

Research Basis of the Underlying Premises of *DynaNotes™ Laboratory Skills Series*

There is an abundance of research supporting the underlying premises of the *DynaNotes Laboratory Skills Series*, including the use of:

- visual aids/graphic organizers
- vocabulary development/reinforcement
- collaborative/learning center activities
- color coding

Visual Aids/Graphic Organizers

Visual aids including diagrams, pictures, and charts can enhance comprehension in areas like science. The experiments of Carlson, Chandler, and Sweller (2003) demonstrated how chemistry students benefited from the use of chemistry diagrams as compared to a text-based format.

Graphic organizers are visual representations of concepts and ideas. Gallavan and Kottler (2007) describe graphic organizers as visual tools that aid in the understanding, application, and organization of information. Graphic organizers can help sort information, view relationships, show meaning, and manage data. Erin Fealy (2010) found in her case study of third-grade students that graphic organizers assisted students in locating and comprehending information within texts. Graphic organizers can help English language learners and students with learning disabilities. Ives and Hoy (2003) assert that graphic organizers can be used when traditional instruction emphasizes language skills that the students do not possess.

The *Laboratory Skills Series* reference cards and review guide, along with their coordinating teacher CDs and posters, use graphic organizers and visual aids to help students comprehend and organize laboratory concepts. Labeled diagrams, flow charts, and tables concisely convey critical laboratory information.

Vocabulary Development/Reinforcement

Research recommends vocabulary development and reinforcement for all students. A study of 21 sixth-grade classrooms by Kelley, Lesaux, Kieffer, and Faller (2010) showed that teaching academic vocabulary in meaningful and systematic ways helped to improve students' vocabulary and reading comprehension.

Madeline Kovarik (2010) states that vocabulary instruction is critical in content areas, and particularly so for economically disadvantaged students who may come to school with limited background knowledge. The research of Burgoyne, Kelly nee Hutchinson, Whiteley, and Spooner (2009) showed that the difficulties that English Language Learners have in understanding texts are related to these students' significantly lower level of vocabulary knowledge. Likewise, Jalongo and Sobolak (2011) assert that students need to be actively engaged in vocabulary development to show vocabulary gains. Those students who speak English as a second language and those who are economically disadvantaged are particularly at risk of not making

vocabulary gains. Medina et al. (2007) in *Science Teacher* proposes that English Language Learners may benefit from explicit teaching of new scientific vocabulary. Sharilyn Daniels' 2009 study found that English Language Learners showed gains when they were provided with intervention that included exposure to vocabulary words, definitions, model sentences, and context.

The *Laboratory Skills Series* review guides and card decks provide definitions for key laboratory and measurement terms in student-friendly formats.

Collaborative/Learning Center Activities

National Science Education Teaching Standard E states that the use of collaborative student activities not only "enhances the understanding of science, it also fosters the practice of many skills, attitudes, and values that characterize science." Furthermore, *National Science Education Program Standard B* states that a science program should be developmentally appropriate and interesting and it is important to "build understanding of basic ideas across the grade levels. In designing curricula, care should be taken to return to concepts in successive years so that students have the opportunity to increase and deepen their understanding and ability as they mature."

"Student understanding and retention can be enhanced and improved by providing alternative learning activities and environments" (p. 259) according to Chow, Woodford, and Maes (2011). In her research study, Davis (2004) finds that the use of multiple intelligence learning centers leads to improved student achievement, behavior, and self-esteem for fourth grade science students. Irwin, Nucci, and Beckett (2003) in *Science and Children* qualitatively describe their success in using science learning centers to promote positive interaction among students of different backgrounds and ability levels.

The *Laboratory Skills Series*, including the LabMatch™ card decks, workbook, and lab equipment reference cards are designed for use in collaborative learning centers. The products are used at various grade levels to reinforce and build on the science skills that all students must acquire.

Color Coding

Valerie Kirschenbaum states in her 2006 *Educational Leadership* article that today's texts must compete with more visually exciting modern media forms like movies, television, and the Internet. To do this she suggests designing instructional materials with colored words, varied font sizes, and colorful imagery. She claims this will greatly improve student achievement and engagement. Her ideas are supported by the research work of Ozcelik, Karakus, Kursun, and Cagiltay (2009). Their study of fifty-two participants showed that the use of color coding increased retention and performance. Color coding helped the participants more efficiently locate important information.

The *Laboratory Skills Series* products include color coding techniques and visual diagrams and examples to increase comprehension and interest.

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