehension.

At the start of the summer break, the reading specialist identified and arranged for an expert in reciprocal teaching to conduct the initial two-day professional development session. He shared with the consultant textbooks from the English language arts, mathematics, science, and social studies classes at Riverside Junior/Senior High School so that he could use them to model the strategies. The reading specialist also worked with the consultant to determine some of the important aspects of reciprocal teaching in which teachers were likely to require ongoing support.

The initial professional development took place during two of the back-to-school professional development days. During this time, the consultant introduced reciprocal teaching by providing a videotaped lesson of students using the strategy. She also briefly discussed the research and rationale that supports the use of this approach. To encourage active learning, the consultant stopped occasionally and asked the teachers to explain to a colleague sitting near them how the information related to understanding text in their classes. Next, the four comprehension strategies that comprise reciprocal teaching were reviewed individually: clarifying, generating questions, summarizing, and predicting. Each was discussed and modeled by the facilitator, using passages from the schools' textbooks. To ensure teachers were comfortable with the various parts of reciprocal teaching, the consultant and reading specialist worked together to guide small groups of teachers in practicing the steps after each was presented and modeled.

The principal started the second day of the initial professional development by having teachers share their reflections from the practice opportunities the day before. Teachers were asked to comment on which aspects went well, which were challenging, and how challenges might be overcome. The principal communicated how these issues would be followed-up in a series of collaborative sessions where colleagues could support each other in building their skill with reciprocal teaching. The reading specialist added his commitment to demonstrating and co-teaching lessons in classrooms, or offering feedback and clarification in the collaborative meetings.

The principal then reintroduced the consultant, who reviewed the work from the previous day by showing video clips of content-area teachers introducing the steps of reciprocal teaching to their students. To further promote strong working relationships among the teachers and more active learning, the consultant provided time during this second day of the initial professional development to 'put it all together'. Teachers worked in departmental groups to plan lessons incorporating reciprocal teaching with text from their content area. The consultant and reading specialist monitored the work and offered feedback. Finally, each group planned next steps in terms of when they would implement their lessons and meet with their colleagues to debrief.

Throughout the year, the reading specialist facilitated ongoing support for the teachers to implement reciprocal teaching successfully. He obtained more DVDs of reciprocal teaching model lessons to which teachers could refer as

needed. He scheduled time each week to observe and provide feedback in the classrooms of teachers who requested his assistance. When teachers asked the reading specialist to model reciprocal teaching, the two experts worked together to select the passage(s)/text(s) to be used and discuss the important concepts and ideas. The reading specialist always emphasized the importance of preserving the content while using the process of reciprocal teaching. He told his colleagues that he could not plan a lesson without their expertise in the domain-specific concepts students needed to know.

The principal also provided ongoing support by granting release time for teachers to observe each other implementing reciprocal teaching and provide feedback on the lessons. Because improving comprehension was a school-wide goal, there was time during each faculty meeting to share reflections and successes, review data monitoring students' progress in comprehension, and plan the next steps of the effort. In addition, the principal identified time in the schedule for teachers to collaboratively plan more lessons incorporating reciprocal teaching and to analyze student data to monitor whether comprehension was improving. The reading specialist helped facilitate these conversations and found other individuals who could provide particular content expertise when needed.

CONCLUSION

This document provides research-based information on academic literacy instruction in the content areas. Specifically, we focus on the effective use of text in subject-area classrooms. The information regarding the NAEP and its reading framework has been included to help educators understand the importance of teaching academically challenging vocabulary and research-based comprehension strategies. A review of the five recommendations of instructional improvement for content-area teachers provides a refresher of the themes considered pivotal to improving adolescent literacy. Research that supports instruction in vocabulary and comprehension strategies allows us to include illustrations of effective classroom practices that have had a positive effect on adolescents' achievement in content-area classrooms. These vignettes serve as "research-to-practice" instructional examples of effective vocabulary and comprehension strategy instruction. The synopsis of the research base for professional development reminds us of the kinds of support teachers need to implement instructional practices that improve student achievement. The last section of the guidance document endeavors to put it all together by describing how effective professional development can be designed to support content-area teachers as they implement vocabulary and comprehension instruction and assist students in better understanding the concepts found in content-area texts.

APPENDIX

The Program for International Student Assessment (PISA) is an international assessment of reading literacy, mathematics literacy, and science literacy for 15-year-olds given every three years. The PISA, sponsored by the Organization for Economic Cooperation and Development (OECD), is an international organization comprised of thirty member countries. The PISA includes measures of general competencies such as learning strategies; however, it also focuses on necessary functional skills that students are expected to have acquired as they near the end of their formal education. In each assessment cycle, data in all three subject areas is collected but only one area is assessed in-depth. This provides an updated source of data for every subject area over the course of the three year cycle. The in-depth focus for reading literacy began in 2000 and occurred again in 2009.

Student performance on the PISA is reported on a scale from 0 to 1000 with a mean of 500 and a standard deviation of 100. Scores of OECD member nations are ranked to allow comparison among them. For more information about the 2000 Reading Literacy results see (nces.ed.gov/surveys/pisa). The 2009 Reading Literacy assessment results are expected to be released in December 2010.

As an international assessment, the PISA has made available to the United States data about student reading performance to supplement that provided by the National Assessment of Educational Progress (NAEP). Results of these assessments can be used to better inform policymakers, educators, and the public about student reading performance. Beginning in 1969, the United States utilized the NAEP to assess fourth, eighth, and twelfth grade students in a variety of subjects including reading. NAEP supplies a consistent benchmark for states to gauge student performance. PISA contributes unique information to the NAEP because the international assessment does not focus on curricular outcomes but on applying knowledge in reading, math, and science to problems containing a real-life context.

PISA includes the term "literacy" in each of the subject area assessments in order to emphasize students' ability to apply knowledge flexibly. Reading literacy is defined by PISA as "understanding, using, and reflecting on written texts, in order to achieve one's goals" (Organization of Economic Cooperation

and Development, 2003, p. 108). In comparison, the 2004 NAEP defined reading as "an active and complex process that involves understanding written text, developing and interpreting meaning and using meaning as appropriate to type of text, purpose, and situation" (American Institutes for Research, 2004, p. 2).

RECOMMENDATIONS FOR FURTHER READING

For those wishing to deepen their knowledge in this area, we recommend the following as a place to start.

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