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Research Base

FOR

epath discovery™

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INTRODUCTION

In January 2002, President George Bush signed into law the No Child Left Behind Act of 2001. Under this law, educational programs and materials paid for by federal funding must be based on sound, widely accepted educational research that supports the materials' design, thus increasing the likelihood that the materials will help students achieve the desired learning outcomes. This law, commonly known as NCLB, thus requires educators to be aware of the body of research that supports the design of any materials they are considering for use with their students.

Since its inception in 1990, Peoples Education has built and revised our student learning products based on continual review of the scientific research literature. The foundation of Peoples Education's ePath Discovery™ program is a set of principles derived from the soundest current theory and research on reading and language arts, mathematics, writing, science, social studies, assessment, and literacy. These principles are based specifically on the student learning standards of the state for which the materials are designed.

This document serves both to provide information about the ePath Discovery™ program for Texas and to explain the research on learning theory on which the system is based. Consequently, this document is organized in a way to be useful to educators who are considering the soundness and the practical uses of the materials in classrooms.

First, each principle underpinning the design of ePath Discovery™ is articulated. Second, a paragraph discussing the best-known and most respected educational research supporting the principle is given. Third, a discussion of the way ePath Discovery™ specifically embodies both the principle and its research-based foundation helps prospective educators see how the system can be used to help teachers collect information about their students' strengths and weaknesses and to help students explore their own understandings of the standards-based information they are likely to encounter on the TAKS.

THE CHALLENGE

Today's educators, schools, and districts face a daunting challenge: how to raise student achievement in an increasingly rigorous, standards-based environment. This dilemma is particularly critical because the No Child Left Behind Act requires that:

- Each state adopt challenging academic content standards and challenging student academic achievement standards.
- Each state educational agency implement a set of high-quality, yearly student academic assessments that include, at a minimum, academic assessments in mathematics, reading or language arts, and science that will be used as the primary means of determining the yearly performance of children and discerning whether they meet the state's challenging academic standards.

THE ePath Discovery™ PROGRAM

ePath Discovery™ is an online remediation program with online instruction and practice completely customized to the state curriculum standards for Texas.

ePath Discovery™ allows teachers to remediate specific needs for students with targeted TEKS instruction. Concise lessons provide an experience similar to that of the Measuring Up® worktexts, with interactive elements.

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RESEARCH-BASED PEDAGOGY OF THE ePath Discovery™ PROGRAM

The Texas version of ePath Discovery™ is based on that state's mandated curriculum standards and performance objectives and is completely customized. The ePath Discovery™ program series is designed to support and enhance best practices for effective teaching of Texas's mandated curriculum standards and performance objectives. There are some research-based unifying pedagogical principles that are common across TEKS and that form the foundation of the ePath Discovery™ program's design. Those listed on the following pages apply to ePath Discovery™.

RESEARCH PRINCIPLE 1: Challenging Standards

Educational programs must be based on challenging academic content standards in academic subjects, the teaching of advanced skills, and challenging student academic achievement standards.
(PL 107–110, the No Child Left Behind Act of 2001)

RESEARCH BASIS FOR PRINCIPLE 1

The most extensive and best-known research about the effects of expectations is addressed by Rhona S. Weinstein (2002) in her book, *Reaching Higher: The Power of Expectations in Schooling*, a landmark in support of the results that high standards and expectations can produce. Weinstein's book takes as its thesis that "If . . . we are interested in the development of all children, we must link higher standards to effective teaching strategies for diverse learners. Our assessments of achievement must inform the next steps of instruction, rather than simply hold children accountable for what they may not have been taught."

RESEARCH PRINCIPLE 1 APPLIED

The implication of Weinstein's statement is that assessment must help teachers understand what students know and need to know. ePath Discovery™ can be used with students to help teachers know in advance where gaps in student understanding lie. Teachers can then begin to think about filling in those gaps for all learners. The TEKS demand high achievement for all learners, and ePath Discovery™ can be seen first as an aid to student learning toward those goals and second as a step toward positive assessment results. ePath Discovery™ can be used with all students of all abilities; it allows all teachers of all students to see where their students need help in approaching the TEKS and even allows teachers to work differently with different students to make necessary progress. In other words, using the program allows teachers to enact the principle that high standards can result in higher achievement for all students by using the assessment materials to inform the next steps of instruction.

Research Principle 2:
Learning mathematics from multiple perspectives

"Students develop a much richer understanding of mathematics and its applications when they can view the same phenomena from multiple mathematical perspectives."
(NCTM, 2000)

Research Basis for Principle 2

NCTM explains: "Mathematical ideas can be represented in a variety of ways: pictures, concrete materials, tables, graphs, number and letter symbols, spreadsheet displays, and so on. The ways in which mathematical ideas are represented is fundamental to how people understand and use those ideas." The notion of multiple perspectives grows out of social constructivism (Gergen, 1995) and builds on the related concepts of metacognition. (Schoenfeld, 1992) Flexibility in choosing the appropriate representation is important for learning to solve unfamiliar problems.

Research Principle 2 Applied

ePath Discovery™ allows students to use current mathematical understandings to solve what might at first seem to be unfamiliar problems. Students will be using real mathematical techniques for problem-solving, teachers will gain additional insight into how their students are thinking about problems, and students will have one more tool for approaching the mathematics section of the TAKS.

Research Principle 3:
Inquiry in science

Teaching science should be consistent with the nature of scientific inquiry and should reflect scientific values.

Research Basis for Principle 3

National organizations such as the National Research Council (1995) and the American Association for the Advancement of Science (1994) have advocated for the importance of inquiry. When students engage in scientific inquiry, they find themselves in a process that "leads to asking questions, making discoveries, and rigorously testing those discoveries in the search for new understanding. Inquiry . . . should mirror as closely as possible the enterprise of doing real science." (National Science Foundation, 1998) The position is supported empirically by the meta-analysis conducted by Shymansky, Hedges, and Woodworth (1990) that found that science curricula based on inquiry principles were more effective than the traditional textbook programs across a number of different measures of student understanding of science.

Research Principle 3 Applied

ePath Discovery™ for science addresses the scientific process and theories with its very first lessons and then draws upon that process throughout all subsequent lessons.

Research Principle 4:
Test preparation

Teachers are responsible for teaching the skills, knowledge, and behaviors essential to answering test questions, as well as preparing their pupils for the formal assessments.

Research Basis for Principle 4

Gulek (2003) writes that adequate and appropriate test preparation plays an important role in helping students demonstrate their knowledge and skills in high-stakes testing situations. Becker (1990) conducted an extensive meta-analysis of the research and concluded that on average, helping students understand how to approach test questions can help increase SAT scores. Sloane & Kelly (2003) write that "Students can be effective instruments in their own learning if the teacher is clear on the learning goals and the students are informed of their current performance and given clear steps for remediation. . . . The task for teachers is to know and understand their state's standards, and then translate this knowledge to continuously help students learn and self-assess to meet those standards."

Research Principle 4 Applied

Working specifically through questions ("What, exactly, is the question asking?" "What kind of answer will you be looking for?" "Why did you choose the answer you chose?") can be a fruitful practice in reasoning. The cognitive skills required for understanding and answering test questions are higher-order thinking skills; making these skills overt for students can improve their understanding of the many tasks in their lives that will involve reading and answering questions, well beyond the demands of the TAKS.

To this end, ePath Discovery™ provides assessment activities embedded in each lesson to provide practice on applying curriculum standards in the idiom of the TAKS. Each question in ePath Discovery™ is linked to the TEKS and TAKS objectives. Based on the student's performance, the system will automatically level the student to the appropriate lesson. Students work through targeted lessons based on their needs. This means that teachers use ePath Discovery™ to help students become familiar with the TEKS and experience test questions that resemble those on the TAKS.

Research Principle 5: Formative assessment

"A major purpose of evaluation is to help teachers better understand what students know and make meaningful decisions about teaching and learning activities."

Research Basis for Principle 5

Assessment comes in two forms: formative and summative. Standardized tests like the TAKS are a summative assessment, or testing that occurs at the end of a given amount of instruction. Formative assessment occurs throughout a unit of instruction; because it occurs more frequently, and because its purpose is to inform further instruction, students receive more immediate feedback on their learning. "Formative assessments . . . are essential. They permit the teacher to grasp the students' preconceptions, understand where the students are in the 'developmental corridor' from informal to formal thinking, and design instruction accordingly" (Bransford, et al., 2000).

Research Principle 5 Applied

Together, teacher observation and ePath Discovery™ enable teachers to define and implement a **P3®—Personal Prescriptive Path®** of instruction for all students, no matter how diverse.

Students' approaches to and solutions of questions provide teachers with extra information about what their students know and how they think. The ePath Discovery™ program can provide a great deal of information for teachers about their students. ePath Discovery™ provides focused remediation based on placement assessment results, manual teacher assignments, or other formative assessment results. The program also provides teachers with reporting of students' usage, overall progress, and individual lesson results. ePath Discovery™ is a powerful instructional tool for informing classroom instruction in ways more profound than simple test preparation.

RESEARCH PRINCIPLE 6:
Strengths of computerized technology, particularly in preparing for standardized testing

RESEARCH BASIS FOR PRINCIPLE 6

According to Coley, Cradler, & Engel (1997) "studies show that computer based instruction can individualize instruction and give instant feedback to students, even explaining the correct answer. The computer is infinitely patient and nonjudgmental, thus motivating students to continue." Meta-analyses of computer-based instruction by Kulik (1994) provide support for the effectiveness of technology across many applications. Given the research basis for the effectiveness of test preparation, the fact that technology can give as much feedback as the student needs, on the student's time and at the student's pace, it stands to reason that computer-based instruction based on the TEKS that prepares students for the format and content of the TAKS would provide many students—including those who need more time and may learn more slowly—with special learning opportunities.

RESEARCH PRINCIPLE 6 APPLIED:

ePath Discovery™, a learning system that provides the content of Measuring Up® online with instant feedback, is available to students in the state of Texas. Based on the TEKS, the system allows all learners individualized instruction at their own pace. The questions are provided in the idiom of the TAKS, thus allowing students opportunities to become familiar with both standards-based content and test format. For many learners, especially those who learn better with more individualized opportunities to self-pace and practice, the online format is both more reinforcing and more motivating than a paper-and-pencil version would be. ePath Discovery™ is a way of increasing the opportunities for standards-based learning and practice for more learners in Texas.

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