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Leveraging AI to Enhance Vocabulary Instruction: A Teacher's Guide

By Dr. Elfrieda H. Hiebert

The vocabulary gap among students remains one of education's most persistent challenges. Research consistently shows that students from different socioeconomic backgrounds enter school with disparate vocabulary exposure and levels (Hart & Risley, 1999). This divide can have profound implications for academic success across all subject areas, affecting not just reading comprehension but also writing ability, content-area learning, and overall academic achievement. But recent advances in artificial intelligence (AI) models offer promising solutions for teachers in closing the vocabulary gap. Computational advances have revolutionized language analysis beyond basic metrics of frequency and sentence length. We can now explore richer dimensions of language, such as when children acquire words and the spectrum between concrete and abstract concepts. Such sophisticated analysis holds promise for vocabulary instruction that supports student learning. This paper explores how AI can transform three critical aspects of vocabulary instruction: word selection, activity design, and assessment.

A Framework for Word Selection: Enriching Teachers' Expertise

The conventional approach to vocabulary selection has relied heavily on educators trusting publishers' recommendations or picking words from texts that they view as new or interesting to students. But typically, there are many more words in texts that can be taught. For example, analyses of middle-grade texts reveal that approximately 8% of words are likely to occur infrequently or rarely in texts (Hiebert et al., 2024). In a novel like *Ninth Ward* by Jewell Parker Rhodes (2012), this translates to roughly

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375 potentially challenging words for the last three chapters alone. This amount is far more than teachers can practically address through conventional instruction methods, a dilemma that has historically challenged teachers in selecting words for vocabulary instruction. AI changes this dynamic by helping teachers systematically identify which words are most crucial for instruction based on multiple factors, including importance to comprehension. Professional judgment remains absolutely essential. In fact, it becomes even more important as AI provides more options for vocabulary instruction.

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Theme-Related Vocabulary

One of AI's most powerful capabilities is identifying theme-related vocabulary, including words that might not appear explicitly in the text. Consider how this works in practice with the novel *Ninth Ward*, which follows a young girl's experience during Hurricane Katrina. When analyzing this text, AI doesn't just identify storm-related words like *gale, surge,* and *flood*. It goes deeper, finding words that capture the underlying themes of the story, even when those precise words do not appear in the text. For example, while Lanesha, the protagonist in *Ninth Ward*, demonstrates remarkable resilience throughout her ordeal, the word *resilience* itself never appears in the text. AI identifies the vocabulary for this implicit theme (*resilience, perseverance*) and, as shown in Table 1, other words representing essential themes in the text but not explicitly stated, such as *community* and *devastation*. Teachers can support students in finding the places in texts that exemplify these themes, fostering both vocabulary and comprehension development.

Challenging Words

AI's analysis of potentially challenging words goes beyond simple frequency counts or readability measures. It considers multiple dimensions of word difficulty, as evident in the five words proposed as challenging in Table 1. These words present potential challenges for less proficient sixth-grade readers, particularly given their varied origins. For example, the French origins of the word *debris* give it an unexpected pronunciation pattern that differs from typical English phonics rules, and it's likely outside most students' everyday vocabulary. While *angling* and

Table 1. Words in Four Categories: AI Recommendations from *Ninth Ward* (Chapters 13–15)

Theme	Challenge	General Academic	Concrete
• devastation • exhaustion • fortitude • community • resilience	• debris • angling • mooring • perpendicular • bobbles	• balance • current • horizon • symbol • parallel	• gutter • shingles • hatchet • tarp • levee

perpendicular might be familiar from math class, the inclusion of these words that illustrate Lanesha's engineering-focused perspective requires students to extend their understandings of these words. *Mooring* is another potentially difficult word. While students might have encountered *Moors* in a social studies text, the origins of *mooring* are quite different and pertain to a practice—securing a vessel—that is likely unfamiliar to many middle-grade students. Even a seemingly simple word like *bobbles* can be challenging because it takes the familiar root *bob* but uses it in an unusual form that rarely appears in everyday conversation.

High-Utility Academic Vocabulary

Perhaps one of AI's most valuable contributions to vocabulary instruction is its ability to identify words that students will encounter repeatedly across different subjects and at higher reading levels. These high-utility academic words often form word families that extend across multiple contexts and disciplines.

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The word family centered around *balance* is illustrated in the vocabulary of *Ninth Ward*. The basic form of the word appears in descriptions of physical balance, but related forms like *unbalanced, rebalance*, and *counterbalance* extend its meaning. Students are receiving support in learning a word family that appears across multiple academic contexts: in science (balanced forces), mathematics (balanced equations), and social studies (balance of power).

Concrete Vocabulary

Concrete words, despite their tangible nature, cannot be assumed to be universally understood by students. For example, words such as *magnolia* or *jambalaya* from *Ninth Ward* may not be apparent to all middle graders. While concrete words theoretically should be easier to learn since they refer to physical objects or perceptible experiences, this advantage only exists if students have had exposure to the concept. AI systems that incorporate concreteness ratings alongside other metrics can better differentiate between words that might benefit from visual instruction strategies (highly concrete words) and those requiring more abstract instruction, such as the high-utility academic words. A brief visual or description can help students grasp the meanings of unfamiliar words like *jambalaya* or *magnolia*.

Summary of Strategic Word Selection

AI-supported vocabulary analysis can help teachers identify various word types—thematic, challenging, academic, and concrete—enabling more targeted instruction. This allows teachers to customize the depth of vocabulary teaching, determining which words

need extensive practice versus brief exposure. This approach allows students to master more vocabulary during instructional time than the traditional method of learning six to eight words weekly from text (Stahl & Nagy, 2007).

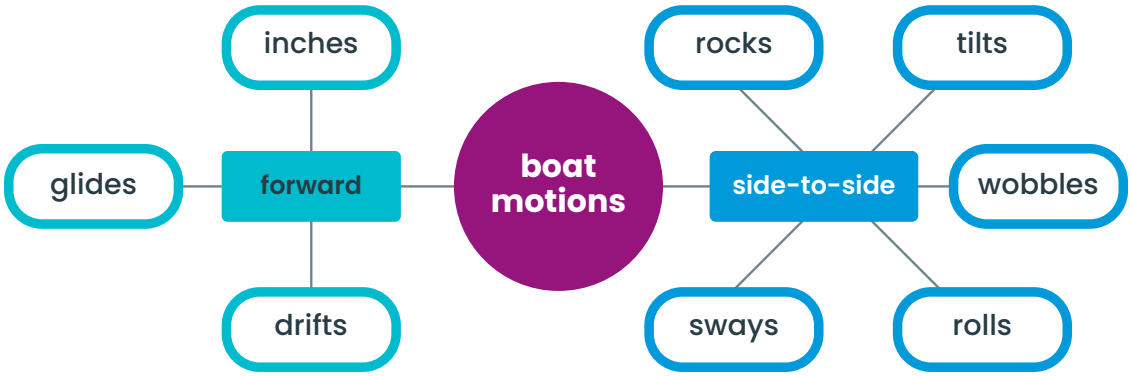
Designing Engaging Activities with AI Support

The identification of important vocabulary words is only the first step. AI can also transform how we teach these words through two powerful vocabulary activities: semantic mapping and semantic gradients.

Semantic Maps: Building Word Networks

AI's ability to generate semantic maps can give teachers an aid in supporting their students' understandings of the connections between words. Semantic maps show relationships between words and concepts in ways that help students build mental networks of word meanings. Authors often use a variety of words to describe a trait, event, or movement. When students understand the nuances of meaning conveyed by a group of words, their comprehension is aided, as is their vocabularies for writing and speaking. For example, in *Ninth Ward*, the author uses a range of words to describe the movement of the boat: *bobbles, wobbles, sways, rocks, tilts, rolls, glides, drifts*, and *inches*. Both a complex and a simplified semantic map, generated through AI, appear in Figure 1.

Figure 1 AI-Generated Semantic Maps of Boat Motion Words



Teachers can use these maps as starting points, modifying them based on their goals and students' backgrounds. Students can then generate their own maps around vocabulary from themes in the text. Maps can grow and change as students encounter new words and make new connections.

Semantic Gradients: Understanding Word Relations

One critical aspect of vocabulary knowledge is understanding subtle differences between related words. AI can create semantic gradients that show these nuanced relationships. As with semantic maps, both a complex and simplified version of

a semantic gradient is given in Figure 2. These semantic gradients illustrate the nuanced relationships among words having to do with rainfall. A drizzle might cause minor inconvenience, while a deluge leads to flooding that requires evacuation.

Figure 2 AI-Generated Semantic Gradients of Words for Rain

Intensity	Word	Description
Lightest	mist	Extremely fine water droplets, almost like a cloud touching the ground
Light	sprinkle	Very light, sporadic drops barely wetting the surface
Light-Medium	drizzle	Continuous but very light rain, more substantial than a sprinkle
Medium	shower	More consistent rainfall, but still relatively gentle
Medium	rain	Standard, typical rainfall with moderate droplets and consistent flow
Medium-Heavy	downpour	Intense, heavy rainfall that comes down strongly
Heavy	deluge	Extremely heavy rain, almost overwhelming in its intensity
Heaviest	cloudburst	Sudden, extremely intense rainfall with maximum precipitation

Activities in which students identify, sort, and describe words in such gradients can serve multiple learning purposes, including providing them with a range of options for expressing similar but distinct ideas in their writing. As importantly, students can develop deeper knowledge of relationships among words and how subtle differences in meaning can influence communication.

Reimagining Assessment with AI

Another piece of the vocabulary instruction puzzle is assessment, and here too, AI can offer support. Traditional vocabulary assessment often relies heavily on matching definitions or synonyms. Such tasks may not accurately reflect students' ability to understand and use words in context. AI can support vocabulary assessments that provide feedback about students' knowledge of vocabulary, both prior to and after instruction.

Contextualized Sentence Assessments

Rather than presenting isolated words or simplified contexts, AI can select sentences from texts for vocabulary assessments. The sentences with target vocabulary from *Ninth Ward* are given in Table 2. The second set of sentences illustrates an assessment of students' ability to use inferences to recognize the vocabulary for implicit themes in a text such as *Ninth Ward*.

Table 2. Examples of Two Assessment Formats: AI Recommendations for Ninth Ward (Chapters 13-15)

Sentence-Level (from Target Text)	Sentence-Level (Inferencing Implicit Themes)	Maze/Passage-Level (based on Target Vocabulary)
Here are words from *Ninth Ward*: debris | fortitude | bobbles mooring | perpendicular Here are places in *Ninth Ward* where the words appear. Put the word that works best in the sentence: 1. TaShon says softly. "Strength to endure." "That's right. We're going to show _____." 2. The boat _____, side to side. Up and down. Then, it's free. 3. What if the boot's caught on something hiding beneath the water? What if it'll never be free from its _____? 4. Neither me nor TaShon scream as we see the _____ bump against our boat. 5. A sharp right angle. If it'd been parallel, it might've floated out at least on the north side. But being _____, it needs to be unstuck.	Identify which of these themes the group of sentences show: resilience | devastation community 1. _____ • "We can't do this," says TaShon, dropping his end of the trunk. "We've got to," I say. "Mama Ya Ya wouldn't want us to give up." • "I'm Lanesha. Born with a caul. Interpreter of symbols and signs. Future engineer. Shining love." 2. _____ • "The men—good Cajun folk—give us a jug of water and Power Bars." • "Thank goodness, I have TaShon." 3. _____ • "Outside, I can see water, covering one story houses, almost to their rooftops. Cars are completely covered. Lamps and electric poles look half their size." • "The horizon is like none I've seen before. Just tips of houses. Tops or halves of trees. Lampposts hacked off by water."	Directions: For each blank, circle the word that makes the most sense in the story. The water filled our streets. Looking at all the devastation made my heart hurt. Bits of _____ (flowers, debris, silver) floated everywhere in the water. Our small community was underwater, but _____ (some, we, few) weren't giving up. My big brother James and I _____ (slept, stood, danced) on our roof, watching the current below. Our _____ (laughter, exhaustion, sunshine) made it hard to keep going. But we had to stay strong and _____ (hide, show, sing) fortitude, just like Mama taught.

Maze Assessments

Maze assessments, which in the past have required detailed efforts on the part of developers, can be created in a timely fashion with target words from a text, as illustrated in Table 2. These assessments, where students select appropriate words while reading connected text, provide insights into multiple aspects of reading ability simultaneously. They show not just whether students know word meanings, but how well they can apply that knowledge while reading a related text.

Implementation in Practice

The aids that AI can give of target words, instructional activities, and assessments can support teachers' goals and lessen their already heavy workloads. But these aids are meaningless without teacher judgment. Teachers must be clear and specific about the queries they make of AI. Further, they also need to be thoughtful evaluators of whether the results of an AI search provides the content that they need to meet their instructional goals and students' needs. The key to more focus in vocabulary and a broader array of activities and assessments lies in viewing AI as a partner in the instructional process, one that enhances rather than replaces teacher expertise. When used thoughtfully, AI can help teachers make more informed decisions about vocabulary instruction while maintaining the personal touch that makes learning come alive for students.

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