

Vocabulary Quest Series Research

Research on vocabulary substantiates the necessity of providing systematic vocabulary instruction due to the following conclusions: a relationship exists between vocabulary and achievement; comprehension improves when students have a direct connection between the word and word meaning; some vocabulary is specific to the content of a subject and must be taught in context; and fluent use of vocabulary is vital to student achievement.

Mentoring Minds seeks to design products for educators that lead to student success and that are based on research. The Product Development Team sought to implement findings from research as they worked collaboratively to develop the *Vocabulary Quest Series*. The purpose of the vocabulary products is to increase the performance of students and assist educators as they strive to improve vocabulary instruction in science and math. The ability of students to achieve in these content areas is dependent upon language (Buxton, 1998; Lee & Fradd, 1998). Science and math require specialized vocabulary. Therefore, mastering content-specific vocabulary can be a challenge for all students, especially when there are some everyday words with different meanings in the math and science disciplines (Carlson, 2000). No one can depend on the assumption that students will learn the necessary vocabulary by chance. All students need and benefit from direct vocabulary instruction (Gunning, 2003; Vacca, Vacca, Cove, Burkey, Lenhart, and McKeon, 2003).The values of providing a systematic approach to teaching content vocabulary are many.

Vocabulary refers to words students need to know to communicate effectively. Vocabulary takes two forms: oral vocabulary and reading vocabulary. When we speak or listen, oral vocabulary is used. Reading vocabulary are words we use or recognize in text. Vocabulary plays an important role in comprehension of print. A word that is not part of a student's oral vocabulary causes difficulty in grasping the meaning of what the student is reading. The National Reading Panel (2000), after an extensive research review, indicated effective instruction allow for both incidental and planned instruction that includes a variety of methods for acquiring new vocabulary and extending the depth of vocabulary learned.

Vocabulary is important in learning to read. Stahl and Fairbanks (1986) concluded that instruction centered on words like the high-frequency word lists can boost a student's ability to comprehend new content by 12 percent. Building word recognition skills means increasing the number of words that a reader can recognize effortlessly and without thought. These skills lead a student to recognize words automatically. Increasing difficulties arise as students progress through the grades, particularly at the secondary level, when the reading load in content areas such as math, science, and social studies greatly increases. Reading can be easier and a student can maintain the pace as the reading load

increases if automaticity of a large group of words has been acquired early on in school. Recognizing words and phrases on sight improves reading fluency and comprehension.

The *Sight Words and Phrases Vocabulary Card Set* contains cards for 220 most commonly used words that comprise from 50% to 85% of the text found in early reading materials. These words can be sold by levels with the *Sight Words and Phrases Vocabulary Strips* product. *Sight Word Nouns Vocabulary Strips* contain 95 nouns and phrases that are found in materials for early readers. As students are introduced to new sight words, they should see the words, say the words, and spell the words. Brain research suggests that the involvement of more senses in the acquisition of knowledge leads to retention and recall of that knowledge. In the *Sight Words Word Play* book, cheers, chants, and many other multi-sensory experiences are suggested to involve the learner actively.

Students have to understand vocabulary to understand the academic content they encounter in school. Stahl and Fairbanks (1986) revealed when specific vocabulary from academic subject areas is selected as the focus of instruction, the result was a 33 percent increase. Therefore, it appears when students are taught specific content vocabulary in each subject area at each grade level, students have an excellent opportunity to acquire the academic background knowledge they need to understand the subject area content. Teaching content vocabulary using a systematic approach appears to be a powerful tool for student success (Marzano & Pickering, 2005). Furthermore, research firmly documents that academic background knowledge has an effect on academic achievement. Any intervention for the achievement of students should identify increasing students' content vocabulary knowledge through direct instruction as a leading priority (Marzano, 2004). These conclusions form the foundation for the development of the *Vocabulary Quest Series*.

When students read or study about a topic, students understand or relate to what is being studied if they understand the basic vocabulary. When this background knowledge is non-existent, then difficulty is encountered when information is read or heard. Evidence indicates that some students may have gained the background knowledge needed through exposure at home and other experiences. Other students might come to school lacking in such experiences. Consequently, gaps in learning appear and as time progresses the gaps might widen. Thus, the *Science and Math Vocabulary Wheels* and vocabulary card sets are tools teachers may use to provide the essential vocabulary needed. *Science and Math Vocabulary Wheels* encourage a systematic instructional approach and suggest strategies for teaching the vocabulary. The *Word Play* books offer a multitude of ideas for students to work individually, as partners, in groups, in teams, or as a unified whole class group to develop, review, and reinforce content vocabulary. *Vocabulary Quest Activity Card Sets* and *Giant Size Math, Science, and Sight Word Vocabulary Card Sets* present variety in differing sizes of vocabulary cards and include suggestions on engaging students in meaningful vocabulary practice.

According to scientific research, most vocabulary is developed indirectly, yet some vocabulary must be taught through direct instruction. Indirect vocabulary instruction occurs through daily encounters with the oral and written word. Students need to hear text read aloud with meaning, engage in discussions or conversations to grasp word meaning, and participate in reading extensively on their own. Learning vocabulary directly implies that students are taught specific vocabulary and strategies to learn the vocabulary.

Word-learning strategies include learning how to use reference aids. Word-learning strategies are important for English learners and native English speakers as reported by Carlo, August, and Snow (2005). Difficult words representing complex concepts and that are not a part of the experiences of a student should be taught directly. Direct instruction leads to better reading comprehension of a subject when students are taught content related vocabulary. More specifically, a higher level of comprehension exists when students work actively with vocabulary over an extended time period.

According to the writing of Thompson and Rubenstein (2000), it appears that the fluent use of content vocabulary is a factor for achievement.

To solidify student understanding of content vocabulary, students should experience the use of vocabulary in different contexts, receive increased exposure to the vocabulary, and develop word consciousness. Both the *Math Vocabulary Strategies Wheels* and the *Science Vocabulary Strategies Wheel* provide a core vocabulary list and offer the teacher multiple instructional strategies with which to establish a foundation for learning essential vocabulary. The variety in vocabulary card sets provides the student multiple yet varied opportunities for working with vocabulary.

Research shows that student interaction with others deepens the understanding of vocabulary and promotes word consciousness. Making word consciousness a necessary element of an effective vocabulary approach is strongly supported by Anderson and Nagy (1992); Beck, McKeown, and Kucan (2002); Nagy (2005). The products in the *Vocabulary Quest Series* support this finding. The vocabulary products allow teachers to incorporate opportunities for students to engage in group interaction, brainstorm, work in partners, or simply provide a time for students to share, explain, and extend their perception of words and their meanings.

Pressley (1998) supports direct instruction that allows students to elaborate on the meaning of vocabulary as opposed to merely memorizing the definition. A discussion of terms helps students correct any misunderstandings they may or may not realize existed. Collaboration helps all students learn vocabulary accurately. It is generally accepted that students can, at times, help other students develop understanding when a teacher cannot. Furthermore, we at Mentoring Minds encourage teachers to be available to students as a facilitator

and a model. The vocabulary strategies wheels advocate that teachers, when designing instructional opportunities for quality vocabulary instruction, include time to clarify or assess the level of student understanding. The role of the teacher and the assessment opportunity are both affirmed in the research as essential elements for vocabulary building.

Games are instructional opportunities that allow students to practice the meaning of vocabulary in a manner that interests students. Games excite students, help students recreate images, and provide engagement times that continue to draw the vocabulary to the forefront of the mind. Assessment opportunities of vocabulary can be offered through a game format. Multiple repetitions of the content vocabulary promote internalization of vocabulary and concepts. Research confirms that vocabulary should be revisited using varied approaches to develop fluency.

Mental Math Loop is a collection of I Have Who Has math games. These instructional experiences are fun ways to practice mathematical concepts with the entire class or a small group. Each game contains thirty 8.5" x 5.5" cards. A complete boxed set includes seven math games for the indicated grade spans: grades 2-3, grades 4-5, and grades 6-8. The game format actively engages students in critical thinking, requires students to readily apply their mathematical knowledge to solve problems, and utilizes a vocabulary emphasis. *Mental Math Loop* demonstrates students' abilities to make mathematical concept connections through intensive vocabulary reinforcement and enhancement.

Students can deepen their understanding by adding to their knowledge base of particular vocabulary terms. Encountering the vocabulary frequently to deepen the meaning is a finding upheld by Beck, McKeown and Kucan (2002) and Nagy (2005). For the repetitions to be effective, learned word meanings must have meaningful associations (Stahl and Fairbanks, 1986). Both the *Vocabulary Quest Activity Cards* and the *Vocabulary Card Sets* contain a graphic or example representation that helps the student visualize math and science words and word meanings. Other vocabulary products in the series provide multiple opportunities and multi-sensory strategies for students to revisit vocabulary as opposed to a single encounter or a one-time exposure. Studies suggest multiple exposures and interaction with knowledge over time to lead to integrating and retaining the knowledge into the memory (Rovee-Collier, 1995; Nuthall, 1999; Nagy and Anderson, 1984).

Vocabulary Adventure provides a unique avenue to address mathematics vocabulary. This research-based instructional tool employs Bloom's Taxonomy, problem solving, and journaling to develop math vocabulary while on an imaginary journey. Each vocabulary word has questions and activities showcasing critical thinking levels which add the dimensions of depth and complexity necessary to understand the word and its meaning. Students must be given opportunities to process information at different levels of thinking to cope

with the rapidly, changing world. A goal of education is to teach students to become effective thinkers (Gough, 1991). *Vocabulary Adventure* is written to reflect comprehension and learning of vocabulary based on several levels of cognitive processing. At the lower levels of thinking, students derive the meaning of the vocabulary word targeted. At the higher levels of critical thinking, skills such as demonstrating the student's ability to form inferences, to make real-world connections, and to make value judgments using the vocabulary are addressed. Journal writing is included at the end of each two-page student vocabulary activity which encourages students to put their thoughts onto paper making their thinking visible. Many writers support the value of students writing about vocabulary (Azzolino (1990); Chapman (1996); Dougherty (1996); and Mayer and Hillman (1996). Rubenstein and Thompson (2002) declared that open-ended writing prompts allow teachers to analyze a student's thoughts about vocabulary and adjust instruction to accommodate any student misunderstandings about vocabulary meaning. Research concludes when students work on activities at higher levels of thinking, combined with a variety in teaching strategies, retention and comprehension improve. Activities in *Vocabulary Adventure* provide students varied opportunities to extend their learning independently and to apply the mathematical ideas learned while developing students' higher levels of thinking.

Brain research (Sylwester, 1995; Caine and Caine, 1997) suggests teachers can promote thinking and learning. The strategies suggested on the vocabulary wheels, the activities in the *Word Play* books, and the underlying design of the entire *Vocabulary Quest Series* reinforce the major brain research findings. Implications for vocabulary application within the classroom include:

- Learning takes time. Acquisition of new vocabulary takes time and practice to consolidate knowledge;
- Connect new vocabulary to prior learning and real-world contexts;
- Create an atmosphere for vocabulary instruction that is relaxed, free of threats, yet challenges the mind;
- Incorporate varied vocabulary teaching techniques to invite learners to respond using visual, tactile, emotional and auditory preferences. For example, graphic organizers help the brain see a big idea by breaking concepts into parts. Studies involving multi-sensory teaching experiences show students achieve more gains in learning than when taught with merely a visual or an auditory approach (Farkas, 2003; Maal, 2004). Active engagement with the use of multi-sensory instruction appears to create the optimal learning setting (Stahl and Fairbanks, 1986);
- Offer immediate feedback when students are learning new vocabulary to stimulate and support students. Trillions of unconnected neurons are in the brains of babies. These neurons must be connected to other neurons to result in a better functioning brain. When students are emotionally stimulated and supported in their learning, more brain connections are formed;

- Utilize multiple forms of higher level thinking questions to increase comprehension; and,
- Employ more than the traditional forms of teaching and testing to engage student learning.

Strategies recommended on the *Math and Science Vocabulary Wheels* are reflective of the fact that students learn and think in multiple ways. Specific strategies that include oral, written, visual, auditory, and kinesthetic approaches are included on the wheels and in the *Word Play* books. Variety in vocabulary instructional strategies has been discussed by many writers (Borasi, Siegel, Fonzi, and Smith, 1998; Carbo and Hodges, 1988; Gardner, 1983;) Some researchers contend that literature coupled with teacher-student talk adds value to vocabulary (Beck and McKeown, 2001; Penno, Wilkinson & Moore, 2002). When assessing the vocabulary understanding of students, teachers should utilize a variety of assessments other than the traditional paper-and-pencil tests. The information derived from assessment is a powerful tool to monitor the development of student understanding, to revise instruction, and to provide reflection for learners. It is noted that effective teachers utilize assessment tasks as quality learning experiences (NRC, 1996). Assessment feedback supplies the learner with self-assessment information but it also enhances motivation which is crucial to achievement. Learning improves with consistent feedback (Linnenbrink and Pintrich, 2002; Pintrich and Schunk, 2002; Heath and Glen, 2005). Therefore, an assessment section was included on both the *Science and Math Vocabulary Wheels* to assist teachers in exploring different avenues in order to gain knowledge of the current understanding level of vocabulary for students and the nature of their thoughts.

Oral strategies (Silver, Kilpatrick, & Schlesinger, 1990) show the thought processes of a student, but also allow a teacher to revise the instructional format if warranted. Many authors support the need to offer visual instruction for those who need an image, such as a graphic, symbol, or picture to reinforce the word meaning or concept. Scruggs and Mastropieri (1992) recommend mnemonics, picture clues and appropriate peer assistance to help special needs students remember vocabulary words essential to concept mastery. Graphic organizers, illustrations, and other such images help a learner form initial meaning or revisit the terms to deepen and extend vocabulary relationships (Horton, Lovitt and Bergerud, 1990; Toumasis, 1995; McCoy, Baker, & Little, 1996). *Vocabulary Card Sets*, *Vocabulary Quest Activity Card Sets*, *Giant Size Math and Science Card Sets*, and *Vocabulary Adventure* utilize graphic representations or examples of the word and its definition to develop and extend student comprehension. Tactile/Kinesthetic strategies are also shared on the wheels and specifically described activities were noted in the *Math and Science Word Play* books (Carbo and Hodges, 1988).

Nonlinguistic representation provides a basis for students, especially ESL, to understand content vocabulary when they might not have a grasp of English. Learning vocabulary involves students making connections with things and/or

experiences that are familiar. Marzano and Pickering (2005) suggested using the student's native language to provide the instruction (description, explanation, or example) of new vocabulary. When this is not a possibility, students could be grouped with at least one group member who understands English. Another alternative is to seek a bilingual assistant or a volunteer to assist (Marzano & Pickering, 2005). Many words specific to math sound the same as other words in the English language but are spelled differently and have different meanings (e.g., add/ad, rows/rose, hour/our). There are other words in our language that are spelled the same but have different meanings (e.g., angle, table, edge). Due to the language factor among all learners, Adams, Thangata, and King (2005) suggest explicit vocabulary instruction leads to proficiency with and appropriate comprehension of the mathematical language. Activities in the *Word Play* books and in *Vocabulary Adventure* will prompt the use of math vocabulary in context so that the correct meaning is applied.

The rationale for the development of the entire line of products in the *Vocabulary Quest Series* is based upon the aforementioned analysis of research. After reviewing National Standards, participating in a study of the literature, holding 'think tank' discussions with teachers and administrators, and brainstorming key educational experiences of the consultants, the need for multiple vocabulary products surfaced. With evidence-based research as our guide, the Mentoring Minds' Product Development Team developed the Math/Science/Sight Word vocabulary card sets, vocabulary strips, activity cards, giant size cards, transparencies, *Math Vocabulary Wheels*, *Science Vocabulary Wheel*, *Math Word Play*, *Science Word Play*, *Sight Words Word Play*, *Mental Math Loop* and *Vocabulary Adventure*. These educational products comprise the *Vocabulary Quest Series*.

The vocabulary selected for each product is based on National Standards and parallels grade level content. The presented vocabulary on the *Math and Science Vocabulary Wheels* serves as a guide for any campus to use in determining the core vocabulary or a campus can adopt the vocabulary as suggested on the wheels as the core vocabulary. When a campus adopts a common core vocabulary for each grade level and for each subject and implements the vocabulary using specific school-wide strategies, the results can be powerful. When this approach spreads among the schools in a district, the results can have a greater impact on student success. The *Vocabulary Quest Series* consists of an extensive collection of vocabulary products that provide convenient, well-organized, and educationally-sound resources for teachers. Research conclusions and the pursuit toward excellence in education were the driving forces behind the creation of these products. Student learning can be favorably influenced when teachers use the *Vocabulary Quest Series* and implement the suggested strategies.

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