GREAT MINDS

every child is capable of greatness

What is the Relationship Between Knowledge and Learning?

QUICK LINKS

Knowledge acquisition begins in infancy and continues throughout a person's life.

Knowledge is everywhere, just waiting to be acquired.

Knowledge crosses every subject area and grade level.

But how do students build new knowledge and connect that knowledge to what they already know?

How do you show students that you can "have a great heart" both literally and figuratively? How do you help your youngest students get excited about counting—and how can you help them see that art can open the door to this learning? And how do you help students understand that chemical reactions don't just take place in science labs but happen in real life, even affecting works of art like the Statue of Liberty? **By ensuring that knowledge-building takes place everywhere.**

When students work with rich knowledge-building curricula throughout their school experience, their knowledge grows exponentially. When students are provided the tools to build knowledge, they are given access to understand the world.

Building Layers of Knowledge

To understand how curriculum can help students build enduring knowledge, let's first ground the discussion in working definitions of the types of knowledge that impact students' learning. Understanding the relationship between existing knowledge and new knowledge—and, when needed, how to bridge the gap between the two—is critical for ensuring that students have the right learning conditions in place to build knowledge. Here are three types of knowledge that impact student learning.

- ☐ **Prior knowledge**: This is the knowledge that students have previously acquired that they can draw upon to support new learning. Students may acquire this knowledge through their own cultural experiences and practices (i.e., funds of knowledge) or exposure to related content such as a book, TV show, movie, song, or trip to a museum or cultural center. Students also build prior knowledge from previous instruction in school. As students learn more, their prior knowledge grows, but it is important to remember that students' prior knowledge may be incomplete or include misconceptions.

- ☐ **Assumed knowledge:** This is the knowledge that an author assumes the reader has already acquired before engaging with their text. No author provides every detail needed to make sense of a text and expects that readers will be able to draw on their own prior knowledge to fill in gaps or to make inferences. Not all students bring the same prior knowledge to a text. If students do not have the assumed knowledge required to understand a text, they are likely to struggle to fully comprehend the text and learn from it.

- ☐ **Background knowledge:** This is the knowledge that content-rich curricula can provide to students through strategic selection, sequencing, and repetition of key topics and ideas. Building background knowledge ensures no student is left without important assumed knowledge needed to access new content, regardless of the depth or accuracy of the prior knowledge they had on a topic. Educators may need to explicitly teach contextual information to help students better understand new concepts and content. Today's background knowledge is tomorrow's prior knowledge.

How do these types of knowledge work together in the classroom to help students build enduring knowledge? Let's look at some research and examples.

Prior knowledge

Helping students activate their prior knowledge primes students for new learning. As Natalie Wexler states in *The Knowledge Gap* (2019), "The more knowledge a child starts with, the more likely she is to acquire yet more knowledge. She'll read more and understand and retain information better, because knowledge, like Velcro, sticks best to other related knowledge" (35). When students lack sufficient prior knowledge and no one fills in needed background knowledge for them, they'll likely struggle to make meaning of a text. As cognitive scientist Daniel Willingham puts it, "There is much more to comprehending oral or written language than knowing vocabulary and syntax. Comprehension demands background knowledge because language is full of semantic breaks in which knowledge is assumed and, therefore, comprehension depends on making correct inferences" (American Federation of Teachers 2006). When students have knowledge of a topic before engaging in new learning on that topic, their cognitive load is lightened: They're not trying to learn entirely new vocabulary and content while also trying to derive meaning from the text.

One piece of evidence supporting Willingham's point comes from a 1988 study by Donna R. Recht and Lauren Leslie, in which students were asked to retell a written account of a baseball game. This research showed that when students—even strong readers—don't have prior knowledge of the topic of a text, their comprehension of that text is greatly diminished. The research also showed that even readers who struggle may demonstrate higher comprehension of the text if they have prior knowledge of the topic. As Natalie Wexler puts it, "A student's ability to comprehend a text will vary depending on his familiarity with the subject; no degree of 'skill' will help if he lacks the knowledge to understand it" (30).

By helping students access and activate their prior knowledge, teachers can better understand what students already know and can identify students' misconceptions and gaps in their understanding. While prior knowledge is usually an advantage for students in their learning, it can present challenges if the student holds misconceptions or inaccurate information, which can inhibit students' reading comprehension. Smith et al. (2021) highlight studies that found when the information in a text contradicted students' prior knowledge, the students often gave preference to their prior knowledge.

Additionally, when educators ask students to draw upon their prior knowledge, they are encouraging students to bring their own cultural experiences and practices into the classroom. When educators understand the home experiences of their students, they can look for ways to connect students' lived experiences with new learning, making the content feel more real and accessible to students. Researchers Moll et al. found in their 1992 study that teachers are "the bridge between the students' world, theirs and their family's fund of knowledge, and the classroom experience" (137). When teachers welcome students' funds of knowledge into the classroom, students' lived experiences are validated, students learn from each other, and their lived experiences form part of the foundation upon which new knowledge can be built.

Background knowledge and assumed knowledge

In *The Knowledge Gap*, Natalie Wexler explores how background knowledge relates to assumed knowledge. She writes, "Authors leave out information for the same reasons we all do: they don't want to bore their audiences, they assume readers have a certain amount of knowledge, and they rely on them to use it to fill in what's missing" (52). It may seem as though this is not an insurmountable problem and that students can learn the missing context, but Wexler explains how much assumed knowledge can affect students' comprehension and retention of information: "By the time you've Googled the meaning of a word, you've interrupted the flow of understanding that comprehension depends on; readers begin to find a text difficult to understand when a mere 2 percent of the vocabulary is unfamiliar" (52).

What does it feel like to lack the necessary background knowledge? In his video "Teaching Reading is Teaching Content" (2009), Daniel Willingham offers this potentially mystifying sentence as an example: "This brain scan is fuzzy, so I think the patient was wearing makeup" (2:35). For this sentence to have meaning, the reader must know about brain scans as well as the ingredients of makeup products. As Willingham points out, the background knowledge and assumed knowledge needed to understand the point of the sentence is that "brain scans use magnets, so metal makes images fuzzy" and that "makeup contains trace amounts of metal" (2:53). Without this knowledge, rendering any meaning from the sentence is nearly impossible.

Students who arrive at a text with insufficient prior knowledge will struggle with the text. Before students approach a new text, educators should help supply the necessary background information, but they need to do so in a meaningful way that contributes to learning and is not simply providing disconnected facts. Students can build background knowledge in a multitude of ways. They may look at works of art, listen to a recording, read articles, or read excerpts of other texts that provide background information for the learning task ahead.

Educators must consider students' prior knowledge and the assumed knowledge required by a text or new learning. Only then can educators determine what background knowledge is essential for students to successfully engage in new learning.

Building Knowledge Across Content Areas

While many of the above examples imply that students are accessing a written text, students need background knowledge to make sense of learning outside the ELA classroom too. "Texts" can be any medium for learning—such as videos, art, cultural experiences, music, poetry, and pictures. Therefore, educators must consider the background knowledge required for new learning for students across all content areas.

Imagine students who are reading about cells in the science classroom but have never seen a picture of a cell, do not know the definition of the word, and are thinking it is spelled *sell*. These students are likely using so much cognitive power trying to reconcile what the word is and what it might mean that they're not able to retain information about the topic, whether it is provided through text or through direct instruction. Additionally, students may struggle to build enduring knowledge if the information they're learning in the classroom contradicts or challenges their prior knowledge. Students are more likely to build new knowledge if their prior knowledge is acknowledged and they are supported in reassessing their prior knowledge when presented with new information (Campbell, Schwarz, and Windschitl 2016). Without this opportunity to revisit existing knowledge after the introduction of new information, students may treat the new information as facts to be memorized rather than information to connect to their existing knowledge.

Read the **science knowledge-building paper** to learn more about supporting student misconceptions.

Now consider students in the math classroom. Word problems are notorious for tripping up students if they have trouble comprehending the sentences or if the scenario is unrelatable to them, so assumed knowledge matters here as well. Much of math instruction is also built on the assumption that students have mastered the concepts and content that form the background knowledge for their current learning. However, if educators do not check to confirm that students know, for example, what an equal sign represents, then subsequent student learning is complicated. Daniel Willingham (2009/2010) offers the example that "if you think an equal sign means 'put the answer here,' you'll be confused the first time you see an equation with terms on *both* sides of the equal sign" (17–18). Students without an accurate and complete understanding of what an equal sign means will need educators to help them acquire that background knowledge for future learning.

Read more about the **building enduring math knowledge.**

Educators serve as a bridge between students' current knowledge and the knowledge students need to successfully access new learning. To make this connection work, educators need to understand students' prior knowledge in order to prime students for new learning. Educators must also assess the assumed knowledge expected by curriculum texts to identify gaps, if any, between that assumed knowledge and students' prior knowledge. Educators then can prioritize the background knowledge students need to comprehend their new learning and address any incomplete knowledge or misconceptions so that students can meaningfully build new knowledge.

Building Knowledge Within and Across Disciplines

Knowledge acquisition is multifaceted. The same topic revisited in multiple content areas serves as a vehicle for both knowledge building and skill building. Let's take for example a topic that captivates many students: space. For many students, they will only learn about space in the science classroom. But with knowledge-building curricula, the topic of space can provide students a real-world context to apply their learning in the math or English language arts classroom. How can studying space travel through each of these disciplines help students build knowledge?

> As early as elementary school, students can start applying mathematical learning to their understanding of space travel. In *Eureka Math²*™ Grade 2 Module 5, as students learn about customary measurement, they explore an example from history—the challenge of calculating the distance to the moon. They consider questions such as the following:

- *Which unit of measurement would be the best to measure the distance to the moon?*
- *What are human computers and how are their roles important?*
- *What could go wrong if people use different measurement units?*

As part of this learning, students build knowledge about the NASA space program as they study the mathematicians, engineers, and human computers—Katherine Johnson, Mary Jackson, and Dorothy Vaughan—whose calculations helped NASA safely send the first American astronaut to space and back in 1961 and the first humans to the Moon in 1969. Students also see that what they're learning has a tangible application to the world and to human history.

Students also explore space in Grade 3 Module 2 of *Wit & Wisdom®*, and *Arts & Letters*™ English language arts. Over the course of this outer space module, students read *Moonshot: The Flight of Apollo 11* by Brian Floca to examine the historic Apollo 11 moon landing and answer the Essential Question: How do people learn about space? But in learning the history and science behind this event, students will also explore language arts concepts and skills, including why introductory paragraphs are important; how to ask and answer questions about a new text, citing evidence from texts; how to identify the parts of an introductory paragraph for an opinion essay; and how the text helps students build knowledge.

Students revisit *Moonshot: The Flight of Apollo 11* when they learn about orbit and rotation in Grade 5 Module 4 of *PhD Science®*. Students draw on their prior knowledge about the Moon as they seek to answer the Essential Question: How can we explain our observations of the sun, the moon, and stars from earth? Students bring to the module their Grade 2 knowledge about how the distance to the moon is calculated and how that distance can change and about humans' historic relationship with and evolving knowledge of the moon.

Knowledge, in All Forms, Matters

Knowledge matters for student learning. Students learn better when they have prior knowledge to bring into new learning, when the topics and texts they explore have rich content and are worthy of discussion, and when students are continually given opportunities to build more knowledge by studying topics in a coherent manner. When educators can help students navigate gaps between their prior knowledge and their new learning—bridging the assumed knowledge gap—and then find a meaningful way to share that critical background knowledge with students so that it "sticks," students will build even more knowledge. No student should be left behind or at a deficit because their prior knowledge falls short of what the text or topic demands. Students are knowledge builders; they deserve coherent curricular materials that help them build enduring knowledge within and across content areas.

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