twig SCIENCE

White Paper

Using Science to Accelerate Literacy in the Classroom



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The Literacy Challenge

We all know that teachers are often tight on time. With new frameworks and state standards to keep in mind, there is an increasing pressure to prepare students for state assessments while not neglecting any subject or topic. Thankfully, there are ways to teach more efficiently. An easy time-saver is teaching two subjects at once. Not only does this save time—it can also actually increase understanding among students. In fact, studies have found that incorporating literacy into other subjects, such as science, is essential to significantly improving student literacy.

Likewise, addressing literacy in, for example, science class has been shown to improve students' science skills. Yore et al. (2003) have argued that "language is fundamental to science" and "literacy strategies allow students to develop their understanding of science and to do and communicate science." Other academics, such as Brophy et al. (2013), Donovan & Bransford (2005), and Duschl & Osborne (2002), similarly argue that literacy is a fundamental part of successful disciplinary study.

"Language is fundamental to science."

Yore et al.

About Twig Science

Twig® Science from Imagine Learning was designed from the ground up for the NGSS/3-D science by award-winning STEM education specialists. Students investigate and make sense of phenomena through multiple modalities — from hands-on activities and digital and video investigations to collaborative projects — empowering each and every student to connect with learning tailored for them.

Why Is Literacy So Important?

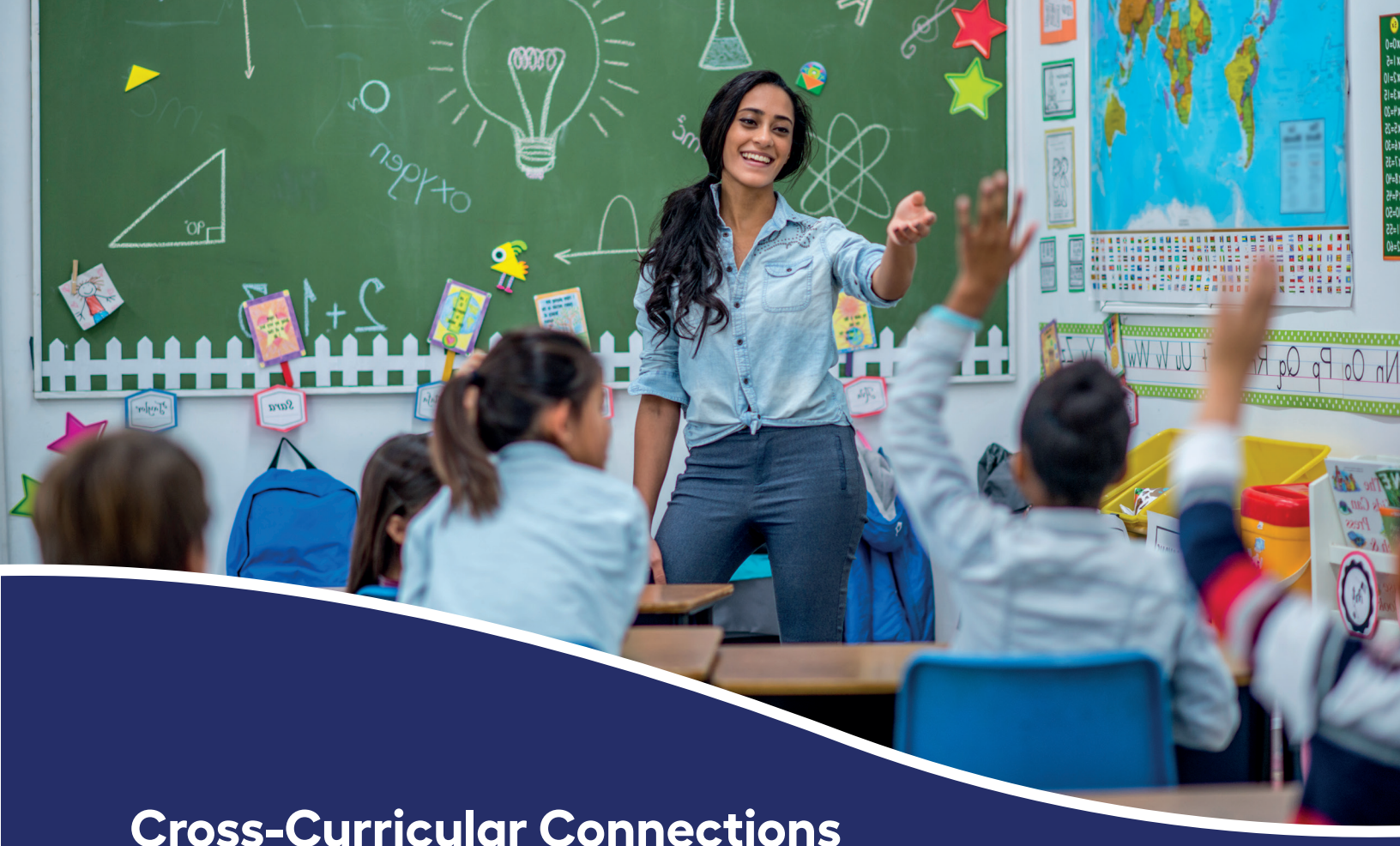
Literacy is one of the most important skills we teach students—especially today, when communication and the dissemination of information looks very different from what it did only 10 or 20 years ago. Children growing up today will have to learn not just how to read and understand information, but also how to critically analyze and synthesize information that comes from various media—text, video, social media, and so on. They will also have to create and critique their own and others' creations—not just written text, but also creations such as videos and websites.

Literacy is a multifaceted skill that needs to be addressed early and returned to again and again throughout a student's education. Nagy and Townsend (2012) argue that it's important to focus on "words as tools" rather than teaching academic vocabulary in isolation. In other words, students need to be able to actively use and apply new language in the classroom.

"Focus on words as tools, rather than teaching academic vocabulary in isolation."

Nagy and Townsend





Cross-Curricular Connections

Since literacy is a crucial skill in all disciplinary study, it is, of course, addressed in any subject-specific framework, often with emphasis placed on similar aspects such as explaining, arguing, and asking. There are, for example, numerous connections between science standards and ELA standards, such as students being expected to "engage in argumentation from evidence; construct explanations; obtain, synthesize, evaluate, and communicate information; and build a knowledge base through content-rich texts." (Wright, 2019) When applied to science, students need to be able to understand scientific language, analyze scientific content, and communicate their findings with peers.

As Thier and Daviss (2002) have argued, being scientifically literate in the 21st century means possessing "a set of skills that marries knowledge of science concepts, facts, and processes with the ability to use language to articulate and communicate about ideas." Science class is therefore an excellent opportunity for teachers to address students' literacy skills and address Tier 2 and 3 vocabulary. Incorporating literacy into science class is especially beneficial for students in nondominant groups, who due to time constraints might otherwise have to prioritize literacy over other subjects, such as science.

The Importance of Tier 2 Vocabulary

While most students arrive at school fairly confident in Tier 1 language (common, everyday speech that is used in day-to-day life), it takes time to build up a broad Tier 2 and 3 vocabulary. Tier 3 words are subject-specific words that we rarely come across day to day—for example, scientific vocabulary such as "molecule" or "isotope." Tier 2 words, meanwhile, are not used as often in everyday speech, but are common in written text, and can be applied to many contexts and subjects. These are words such as "analyze," "process," or "accurate." Beck et al. (2002), who first came up with the three-tier vocabulary model, argue that Tier 2 words are crucial for comprehension, as they are wide ranging and occur frequently in various domains. As such, they are incredibly important for students to master in order for them to understand disciplinary text and confidently discuss various topics.

The Three-Tier Vocabulary Model

Tier 1	Basic Words	house, animal, table, pencil, book, find, look, etc.
Tier 2	High-Utility Words	analyze, process, accurate, evaluate, significant, interpret, correspond, consequence, etc.
Tier 3	Academic Content Words	molecule, isotope, biome, irrigation, photosynthesis, alliteration, estuary, etc.

Inquiry-Based Instruction

A powerful way to approach literacy in science class is inquiry-based science instruction. Students are allowed to be curious about the world, go searching for answers, communicate and collaborate with their peers, and put their ideas into words. The benefit of this is twofold: students practice and improve their literacy skills while also learning about science. As Hapgood and Palincsar (2006) argue, "to build literacy [...] students need opportunities to use oral and written language to learn about the world and to communicate their ideas and observations." An inquiry-based approach to science will accelerate students' exposure to tiered vocabulary as they take part in discussions through investigations of new concepts. Ultimately, they become more confident both in approaching STEM topics and in tackling complex language and texts, as well as multimedia content.



Literacy Support in Twig Science

All this research points to two things: literacy is central to student success in disciplinary studies, and promoting literacy in disciplinary studies is beneficial to students' overall literacy skills. For teachers, this means that the focus should lie in incorporating literacy wherever they can. The good news is that many teachers likely already do this, at least to some extent, without realizing it. Each time you ask your students to watch a video or read a text and discuss it with their peers, or when you tell them to go off and do their own research, you are in fact addressing literacy.

However, there are also more deliberate ways of doing this. In Twig Science, we have made sure to include clear strategies and scaffolding in order to support teachers in the classroom:

- Videos include closed-captioning for text tracking and vocabulary building, plus related infographics to solidify vocabulary.
- Prior-Knowledge Read-Alouds address background knowledge and academic content vocabulary while providing examples of informational text and scientific writing models.
- Student Twig Books provide myriad opportunities for writing, reading, and interpreting text.
- Magazine-style leveled readers (with mini-lessons) give opportunities for developing close-reading strategies and comparing comprehension between first and second reads. These also include vocabulary and decoding support with phonemic awareness, word study, Enhanced Tier 2 Vocabulary Routines, and more.
- Stanford SCALE Language Routines are embedded throughout the program, providing plenty of opportunities for addressing literacy skills and preparing students for state assessments.
- Built-in English Language Arts / English Language Development Supports, such as text supports, additional definitions, and context clues help accelerate English Language proficiency and give students confidence in speaking, reading, writing, and listening domains.

All of these supports encourage students to become observant readers, critical thinkers, effective communicators, and inquisitive learners—all skills necessary to master both science and literacy. And students do all this while exploring the world around them, learning about fascinating phenomena, and working as real scientists. In the words of Hapgood and Palincsar (2006), "learning about the world and sharing one's own discoveries can be powerful motivators for learning to read, write, and speak effectively."



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