Georgia Science Teachers Association
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The Role of Science Learning in Supporting Literacy Development
Georgia Science Teachers Association, September 2022

Summary: Building knowledge through effective science instruction in grades K-12 must be part of a systematic, research-based approach for helping every Georgia student learn to read. Science content knowledge and vocabulary enhance reading comprehension for students, and students develop this knowledge most effectively through a combination of hands-on investigations, reading (and readalouds for young students), discussion, and writing. Science can also give students context and motivation to read and write. Any policy aimed at supporting literacy learning for Georgia's students must include adequate time for high quality, experience-based science learning.

Full Statement

The Georgia Science Teachers Association (GSTA) is a statewide professional association representing nearly 1,000 science teachers, leaders, and higher education faculty who are committed to excellent science education for the students of Georgia. We appreciate Representative Gambill, Representative Evans, and others for bringing light to this important issue through the resolution to create the House Study Committee on Literacy Instruction. We are pleased to offer our assistance and our input on how science learning can support these efforts.

GSTA believes reading to be a foundational skill and one which every citizen of our state deserves the best possible opportunity to master. GSTA also agrees with many educators, policy makers, and scholars that a new approach is needed to provide that opportunity. Over the past three decades, time spent on science in U.S. elementary classrooms, particularly in grades K-2, has declined as more time has been dedicated to teaching reading (Horizon Research, Inc., 2019). Reading achievement, however, has remained flat over that time (U.S. Department of Education, various years). Therefore, we support efforts to promote an approach to teaching reading based on the best available evidence from neuroscience, cognitive psychology, and educational research.

Science can provide important context and motivation for reading and writing. That is, science can give students something to read and write ABOUT and a compelling reason to do so. Reading comprehension strategies are more effective when taught in the context of science (Guthrie et al., 2004), and students are better able to transfer those strategies to other areas when they learn strategies in context of familiar content (Gaultney, 1995). Science learning can also enhance students' motivation to read by providing a purpose; as well as from student reflections on how they benefit from text (Barber and Klauda, 2020).

It's easy to imagine upper elementary and older students reading to learn about a science topic after conducting a lab. What may be less intuitive but is supported by years of research is that knowledge of science (and other domains) is needed for young students to develop into proficient readers. In the simple view of reading spelled out by Gough & Tunmer (1986), word recognition and language comprehension multiply to determine an individual's reading ability. Thus, a child who can

decode words but cannot attach meaning to them is in no better position than one who cannot recognize the words on a page.

As educators, we know that neither reading nor learning to read are simple matters. Dr. Hollis Scarborough's reading rope image (see below) offers an excellent visual representation of the set of knowledge and skills that allow students to become skilled readers.

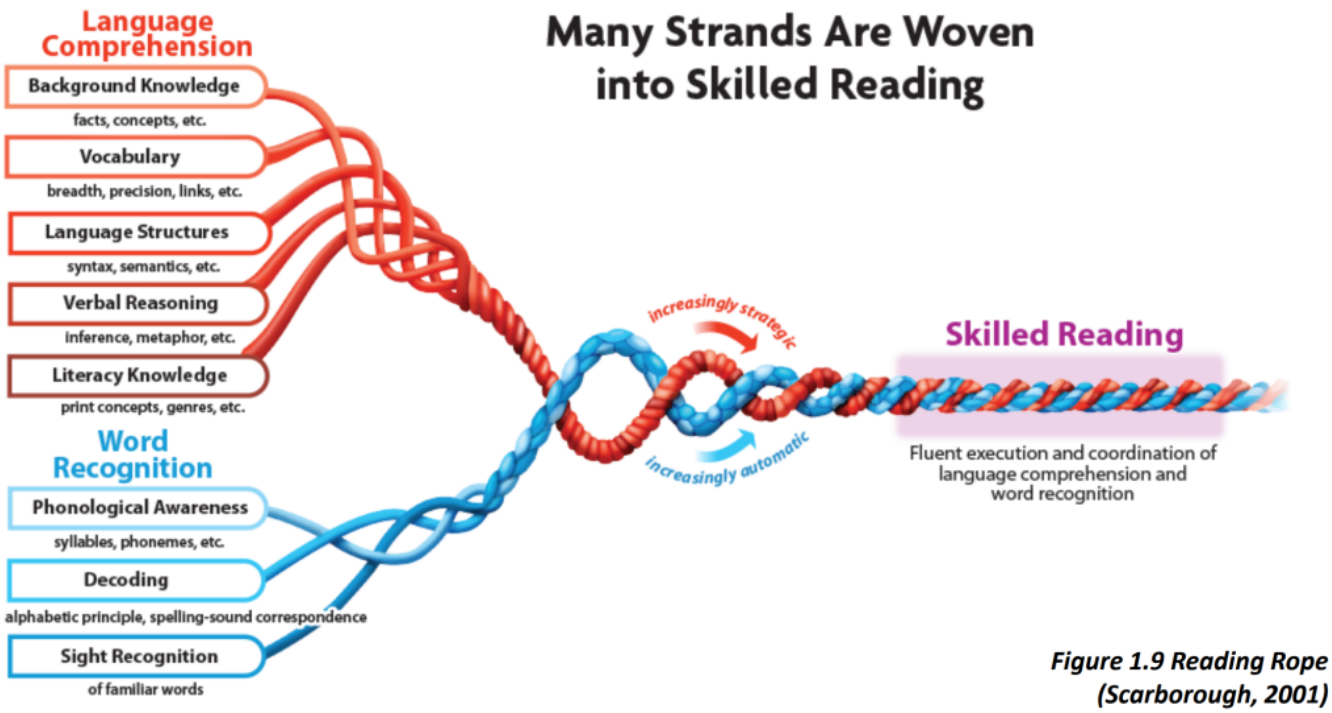

Figure 1.9 Reading Rope (Scarborough, 2001)

Image by International Dyslexia Assoc. (https://dyslexiaida.org/event/a-20th-year-celebration-of-scarboroughs-reading-rope/); originally appeared in publication: Scarborough, H.S. (2001). Connecting early language and literacy to later reading (dis)abilities: Evidence, theory, and practice. In S. Neuman & D. Dickinson (Eds.), *Handbook for research in early literacy* (pp. 97–110). New York, NY: Guilford Press.

The reading rope visual offers three important lessons. First, knowledge is crucial to language comprehension and therefore to reading comprehension. Both background knowledge and vocabulary knowledge are required to make sense of text. In fact, students with lower reading skills but higher levels of background knowledge outperform more skilled readers with lower levels of background knowledge when they are assessed on comprehension. This was demonstrated in the oft-cited "baseball study" by Recht and Leslie (1988) and is supported by more recent research. In fact, Priebe, Keenan, and Miller (2010) even found that prior knowledge improves students' word recognition and fluency and reduces their reading errors. Second, we see that each component of the rope has a reciprocal relationship with the others. That is, comprehension supports decoding just as decoding supports comprehension. Finally, we can think of the reading rope as a model of how students develop into proficient readers over time. If we think of a time scale along the bottom of the rope where students begin developing their knowledge and skills at a young age and continue to strengthen them throughout their lives, then we come to a clear conclusion.

We cannot afford to think of the primary grades as a time when students only need to learn to read. Rather, students are constantly building the knowledge (background knowledge, vocabulary, and literacy knowledge) needed to become successful readers with strong comprehension (Pearson et al., 2020). Thus, our approach to reading instruction must honor this fact and must begin to build students' knowledge from their earliest experiences in school. In practical terms, this means we cannot sacrifice content learning in science in hopes of bolstering students' literacy learning. If we do so, then we are

only weakening some strands of the rope while we attempt to strengthen others. The end result will be a rope whose strength cannot withstand the pressure of learning demands in later grades.

Therefore, we believe–and research supports–efforts to improve literacy learning, including in early grades, must be implemented in a way that preserves or enhances the time dedicated to science learning. Even while students are learning to read in grades K-2, they can and must build knowledge needed to comprehend text through hands-on experiences, discussion, and read alouds (Pearson et al., 2020). Neglecting the task of building science knowledge and vocabulary, even in primary grades, would not only neglect our duty to engage students in the K-2 science standards but would also "leave a ticking time bomb for later" grades in the form of a knowledge gap, both in individual students and across student subgroups, that gets harder and harder to fill (Shanahan, 2020). What's more, this gap would disproportionately affect students who are economically disadvantaged, the very students who are most vulnerable to reading difficulties.

Returning to Georgia's science standards, it is also important to note reading, writing, and other literacy practices are an integral part of professional practice in science and of those standards. In fact, professional scientists and engineers spend more than half of their time reading and writing (National Research Council, 2012). This is why the Georgia Standards of Excellence in science, beginning in kindergarten, explicitly include literacy. Every overall standard begins with the phrase "obtain, evaluate, and communicate information." This is a direct call for students to read, think about, and write texts as they learn science. Simply reading about science is not the same as engaging in reading while doing science that is aligned to grade-level science standards. Integrated lessons and curricula should be developed by experts from both disciplines and should reflect the key practices from each domain. Teaching science, more often and more effectively, will help us build students' literacy skills and knowledge.

In conclusion, building knowledge through effective science instruction in grades K-12 must be part of a systematic, research-based approach for giving every Georgia student access to the literacy abilities they need to thrive. GSTA looks forward to supporting this effort in any way possible. Please do not hesitate to reach out for additional information or to discuss next steps.

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- This statement is based in part on Speaking Up For Science and Social Studies, a presentation by Dr. Nell K. Duke, available here: https://www.youtube.com/watch?v=LAWO2lvAnjI.

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