



The MIND Research Institute created the visually-based Spatial-Temporal Math (ST Math®) program to engage all students in the strategic and creative thinking that guides the new Common Core State Standards for Mathematics (CCSSM). Through visual and kinesthetic online manipulative games organized into mastery-based objectives, ST Math provides multiple rich, interactive representations for teachers and students to experience all of the conceptual areas covered by CCSSM. ST Math also fully integrates the Standards for Mathematical Practice into the grade-level content, enabling students to develop long-term problem-solving skills and a deep conceptual understanding of mathematics with strong connections between concepts and across grades.

## MATHEMATICAL PRACTICE STANDARD

## HOW ST MATH HELPS STUDENTS DEMONSTRATE UNDERSTANDING AND MASTER THE STANDARD

### 1 Make sense of problems and persevere in solving them

Unlike any other instructional software, ST Math engages students in learning through problem solving. Students are challenged with 50 or more complex problems during a single session, building mastery through the development of strategic thinking, conceptual understanding, perseverance and practice.

**Example:** *In the Upright JiJi game, students must manipulate the sphere to get JiJi the penguin into the indicated position.*



### 2 Reason abstractly and quantitatively

ST Math content objectives are designed around learning paths that begin with basic concepts but end in rigorous applications where students use abstract, quantitative, and creative reasoning to solve non-routine problems.

*ST Math takes students to the highest level of thinking and applying math: the ability to creatively problem-solve in non-routine ways.*



### 3 Construct viable arguments and critique the reasoning of others

With Teacher Mode, the ST Math software provides teachers the opportunity to bring the games into the classroom and use them as a vehicle for classroom discussion, asking students to make conjectures, discuss problem solving strategies in groups, and clearly explain and justify their reasoning.

### 4 Model with mathematics

Learning paths guide students' progress from visual to symbolic to contextual problem solving, using mathematics to model and describe complex situations.

**Example:** *This screenshot represents the highest level of the game where students demonstrate their knowledge through language.*



Through touch technology integration, ST Math bridges the gap between visual and physical manipulatives, enabling students to choose real-world tools and strategically use them to solve problems.

**5** Use appropriate tools strategically

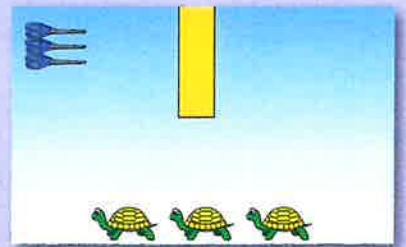
**Example:** *By using the scale in this measurement game students interact with a real-world tool in order to form a strategy for problem solving. Students can compare the weights using the balance scale to determine how to place the weights in order of increasing magnitude.*



**6** Attend to precision

Students directly experience precision in mathematics, connecting the precision inherent in symbolic representations to precision in measuring and using tools.

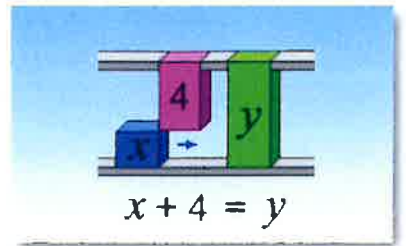
**Example:** *In this beginning fractions game, students must cut the bar precisely into three equal parts each representing one-third.*



**7** Look for and make use of structure

Each game in ST Math is based on a visual schema. Students internalize these interactive representations, connecting the structure of the models with the symbols, and using this structure to solve problems.

**Example:** *When solving equation-based problems, students connect visual representations to the symbolic.*



**8** Look for and express regularity in repeated reasoning

Each key concept is presented in multiple games with different representations, allowing students to identify ideas and reasoning strategies that enable them to solve problems in different forms.

**Example:** *Games found in the Addition and Subtraction objectives engage students in solving puzzles with a variety of models, including blocks, ten-frames, and number lines.*



# ST Math Provides All Students with Transformative Learning Experiences

## The Power of Visual Learning

Interactive visual models let all students engage in complex mathematical problem solving. Students receive comprehensible input on screen, without unnecessary distractions, that guides them in constructing the meaning behind the math.

## Intrinsic Motivation for Problem Solving

ST Math leverages students' love for gameplay to foster an enthusiasm for mathematical problem solving.

## Scaffolded Learning Paths

Carefully constructed math content sequences gradually introduce mathematical symbols and language while increasing the level of rigor in order to expand students' schema of knowledge.

## Immediate and Informative Feedback

Richly animated puzzles show students the consequences of a chosen solution immediately after each attempt. This real-time feedback activates the mind's natural perception-action learning cycle, allowing students to adjust their thinking and learn from mistakes.

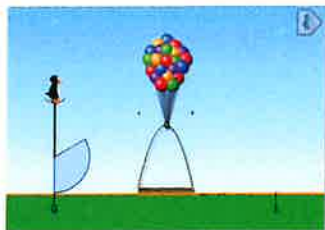
## Curriculum Connections

ST Math aligns to mathematical content and practice standards for each state. Teachers receive the instructional support they need to facilitate deep and engaging learning experiences.

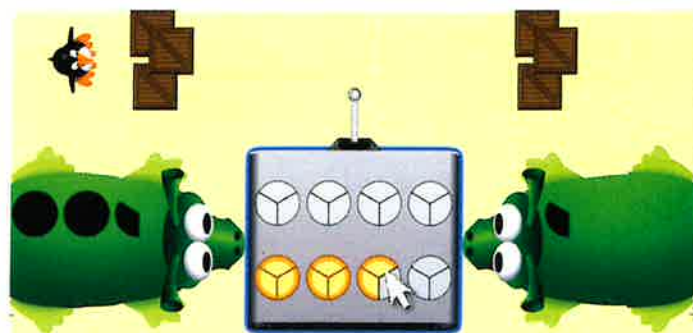
## Find Out More About ST Math



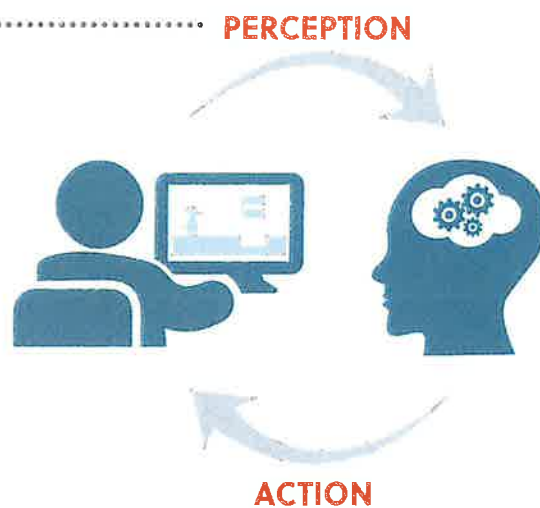
Watch **Teaching Without Words**  
[bit.ly/visualmath](http://bit.ly/visualmath)



Play the **ST Math Demo**  
[bit.ly/STMathDemo](http://bit.ly/STMathDemo)



This fraction concepts puzzle visually asks the question:  
"How much pie do you need to feed both monsters?"



## VISUAL LEARNING TRANSFORMS ELL MATH EDUCATION



All students, regardless of language proficiency level, have the ability to think deeply about mathematical concepts. However, when math is presented only as words and numbers on a page, English language learners can miss out on crucial opportunities to understand the meaning behind the math.

The ST Math game-based learning program guides students at all language proficiency levels in visualizing math concepts through tantalizingly tricky puzzle challenges.

### How It Works...

**Ratio**

#### 1 Visually Present Math Concepts

The game visually asks the ratio question: "If each purple fruit monster eats 3 bananas, how many bananas will 3 monsters eat?"

**Ratio Symbol**

#### 2 Introduce Mathematical Symbols

Using the division bar, the visual asks: "If each monster eats 2 bananas, how many monsters will eat 14 bananas?"

**Ratio Language**

#### 3 Introduce Language

Students learn the language for stating ratios.

#### 4 Transfer Learning to New Concepts

Students learn that ratios are used in linear relationships.

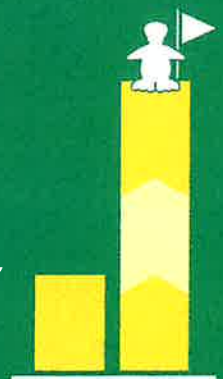


### Visual Learning Activates the Mind

Designed by experts in neuroscience, the ST (Spatial-Temporal) Math brain-building games provide all students the opportunity to become confident and capable problem solvers and to reach higher levels of math achievement. Research shows that:

- Mathematics learning and performance is optimized when the areas of the brain that work with visual and spatial information are activated.
- Teaching students through visual experiences improves math performance significantly, even on symbolic or language-heavy tasks.

Schools using ST Math have **doubled** - or - **tripled** their growth in math proficiency

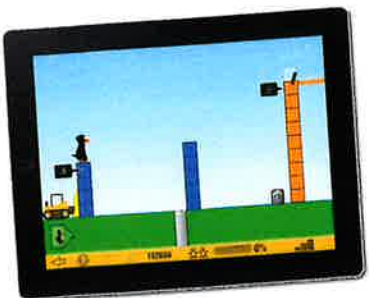


## ST Math<sup>®</sup> - The Leader in Visual Learning in Mathematics

ST Math<sup>®</sup> is the leader in visual learning in mathematics delivered through instructional software. Based on applied neuroscience research, Spatial-Temporal (ST) Math engages students in developing a deep conceptual understanding of mathematics by manipulating visual models to solve problems in a self-paced, mastery-based environment. The ST Math program family ensures that all students have access to rich content that drives critical thinking.

ST Math includes embedded assessments, detailed reporting of student learning patterns, and interactive whiteboard functionality. ST Math is aligned to Common Core and state standards, integrates with core instruction, and is accessible on desktop or laptop computers and on supported tablets, enabling anywhere, anytime learning.

**ST Math: K-6** contains an on-grade-level curriculum for each grade level.



- Moves all students, including English Language Learners and Special Education students, towards reaching deep conceptual understanding of math topics.
- Aligns to Common Core and state standards.
- Complements core curricula, giving teachers the opportunity to connect models from the software to procedures and math symbols taught in the classroom.
- Contains pre- and post-quizzes for each learning objective in grades 2 through 6 for progress monitoring and to support teacher's understanding of student learning on each objective. Kindergarteners and 1st graders do not take quizzes.
- Includes reports that provide teachers with data that can inform teaching decisions.
- Has a proven impact on student math achievement from kindergarten through grade 5, with the same results expected for the new grade 6 curriculum.



### What is the **ST** in **ST Math**?

Born out of neuroscience research at the University of California, Irvine, the visual approach MIND Research Institute uses in the development of ST Math accesses the brain's innate "spatial-temporal" (ST) reasoning ability. This ability, which lies at the core of innovative thinking and sophisticated problem-solving, allows the brain to hold visual, mental representations in short-term memory and to evolve them in both space and time, thinking multiple steps ahead.



# What Does ST Math Offer Students as The Leader in Visual Learning in Mathematics?



## Visual Learning

Teaches students mathematical concepts through manipulating interactive visual models found in ST Math's richly animated games to solve problems.



## Learning Paths

Provide carefully structured sequences of math content that move from the visual models to incorporating mathematical symbols and language, scaffolding to move students through with a desirable level of difficulty.



## Real-time Informative Feedback

Enables students to make predictions about the visual models and to "learn by doing" based on the feedback that adapts to each student answer, showing why the solution was correct or incorrect.



## Intrinsically Motivating Problem Solving

Builds students' intrinsic motivation as they experience success in solving challenging problems, making learning math fun as students experience success and take ownership of their learning.

## Learning Never Stops

Whether using ST Math on a device at school, as the center of a discussion in the classroom, or at home to complete assigned homework objectives, learning never stops with ST Math.



## ST Math: K-6 Content Sampler

Based on Common Core State Standards Alignment. ST Math is also aligned to individual state standards.

### Kindergarten

- Counting and Numbers
- Understanding Addition and Subtraction
- Greater Than, Less Than, Equal To
- Foundations of Place Value
- Shapes and Position
- Sorting and Classifying

### Grade 1

- Addition and Subtraction
- Place Value Concepts
- Comparing Numbers
- Equal Shares and Partitioning
- Creating Composite Shapes
- Measurement Concepts

### Grade 2

- Place Value Bundles
- Addition and Subtraction Situations
- The Number Line
- Equal Shares and Partitioning
- Time and Money
- Composing and Decomposing Numbers

### Grade 3

- Multiplication and Division Situations and Relationships
- Fractions
- Rounding and Place Value

- Concepts of Area and Perimeter
- Volume, Weight and Time
- Number Patterns

### Grade 4

- Extending Place Value
- Fraction Addition and Subtraction
- Patterns in Number and Shape
- Comparing and Rounding
- Angles, Lines and Symmetry
- Fractions and Decimal Notation

### Grade 5

- The Place Value System
- Operations with Whole Numbers and Decimals
- Fraction Multiplication and Division
- The Coordinate Plane
- Patterns and Relationships
- Comparing and Rounding Decimals

### Grade 6

- Proportional Relationships
- Fraction Division
- Properties of Operations
- Negative Numbers
- Coordinates and Distances
- Decimal Operations

## Technical Requirements



Works on Macs, PCs, and Chromebooks.

ST Math is also available on iPad 2 and newer, and most Android tablets.



A high-speed Internet connection is required. For detailed technical requirements, visit our website.

# Making an Impact

Increase in average percentage of students proficient or better in math



This data is gathered from state standardized math tests of 70,655 students across the nation for new, fully implemented grades. 1 one year ST Math use 2 two years ST Math use \* P < .05 † Advanced/Commented (n) = number of schools

Without ST Math With ST Math Schools without ST Math had similar baseline scores to schools with ST Math.

