

## Research Basis of the Underlying Premises of *DynaNotes™ Programs*

Research supports the design features and underlying premises of the *DynaNotes Programs*. Although the programs vary by subject and grade level, each includes

- course notes,
- explicit instruction, and
- a variety of engaging activities (e.g., warm-ups, games, tactile-kinesthetic activities, practice problems, and formative assessments) that align with the TEKS and address various learning styles.

### Course Notes

Research indicates that text organization, graphic organizers, color usage, and vocabulary reinforcement benefit many learners. The course notes included in the *DynaNotes Review & Intervention Programs* incorporate these four features to support and scaffold students.

Good text organization is critical. McTigue and Slough (2010) state that informational texts must include the following features to enable comprehension: concreteness, clear author's voice, coherent writing structure, proper incorporation of visual aids, and integrated visual and verbal information. Researchers Lorch, Lemarie, and Grant (2011) found that using hierarchical organization and signaling devices like headings led to quicker text searches. Similarly, a 2010 study by Cauchard, Eryolle, Cellier, and Hyona supports the use of devices like topic headings to aid in the search process. *DynaNotes* course notes use headings, subheadings, and consistent formatting for easy signaling and information location. Additionally, the lack of distracting information, inclusion of strictly relevant information, and use of concrete examples also enable students to leverage the course notes effectively.

Graphic organizers are visual representations of concepts and ideas. An expert panel from the U.S. Department of Education's National Center for Education Evaluation and Regional Assistance states that there is strong evidence to support the use of visual representations for students. The panel found that when instruction used multiple strategies, all of which included checklists and visual aids, students' mathematical procedural knowledge improved (Woodward et al., 2012). Researchers Roberts and Truwax (2013) believe that ambiguities in mathematics vocabulary can be even more challenging for English Language Learners. They recommend the use of graphic organizers and word walls to organize student learning. Additionally, a study found that the pairing of graphic organizers and explicit instruction improved science comprehension for students with autism spectrum disorder (Knight et al., 2013). *DynaNotes* course notes incorporate graphic organizers, including tables, diagrams, models, graphs, maps, prompts, and lists of steps. The National Center for Education Evaluation and Regional Assistance recommends teachers provide prompts and lists of steps to help

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students monitor and reflect when they are solving problems (Woodward et al., 2012).

The use of color benefits learners. Valerie Kirschenbaum (2006) states that today's texts must compete with more visually exciting media forms. Therefore, she suggests designing instructional materials with colored words, varied font sizes, and colorful imagery. Her ideas are supported by the research work of Ozcelik, Karakus, Kursun, and Cagiltay (2009). Their study of 52 participants showed that the use of color coding increased retention and performance. Color coding helped the participants more efficiently locate important information. *DynaNotes* course notes incorporate colorful vocabulary words, definitions, examples, visual models, images, and maps.

Research studies and experts are in support of effective vocabulary development. For example, the National Center for Education Evaluation and Regional Assistance recommends that mathematics educators provide "a list of academic words and phrases (e.g., *addition*, *not greater than*) that are essential for teaching a given unit" (Woodward et al., 2012, p. 16). Jalongo and Sobolak (2011) assert that students need to be actively engaged in vocabulary development to show vocabulary gains. Madeline Kovarik (2010) states that vocabulary instruction is critical, particularly for economically disadvantaged students who may come to school with limited background knowledge. A study of 21 sixth-grade classrooms by Kelley, Lesaux, Kieffer, and Faller (2010) shows that teaching academic vocabulary in meaningful and systematic ways helped to improve students' vocabulary and reading comprehension. The research of Burgoyne, Whiteley, and Spooner (2009) indicates that the difficulties that English Language Learners have in understanding texts are related to these students' significantly lower level of vocabulary knowledge. 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. *DynaNotes* course notes provide concise definitions for academic vocabulary words. Their accompanying examples and images also help reinforce vocabulary in appropriate contexts.

### Explicit Instruction

The *DynaNotes Review & Intervention Programs* include explicit instruction, a research-supported strategy. One meta-analysis of 580 comparisons found that outcomes were favorable for explicit instruction when compared with unassisted discovery under most conditions (Alfieri et al., 2011). Another meta-analysis indicated that students with learning disabilities benefited from explicit vocabulary instruction when reading science-related material (Kaldenberg, Watt, & Therrien, 2015). In yet another study, students received instruction on math equivalence concepts either before or after they attempted to solve and explain practice problems. Those who received instruction before

solving problems demonstrated greater procedural and conceptual knowledge. The researchers concluded that the most effective sequencing of activities is conceptual knowledge transfer prior to problem solving (Fyfe, DeCaro, & Rittle-Johnson, 2014). The National Center for Education Evaluation and Regional Assistance “believes academic language, including the language used in mathematics, should be taught explicitly so that all students understand what is being asked in a problem and how the problem should be solved” (Woodward et al., p. 16).

Explicit instruction is also beneficial for English Language Learners. With respect to English Language Learners, Claire Sibold (2011) states that “effective vocabulary instruction emphasizes direct instruction” (p. 25) and that “it is important to explicitly teach vocabulary using effective strategies that will engage students in learning new words—for example, association strategies, imagery, and graphic organizers” (p. 26).

### **Variety of Engaging Activities**

Boredom has been shown to result in negative academic performance (Pekrun et al., 2014). Likewise, Chow, Woodford, and Maes (2011) state that “student understanding and retention can be enhanced and improved by providing alternative learning activities and environments” (p. 259). These are among the many reasons why the *DynaNotes Review & Intervention Programs* contain a variety of engaging activities (e.g., warm-ups, games, tactile-kinesthetic activities, practice problems, and formative assessments) that both align to the TEKS and address various student learning styles. Although debate exists on the empirical effectiveness of learning styles-based instruction, the theory still maintains a broad acceptance in practice (Cuevas, 2015).

Warm-up activities prepare and prompt students for the day’s concepts. The National Center for Education Evaluation and Regional Assistance encourages these type of activities, including “using think-alouds and discussions” (Woodward et al., p. 1).

Research shows that games can enhance learning and motivation. One meta-analysis examining the effectiveness of digital games and learning for K-16 students found that digital games significantly enhanced student learning as compared to nongame conditions (Clark, Tanner-Smith, & Killingsworth, 2016). Another study indicated that the competition and collaboration involved when urban middle school study participants played digital math games resulted in improved math fluency, stronger mastery goal orientation, and greater situational interest and enjoyment (Plass et al., 2013). Klara Pinter (2011) states that math games allow opportunities for all levels of students to develop strategies, ask questions, and formulate hypotheses. The digital and traditionally formatted games contained in the *DynaNotes Review & Intervention Programs* can be used individually or in small group settings to help accomplish such goals.

The *DynaNotes Review & Intervention Programs* address a variety learning styles, including tactile-kinesthetic. Hands-on learning activities include cutting, folding, manipulating, and matching. Studies show that such hands-on learning is beneficial. Researchers Terzian and Moore (2009) evaluated 11 summer learning programs involving economically disadvantaged urban students and found that the effective programs included hands-on, enjoyable activities that had real-world applications. Hands-on learning also positively impacts standardized test scores. Dunn and Dunn (2005) state that “when schools with underachieving minority, poor students in various sections of the nation introduced tactual and kinesthetic instruction, they evidenced statistically higher standardized achievement test scores in reading and mathematics within one year” (p. 273). Another study found that gifted middle school students were more likely to remain motivated and engaged when participating in hands-on activities (Rayneri, Gerber, & Wiley, 2006).

Practice problems, like those found within the *DynaNotes Review & Intervention Programs*, offer students the opportunity to apply their knowledge and skills. This is in line with the National Center for Education Evaluation and Regional Assistance’s recommendation that mathematics teachers “give students assignments that provide already worked solutions for students to study, interweaved with problems to solve on their own” (Woodward et al., p. 16). The course notes contained in the *DynaNotes Review & Intervention Programs* provide worked-out solutions to problems, while the activity book offers opportunities for students to problem solve and practice on their own.

The *DynaNotes Review & Intervention Programs* offer numerous opportunities for formative assessment (ongoing evaluations of student progress), including pre-tests and post-tests as well as skill builder, skill developer, skill extender, and skill checker activities. The programs’ multiple choice questions, which have formats similar to those found on standardized tests, help measure in-progress student achievement. Research studies demonstrate the effectiveness of formative assessment. For example, a study of 4,091 students concluded that those participants who completed formative assessment significantly outperformed the non-formative assessment control group on tested concepts (Phelan, et al., 2011).

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