



Talent Development

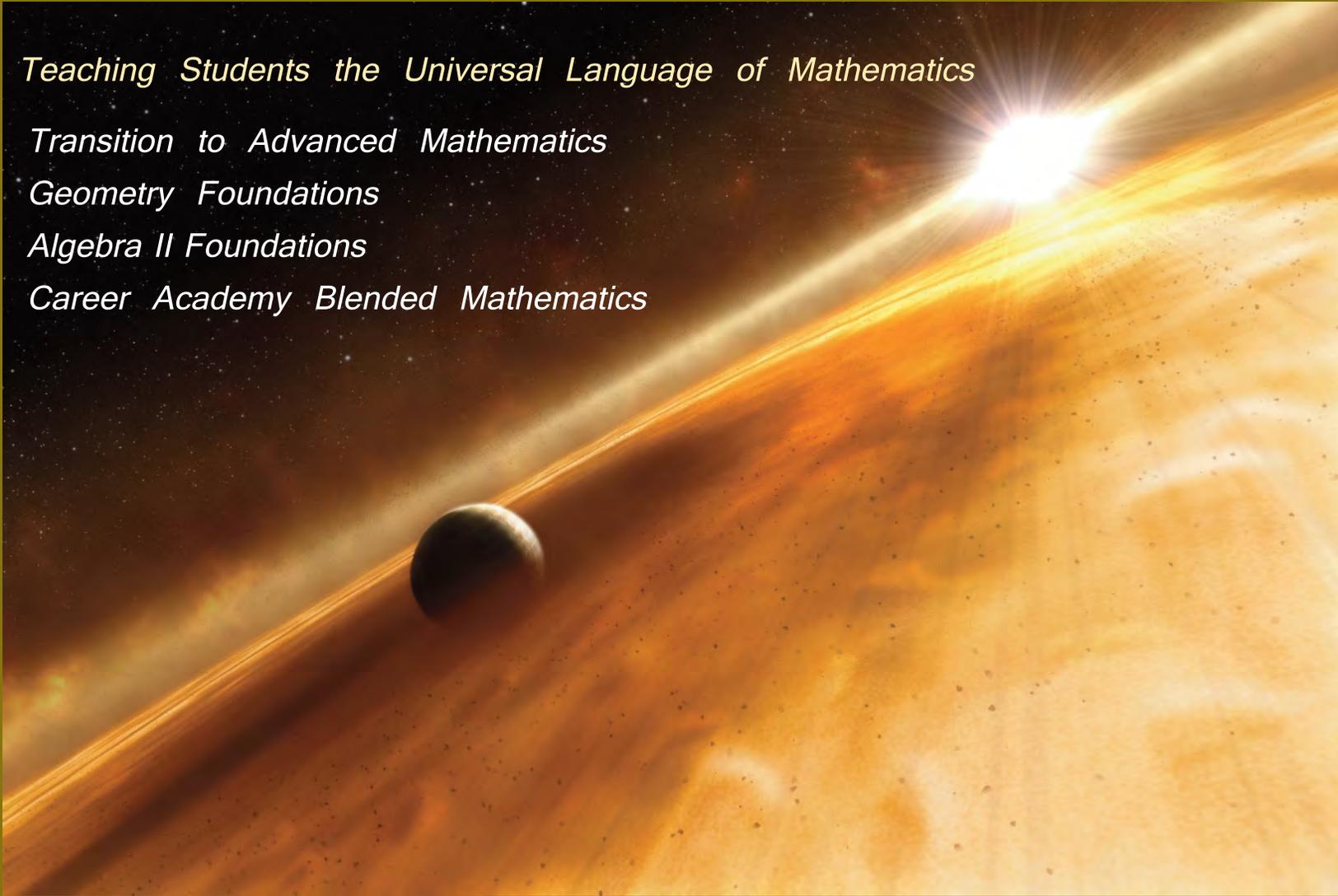
Teaching Students the Universal Language of Mathematics

Transition to Advanced Mathematics

Geometry Foundations

Algebra II Foundations

Career Academy Blended Mathematics





Talent Development Mathematics Initiative uses research-based practices to foster high mathematical achievement in all students.

The nation’s adolescents are finding that to be prepared for post-secondary experiences, they must have a minimum of three years of high school mathematics. Some educators believe that a continuum of “skills only” and math-facts memorization will successfully prepare them for the highly competitive post-secondary challenges.

However, the NAEP’s 2009 Nation’s Report Card, reported **only 34% of America’s 8th-graders performed “at or above” the “proficient” level in mathematics.**

Over the last two decades, Talent Development has made positive strides in not only changing the landscape of teaching mathematics but also developing effective strategies and materials to support teachers.

TD’s ongoing research has provided some interesting results — not only have we learned more about how students learn, but also about how teachers teach!

RESPONDING TO SCHOOLS IN CRISIS

In the mid 1990s, a team of researchers and practitioners from Johns Hopkins University collaborated with high school teachers and administrators at Patterson High School in Baltimore to develop solutions for helping 9th-grade students succeed in Algebra I. Borne from the initial research was *Transition to Advanced Mathematics* (TAM), a course strategically designed to prepare students for Algebra I. After its initial implementation at Patterson High School, the course was implemented in other schools in Baltimore and Philadelphia. By early 2000, schools from New York to New Orleans were using *Transition to Advanced Mathematics*.

While conducting initial research and continuing curriculum development, it became evident that students were benefitting not only from the TAM curriculum but also from the teaching and instructional strategies accompanying it. Increasing numbers of students completing algebra created a need for Talent Development to continue its math sequence. TD Mathematics Initiative developed two new courses — *Geometry Foundations* and *Algebra II Foundations*.

These “double-dose” courses give students the extra support for success in Algebra I, Geometry, and Algebra II. Research shows that the TD classroom model, combined with our research-driven curriculum, helps teachers teach students mathematics, and engages students to want to learn mathematics.

<i>TD MATHEMATICS INITIATIVE</i>	
<i>Sequence for Transition Courses</i>	
<i>1st Semester</i>	<i>2nd Semester</i>
<i>Transition to Advanced Mathematics</i>	<i>Algebra I</i>
<i>Geometry Foundations</i>	<i>Geometry</i>
<i>Algebra II Foundations</i>	<i>Algebra II</i>

GIVING TEACHERS & STUDENTS THE PROPER TOOLS

TD Mathematics Initiative curricula incorporate research findings, field results, and the best information available regarding how students learn mathematics.

TD Mathematics Initiative courses use a multi-tiered approach, including:

- Strategic use of schedules and time
- Reflective practices for teachers
- Evidence-based teaching practices

TD Mathematics Initiative courses are designed to:

- Spark students' problem-solving abilities
- Develop students' number sense
- Increase students' mathematical and verbal communication skills
- Increase students' desire and belief in their mathematical abilities



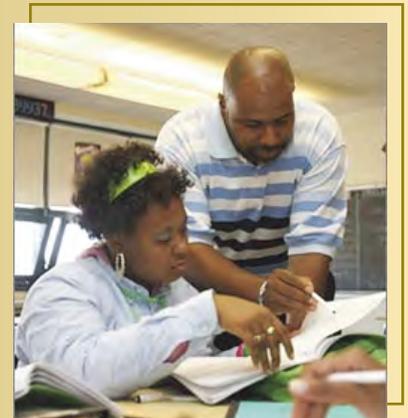
Students work in groups, with partners, and individually to solve problems, share solutions, and construct understanding.

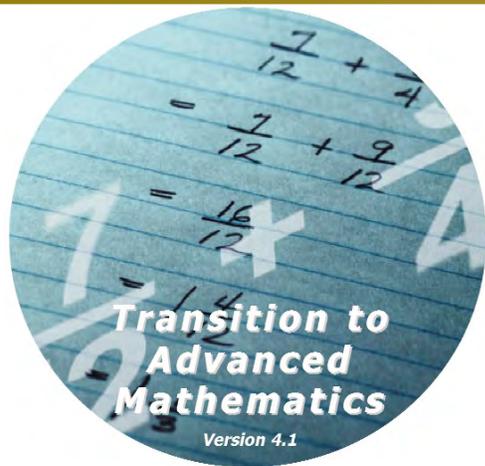
Transition to Advanced Mathematics, *Geometry Foundations*, and *Algebra II Foundations* all engage students with activities that link mathematical skills or abstract mathematics to something concrete. These activities allow students to make connections to prior knowledge and think about their own mathematical thinking. Various teaching and learning strategies give students multiple entry points into each lesson's mathematical topic and address the variety of learning styles within the classroom.

When taught as designed, TD Mathematics Initiative courses offer students and teachers classroom experiences that allow them to build a solid foundation of mathematical understanding.

TD MATHEMATICS INITIATIVE CORE BELIEFS

- Students benefit from conceptual and procedural activities linked to mathematical concepts.
- Students bring a variety of experiences to the mathematics classroom — it is important to uncover students' prior understanding, preconceptions, and misconceptions when representing mathematical ideas.
- Manipulatives and concrete models are beneficial when used appropriately.
- Students need opportunities for success.
- Justifying responses and providing evidence to support conclusions are important components of learning.
- Metacognition is needed to secure understanding.
- Teachers are best served as facilitators of student learning.
- One cannot truly learn mathematics without talking about the mathematics.
- Differentiation can occur in the direct part of the lesson through addressing a variety of learning and thinking strategies.
- Pedagogical content knowledge means not just knowing a variety of instructional strategies but also which strategy best supports the concept, learner, and situation.
- All students have something to contribute when activities allow for multiple entry points and approaches.
- Extended class time allows students to access higher mathematics.
- Students need opportunities to work with multiple representations of key mathematical ideas.
- Success in mathematics requires students to persist and try a variety of mathematical approaches.





Transition to Advanced Mathematics (TAM) was the first course designed by the TD Mathematics Initiative team. In conjunction with Algebra I, TAM offers students a year-long “double-dose” of mathematics instruction. It is an 80- to 90-minute course offered daily during the first semester. Research has shown that TAM prepares students for the rigorous sequence of standards-based high school mathematics courses.

TAM encourages students' conceptual understanding of key ideas that underlie all high school mathematics and sharpens their overall basic mathematical skills. TAM challenges students to think through and understand what they are doing, learn from one another, communicate and respect ideas, and make connections between mathematics and the world.

Transition to Advanced Mathematics' content is built upon three factors:

- Analysis of existing research on best practices for teaching mathematics to poorly prepared adolescents.
- Research from classroom teachers about skills and abilities their students lack.
- Examination of the skills and abilities necessary to succeed in standards-based courses and high-stakes assessments.

Unit 1: Mathematical Reasoning, Data Analysis, and Probability

Students learn how to collect and analyze real world data, use statistical tools and approaches to make data-based decisions and interpretations, and learn how collecting and presenting data can influence interpretation.

- Lesson 1: Topics in Number Theory
- Lesson 2: Number Patterns
- Lesson 3: Inductive Reasoning
- Lesson 4: Data Analysis
- Lesson 5: Descriptive Statistics
- Lesson 6: Probability

Unit 2: Numbers and Integers

Students develop understanding and the need for the different number sets with a focus on the four main operations on a set of integers.

- Lesson 1: Natural Numbers to Integers
- Lesson 2: Adding Integers
- Lesson 3: Subtracting Integers
- Lesson 4: Multiplying Integers
- Lesson 5: Dividing Integers
- Lesson 6: Natural Numbers to Rational Numbers

Unit 3: Rational Numbers

Students explore rational numbers from both an additive (absolute) and multiplicative (relative) approach.

- Lesson 1: Relative and Absolute Reasoning
- Lesson 2: Percents
- Lesson 3: Finding Percents
- Lesson 4: The Multiple Personalities of Rational Numbers and Unitizing Revisited
- Lesson 5: Common Denominators and Adding/Subtracting Fractions
- Lesson 6: Multiplying Rational Numbers
- Lesson 7: Reciprocals and Dividing Fractions
- Lesson 8: Investigating the Mysteries of Decimals
- Lesson 9: Ratios and Rates

Unit 4: Measurement

Students learn how to accurately measure by selecting and using appropriate techniques, units, and tools. Students use geometric measures of length, area, volume, and angles.

Lesson 1: Measuring Concepts and Skills

Lesson 2: Areas and Perimeters

Lesson 3: Rectangles and Parallelograms

Lesson 4: Angles and Angle Measures

Lesson 5: Getting Ready for Pythagoras

Lesson 6: Locations for Real Numbers

Lesson 7: Slope

Lesson 8: Slopes for Special Lines

Students learn how to look for, generalize, and use patterns; understand the meaning and nature of variables; represent algebraic problems verbally, visually, concretely, and symbolically; and begin to appreciate algebraic language and the power of symbolism.

Lesson 1: Order of Operations

Lesson 2: Equivalence

Lesson 3: Opposite Operations

Lesson 4: Solving One-Step Equations

Lesson 5: Solving Two-Step Equations

Lesson 6: Tables and Graphs

Lesson 7: Patterns

Lesson 8: Introduction to Functions

Lesson 9: Exploring and Analyzing Graphs

Unit 5: Patterns and Functions Introduction to Algebra

STUDENT
JOURNALS
AVAILABLE IN
SPANISH
TRANSLATIONS

KEY COMPONENTS & ADVANTAGES

PEER-ASSISTED STARTER ACTIVITIES

Each lesson begins with a “Problem of the Day.” This activity supports students’ development of number sense and mathematical reasoning. Students are challenged to determine if given situations “make sense” in different mathematical contexts. Ranging from the number of “kangaroo leaps” in a football field to a reasonable guess of the number of hours the average person watches TV, these problems use an open-ended format that promotes developing a community mathematical learners and refining inter-personal and mathematical communications.

WHOLE-CLASS DISCOVERY

TAM lessons provide a wide variety of opportunities for students to re-explore concepts they were taught in middle school in a novel context. This provides teachers with an excellent opportunity to facilitate classroom dialogues about new topics, such as “Goldbach’s Conjecture,” “abundant,” “deficient,” and “perfect” numbers. Students learn new ways to conceptually represent such topics as prime and composite numbers. Topics and contexts were selected specifically to pique student interest and develop confidence in their ability to think mathematically. They also address the prerequisite areas needed for success in second-semester Algebra I.



Assorted activities built into each lesson engage students in discussions of how and why basic mathematics works in everyday life.

Geometry Foundations



Geometry Foundations (GF) offers the same beneficial “double-dose” strategy to geometry students as TAM. GF reviews basic algebraic skills and fosters students’ conceptual understanding of key ideas in high school geometry.

GF helps students:

- Learn missing mathematical components.
- Develop new concepts.
- Broaden depth of understanding.
- Strengthen skills and mathematical reasoning.

Geometry Foundations uses TD Mathematics Initiative’s strategies of working in partnerships, challenging students to think through and make sense of what they are doing, learn from one another, share and respect ideas, and make connections between geometry and the world.

Unit 1: Introduction to Geometry

A variety of topics allows students to begin the year successfully, review basic fundamentals, develop cooperative learning strategies, increase skills with manipulative and geometric tools, and discover new concepts.

- Lesson 1: Chromatic Numbers
- Lesson 2: Lines of Symmetry
- Lesson 3: Rotational Symmetry
- Lesson 4: Cutting the Pattern
- Lesson 5: Similarity
- Lesson 6: The N^{th} Term

Unit 2: Measurement

Students will engage in an array of measurement activities that help them conceptually understand length, area, and volume.

- Lesson 1: Metric Identification Card
- Lesson 2: Counting Squares
- Lesson 3: Walking the Distance
- Lesson 4: Distance Proportions
- Lesson 5: Area and Perimeter
- Lesson 6: Cube Nets
- Lesson 7: Surface Area and Volume
- Lesson 8: Big Base

Unit 3: Properties of Objects

Students investigate the common properties of basic geometric shapes by physically interacting with cutouts and drawings.

- Lesson 1: Circles
- Lesson 2: Basic Triangles
- Lesson 3: Special Triangles
- Lesson 4: Quadrilaterals
- Lesson 5: Parallelograms
- Lesson 6: Special Quadrilaterals
- Lesson 7: Pythagorean Theorem
- Lesson 8: Center of Mass
- Lesson 9: Circumscribed Circles
- Lesson 10: Inscribed Circles



Unit 4: Coordinate Geometry

Students review the fundamental skills and concepts to work effectively with the coordinate plane hands-on activities.

- Lesson 1: Plotting Points
- Lesson 2: Calculator Plotting
- Lesson 3: Rise and Run
- Lesson 4: Slope
- Lesson 5: Parallel
- Lesson 6: Perpendicular
- Lesson 7: Distance Formula
- Lesson 8: Midpoint
- Lesson 9: Coordinate Proof

Unit 5: Language of Geometry

Students learn the formal terms and objects common to geometry. They also construct meaningful understanding of geometric terms and objects.

- Lesson 1: Get the Point!
- Lesson 2: Line it Up?
- Lesson 3: The Plane Truth
- Lesson 4: Space
- Lesson 5: Segments and Rays
- Lesson 6: Angles
- Lesson 7: Congruence
- Lesson 8: Similar
- Lesson 9: 3-D Objects

KEY COMPONENTS & ADVANTAGES

PEER-ASSISTED STARTER ACTIVITIES

A “Problem of the Day” begins each *Geometry Foundations* lesson. These activities provide multiple entry points to non-routine problems with many exploring spatial relationships. Pairs, or small groups, of students begin work immediately upon entering the classroom.

ALGEBRA CONNECTIONS

Many students need support with algebra. *Geometry Foundations* includes activities and exercises at the end of each lesson to help students review and connect important algebra and geometry concepts. Each Algebra Connection exercise is linked to the geometry concepts covered in the lesson.

WHOLE-CLASS DISCOVERY

Geometry Foundations lessons give students the opportunity to use tools and sometimes construct objects that help them conceptually understand basic geometric topics: measurement, property of objects, and coordinate geometry. Some components feature groups that work together and give class presentations to explain the approach they used to solve an exercise.

GF engages students first semester and gives them a concrete understanding of geometry, allowing them to be more successful when they move into the second-semester geometry course that is more theorem-based.

STUDENT JOURNALS AVAILABLE IN
SPANISH TRANSLATIONS

The TD Mathematics Initiative Classroom

- Consumable student materials that engage students in transitional activities to build strong foundations.
- Materials that encourage procedural **and** conceptual understanding of “big ideas.”
- Opportunities for peer-assisted learning.
- Exercises and activities designed to reveal students’ pre-conceptions and misconceptions.
- Proven strategies that promote student metacognitive and self-directed thinking and learning.
- Encouraging classrooms where students learn from one another, share ideas, and respect others’ ideas.
- Lessons designed to connect mathematics to the real world.
- Students develop abilities to transition from concrete mathematics thinking to abstract thinking.



Algebra II Foundations (AIIF) is a research-based course combining traditional and innovative teaching strategies. AIIF is designed to help students build the “habits of mind” needed for success in Algebra II. The course emphasizes the connections between numeric representation, graphic representation, and algebraic notation.

AIIF fosters students’ conceptual understanding of key ideas that underlie Algebra II. AIIF challenges students to think through and make sense of what they are doing, learn from one another, share and respect ideas, and make connections between mathematics and the world.

Solving One-Variable Equations

Students apply the basic equality properties and order of operations to construct understanding on solving one-variable equations.

- Lesson 1: Expressions and Properties
- Lesson 2: Solving Equations by Using Properties
- Lesson 3: Order of Operations
- Lesson 4: Solving Equations Using Order of Operations
- Lesson 5: Solving One-Variable Inequalities
- Lesson 6: Solving Absolute Value Equations and Inequalities
- Lesson 7: Ratios, Proportions, and Percent of Change

Linear Functions

Students review basic coordinate plane and linear concepts and move toward a deeper understanding of linear functions and linear function applications.

- Lesson 1: Plotting Points
- Lesson 2: Linear Equations in Slope-Intercept Form
- Lesson 3: Applications of Linear Functions in Slope-Intercept Form
- Lesson 4: Linear Function Notation
- Lesson 5: Other Forms of Linear Functions
- Lesson 6: What is a Function?
- Lesson 7: Linear Regression
- Lesson 8: Linear Inequalities

Systems of Equations

Students’ develop abstract thinking needed for solving a system of equations through a series of concrete manipulatives, diagrams, and graphs.

- Lesson 1: Two Items, One Table
- Lesson 2: Two Items and a Diagram
- Lesson 3: Balance Scales
- Lesson 4: System of Equations and Tiles
- Lesson 5: Solve Systems of Equations by Graphing

Non-Linear Functions

Students investigate the basic properties of many non-linear functions (both symbolically and graphically) using graphing calculators.

- Lesson 1: Introduction to Quadratic Functions
- Lesson 2: The Quadratic Formula
- Lesson 3: Graphing Quadratic Functions and Their Applications
- Lesson 4: Power Functions
- Lesson 5: Inverse Variation
- Lesson 6: Exponential Functions
- Lesson 7: Step Functions
- Lesson 8: Miscellaneous Non-Linear Functions

Probability & Statistics

Through a unique set of constructivist-based activities, students explore fundamental big ideas of probability and statistics.

- Lesson 1: Fundamental Counting Principle
- Lesson 2: Permutations and Factorials
- Lesson 3: Combinations
- Lesson 4: Probability
- Lesson 5: Expected Winnings
- Lesson 6: Parameters and Statistics

KEY COMPONENTS & ADVANTAGES

WHOLE-CLASS DISCOVERY

For each unit we have developed a sequence of lessons that use a variety of strategies to actively engage students and provide them with the core knowledge and mathematical approaches they need to succeed in high school mathematics.

Each lesson begins with a motivational activity designed to engage students, and it proceeds through discovery activities designed to actively involve students in the learning process. Students working in partnerships or cooperative groups complete these activities.

DIFFERENTIATED INDIVIDUAL & SMALL GROUP INSTRUCTION

Supplemental materials provide additional reinforcement of the lessons’ objectives and other fundamental mathematical concepts.

Career Academy Blended Mathematics

A NEW SERIES OF SUPPLEMENTARY LESSONS THAT WILL ENHANCE ALL STUDENTS' MATHEMATICAL LEARNING EXPERIENCES.

Career Academy Blended Mathematics (CABM) is a series of exciting projects that include advanced material and supplement existing Talent Development and general curricula. CABM presents mathematics in an engaging manner while corresponding with state and district mathematics standards. These projects provide extensive real-world applications embedded with career themes to equip students with the critical thinking abilities to prosper beyond high school. CABM's in-depth, multi-day projects align with geometric, algebraic, and trigonometric topics found in every high school mathematics class.



A Baltimore Talent Development High School student team works on the initial phase of the CABM Staircase Design project.



Here, the student team works on the second phase of the Staircase Design project – constructing the staircase.



Construction complete!
The student team proudly displays the completed staircase.

Current CABM Lessons

- **Auto Racing** (*Geometry & Trigonometry*)
- **Cocoa Production** (*Data Analysis & Representation*)
- **Difference Boxes** (*Mathematical Analysis*)
- **Square Law** (*Proportions & Quadratic Equations*)
- **Puff Pastry Layers** (*Exponential Functions*)
- **Census Estimation** (*Data Analysis & Representation*)
- **Staircase Design** (*Slope & Trigonometry*)
- **Tree Height** (*Linear Equations*)
- **West Nile Virus** (*Data Analysis & Representation*)
- **Sports Jump!** (*Health & Fitness/Sports*)

Each CABM Project Contains. . .

Collaborative Student Research Teams

- Builds mathematical/scientific communication between peers
- Promotes teamwork

Background Information Reading

- Provides relevance
- Promotes career knowledge
- Presents global picture of topic
- Provides context for mathematical derivations

Experiment/Construction Activity

- Builds links between tactile objects and high level mathematics

Mathematics Investigation/Data Analysis

- Links representations and translations between representations

Students will:

- Collect data, tabulate, graph, calculate, determine mathematical functions from graphs and data, make predictions

Class Presentations

- Promote mathematical and scientific communication
- Show multiple aspects of overall problem

TD Mathematics Initiative relies on field data collected each school year to ensure our curriculum is not only up to the highest standards but also able to integrate new teaching and learning strategies with proven results!

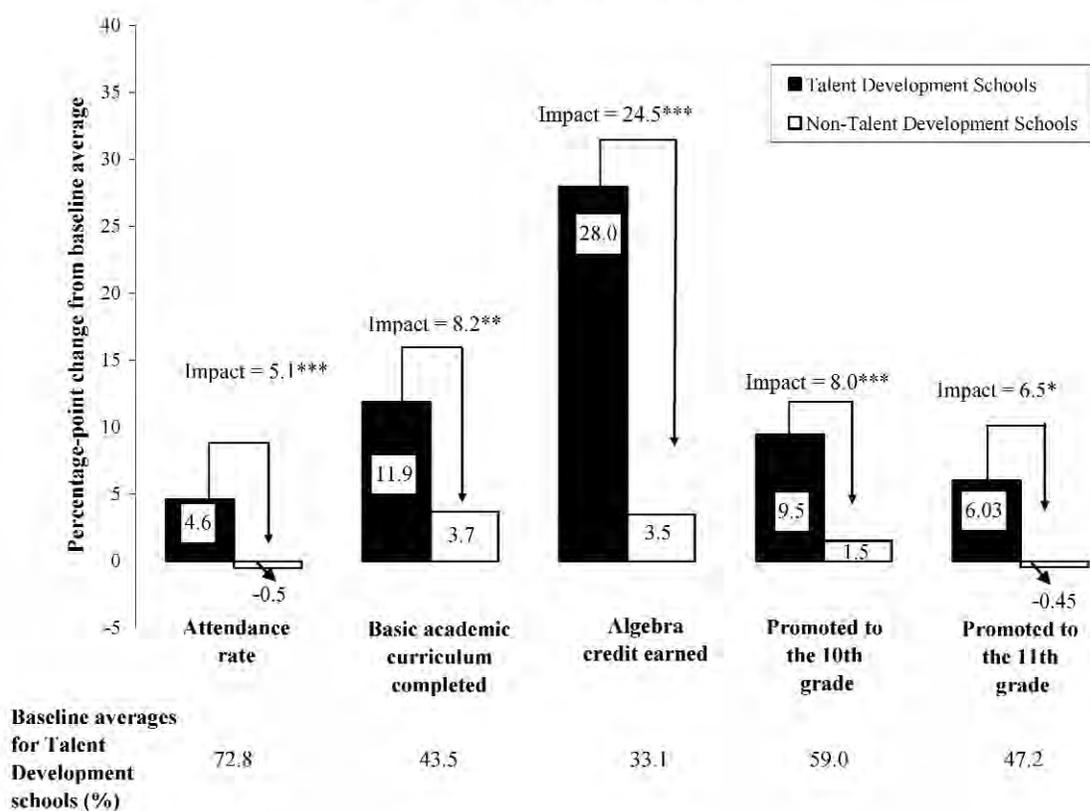
CLOSING THE GAP

Research conducted by Johns Hopkins University and Talent Development High Schools shows that students achieve when they attend schools where teachers and curriculum are responsive to their educational and societal needs. Independent evaluation finds that students attending Talent Development High Schools are more likely to succeed academically than students in comparison high schools.

Students showed dramatic gains in algebra credits: Talent Development schools nearly doubled the percentage of students earning credits in Algebra I, a primary gatekeeper course for grade promotion and graduation.

(Source: 2005 MDRC report)

Impacts on and Baseline Averages for Key Outcomes for First-Time Ninth-Grade Students



In 2007, the U.S. Department of Education awarded Johns Hopkins University a major research grant to conduct a rigorous study of the impact of *Transition to Advanced Mathematics/Algebra I* on student learning. To obtain the grant, TD had to demonstrate initial evidence of TAM's effectiveness. During the 2008-2009 and 2009-2010 school years, 13 districts and 46 schools participated in the study. High schools in each district were randomly assigned to either implement TAM (first semester) and Algebra 1 (second semester) or a "Stretch Algebra" (Algebra 1A/1B throughout the school year) curriculum of their choosing. The study examines student growth in intermediate mathematics, Algebra 1 proficiency, algebra grades, and credit accumulation in algebra. Results are expected in 2011.



BENEFITS FOR STUDENTS

Students respond...

Students across the country are responding to TD Mathematics Initiative!



“I love the *Transition to Advanced Mathematics* program! Before TAM, I HATED math, but that program helped me understand math a lot better. It got me more involved in doing problems and work better. I loved it!”

“Thanks to TAM, I feel more confident to take on math problems all by myself.”

“I liked actually learning!”

“It gave me a picture in my head about what I learned and how to solve the problem.”

Making the Grade. . .

In the late 1990s, Strawberry Mansion High School in Philadelphia was one of the city’s lowest-performing high schools. By 2001, only 2% of its 11th-graders were proficient in mathematics, and its graduation rate was well below 50%. Strawberry Mansion High School and Talent Development High Schools allied to solve this crisis, and today, Strawberry Mansion is the neighborhood high school with the greatest achievement and graduation gains in the school district.

Over the past six years, the percentage of students proficient in mathematics has grown by 51 percentage points and the school’s graduation rate has risen to 74.5 percent.

BENEFITS FOR TEACHERS

- Evidence-based, engaging curriculum that is regularly updated based on research, field results, and studies.
- A comprehensive “Teacher’s Kit” containing all the necessary components and resource materials to successfully implement TD curriculum.
- Teacher manuals outline successful teaching strategies, lesson aids, and optional activities to engage students in successful learning.
- Technology integration that fosters understanding of mathematical ideas in representational forms.
- TD coaches and professional development foster curriculum understanding and teacher development.

Teachers respond...

“I like *Geometry Foundations* because it engages students with hands-on learning experiences, rather than being told formulas or concepts directly. Students are able to discover them for themselves through manipulatives and concept construction.

Teachers comment on TD Mathematics Initiative components:

- The hands-on activities are very good.
- I like all the resource materials that accompany the course.
- The *CABM* lesson on building roofs really drives home the idea of steepness.

“Kids appear to be more willing and enthusiastic to “explain and justify” their answers.”

“Curriculum has helped kids feel more comfortable with each other.”



Talent Development offers a wide array of courses. If you would like a course prospectus or more information on any of our courses, please contact us, and we will be happy to forward you additional information. You are also invited to visit our website at www.csos.jhu.edu for complete information on Talent Development programs and curricula.

ENGLISH LANGUAGE ARTS

Strategic Reading
Reading & Writing in Your Career
College Prep Reading & Writing
Literacy Lab

MATHEMATICS

Transition to Advanced Mathematics
Geometry Foundations
Algebra II Foundations
Career Academy Blended Mathematics

SOCIAL STUDIES

Freshman Seminar

Talent Development Secondary
2701 N Charles Street, Suite 300
Baltimore, MD 21218

Telephone: (410) 516-8800
Facsimile: (410) 516-8890

