The Scientifically Based Research for Nancy Larson® Science

Prior Knowledge

Assess

Vocabulary

Review

Explicit Instruction

Application

Glennie Buckley, Ed.D
Educational Consultant

Nancy Larson® Science

The Scientifically Based Research for the Nancy Larson® Science Program

Glennie Buckley, Ed.D.

Introduction

Textbook selection is a key element in providing sound instruction for students in any discipline. When considering the role science plays in our lives today, textbook selection and appropriate instruction is clearly imperative (Hayes, Wolfer, & Wolfe, 1996; Jager-Adams, 2009). According to Pappas (2006, p. 229), "the books used in science instruction do matter. They are significant for literacy and for science." In the American School Board Journal, Jones (2000) wrote about the problem of the "glitz" and "razzle dazzle" in many science textbooks. Nancy Larson® Science provides authentic informational text that is organized logically and is designed to provide science instruction in a clear format that is uncluttered with information and illustrations that are irrelevant to or actually hinder students' learning.

Nancy Larson® Science builds the foundation students need to become knowledgeable consumers and producers of science in the 21st century. The program is grounded in appropriate pedagogy. Lessons at every grade level include multiple strategies and activities. As Wellington and Osbourne (2001, introduction p. 8) state: "Science education involves a range of ways of communicating (visual, verbal, graphical, symbolic, tactile) and which can be exploited to engage with different learning styles and abilities."

Table of Contents

Science Instruction

According to Minstrell and Kraus (2005):

> Teachers need to unconditionally respect students' capacities for learning complex ideas, and students need to learn to respect the teacher as an instructional leader. Teachers will need to earn that respect through their actions as a respectful guide to learning. (p. 477)

In keeping with that advice, Nancy Larson® Science lessons are presented in a balanced approach that guides students' learning while respecting the knowledge they bring to the classroom as well as their capacity and motivation to learn. Both issues are addressed in multiple studies and publications including Cole (2008) and the Committee on Science Learning, Kindergarten Through Eighth Grade; National Research Council (2007).

Nancy Larson® Science includes both direct, explicit teaching that provides the basic scientific knowledge students need in order to have a firm understanding of the nature of science and hands-on applications that allow children to gain understanding by applying their scientific information to real-life situations. The value of direct instruction is addressed in multiple studies (Adelson, 2004; Akerson, Abd-El-Khalick, & Lederman, 2000; Hall, 2009; Kirschner, Sweller, & Clark, 2006; Klahr & Nigam, 2004; Minstrell & Kraus, 2005), and hands-on applications that allow children to gain understanding by applying their scientific information to real-life situations. Gallagher (2000) and Perkins (1993) both discuss the importance of hands-on applications. Combining hands-on activities with reading informational text will support the inquiry process (Hapgood & Palinscar, 2006). According to Schmoker (2011, p. 168), "The best way for students to learn is not by having them memorize disconnected facts. It is by providing frequent, focused opportunities for close critical reading, talking, and writing about science concepts" (p. 168).

Nancy Larson® Science lists carefully selected science trade books that have been determined to contain accurate science content. Teachers may use these trade books to complement certain text lessons. Based on her research related to science trade books, Rice (2002, p. 563) advises: "Trade books should supplement, not supplant quality science texts; they should be picked with care, not swept *en masse* from the library shelf."

Rather than providing limited information about a broad number of topics, Nancy Larson® Science focuses on a few core concepts so that students gain a deeper understanding of those concepts, are challenged to think at higher levels, can develop scientific reasoning, and can generalize their understanding to situations beyond the immediate lesson. Researchers who address the importance of higher-order thinking include Bybee and Van Scotter (2006–2007), Jager Adams (2009), and Perkins (1993).

Technology

Nancy Larson® Science teacher resources include CDs, slide shows, and the Nancy Larson® Science website. All resources are carefully selected aids that are directly related to the science content, are accurate, and enhance students' comprehension by focusing on the key concept of the lesson.

Expanding Teachers' Science Knowledge

Nancy Larson® Science expands the science knowledge of classroom teachers in carefully designed, explicit lessons grounded in valid and proven scientific concepts. The importance of this value-added component of the program is supported by research concerned with the issue of teachers' understanding of science (Dorph, R., Goldstein, D., Lee, S., Lepori, K., Schneider, S., & Venkatesan, S., 2007; Gess-Newsome, n.d.; Lederman and Flick, 2003; Loucks-Horsley & Matsumoto, 1999; Loucks-Horsley, Stiles, Mundry, Love, & Hewson, 2009; National Research Council, 2000). Many teachers have only a superficial understanding of science and are the first to admit that they lack the education and training to be highly qualified to teach in the discipline. The result is that science is given little time and attention in the curriculum, especially at the elementary level (Gess-Newsome, n.d.).

Instructional Strategies

Nancy Larson® Science includes multiple research-based instructional strategies that support the learning styles and needs of diverse learners.

Questioning

"Questioning is a critical focus in science, because without questions there would be no answers" (Wetzel, 2008, p. 1). Wixon (1983, p. 287) entitled an article for the Reading Teacher "What you ask about is what children learn." James and Carter

(2007) address the importance of questioning and the multiple aspects of questions that teachers must consider, including the levels of their questions. Nancy Larson® Science lessons include questions that are focused on the topic, engage students in multiple levels of thinking, and are repeated in multiple forms to reinforce learning and remembering.

Graphic Organizers and Visual Representations

Research is clear about the power of graphic organizers and visual representations across content areas (Bellanca, 2007; Dye, 2000; Hall & Strangman, 2002; Holliday, n.d.; Kim, Vaughn, Wanzek, & Wei, 2004; Love, n.d.; Report of the National Reading Panel, 2000). The inclusion of graphic organizers and visuals is especially helpful for English Language Learners and students with learning disabilities (Cummins, n.d.; Gray & Fleishman, 2004; Grumbine & Alden, 2006; Sigueza, 2005).

In Nancy Larson® Science, students use and construct a variety of graphic organizers and visuals (pictures) appropriate to understanding the specific content being studied.

Text Look-Back

The text look-back strategy engages students in returning to text to locate and reread information. The strategy has been shown to help students recall information, which is especially important for expository text that is filled with detailed information (Alvermann, 1988; Garner, Hare, Alexander, Haynes, & Winograd, 1984). Nancy Larson® Science teaches students to use the look-back strategy to reinforce learning.

Highlighting

Highlighting or underlining science vocabulary focuses students' attention on key concepts necessary for comprehension and for answering questions that may be posed on science assessments. The effectiveness of this strategy has been documented by researchers including Calkins, Montgomery, and Santman (1999), Jones (2006), Robertson (2008), and Thorne (2006).

Drama/Role-playing

Drama/role-playing in Nancy Larson® Science provides students an opportunity to interpret and explore their understanding of science concepts. Many researchers support the effectiveness of this teaching strategy including Pinciotti (1993), Robbins (1988), Sturm (2009), and Wilhelm (2002).

Music

Music is included in Nancy Larson® Science. Research articles and resources are available that support the use of music as an avenue for promoting the retention of information and for motivating young students to be fully engaged in the learning process. Among the researchers who address this issue are Jensen (2002a), Jensen (2002b), Molyneaux (2007), Prescott (2005), and UCLA (2009).

Reading and Writing

Nancy Larson® Science uses both reading and writing strategies to support and enhance learning while maintaining a focus on the science concepts that are at the heart of each lesson. Students have multiple opportunities to use writing to demonstrate learning by writing procedures, drawing conclusions, comparing and contrasting information, summarizing results of experiments, answering questions, and preparing charts.

The importance of including writing in science lessons to help students learn and remember more is addressed in the literature. Willis (1993) and Daniels, Zemelman, and Steineke (2006) are among the many researchers who advocate writing across the curriculum.

Bowers (2000) discusses the relationship of reading and writing to science and provides a chart depicting the interrelationships of reading, writing, and science.

Comprehending information can be supported through teacher read-alouds in primary grades before students are able to read text independently (Smolkin & Donovan, 2001).

According to Jager Adams (2009, p. 29),
"…the greatest cognitive and literacy benefits of text-based expertise depend on reading deeply in multiple domains about multiple topics." Hapgood and Palinscar (2006) address the importance of including informational text in children's reading experiences.

Nancy Larson® Science is based on the principle that effective lessons should include accurate science (prior knowledge), scientific terms (vocabulary), teacher support (explicit instruction), hands-on student activities (application), examination of lesson content (review), and evaluation of learning (assessment).

Prior Knowledge

Each lesson builds on the students' prior knowledge from previous lessons as well as background knowledge students bring from their life experiences. Christen and Murphy (1991), Egan (2003), and Farrell (n.d.) are among the many researchers who have identified the importance of addressing prior knowledge as an effective strategy.

Vocabulary

Direct vocabulary instruction is a key component of Nancy Larson® Science. The list of studies that have shown the value of both incidental and intentional, direct instruction on both content knowledge and reading comprehension in reading and science is long and includes major researchers as well as successful practitioners.

The importance of teaching vocabulary and its influence on comprehension is addressed by Baumann and Kameenui (2003), Beck, McKeown, and Kucan (2002), Blachowicz, Fisher, Ogle, and Watts-Taffe (2006), Cornerstones of Reading Comprehension, (n.d.), Cunningham (2008), Feldman and Kinsella, (n.d.), Lehr, Osborn, and Hiebert (2004), and Marzano and Pickering (2005).

Additionally, intentional, direct vocabulary instruction is especially beneficial for English Language Learners (Marzano & Pickering, 2005).

Nancy Larson® Science includes word walls extensively to solidify important concepts. Research is replete with references to the importance of word walls (Brabham & Villaume, 2001; Rycik, 2002; Wagstaff, 2005).

Explicit Instruction

Nancy Larson® Science includes both direct, explicit instruction and hands-on application. Direct, explicit instruction provides the foundation for hands-on application. Support for explicit instruction is widespread in the literature. Among researchers addressing explicit instruction are Chall (2000), Hall (2002), Report of the National Reading Panel (2000), and Tarver (n.d.). The steps in explicit instruction include the teacher explaining the lesson, modeling the lesson, providing guided practice and application, and arranging for student independent practice ("Empowering Teachers: Explicit Instruction," n.d.). During explicit instruction the teacher breaks down the concept or skill into distinct parts, appeals to a variety of sensory modalities, engages in thinking aloud, and actively interacts with students. ("Explicit Teacher Modeling," n.d.).

Application

Hands-on activities are motivating and allow students to apply what they have learned through observation and data collection. From this they draw conclusions based on their first-hand experiences. Many researchers have addressed the issue of hands-on learning. Among those who discuss the effectiveness of hands-on practice are Haury and Rillero (1994), and Minstrell and Kraus (2005). Nancy Larson® Science includes hands-on applications that are designed to engage students and enhance their understanding of the lesson.

Review

Reviewing the science concepts focused on during each lesson is a means of ensuring that students will retain the information. Keeley (1997) and Sousa (2007) both discuss the value of reviewing. According to Fisher and Frey (2007, p. 2), "Checking for understanding is an important step in the teaching and learning process." Sprenger (2005, p. 9) identifies seven steps for remembering: "Research, Reflect, Recode, Reinforce, Rehearse, Review, and Retrieve." The processes inherent in Sprenger's seven steps are an integral part of Nancy Larson® Science.

Assessment

Authentic assessments based on classroom instruction are ongoing throughout the Nancy Larson® Science program. These performance-based assessments include checking samples of students' written work, drama/role-playing exercises, hands-on activities and experiments, drawings, graphic organizers, and contributions during discussions. Research supports such assessments that allow the teacher to closely monitor students' understanding of science concepts and progress throughout each unit (Committee on Classroom Assessment and the National Science standards, 2001; National Research Council, 2000; Spektor-Levy, Eyon & Scherz, 2008). On-going reviews after each chapter in Nancy Larson® Science are formative assessments that provide the teacher with feedback to use for adjusting instruction. Brookhart (2010), Fisher and Frey (2007), and Popham (2008) are among the many researchers who discuss the value of formative assessments. According to the Committee on Science Learning, Kindergarten Through Eighth Grade (2007, p. 251), "Ongoing assessment is an integral part of instruction that can foster student learning when appropriately designed and used regularly." More formal assessments that mirror questions on lesson reviews and that are similar to state and standardized tests questions are included in the program.

Conclusion

Nancy Larson® Science supports student learning through a balanced approach grounded in six principles: accessing prior knowledge, expanding scientific vocabulary, teaching through systematic and explicit instruction, facilitating hands-on applications, reviewing lessons, and assessing learning in multiple formats.

Glennie Buckley received her doctorate in education from Kansas State University. She is a retired administrator with Topeka Public Schools, Topeka, Kansas. Her teaching experience spans all levels: elementary, middle, and high school. She currently supervises practicum students at Washburn University.

References

Adelson, R. (2004). Instruction versus exploration in science learning. *Monitor on Psychology, 3*5(6), 34. Retrieved from www.apa.org/monitor/jun04/instruct.aspx

Akerson, V. L., Abd-El-Khalick, F., & Lederman, N. G. (2000), Influence of a Reflective Explicit Activity-Based Approach on Elementary Teachers' Conceptions of Nature of Science. *Journal of Research in Science.* Abstract retrieved February 11, 2011, from Teaching, 37: 295–317. doi: 10.1002/(SICI)1098-2736(200004)37:4<295::AID-TEA2>3.0.CO;2-2.

Alvermann, D. E. (1988). Effects of Spontaneous and Induced Lookbacks on Self-Perceived High- and Low-Ability Comprehenders. *Journal of Educational Research, 81,* 325. Abstract retrieved from www.questia.com/PM.qst?a=o&d=76946922

Baumann, J. F. & Kameenui, E. J. Eds. (2003). *Vocabulary Instruction: Research to Practice,* New York: Guilford Press.

Beck, I., McKeown, M., & Kucan, L. (2002). *Bringing Words to Life: Robust Vocabulary Instruction,* New York: Guilford Publications, Inc.

Bellanca, J. A. (2007). *A Guide to Graphic Organizers: Helping Students Organize and Process Content for Deeper Learning* (2nd ed.). Thousand Oaks, California: Corwin Press.

Blachowicz, C., Fisher, P., Ogle, D., & Watts-Taffe, S. (2006). Vocabulary: Questions from the classroom. *Reading Research Quarterly, 41,* 524–539.

Bowers, P. (2000). *Reading and Writing in the Science Classroom.* Retrieved from http://eduplace.com/science/profdev/articles/bowers.html

Brabham, E. G. & Villaume, S. K. (2001). Building walls of words. *The Reading Teacher, 54,* 700–702.

Brookhart, S. M. (2010). *How to Assess Higher-Order Thinking Skills in Your Classroom.* Alexandria, VA: ASCD. http://www.ascd.org/publications/books/109111.aspx

Bybee, R. & Van Scotter, P. (2006–2007). Reinventing the Science Curriculum. *Educational Leadership, 64*(4), 43–47.

Calkins, L., Montgomery, K., & Santman, D. (1999). Helping Children Master the Tricks and Avoid the Traps of Standardized Tests. *Practical Assessment, Research & Evaluation, 6*(8). Retrieved from http://PAREonline.net/getvn.asp?v=6&n=8

Chall, J. (2000). *The Academic Achievement Challenge: What Really Works in the Classroom?* New York: Guilford Publications.

Christen, W. L. & Murphy, T. J. (1991). Increasing Comprehension by Activating Prior Knowledge. ERIC Clearinghouse on Reading and Communication Skills, Bloomington, IN. Retrieved from www.ericdigests.org/pre-9219/prior.htm (ED328885).

Cole, R. W. (2008). Educating Everybody's Children: We Know What We Need to Do. In R. W. Cole (Ed.), *Educating Everybody's Children: Diverse Teaching Strategies for Diverse Learners (2nd Ed.).* (Alexandria, VA: ASCD. Retrieved from http://www.ascd.org/publications/books/107003.aspx

Committee on Classroom Assessment and the National Science Education Standards (2001). *Classroom assessment and the national science education standards.* Atkin, J. M., Black, P., & Coffey, J. (Eds.). Washington, DC: National Academies Press. www.nap.edu/openbook.php?record_id=9847&page=R1

Committee on Science Learning, Kindergarten Through Eighth Grade; National Research Council (2007). *Taking Science to School: Learning and Teaching Science in Grades K–8*

(2007). Duschl, R. A., Schweingruber, H. A., Shouse, A. W. (Eds.). Washington, DC: National Academies Press. www.nap.edu/openbook.php?record_id=11625

Cornerstones of Reading Comprehension: Teaching for Vocabulary and Text Understanding. (n.d.). Retrieved February 7, 2011, from www.designedinstruction.com/learningleads/reading-vocabulary-text.html

Cummins, J. (n.d.). *Supporting ESL Students in Learning the Language of Science.* Saddle River, NJ: Pearson/Scott Foresman. Retrieved February 11, 2011, from http://assets.pearsonschool.com/asset_mgr/current/20109/Supporting_ESL_Science.pdf

Cunningham, P. M. (2008). *What Really Matters in Vocabulary: Research-based Practices across the Curriculum.* Boston: Allyn & Bacon.

Daniels, H., Zemelman, S., & Steineke, N. (2006). *Content-Area Writing: Every Teacher's Guide.* Portsmouth, NH: Heinemann.

Dorph, R., Goldstein, D., Lee, S., Lepori, K., Schneider, S., & Venkatesan, S. (2007). The Status of Science Education in Bay Area Elementary Schools: Research Study e-report. Lawrence Hall of Science, University of California, Berkeley, California. Retrieved from www.lawrencehallofscience.org/rea/bayareastudy/pdf/final_to_print_research_brief.pdf

Dye, G. (2000). Graphic Organizers to the Rescue! *Teaching Exceptional Children, 32,* 1–5. http://www.dldcec.org/pdf/teaching_how-tos/graphic_organizers.pdf

Egan, K. (2003). Start with What the Student Knows or with What the Student Can Imagine? *Phi Delta Kappan, 84,* 443–445.

Empowering Teachers: Explicit Instruction (n.d.). Retrieved February 18, 2011, from http://www.fcrr.org/assessment/ET/elements/expInst.html

Explicit Teacher Modeling (n.d.). Retrieved February 18, 2011, from http://www.coedu.usf.edu/main/departments/sped/mathvids/strategies/em.html

Farrell, J. (n.d.). What Exactly is "Prior Knowledge?" Retrieved February 7, 2011, from www.readfirst.net/prior.htm

Feldman, K. & Kinsella, K. (n.d.). Narrowing the Language Gap: The Case for Explicit Vocabulary Instruction (Professional Paper). Retrieved February 7, 2011, from http://teacher.scholastic.com/products/authors/pdfs/Narrowing_the_Gap.pdf

Fisher, D. & Frey, N. (2007). Checking for Understanding: Formative Assessment Techniques for Your Classroom. Alexandria, VA: ASCD.

Fountas, I. C. & Pinnell, G. S. (2001). *Guiding Readers And Writers Grades 3–6: Teaching Comprehension, Genre, And Content Literacy.* Portsmouth, NH: Heinemann.

Gallagher, J. J. (2000). Teaching for Understanding and Application of Science Knowledge, *School Science and Mathematics, 100,* 310–318. Excerpt retrieved February 9, 2011, from www.questia.com/PM.qst?a=o&se=gglsc&d=5002369895

Garner, R., Hare, V. C., Alexander, P., Haynes, J., & Winograd, P. (1984). Inducing Use of a Text Lookback Strategy Among Unsuccessful Readers, *American Educational Research Journal, 21,* 789–798. Retrieved from http://www.jstor.org/stable/1163001

Gess-Newsome, J. (n.d.). Delivery Models for Elementary Science Instruction: A Call for Research. *Electronic Journal of Science, 3*(3). Retrieved February 7, 2011, from http://wolfweb.unr.edu/homepage/crowther/ejse/newsome.html

Gray, T. & Fleischman, S. (2004). Successful Strategies for English Language Learners, *Educational Leadership, 62*(4). 84–85. http://www.austinschools.org/curriculum/soc_stud/resources/documents/SuccessfulStrategiesforELL_ResearchMatters.pdf

Grumbine, R. & Alden, P. B. (2006). Teaching science to students with learning disabilities. *The Science Teacher. 73*(3), 26–31. Retrieved February 7, 2011, from *General OneFile. Web*

Hall, T. (2009). *Explicit Instruction.* CAST. Retrieved from http://aim.cast.org/learn/historyarchive/backgroundpapers/explicit_instruction

Hall, T. & Strangman, N. (2002). *Graphic Organizers.* Wakefield, MA: National Center on Accessing the General Curriculum. Retrieved from http://aim.cast.org/learn/historyarchive/backgroundpapers/graphic_organizers

Hapgood, S. & Palinscar, A. S. (2006). Where literacy and science intersect. *Educational Leadership, 64*(4), 56–61.

Haury, D. L. & Rillero, P. (1994). *Perspectives of Hands-On Science Teaching.* Retrieved February 11, 2011, from http://www.ncrel.org/sdrs/areas/issues/content/cntareas/science/eric/eric-toc.htm

Hayes, D. P., Wolfer, L. T., & Wolfe, M. F. (1996). Schoolbook Simplification and Its Relation to the Decline in SAT-Verbal Scores, *American Educational Research Journal, 33,* 489–508. Published by: American Educational Research Association Stable URL: http://www.jstor.org/stable/1163293

Holliday, L. G. (n.d.). Research Matters – to the Science Teacher: A Guide to Assessing, Selecting, and Using Science Textbook Visuals. Retrieved February 9, 2011, from www.narst.org/publications/research/textbook.cfm

Jager Adams, M. (2009). The Challenge of Advanced Texts: The Interdependence of Reading and Learning. In Elfrieda H Hiebert (Ed.), *Reading more, reading better: Are American students reading enough of the right stuff?* New York: Guilford. Retrieved from www.childrenofthecode.org/library/MJA-ChallengeofAdvancedTexts.pdf

James, I. & Carter, T. S. (2007). Questioning and Informational Texts: Scaffolding Students Comprehension of Content Areas, Forum for Public Policy: Journal of the Oxford Round Table. Retrieved from www.forumonpublicpolicy.com/archivesum07/james.rev.pdf

Jensen, E. (2002). Musical Arts Make Sense! *Songs for Teaching Using Music to Promote Learning.* Retrieved February 7, 2011, from www.songsforteaching.com/ericjensen/2.htm

Jensen, E. (2002). *Music With the Brain in Mind.* Thousand Oaks, California: Sage Publications.

Jones, R. (2000, December) Textbook troubles (Subhead: Today's textbooks have a lot of razzle-dazzle, but where's the content?). *American School Board Journal.* Retrieved from www.illinoisloop.org/textbooks.html

Jones, R. C. (2006). *Strategies for Reading Comprehension: Selective Underlining.* Retrieved from http://www.readingquest.org/strat/underline.html

Keeley, M. (1997). *Memory and the Importance of Review.* Newton, PA: Bucks County Community College. Retrieved January 26, 2011 from www.bucks.edu/~specpop/memory.htm

Kim, Ae-Hwa, Vaughn, S., Wanzek, J., & Wei, S. (2004, March/April). Graphic organizers and their effect on the reading comprehension of students with LD: a synthesis of research. *Journal of Learning Disabilities, 37,* 105–118. Doi:10.1177/00222194040370020201

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why Minimal Guidance during Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-Based, Experiential, and Inquiry-Based Teaching. *Journal of Educational Psychology, 41,* 75–86. Retrieved from http://projects.ict.usc.edu/dlxxi/materials/clark/Constructivism_EP_05_Kirschner_Sweller_Clark_Ss.pdf

Klahr, D. & Nigam, M. (2004). The Equivalence of Learning Paths in Early Science Instruction: Effects of Direct Instruction and Discovery Learning. *Psychological Science, 15*(10), 661– 667. Retrieved February 9, 2011, from http://www.jstor.org/stable/40064024

Lederman, N. G. & Flick, L. B. (2003). The Matter of Subject Matter (Editorial). *In School Science and Mathematics, 103,* 361–365. Retrieved February 9, 2011, from Academic OneFile. Web

Lehr, F., Osborn, J., & Hiebert, E. H. (2004). *Research-Based Practices in Early Reading Series: A Focus on Vocabulary.* Honolulu: Pacific Resources for Education and Learning. Retrieved from http://www.eric.ed.gov:80/PDFS/ED483190.pdf

Love, S. (n.d.). *Graphic Organizers.* Retrieved February 9, 2011, from http://www.mentoringminds.com/graphic-organizers.php

Loucks-Horsley, S. & Matsumoto, C. (1999). Research on professional development for teachers of mathematics and science: The state of the scene. *School Science and Mathematics, 99* (5), 258–271. Retrieved February 9, 2011, from Academic OneFile via Gale

Loucks-Horsley, S., Stiles, K., Mundry, S., Love, N., & Hewson, P. (2009). *Designing Professional Development for Teachers of Science and Mathematics (3rd Ed).* Thousand Oaks, California: Corwin Press.

Marzano, R. & Pickering, D. (2005). *Building Academic Vocabulary: Teacher's Manual.* Alexandria, VA: ASCD.

Minstrell, J. & Kraus, P. (2005). Guided Inquiry in the Science Classroom. In Donovan, S. M. & Bransford, J. D. (Eds) How Students Learn: History, Mathematics, and Science in the Classroom. (pp. 475–514). Washington, DC: National Academies Press. Retrieved from www.nap.edu/openbook.php?record_id=10126&page=475

Molyneaux, C. (2007, Summer) Using Music in the Science Classroom. *Science in School, 5,* 32–35. Retrieved from www.scienceinschool.org/2007/issue5/music

National Research Council. (2000). *Educating Teachers of Science, Mathematics, and Technology: New Practices for the New Millennium.* Washington, DC: National Academies Press. Retrieved from http://www.nap.edu/openbook.php?record_id=9832&page=R1

Report of the National Reading Panel (2000). Teaching Children to Read: An Evidence-Based Assessment of the Scientific Research Literature on Reading and Its Implications for Reading Instruction. Washington, DC: US Department of Health and Human Services. Available: http://www.nichd.nih.gov/publications/nrp/smallbook.cfm

Pappas, C. (2006). The Information Book Genre: Its Role in Integrated Science Literacy Research and Practice. *Reading Research Quarterly, 41,* 226–250.

Perkins, D. (1993). Teaching for Understanding. *American Educator: The Professional Journal of the American Federation of Teachers, 17(3),* 8, 28–35. Retrieved from www.exploratorium.edu/ifi/resources/workshops/teachingforunderstanding.html

Pinciotti, P. (1993). Creative Drama and Young Children: The Dramatic Learning Connection (excerpt, p. 24). *Arts Education Policy Review, 94*(6), 24–28. Retrieved February 6, 2011 from www.questia.com/googleScholar.qst?docId=97806984

Popham, W. J. (2008). *Transformative Assessment.* Alexandria, VA: ASCD.

Prescott, J. O. (2005, January). Music in the Classroom: Instructor's handy guide for bringing music into your classroom. *Instructor.* Retrieved March 6, 2011, from http://teacher.scholastic.com/products/instructor/jan05_music.htm

Rice, D. D. (2002). Using trade books in teaching elementary science: Facts and fallacies. *The Reading Teacher, 55*(6), 552–565.

Robbins, B. (1988). Creative Dramatics in the Language Arts Classroom. ERIC Digest 7, Eric Clearinghouse on Reading and Communication Skills. Retrieved from www.ericae.net/edo/ed297402.htm

Robertson, K. (2008). *Increasing ELL Student Reading Comprehension with Non-fiction Text.* Retrieved from www.colorincolorado.org/article/29035

Rycik, M. (2002). How primary teachers are using word walls to teach literacy strategies. Ohio Reading Teacher. Retrieved from http://findarticles.com/p/articles/mi_qa4064/is_200207/ai_n9098510/

Schmoker, M. (2011). Focus: Elevating the Essentials to Radically Improve Student Learning. Alexandria, VA: ASCD.

Sigueza, T. (2005). Graphic Organizers. Retrieved from www.colorincolorado.org/article/13354?theme=print

Smolkin, L. B. & Donovan, C. A. (2001). The Contexts of Comprehension: The Information Book Read Aloud, Comprehension Acquisition, and Comprehension Instruction in a First-Grade Classroom. *The Elementary School Journal, 102,* 97–122.

Sousa, D. (2007). *How the Brain Learns Mathematics.* Thousand Oaks, CA: Sage Publications.

Spektor-Levy, O., Eylon, B., & Scherz, Z. (2008). Teaching communication skills in science: Tracing teacher change. In *Teacher and Teacher Education, 24,* 462–477.

Sprenger, M. (2005). *How to Teach So Students Remember.* Alexandria, VA: ASCD.

Sturm, B. (2009, autumn). The drama of science. *Science in School, 13,* 29–33. Retrieved from http://www.scienceinschool.org/repository/docs/issue13_drama.pdf

Tarver, S. G. (n.d.). Myths about direct instruction and research that refutes those myths. Retrieved from www.schoolinfosystem.org/pdf/112004/ditarver.html

Thorne, G. (2006). 10 Strategies to Enhance Students' Memory. Retrieved from www.cdl.org/resource-library/articles/memory_strategies_May06.php

University of California, Los Angeles (UCLA), Health Sciences (2009, July 21). The Sounds Of Learning: Studying The Impact Of Music On Children With Autism. *ScienceDaily.* Retrieved February 11, 2011, from http://www.sciencedaily.com/releases/2009/07/090720220414.htm

Wagstaff, J. (2005). Word Walls That Work. Retrieved from http://www2.scholastic.com/browse/article.jsp?id=4380

Wellington, J. & Osborne, J. (2001). Introduction. In *Language and literacy in science education,* (1–8). Buckingham, England: Open University Press. Retrieved from www.mcgraw-hill.co.uk/openup/chapters/0335205984.pdf

Wetzel, D. R. (2008). 20 Questions to Ask Students in Science Projects: Children Develop a Better Understanding by Asking Critical Questions. Retrieved from www.suite101.com/content/20-questions-in-science-projects-a58140

Wilhelm, J. D. (2002). *Action Strategies for Deepening Comprehension: Using Drama Strategies to Assist Improved Reading Performance.* New York: Scholastic.

Willis, H. (1993). *Writing Is Learning: Strategies for Math, Science, Social Studies, and Language Arts.* Bloomington, IN: EDINFO Press.

Wixon, K. K. (1983). Questions about a text: What you ask about is what children learn. *The Reading Teacher, 37*(3), 287–293. Retrieved February 9, 2011, from http://jstor.org/stable/20198454