Discovery EDUCATION | MATH TECHBOOK

Transforming Math Education for a Digital Era

A new digital textbook aims to improve conceptual understanding for lasting procedural fluency in math by focusing on real-world situations, using video and interactive games to engage students, and providing teachers with immediate feedback on student performance.

CONTENTS

eSCHOOL NEWS

Daily Tech News & Innovation

EXECUTIVE SUMMARY

Students in the United States continue to struggle with mathematics. In December 2013, the Program for International Student Assessment, a triennial survey that tests the skills and knowledge of 15-year-old students, ranked the U.S. 26th out of 34 Organization for Economic Co-operation and Development countries in math, reading, and science.

Now, a new tech-based approach to math instruction hopes to reverse that slide. Slated for release in January, Math Techbook™ from Discovery Education is a digital textbook that aims to transform the way both students and teachers experience math.

"We wanted to find a way to change the math narrative, to excite students with real-world problems and engaging contexts, and stop the continual decline of our math scores, even among our brightest kids," explained Patrick Vennebush, director of mathematics at Discovery Education. "How can we facilitate learning math in a way that sticks? Teaching math traditionally – lectures and worked examples, followed by algorithmic practice – has not been working."

With two decades of experience in education, Vennebush understands how challenging it can be for students to absorb and comprehend math concepts—and for educators to present the material in fun and engaging ways.

With traditional textbooks, Vennebush notes, students often fail to see how math concepts relate to their own lives. Instead, he believes a more modern, hands-on approach is needed, one that guides students instead of providing the answers along with a series of practice questions. "The people working at Math Techbook have a philosophy that the student needs to be actively exploring and investigating, to be challenged to learn concepts worth knowing in the real world," explained Vennebush.

To that end, Discovery Education's Math Techbook takes an inquiry-based approach that utilizes video, games, and instant feedback to develop math concepts. In addition, it captures student data instantaneously, so teachers can tell whether their class understands the concepts and tailor their instruction accordingly, and students can monitor their own progress.

Designed to focus on Common Core's three aspects of rigor, Math Techbook offers courses for Grades 6 through 8, Algebra I, Geometry, and Algebra II, as well as Integrated Math I, II, and III. From a technical standpoint, the product supports any device, anywhere, anytime in any instructional setting.

While Discovery Education's Math Techbook covers the entire curriculum and is intended to replace traditional textbooks, some educators consider using it as a supplement to their existing texts. While that's possible, the product is not intended to replace the educator. Indeed, the role of the teacher is critical to success. "Math Techbook is not an online math course," cautioned Vennebush. "It is student-centered, but the teacher plays the role of facilitator in the classroom."

HOW MATH TECHBOOK WORKS

Each concept within the all-digital Discovery Education Math Techbook is divided into three primary sections—Discover, Practice, and Apply—that mirror the Common Core's three aspects of rigor: conceptual understanding, procedural fluency, and application. "What's unique about Math Techbook is how students develop conceptual understanding," said Vennebush. "Students are placed in the driver's seat. They investigate to make sense of math on their own, with teacher support. It's about understanding the concepts deeply and applying them to real-life situations."

A key goal of the product is to capture student attention. "We don't give away the punch line," explained Vennebush. "Before we tell students about the Pythagorean Theorem, we show them real-life scenarios about geometry. A digital environment provides a unique way to engage kids with video and interactive explorations."

The importance of video is not lost on Jeff Baugus, the dean and math department chair at Santa Rosa County School District, Florida, who also serves on Discovery's math advisory board. "The video content is very helpful, and Discovery has always been known for its video content," noted Baugus, who tested the Math Techbook in his classroom (see Pilot Project on page 5). "With a digital curriculum, you can add video content to emphasize a point that students can relate to."

Perhaps more important than video and interactive experiences, though, is the product's ability to monitor and analyze student performance. "The biggest distinguishing factor about Math Techbook is how it saves teachers time," explained Baugus. "It allows them to receive and respond to student answers and questions instantaneously. Teachers can better assess student performance and identify if someone is falling behind."

The instructional philosophy behind Math Techbook is its "DPA" approach: Discover, Practice and Apply. The 3 main sectioned tabs reflect the learning progression:

Discover. The Discover tab is where most of the learning takes place, and it's where students develop conceptual understanding. According to Baugus, Discovery's goal was to move away from the kind of chapter-based lessons used in traditional textbooks toward instruction built around concepts. "Each unit has two to five concepts to learn," he explained. "To me, it makes it more cohesive when it's approached in this way."

Using an inquiry-based approach that involves lessons, videos, and questions, students explore math concepts utilizing everyday situations that are relevant to their lives. While Discovery Education Math Techbook contains examples about STEM careers and personal finance, Vennebush notes that it also "contains problems and examples that focus on card tricks, mountain biking, and students' favorite books."

Students are encouraged to collaborate with their peers to determine the mathematics that appears in the videos, but then they must write an explanation of their reasoning. In addition, summary and review sections recap the main points of the concept, and interactive

explorations help to reinforce the material. Because everything is digital, teachers can monitor student progress and conduct formative assessment in real time.

Practice. The goal of the Practice section is to build procedural fluency, meaning that a student should be able to solve math problems based on the conceptual understanding they developed in the Discover section. To do so, students need to understand the underlying structure and how it's composed. "There are several interactive elements where students can practice each concept," said Baugus. "Homework and practice problems can build fluency, and—in the case of Practice— coach them to understand the material."

Practice builds on the Discover segment through the use of "Coach" and "Play" exercises. In Coach exercises, a green check mark appears when a student solves a problem correctly. If the answer is incorrect, however, feedback based on the student's answer is revealed to provide guidance on how the right answer can be obtained.

The Play exercises provide encouragement in a gamified environment where students earn badges and awards. Students make progress toward a badge each time they correctly answer a self-paced, interactive question, and five correct answers within a concept earns a badge.

Unlike in the Coach exercises, students in the Play segment are on their own to complete assignments, and they receive no support on how to answer questions correctly. "The practice is where the homework comes into play," explained Baugus.

Apply. The third phase builds on the conceptual understanding students developed in the Discover section and the procedural fluency they developed in the Practice section. Here, students solve practical math problems that range from calculating the most economical cell phone plan to using equations to predict thunderstorms. "It's incredibly hard to flesh out certain concepts in mathematics, so Discovery has come up with creative solutions taken from real life," explained Baugus. "The problems feature video and text about something useful."

Students can choose among three different scenarios in the Apply section, and they are given an opportunity to develop and defend their work when solving each problem. The problems generally don't have a specific correct answer—rather than simply being asked to provide an answer that is right or wrong, students are required to defend and justify their answers with an explanation. Built-in tools such as a graphic calculator and dynamic geometry software can be used to craft a justification for their work, and screenshots can be shared with their teacher. This approach helps teachers determine—in real time—whether students really grasp the material. Some Apply problems are machine-scored, but most are evaluated by the teacher using a digital rubric, and students receive instant feedback from both a quantitative score and qualitative teacher comments.

OTHER KEY FEATURES

Discovery Education's Math Techbook includes several other features to help teachers deliver instruction more effectively:

Teacher View. This feature allows teachers to turn on "Teacher Notes" which provide suggestions for classroom management and questions for guiding mathematical discussion and demonstration of mathematical practices, as well as providing an answer key for the questions students answer in the Discover section. In addition, it highlights critical information teachers must know to communicate a concept effectively, as well as additional information that teachers ideally should know. "The Teacher View is really helpful for the lesson itself," said Baugus. "There are notes with hints and suggestions to help the teacher organize the class.

My Dashboard. This function allows teachers to review answers in real time. The student progress dashboard is where student work is collected and where teachers can immediately evaluate students' understanding of concepts. "To me, the teacher dashboard is

what makes Discovery Education Math Techbook something every teacher is going to want to use," said Baugus. "I can gauge student performance on my desktop or iPad in real time. I really enjoy being able to pinpoint immediately if a student understood or didn't understand something."

Math Tools. A graphing calculator, scientific calculator, geometry software, whiteboard, and conversion utility are all accessible from the Math Tools tab, which is available on every page—students can use these tools to explore in the Discover section or to help them answer questions on the built-in unit assessments. The cost savings for students and districts are significant, since they're not required to purchase additional resources typically needed when print textbooks are used.

Glossary. What would a math book be without definitions for key terms? The glossary within Math Techbook defines 600+ terms, but it also includes animations, videos, and images to solidify a student's understanding.

PILOT PROJECT

Jeff Baugus, the dean and math department chair at Santa Rosa County School District in Florida, experimented with Math Techbook for several days in his classroom. He was initially hesitant to make the leap from a traditional textbook to digital media, but the results have exceeded his expectations. "Our schools are textbook-based, so this was the first time students got to work in a digital platform," he said. "They found it visually stimulating, and the video and interactive content is both helpful and engaging."

WATCH VIDEO ▶

Students spent their first lesson on math expressions involving a roller coaster ride. According to Baugus, this kind of connection between real-world fun and mathematics helped draw the students in and engage them. "I'm sold," he added. "I believe Math Techbook is a big leap forward for schools and districts."
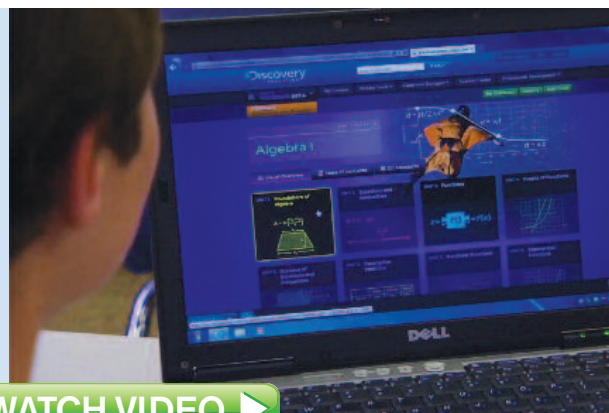
DISCOVERY EDUCATION™

Discovery Education empowers school systems worldwide to create dynamic digital learning environments that improve student achievement. With proven expertise in developing and delivering standards-based digital content and professional development, Discovery Education builds lasting partnerships across the globe that transform teaching and learning.

Serving 3 million educators, and over 30 million students, Discovery Education's services are in half of U.S. classrooms, over 40 percent of all primary schools in the U.K., and more than 50 countries.

Explore the future of education at **www.discoveryeducation.com**.

This Ed-Tech Point of View was produced by eSchool News, a leading publisher and producer of K-12 educational technology publications and events, dedicated to the advancement and wise use of technology to improve teaching and learning for all.

eSchool News offers ed tech decision-makers a range of products—including magazines, white papers, websites, newsletters, webinars, and other products—that provide in-depth coverage of the latest innovations, trends, and real-world solutions impacting the education community.
Explore more at www.eSchoolNews.com.

eSCHOOL NEWS