

Concept Knowledge: Learner, Text, and Instruction

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Learning is a dynamic process. Students encounter various information in various contexts through various people throughout their lives. Consequently, each student brings her/his individual knowledge to the same classroom learning situation. Many students, however, struggle learning content in social studies, science, and other disciplines. To address learning challenges, educators often teach learning strategies such as summarizing, determining main idea, highlighting important information, understanding graphical features (e.g., maps, timelines, flow charts), or disciplinary reading (e.g., reading like an historian). While these approaches are certainly helpful, students still need to build a deep knowledge of content. Students must be able to then apply this learned information when they encounter new information.

This article presents a model for how to deepen students' comprehension: (1) the role of the learner's prior knowledge, (2) the interaction between the learner and text, and (3) the instructional support required to support this learner-text interaction. (See Figure 1.)

[Insert Figure 1 here]

The Learner

Memorization Versus Learning

While learning, particularly in the disciplines, students are exposed to new facts, new concepts, new vocabulary, new graphical features, new ways of thinking about the past, and so on. Because of so much new information, understanding new content becomes difficult. As a result, learning is plagued by a reputation of memorizing facts, dates, events, definitions, names, etc. Memorizing does not always lead to learning.

For instance, most fourth-grade students in the United States learn about the period leading up to the American Revolution (Lord & Noel, 2016). They study the Boston Tea Party, they learn that the colonists tossed the tea into the Boston Harbor as they chanted *no taxation without representation*, they learn that the colonists were angry with the British, and so on. Fourth graders, however, may not understand key concepts such as taxation, representation, or rebellion (Lord, under review). And they likely struggle with concepts such as independence, colonization, and democracy. They may memorize facts, but without understanding rebellion, they may not remember or be able to use the Boston Tea Party events when learning about another insurgence.

Memorizing leads to reproducing text – sometimes verbatim. Theorists, for years, have cautioned educators about teaching disconnected information or “inert ideas” (Whitehead, 1929, p.1) since it leads to the “passive reception of disconnected ideas” (Whitehead, 1929, p. 2). Learning factual information is important, but it is not always accomplished through rote memorization. Facts are not learned in a single instance, and when students do remember factual information, it is likely that they have adequate prior knowledge (National Academies of Sciences, Engineering, and Medicine [NAS], 2018).

When information is not committed to long-term memory, students’ working memory has duration and capacity limitations (Sweller, 1994). Simply, students cannot hold random disconnected information in working memory for a long period of time – the new information must connect to information stored in long-term memory. Therefore, students require adequate knowledge of how all these facts fit together. The research findings are clear – “facts that are placed into a rich structure are easier to remember than isolated or disconnected ones” (NAS, 2018, p. 50).

Importance of Prior Knowledge

For learning to occur, students must comprehend the information. Students must not only understand what the text says but also what the text means (Zwaan, 2016). As students read words and phrases, they determine the linguistic, semantic, and rhetorical structure relations between these words and phrases – in other words, *students comprehend what the text says* (Kintsch, 1998; Zwaan, 2016). This level of comprehension is called the textbase. Students move beyond the textbase when they elaborate this information provided by the text and integrate it with prior knowledge – *students now comprehend what the text means*. This deeper level of comprehension is called the situation model (Kintsch, 1998; Zwaan, 2016).

Prior knowledge deepens students' comprehension and supports learning. There are key benefits to students' prior knowledge:

- (1) Increases processing speed: Knowledge provides a framework for incoming novel information so that students do not need to remember every detail. This reduces their cognitive load or the amount of information that they need to attend to while learning. This knowledge, however, must be retrieved automatically (Sweller, 1994).
- (2) Focuses students' attention: Knowledge helps students discern relevant from irrelevant information, locate new information accurately and rapidly, and make a more deliberate use of knowledge. Knowledge helps them sift through important and unimportant information (NAS, 2018).
- (3) Enhances inferencing and problem solving: Students with adequate prior knowledge make connections (or inferences) between pieces of information. Their knowledge supports generalization, categorization, and problem solving (NAS, 2018).

(4) Facilitates comprehension: Students retain more information. For years, research has indicated that children and adults with prior knowledge about a topic have better comprehension of the text than those with little prior knowledge (Chiesi, Spilich, & Voss, 1979; Pearson, Hansen, & Gordon, 1979; Schneider, Korkel, & Weinert, 1989).

(5) Promotes transfer. Transfer can be defined as initial learning and then applying what was learned when learning something new (Chi & VanLehn, 2012). Students detect common ideas between what they know and what they are learning.

Overall, prior knowledge is a key ingredient in learning and transfer. Transfer is efficient and can support independent learning. Still, transferable ideas must be identified, defined, and taught so that students recognize and understand *underlying* or implied ideas, and then readily access and apply these ideas when learning new information (NAS, 2018).

Text and the Learner: The Interaction

Most explicit text information supports students' comprehension of what the text says (text-based representation). Text, however, also includes underlying information to support students' comprehension of what the text means (construction of the situation model) (Kintsch, 1998; Zwaan, 2016). In order to comprehend, what information do students need to know that leads to learning and transfer? One key to comprehension and learning lies in the specific connections between transferable text information and students' prior knowledge.

Surface Features

Surface features (e.g., events, facts) are directly stated and include, for example, specific events like the Montgomery Bus Boycott, women's suffrage, and the Boston Tea Party, or facts such as the three branches of government. When students understand the surface features, they comprehend what the text says. However, they do not always understand what the text means.

When students only attend to the surface features, they can use the information again when they encounter similar factual information (Chi & VanLehn, 2012; Klausmeier, 1992). For instance, students may learn about the Montgomery Bus Boycott and then recognize this bus boycott when they encounter the same event in a new instructional setting.

Deep Structure

The surface features play an important role in learning. Students apply the information from the surface features as cues that lead them to determine the deep structure of text (Chi & Van Lehn, 2012). First, students must recognize and understand the important ideas from the surface features, such as the colonists were angry because they were paying taxes without representation so they tossed the tea into the harbor. Then they use these explicit ideas to determine the deep structure (or implied information) of, in this instance, the concept of rebellion. This deep structure often pertains to what the text means.

Concepts. Concepts are abstract, implicit, and often unstated. For example, the specific event of refusing to ride the bus is not the idea that can be applied when learning about the Boston Tea Party or women's suffrage. The concept of rebellion is at the deep structure and is essentially the meaning of these events.

Written and spoken discourse include many abstract concepts. For instance, in the area of social studies, concepts include rebellion, representation, immigration, governance, and so on. In science instruction, concepts include habitats, adaptation, water cycle, and many others. These concepts are abstract ideas – mental representations of a person's "organized information about objects, events, actions, qualities, or relationships" (Klausmeier, 1992, p. 268) and include ways of thinking, feeling, or behaving (Parker, 2009).

Students' conceptual knowledge. Students require prior knowledge of the concepts in order to comprehend what the *text means*. The problem occurs when students have not yet learned an important concept. Without adequate prior conceptual knowledge, their comprehension of the information remains only of what the text says (or textbase) (Klausmeier, 1992). Author (under review) found that many fourth-grade students did not yet have adequate knowledge of common concepts (e.g., representation, rebellion, invention, exploration, migration) even though the simple stories that they read included known everyday events.

Conceptual understanding is not easily attained. Since concepts are not the same as names and dates, understanding concepts requires knowledge of the concept and the ability to identify specific examples the concept. Klausmeier (1992) provides a helpful framework. He explains four levels: concrete, identity, classificatory, and formal. At the *concrete* level, students initially learn about a concept and then recognize the learned concept in an identical event. At the *identity* level, students can generalize the concept to a different example of the same event. Next, at the *classificatory* level, students conclude that two different events encompass the same concept. This is an important level of understanding because they are now able to connect dissimilar situations (surface features) by determining the same deep structure of rebellion. Finally, at the *formal* level, students now recognize examples as well as non-examples; they can name the concept and define its attributes.

It is important to note that in order to apply knowledge of a concept to learn about a new event or fact portraying the same concept, students must possess conceptual knowledge at either the classificatory level or formal level (Klausmeier, 1992). As a result, when students first read about the period right before the American Revolution and possess adequate prior knowledge about representation, rebellion, and taxation, they understand that unfair taxation and lack of

representation leads to angry citizens. These citizens become activists as they stand up for their rights.

Students' concept knowledge supports learning and retention of facts – factual information organizes around concepts. When students understand the important concepts, they then require a “firm foundation of factual knowledge ordered around the key concepts of the discipline” (Lee, 2005, p.31). For instance, when students are introduced to factual information concerning the Boston Tea Party *and* the recurring concept of rebellion, and if students *understand* the recurring nature of rebellion (e.g., civil rights' movement, women's rights, migrants' rights), this conceptual knowledge may support learning factual knowledge of the Boston Tea Party. If students, however, do not understand the concept of rebellion and the recurring nature of rebellion, new factual information about the Boston Tea Party remains disconnected.

As a result of conceptual knowledge, students comprehend, they learn, and they are then able to apply (i.e., transfer) this learned information when learning new information (Chi & VanLehn, 2012). For this level of learning to occur, however, there are two key caveats: (1) students need to know to look for the deep structure, and (2) students require prior knowledge of the concepts. When students determine the deep structure of the text (concepts) and comprehend what the text means (construct a situation model), they are then likely to determine that the Boston Tea Party and the Montgomery Bus Boycott are both examples of rebellion.

Instruction

Teachers are instrumental in facilitating their students' comprehension and learning. Teachers must consider the knowledge that students need to support comprehension, helping students determine what the text says *and* also what the text means.

High-Utility, Recurring Concepts

Concept knowledge is critical to comprehension, learning, and transfer. One way to promote and support transfer, is to recognize underlying, recurring concepts and teach them well. Teachers must first identify and organize “concrete cases and detailed knowledge” according to “the core concepts that organize our understanding of the subject matter” (Donovan & Bransford, 2005, p. 15).

For example, elementary students are already learning about various rebellions (Author, 2016). Therefore, teaching rebellion (causes, methods, outcomes) through varied events and/or people – Boston Tea Party, Martin Luther King, Jr., activism during the Holocaust, the Underground Railroad, Occupy Wall Street, and a local strike to save a park – supports teaching and learning. Once students learn the concept, they are more likely to determine rebellion when they read about a new event, making connections between those they have learned and what they are learning.

The benefits of concept instruction. There are teaching and learning benefits to addressing high-utility, recurring concepts. First, since there are fewer concepts than events, facts, dates, and people, concept instruction is efficient. For instance, there are many accounts of activism – past and present – and all of these events are held together by one key idea. Teaching students about various rebellions, individually, requires repeated instruction of many events. Teaching rebellion (causes, methods, outcomes) through a few varied events eases the need for extensive instruction of each rebellion separately.

A second learning benefit is that known concepts become prior knowledge, and prior knowledge is essential for comprehension and learning. When students acquire adequate knowledge of high-utility, recurring concepts, these concepts serve as prior knowledge. This

knowledge reduces students' cognitive load and increases processing speed. For instance, when students learn the concept well, they are more likely to determine rebellion when they read or hear about a rebellious event or person. They make appropriate connections between those accounts they have learned and the new one they are learning about. Furthermore, since concepts function at the deep structure of text, students' learning has moved beyond the surface features, allowing students to comprehend what the text means.

The third benefit is that concepts transfer. The idea that holds the information concerning the Boston Tea Party, the Montgomery Bus Boycott, and Cesar Chavez is the concept of activism or rebellion...not the isolated events. Students' knowledge of rebellion provides opportunities for transfer. Both depth of knowledge (knowing the concept well) and breadth of knowledge (recognizing the concept in other settings or generalizing) promote transfer (Chi & vanLehn, 2012).

Depth of Instruction

After selecting key concepts, it is important to first teach the concept with relevant information so that students learn the concept with ideas that connect to-be-learned information to students' prior knowledge – that is, information that is relevant to their lives. For instance, rebellion, citizens' rights, elections, or the water cycle are part of students' everyday lives, they just need to know it. When new information connects to their lives, and they understand that connection, they realize that they are not separate from the events of the world.

These relevant connections also provide a solid foundation to build from, and then become connections between the known event and the unknown events. For instance, before teaching about the Boston Tea Party, secure students' understanding about the concept of rebellion by including relatable situations of activism such as a local strike, school petition, or a

children's book with a rebellious story character. Discuss the ideas in depth including causes, methods of activism, and outcomes. The key point is selecting a relevant example of a concept that students understand. This example can then serve as an anchor for learning or prior knowledge.

Breadth of Instruction

The next goal must be to ensure that students can determine that different events or facts involve the same concept. This involves teaching the concept widely with varied examples. According to Rugg (1921), students require “constant practice in generalization” (p. 701). Therefore, when teaching rebellion, teachers can provide students repeated exposure of the concept in various contexts (e.g., Boston Tea Party, women's suffrage, a petition to save a park) and time periods (e.g., contemporary and historical accounts).

In planning instruction, provide students opportunities to detect differences and similarities of the same concept (patterns) across various situations. Students must understand how the learned concept in one situation is also present in the second situation, detecting what is the same and what is different in both situations. This is a critical step that leads to transfer (Hattie & Donaghue, 2016). For instance, there are many accounts of activism/rebellion – past and present – and all of these events are held together by one key idea. Students must learn concepts well enough to achieve *automation (or automatic retrieval) and be able to recognize* these concepts in varied settings.

Conclusion

Overall, there is much information to learn in each discipline, therefore, educators can support students' learning by structuring (or restructuring) the subject matter to deepen their understanding of the most important concepts. If the concept is introduced with relevant

information and is taught well (depth and breadth), students can then use this newly learned information during subsequent instruction.

In summary, models of comprehension, such as the RAND model of reading comprehension, help frame various components – text, activity, and reader within a sociocultural context (Snow, 2002). The present model (see Figure 1) addresses specific contributions of students' prior knowledge and how this knowledge contributes to comprehension and learning. *What the text presents must guide what we teach.* If concepts recur and are transferable, it makes good sense to provide direct, explicit instruction of these concepts and to allow students opportunities to encounter them in various settings to ensure generalizability. Instructional focus might best serve students if what students are learning builds knowledge of transferable ideas.

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