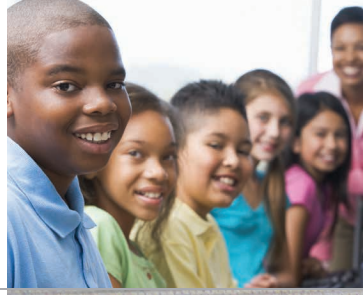
WorldWise
Content-based Learning

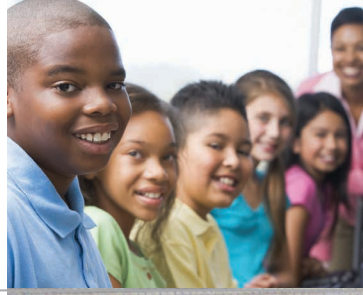


Research for the development of *WorldWise Content-based Learning*

SUSAN HILL

CONTENTS

okapi
educational publishing



INTRODUCTION

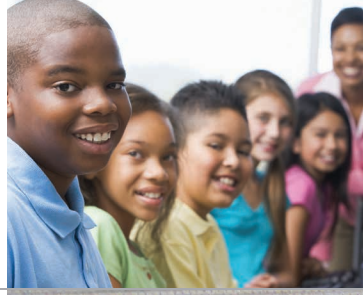
Combining literacy and content-rich opportunities for science and social studies learning enables students to be better prepared for participation as global citizens of the 21st century (MacPhee & Whitecotton, 2011). In the elementary grades, literacy teachers teach reading comprehension, vocabulary, grammar and spelling – tools that need to be applied in all discipline areas (Shanahan & Shanahan, 2017). However, literacy differs across disciplines.

To meaningfully study a discipline, students must understand how literacy is used in that discipline, and also how they can create and critique knowledge within it (Moje, 2008).

THE RESEARCH EVIDENCE UNDERPINNING WORLDWISE CONTENT-BASED LEARNING

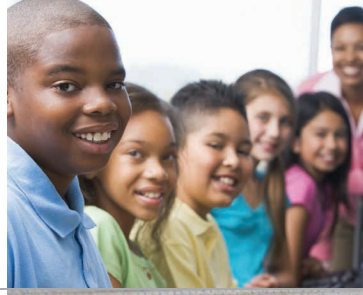
The following table shows the research evidence underpinning the development of the *WorldWise Content-based Learning* program.

RESEARCH EVIDENCE	What this means in *WorldWise Content-based Learning*
Disciplinary literacy *Shanahan & Shanahan, 2017; Connor, et.al., 2017: Herczog, 2013; Britt & Howe, 2014; MacPhee & Whitecotton, 2011; Pearson, Moje, & Greenleaf, 2010.*	• Social studies disciplinary knowledge includes framing questions, gathering and evaluating sources, making claims based on evidence, and forming conclusions. • Scientific disciplinary knowledge includes assessing the nature of evidence, giving attention to precision and detail, synthesizing complex information, understanding intricate arguments, and comprehending events and concepts.
Graphical literacy *Roberts, Norman, Duke, Morsink, Martin, & Knight, 2013; McTigue & Flowers, 2011; Roberts, Brugar, & Norman, 2014; Barnes & Oliveira, 2018; Roberts & Brugar, 2017.*	• Graphical devices include captioned images, maps, tables, diagrams, flow charts, and timelines. • Graphics can provide information that is not included in the body text. • It is vital to teach students how to create and comprehend graphics.
Academic vocabulary and increased morphological awareness *Hiebert, Goodwin, & Cervetti, 2017; Hiebert, 2017; Goodwin, Lipsky, & Ahn, 2012.*	• Academic vocabulary related to topics is introduced. • Attention to morphology improves students' ability to solve unknown words.



RESEARCH EVIDENCE	What this means in *WorldWise Content-based Learning*
Reading strategies and text types *Barnes, Grifenhagen, & Dickinson, 2016; Mesmer, Cunningham, & Hiebert, 2012; Duke & Billman, 2009; Derewianka, 1990.*	• Text types such as reports, explanations, persuasive arguments, and recounts have different purposes, structures, and text features. • The vocabulary, syntax, and discourse registers of different text types affect students' strategies for reading texts with different purposes.
Comprehension *LaRusso, et.al., 2016; Varga, 2017;* *Palincsar & Brown, 1984; Keane & Zimmerman, 1997.*	• Comprehension involves attention to academic language, perspective taking, and complex reasoning. • There is a focus on discussion of metacognition and metalanguage to describe the reading process and text features.
Writing and reading are linked *Pearson, Knight, Cannady, Henderson, & McNeill, 2015; Williams, 2017; Kersten, 2017; Bintz, Wright, & Sheffer, 2010; Cervati & Hiebert, 2017.*	• Mentor text provides a pattern for the students' writing. • Students can create multimodal texts with graphics focussing on real-world issues.
Assessment is formative to inform instruction *Pearson, Knight, Cannady, Henderson, & McNeill, 2015; Shanahan & Shanahan, 2014.*	• Ongoing assessment forms part of the teaching sequence. • Comprehension of the main idea, vocabulary, and graphical literacy is assessed.

okapi
educational publishing



DISCIPLINARY LITERACY

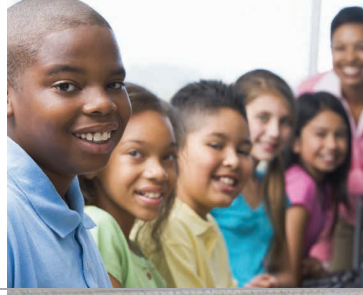
- Social studies disciplinary knowledge includes framing questions, gathering and evaluating sources, making claims based on evidence, and forming conclusions.
- Scientific disciplinary knowledge includes assessing the nature of evidence, giving attention to precision and detail, synthesizing complex information, understanding intricate arguments, and comprehending events and concepts.

Learning to read and write in different discipline areas is a new idea. The discipline areas of English or Language Arts may see students reading narratives featuring characters, setting, and plot, and descriptive, literary language. Whereas, in the discipline area of science, the language is mostly factual, with intricate arguments and complex information. In science writing, the grammar tends to have fewer verbs and more nouns. In the discipline area of social studies, the people and places of contemporary and historical settings are described. Social studies texts use images for illustrative purposes and sometimes to set a mood. In contrast, science texts use graphic elements to increase the precision of the information when words alone cannot explain the concepts (Shanahan & Shanahan, 2017).

The challenge for literacy teachers is to include social studies and science instruction during a designated literacy block. Instructional time in the classroom is a precious commodity and, in the early elementary grades, priority is given to establishing strong literacy skills. As a result, there is often less time to focus on content areas such as social studies and science (Connor, et.al., 2017). However, it is important that students develop literacy skills specific to the discipline areas of social studies and science in those early years of elementary school.

SOCIAL STUDIES

Reading and writing are tools for learning social studies. Research has shown that reading and writing deepen students' understanding of social studies content (Britt & Howe, 2014). Social studies combines civics, economics, geography, and history. Some of the themes that guide the social studies curriculum are: culture, time continuity and change; people, places, and environments; individual development and identity; power and authority; consumption and distribution; global connections; and civic ideals and practices. The approach to disciplinary knowledge in social studies involves framing questions, developing skills for gathering and evaluating sources, making claims based on evidence, and communicating conclusions. The disciplinary approach in social studies is closely linked to Language Arts – reading, writing, speaking, and listening (Herczog, 2013). In practice, a successful social studies classroom is one in which elementary students are regularly engaged in meaningful activities that require them to develop content knowledge as they read texts, write about what they are learning, and share their knowledge with their peers.



SCIENCE

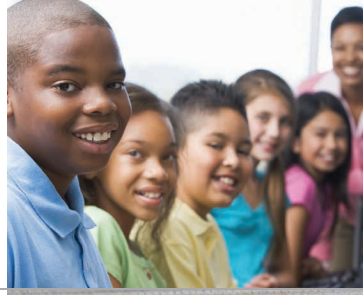
Reading in science requires an appreciation of the norms and conventions of the discipline of science. This includes understanding the nature of the evidence used, paying attention to precision and detail, making and assessing intricate arguments, synthesizing complex information, and following detailed procedures and accounts of events and concepts. Students also need to be able to interpret elaborate diagrams and data that convey information and illustrate scientific concepts not provided in the body text. Previously, there has been a lack of content-area instruction in science due to a number of different factors (Pearson, Moje, & Greenleaf, 2010). First, science texts for the elementary grades have been less engaging and less well written than other texts. Second, less instructional time has been spent on text-based activities than on building content knowledge. Third, both students and teachers have tended to struggle with the concepts, vocabulary, and graphics presented in scientific texts. Clearly there is a need for science texts in the elementary grades to be more reader-friendly, with a focus on engaging readers.

GRAPHICAL LITERACY

- Graphical devices include captioned images, maps, tables, diagrams, flow charts, and timelines.
- Graphics can provide information that is not included in the body text.
- It is vital to teach students how to create and comprehend graphics.

Comprehending graphical literacy, or visual literacy, is critically important (Roberts, et.al., 2013), especially as graphics are increasing in their complexity, diversity, and importance. A recent analysis of science and social studies textbooks, leveled readers, and trade books appropriate for second and third graders revealed that 60 percent of the graphics in these texts provided additional information that was not included in the written text (Fingeret, 2012). While comprehending graphics is important, so too is teaching elementary students to compose graphics within the informational texts they write and present to their classmates (McTigue & Flowers, 2011). Graphical literacy includes timelines, tables, surface diagrams (such as cross-sectional diagrams in earth science), maps, inserts (such as cross-sectional diagrams of mountains), graphs, flow charts, and captioned graphics.

Students in elementary school are now presented with digital, web-based informational texts, which contain a myriad of new graphical devices. They range from fairly simple captioned pictures with hyperlinks to additional information, to dynamically complex animated interactive charts and graphs that allow the viewer to explore and transform data (Roberts, et. al., 2013; McTigue & Flowers, 2011). The quality of graphical devices varies, so Roberts, Brugar, and Norman (2015) have provided guidelines for evaluating the effectiveness of graphical devices to convey meaning.



Scientific metaphors are used in graphical literacy to describe somewhat invisible processes. For example, in a food web, arrows not only indicate direction but also demonstrate how energy is transferred from grass to cows to humans in an 'energy' metaphor. Careful teaching is required to help students make sense of metaphors in science texts. Assisting students to understand that the way in which information is presented can shape learning is crucial for helping them to develop the skeptical nature of scientists, driving them to question and seek out understanding. Barnes and Oliveira (2018) ask educators to be on the lookout for graphics (such as illustrations, photos, charts, and graphs) and figurative language (such as similes, analogies, and symbolism) that provide information not found in the body text. In well-designed texts, visual aids make connections between prior knowledge and new information; however, for educators, it is essential to provide reading aloud and shared reading opportunities to explore the meanings of graphical literacy (McClure & Fullerton, 2017). In addition, encouraging students to notice who, what, and how information is present or absent in a story can enhance critical reading and understanding (Luke & Freebody, 1997).

Roberts and Brugar (2017) conducted research into elementary students' understandings of four common graphical devices that occur frequently in social studies texts: captioned images, maps, tables, and timelines. The results of this study indicated gaps in third-, fourth-, and fifth-grade students' understandings of the purpose of graphical devices and how to gain information from them. The study also revealed a need to: conduct research related to instructional practices and development of graphical comprehension; address graphical literacy instruction as part of pre-service and in-service teacher education programs; and teach students the importance of, and strategies for, learning from graphical elements of text.

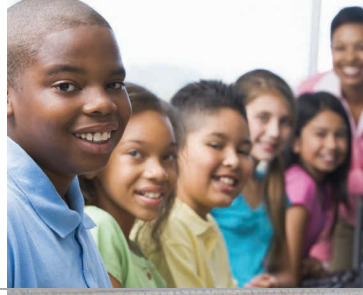
ACADEMIC VOCABULARY AND INCREASED MORPHOLOGICAL AWARENESS

- Academic vocabulary related to topics is introduced.
- Attention to morphology improves students' ability to solve unknown words.

Academic vocabulary takes on an important role in science and social studies texts (Hiebert, Goodwin, & Cervetti, 2017). Texts designed around topics or themes contain more technical vocabulary than other genres (such as narratives and poetry). Academic or content vocabulary can be analyzed using the three-tier model for selecting vocabulary (Beck, McKeown, & Kucan, 2008):

- Tier 1 – conversational everyday words such as 'clock,' 'baby,' and 'happy'
- Tier 2 – general academic words and synonyms of common words, such as 'fortunate,' 'maintain,' and 'typical'
- Tier 3 – technical vocabulary that usually occurs in specific domains (and appears in texts very rarely), such as 'ecosystem,' 'omnivores,' and 'pollinators.'

Morphological awareness is also increasingly important in the third and fourth grades (Goodwin, Lipsky, & Ahn, 2012). As texts become more complex, up to 80 percent of words encountered in texts from third grade on are morphologically complex derived words, the meanings of which can often be determined from the analysis of component morphemes and context. For example, the word 'improve' can be considered part of a word family and can be identified in the words 'improved,' 'improvements,' 'improves,' and 'improving' (Hiebert, Goodwin, & Cervetti, 2017). Science and social studies texts are also particularly dense with words of Latin or Greek origin. These words involve multiple affixes, with roots that cannot stand alone, such as 'credible' and 'taxonomy' (Goodwin, Lipsky, & Ahn, 2012).



READING STRATEGIES AND TEXT TYPES

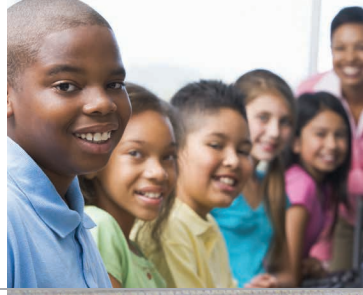
- Text types such as reports, explanations, persuasive arguments, and recounts have different purposes, structures, and text features.
- The vocabulary, syntax, and discourse registers of different text types affect students' strategies for reading texts with different purposes.

Reading informational text types (such as explanations, reports, recounts, and arguments) requires attention to the structure of the texts, such as question–answer, compare–contrast, general statement, and evidence (Derewianka & Jones, 2012). Fisher and Frey (2015) note that, as readers employ a range of strategies while reading texts, it is important for them to notice when these strategies are working or not working. This will allow them to know what strategies to use to comprehend the text.

Close reading is an effective instructional method that encourages students to focus on details while analyzing the language used, structure, images, arguments, and ideas within the text (Grant, Lapp, Moss, & Johnson, 2013). During close reading, students must read and interrogate at all levels: word, sentence, paragraph, image, and whole body of text. Engaging prior knowledge before a close reading of science text is helpful, as students are likely to encounter content density and challenging claims. Before reading, and on subsequent readings, questions can prompt students to search, synthesize, infer, and make judgments that are supported by text-cited evidence (Grant, et.al., 2013). In addition, students can be encouraged to use annotated reading, partner talk, text-based questioning, and reflective writing to build competence and a capacity for reading, writing, listening, and speaking about informational texts.

The ideal format of a literacy lesson uses the concept of gradual release of responsibility, where a teacher progressively transfers the responsibility for making meaning and thinking critically about a text to the student (Pearson & Gallagher, 1983). This gradual release of responsibility may occur within one reading of a text, or it may occur over time with rereading a variety of texts. Paying close attention to how students respond during interactions allows the teacher to discern when more or less support is needed (McClure & Fullerton, 2017).

Through shared, interactive read-alouds and guided reading groups, teachers are able to demonstrate strategies and provide students with multiple opportunities to practice the strategies when the text is read aloud. The supportive context of interactive read-alouds and shared and guided reading can provide a place for co-constructing meaning and drawing on comprehension strategies for students' use. It is recommended that about half of the close reading session involves discussion. To encourage interaction, a low-risk environment where students are willing to contribute to class discussions is required. A low-risk environment places emphasis on students' interests, motivations, and points of view when selecting texts, planning student interactions, and facilitating conversations (McClure & Fullerton, 2017). Providing time for students to respond via conversation throughout the reading of a text in a way that is neither completely student-directed nor engineered entirely by the teacher can offer students an opening to respond to texts in an authentic manner.



COMPREHENSION

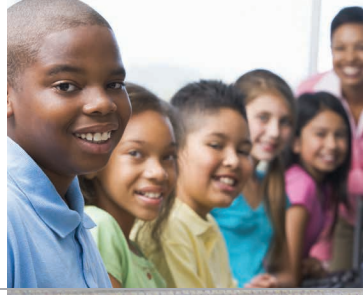
- Comprehension involves attention to academic language, perspective taking, and complex reasoning.
- There is a focus on discussion of metacognition and metalanguage to describe the reading process and text features.

Reading comprehension in the grades 3–5 demands high interest, meaningful texts about issues students care about and can relate to. At this stage, comprehension is dependent on abilities in three domains that go well beyond decoding and oral comprehension: academic language, perspective taking, and complex reasoning (LaRusso, et.al., 2016). Students may struggle with comprehension and misinterpret the author's intent if they don't have some understanding of the academic language in different text types and if they are not aware that authors write from differing viewpoints or perspectives.

Comprehension strategies include inferring, synthesis, analysis, and critique (McClure & Fullerton, 2017; Fountas & Pinnell, 2017). Inferring can mean locating evidence in the text and images to support an inference. Synthesis might involve combining information and identifying new information in a text. Analysis can involve finding facts, categories, cause and effect, problem solution, and various underlying text structures, as well as assessing the effectiveness of text features and graphics. To critique may involve thinking about the quality of the text and expressing opinions and supportive evidence from the text.

Complex reasoning involves metacognition, which is the ability to observe, problematize, and communicate one's own learning and thought processes through an active choice of reading comprehension strategies (Palincsar & Brown, 1984). Important comprehension strategies include literal comprehension, reading between the lines, reading beyond the lines, and making text-to-text links, text-to-self links, and text-to-world links (Keane & Zimmermann, 1997). Metacognition involves students learning to ask questions about the text and the reading process, to survey, adjust, and communicate their use of reading comprehension strategies, as well as using a metalanguage to talk about fiction, information, and their interpretations (Varga, 2017). Metalanguage is using language to describe how texts work, and this means identifying the text as a construction by an author. Metalanguage also describes the interaction between the text and the reader, where the reader reflects upon the reading process used to comprehend the text. Thinking about thinking is metacognition.

Reading persuasive texts with an argument structure has been the focus of recent intervention studies, and research indicates that, provided with effective instruction, students K–5 are capable of engaging in argumentation (Lee, 2017). This research also indicates that students' ability to read and construct arguments is pronounced in particular conditions: when they understand they have agency; when they engage with controversial or real-life issues they can relate to; when they learn to take different perspectives through role-plays; when tasks or topics tap into their interests or questions; and when the audience is made clear to them.



WRITING AND READING ARE LINKED

- Mentor text provides a pattern for the students' writing.
- Students can create multimodal texts with graphics focussing on real-world issues.

WRITING

Writing takes place for a range of purposes based on the content of the books and particularly targeting argument/persuasion and reports/explanations (Pearson, et.al, 2015). One approach that integrates both reading and writing in science is using a mentor text as a pattern for students' own writing (Bintz, Wright, & Sheffer, 2010). In science, students can read and learn from (appropriately leveled) texts, and then use them as models to communicate their own inquiry, investigation, or knowledge. Students may use the structures and patterns of the mentor text as a framework to develop their own writing. In the publishing phase, students share and discuss their authored works, communicating their learning in science. Multimodal representations enable students to share their responses and projects.

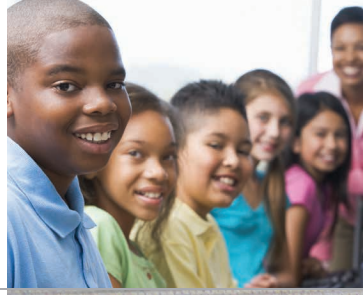
Hiebert, Goodwin, & Cervetti (2017) present an example of an authentic knowledge-building literacy activity by way of fourth graders who gathered data on how water was used in their school. They read experts' recommendations for water conservation practices and then used the findings from gathering data and reading to make recommendations for water conservation practices in their schools and communities. In this example, students read science articles and fiction and nonfiction trade texts. They also read and created charts about water use. Students engaged in interviews, made notes, and summarized what they learned. They created a PowerPoint presentation to share key points with members of their communities.

Lilly and Fields (2014) described a fourth-grade photography and informational writing project where students used photographs as a stimulus for informational writing – a way of integrating literacy with other subjects and motivating students to write interesting, relevant, and creative texts. Complementing composition through words with composition through images can have a powerful impact on student motivation and learning.

Creating multimodal texts with graphics about real-world issues prompts students to read the various textual features of nonfiction books, conduct research, think like scientists, and use the scientific process to stimulate their thinking and share their ideas (Kersten, 2017). Positioning students as authors of their own science books creates passionate, engaged, and knowledgeable inquirers into scientific knowledge.

READER-FRIENDLY TEXTS FOR CONTENT-BASED READING

Two decades of research has shown that comprehending expository texts, especially science texts, can be challenging for learners (Tippett, 2010). In the elementary school, informational books in science can be difficult to read, especially for a large percentage of readers who are less proficient. A substantial body of research into reader-friendly texts informs the development of science and social studies texts. This research cautions against unrealistic assumptions about readers' background knowledge, too many highly technical terms and too much specialized vocabulary, coherence breaks, high density of new concepts (Mikkilä-Erdmann, 2002), and a high inference demand (Beck, McKeown, Sinatra, & Loxterman, 1991).



Reader-friendly science and social studies texts must endeavor to link to the reader's experiences and background knowledge. Reader-friendly texts can be assessed qualitatively by using rubrics (see Hess & Biggam, 2004) with the following seven features:

- word difficulty and language structure
- text structure and discourse style
- features of genre or text type
- background knowledge and/or degree of familiarity
- level of reasoning
- format and layout
- length of text.

Text complexity is evaluated by exploring multiple factors such as text density, text structures and discourse, the use of unfamiliar or archaic language, and extensive background knowledge demands. Hiebert and Pearson (2014) recommend using qualitative analysis of text complexity, focusing on the content or ideas in a text rather than relying on quantitative measures of long words and complex syntax.

ASSESSMENT

- Ongoing assessment forms part of the teaching sequence.
- Comprehension of the main idea, vocabulary, and graphical literacy is assessed.

Assessment of reading comprehension and science concepts has been a focus of research for decades (Pearson, et.al, 2015). Formative assessment is useful for making teaching decisions about instruction in shared, guided, and independent reading and for grouping of students. The three key aspects of assessment are comprehending the main idea, vocabulary, and graphical literacy.

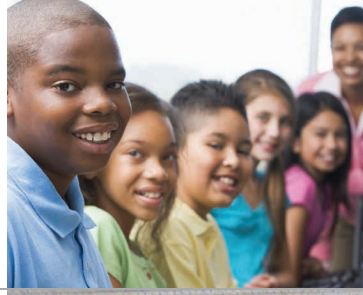
Grasping the main idea is crucial in science and social studies texts, and this involves synthesis and summarizing of information. This means not just focussing on details but getting the key concept of a text. Next, vocabulary, or knowledge of word meanings, needs to be assessed, often by asking for a definition; for example: Which word means …? Which of these is an example of …?

Graphical literacy, a new and important aspect of assessment, can involve describing text features; for example, maps may have an inset and a key, or a biography may be chronological and include pictures (Shanahan & Shanahan, 2017). One of the second-grade informational text Common Core State Standards requires students to 'explain how specific images (in a diagram showing how a machine works) contribute to and clarify a text'. Students may be asked to compare two texts; for example, a newspaper article about a scientific finding that is written in a different style from the scientific source; and a second-grade standard asks students to compare and contrast the most important points presented by two texts on the same topic.

SUMMARY

Reading content-rich texts builds students' disciplinary knowledge in the elementary school. Texts now incorporate a range of graphical devices and academic vocabulary, and the concepts presented require careful reasoning. As texts and the Internet evolve, teachers strive to make students critical consumers and producers of knowledge in the 21st century. Educators are seeking new instructional models for using content-based literacy in elementary schools (Ciampa, 2016).

okapi
educational publishing



REFERENCES

Barnes, E. M. & Oliveira, A. W. (2018). Teaching scientific metaphors through informational text read-alouds. *The Reading Teacher*, 71(4), 463–472. doi.org/10.1002/trtr.1634

Beck, I., McKeown, M., & Kucan, L. (2008). *Creating robust vocabulary: Frequently asked questions and extended examples*. New York: Guilford Press.

Beck, I. L., McKeown, M. G., Sinatra, G. M., & Loxterman, J. A. (1991). Revising social studies text from a text-processing perspective: Evidence of improved comprehensibility. *Reading Research Quarterly*, 26, 251–276. doi.org/10.2307/747763

Bintz, W., Wright, P., & Sheffer, J. (2010). Using copy change with trade books to teach earth science. *The Reading Teacher*, 64(2), 106–119. doi.org/10.1598/RT.64.2.3

Britt, J. & Howe, M. (2014). Developing a vision for the Common Core Classroom: What does elementary social studies look like? *Social Studies*, 105(3), 158–163. doi.org/10.1080/00377996.2013.866930

Ciampa, K. (2016). Implementing a digital reading and writing workshop model for content literacy instruction in an urban elementary (K–8) school. *The Reading Teacher*, 70(3), 295–306. doi.org/10.1002/trtr.1514

Connor, M. C., Dombek, J., Crowe, C. E., Spencer, M., Tighe, L. E., Coffinger, S., Zargar, E., Wood, T., Petscher, Y., & Graham, S. (2017). Acquiring science and social studies knowledge in kindergarten through fourth grade. *Journal of Educational Psychology*, 109(3), 301–320. doi.org/10.1037/edu0000128

Derewianka B. & Jones P. (2012) *Teaching language in context*. Melbourne: Oxford University Press.

Duke, N., Purcell-Gates, V., Hall, L., & Tower, C. (2006). Authentic literacy activities for developing comprehension and writing. *The Reading Teacher*, 60(4), 344–355. doi.org/10.1598/RT.60.4.4

Fingeret, L. (2012). *Graphics in Children's Informational Texts: A Content Analysis*. Doctoral Dissertation ED546078.

Fisher, D. & Frey, N. (2015). Teacher modeling using complex informational texts. *The Reading Teacher*, 69(1), 63–69. doi.org/10.1002/trtr.1372

Fountas, I.C. & Pinnell, G.S. (2017). *Guided reading: Responsive teaching across the grades* (2nd ed.). Portsmouth, NH: Heinemann.

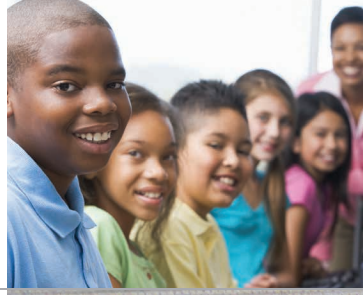
Grant, M., Lapp, D., Moss, B., & Johnson, K. (2013). Students' close reading of science texts: What's Now? What's Next? *The Reading Teacher*, 67(2), 109–119. doi.org/10.1002/TRTR.119

Goodwin, A., Lipsky, M., & Ahn, S. (2012). word detectives: Using units of meaning to support literacy. *The Reading Teacher*, 65(7): 461–470. doi.org/10.1002/TRTR.01069

Hess, K. & Biggam, S. (2004). A discussion of "increasing text complexity". Published by NH, RI, and VT Departments of Education as part of the New England Common Assessment Program (NECAP) Grade Level Expectations for Reading. Accessible online at www.nciea.org/publications/TextComplexity_KH05.pdf

Herczog, M., (2013). The links between the C3 frameworks and the NCSS National curriculum standards for social studies. *Social Education*, 77(6), 331–333.

okapi
educational publishing



Hiebert, E.H., Goodwin, A.P., & Cervetti, G.N. (2017). Core vocabulary: Its morphological content and presence in exemplar texts. *Reading Research Quarterly*, 53(1), 29–49. doi.org/10.1002/rrq.183

Hiebert, E. H. (2017). The texts of literacy instruction: Obstacles to or opportunities for educational equity? *Literacy Research: Theory, Method, And Practice*, 66(1), 117–134. doi.org/10.1177/2381336917718521

Hiebert, E. (2013). Tackling informational text: The case for reader-friendly articles. *Educational Leadership*, 71(3).

Hiebert, E. & Pearson, P. (2014). Understanding Text Complexity. *The Elementary School Journal*. 115. 153–160. doi.org/10.1086/678446

ILA. (2018). *Standards for the preparation of literacy professionals 2017*. Newark: International Literacy Association.

Keane, S. K. & Zimmermann, S. (1997). *Mosaic of Thoughts: Teaching Comprehension in a Reading Workshop*. Portsmouth: Heinemann.

Kersten, S. (2017). Becoming nonfiction authors: Engaging in science inquiry. *The Reading Teacher*, 71(1), 33–41. doi.org/10.1002/trtr.1577

LaRusso, M., Kim, H., Selman, R., Uccelli, P., Dawson, T., Jones, S., Donovan, S., & Snow, C. (2016). Contributions of academic language, perspective taking, and complex reasoning to deep reading comprehension. *Journal of Research on Educational Effectiveness*, 9(2), 201–222. doi.org/10.1080/19345747.2015.1116035

Lee, O. (2017). Common Core State Standards for ELA/Literacy and Next Generation Science Standards convergences and discrepancies using argument as an example. *Educational Researcher*, (46)2, 90–102. doi.org/10.3102/0013189X17699172

Lilly, E. & Fields, C. (2014). The power of photography as a catalyst for teaching informational writing. *Childhood Education*, 90:2, 99–106. doi.org/10.1080/00094056.2014.894791

Luke, A. & Freebody, P. (1997). Critical literacy and the question of normativity: An introduction. In S. Muspratt, *Constructing critical literacies: Teaching and learning textual practice*. Cresskill. N.J: Hampton Press.

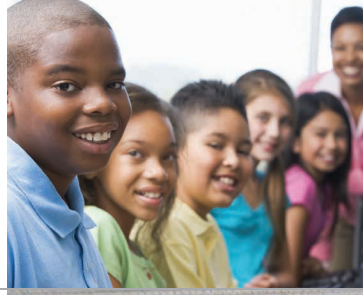
McClure, E. L. & Fullerton, S.K. (2017). Instructional interactions: Supporting students' reading development through interactive read-alouds of informational texts. *The Reading Teacher*, 71(1), 51–59. doi.org/10.1002/trtr.1576

MacPhee, D. & Whitecotton, E. (2011). Bringing the "social" back to social studies: Literacy strategies as tools for understanding history. *The Social Studies* 102(6), 263–267. doi.org/10.1080/00377996.2011.571300

McTighe, J. & Wiggins, G. (2012) Common Core Standards to Curriculum: Five Big Ideas. Accessible online at: http://grantwiggins.files.wordpress.com/2012/09/mctighe_wiggins_final_common_core_standards.pdf.

McTigue, E. & Flowers, A. (2011). Science visual literacy: Learners' perception and knowledge of diagrams. *The Reading Teacher*, 64(8), 578–589. doi.org/10.2307/41203457

okapi
educational publishing



Mikkilä-Erdmann, M. (2002). *Textbook text as a tool for promoting conceptual change in science*. Annales Universitatis Turkuensis, ser. B, tom. 249.

Moje, E. B. (2008). Foregrounding the disciplines in secondary literacy teaching and learning: A call for change. *Journal of Adolescent & Adult Literacy, 52*(2), 96–107.

Palincsar, A. S. & Brown, A. L. (1984). Reciprocal teaching of comprehensive-fostering and comprehension-monitoring activities. *Cognition and Instruction*, I.2, 117–175. doi.org/10.1207/s1532690xci0102_1

Parenti, M. A. (2018). Becoming disciplined about disciplinary literacy through guided retelling. *The Reading Teacher*, 71(4), 473–478. doi.org/10.1002/trtr.1647

Pearson, P.D., Moje, E., Greenleaf, C. (2010) Literacy and science: Each in the service of the other. *Science*, 328(5977), 459–463. doi.org/10.1126/science.1182595

Pearson, P. D., Knight, A., Cannady, M., Henderson, B., & McNeill, K. (2015). Assessment at the intersection of science and literacy. *Theory Into Practice, 54*(3), 228–237. doi.org/10.1080/00405841.2015.1044372

Pearson, P. D. & Gallagher, M.C. (1983). The instruction of reading comprehension. *Contemporary Educational Psychology*, 8(3), 317–344. doi.org/10.1016/0361-476X(83)90019-X

Pearson, P. D., Moje, E., & Greenleaf, C. (2010). Literacy and science: Each in the service of the other. *Science*, 328(5977), 459–463. doi.org/10.1126/science.1182595

Roberts, K., Brugar, K., & Norman, R. (2015). Evaluating texts for graphical literacy instruction: The graphic rating tool. *The Reading Teacher*, 68 (4), 312–318. doi.org/10.1002/trtr.1321

Roberts, K. L. & Brugar, K. A. (2017). The view from here: Emergence of graphical literacy. *Reading Psychology*, 38(8), 733–777. doi.org/10.1080/02702711.2017.1336661

Roberts, K., Norman, R., Duke, N., Morsink, P., Martin, N., & Knight, J.A. (2013). Diagrams, Timelines, and Tables—Oh, My! Fostering Graphical Literacy. *The Reading Teacher, 67*(1), 12–24. doi.org/10.1002/TRTR.1174

Shanahan, T. & Shanahan, C. (2017). Disciplinary Literacy. *Educational Leadership, 74*(5), 18–22.

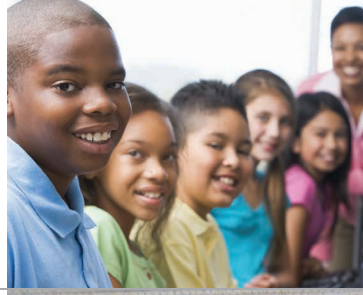
Tippett, C.D. (2010). Refutation text in science education: a review of two decades of research. *International Journal of Science and Mathematics Education*, 8(6), 951–970. doi.org/10.1007/s10763-010-9203-x

Varga, A. (2017). Metacognitive perspectives on the development of reading comprehension: A classroom study of literary text-talks. *Literacy*, 51(1), 19–25. doi.org/10.1111/lit.12095

Williams, C. (2018). Learning to write with interactive writing instruction. *The Reading Teacher*, 71(5), 523–532. doi.org/10.1002/trtr.1643

Wright, T. S. & Cervetti, G. N. (2017). A systematic review of the research on vocabulary instruction that impacts text comprehension. *Reading Research Quarterly, 52*(2), 203–226. doi.org/10.1002/rrq.163

okapi
educational publishing



NATIONAL FRAMEWORKS

National Council for the Social Studies (NCSS). (2013). *College, Career, and Civic Life (C3) Framework for Social Studies State Standards: Guidance for Enhancing the Rigor of K–12 Civics, Economics, Geography, and History.* Silver Spring, MD: NCSS. Accessible online at www.socialstudies.org/C3.

National Council for the Social Studies (NCSS). (2010). *National Curriculum Standards for Social Studies: A Framework for Teaching, Learning, and Assessment.* Silver Spring, MD: NCSS.

National Research Council (NRC). (2011). *A framework for K–12 science education: Practicing, crosscutting subjects.* Washington, DC: The National Academies Press.

National Research Council (NRC). (2014). *Literacy for science: Exploring the intersection of the next generation science standards and common core for ELA standards, a workshop summary.* Washington, DC: The National Academies Press.

Next Generation Science Standards (NGSS). (2013). *Next generation science standards: For states, by states.* Washington, DC: The National Academies Press.

okapi
educational publishing