GEORGIA DEPARTMENT OF EDUCATION

Kathy Cox, State Superintendent of Schools

Training for the New Georgia Performance Standards
Day 1: Standards-Based Education and the GPS

Participant's Guide Mathematics Grades K-2

Use of This Guide

This training program was developed by the Georgia Department of Education as part of a series of professional opportunities to help teachers increase student achievement through the use of the Georgia Performance Standards.

The module materials, including a Content Facilitator's Guide, Participant's Guide, PowerPoint Presentation, and supplementary materials, are available to designated trainers throughout the state of Georgia who have successfully completed a Train-the-Trainer course offered through the Georgia Department of Education.

Materials (guides, presentations, etc.) will be available electronically on http://www.georgiastandards.org under the training tab after all trainings of Day 1 have occurred. Consult the trainer for other availability.

For more information on this or other GPS training modules, please contact Gerald Boyd at gboyd@doe.k12.ga.us

Table of Contents

Use of This Guide 2

Table of Contents 3

Agenda 4

Module Goal 5

Module Objectives 5

K-2 Mathematics At a Glance 6

K-2 Mathematics GPS 7

Grids 20

Phase-in Plan 21

GPS and the Unit Design Process 22

Identifying Desired Results of a Standard 23

A Big Idea… 24

An Enduring Understanding… 25

Essential Questions… 26

Skills and Knowledge 27

Redelivery Action Plan 28

Field Assignment 29

Resources 30

Glossary 33

Selected Terms/Symbols 35

Learning Journal 36

Agenda

This is a one-day course, with approximately seven hours of instructional time.

Introduction

Overview of the Standards

Standards-Based Teaching and Learning

Putting It All Together

Summary and Field Assignments

Module Goal

Demonstrate a deep understanding of the new Georgia Performance Standards and the standards-based education approach, through thoughtful curriculum mapping, development of formative and summative assessments, and the design of instruction matched to the standards and research-based best practices for enrichment and extension through collaboration and teamwork.

Key words from the goal:

- Deep understanding
- Georgia Performance Standards (GPS)
- Curriculum Mapping
- Assessments/Instruction
- Enrichment and Extension
- Teamwork

Note that the goal will not be reached by day one of training alone. It will take preparation, follow up, and seven days of classroom instruction to master this goal. Various days of training will deal with different components of the goal, such as curriculum mapping, assessment, and instruction.

Module Objectives

By the end of day one of training, participants will be able to:

1. Describe the benefits of the GPS.
2. Describe the various phases of the GPS rollout plan.
3. Define terms related to the GPS.
4. Identify four parts of each standard.
5. Describe the unit design process used in standards-based teaching and learning.
6. Identify key components of the applicable standards (for example, 1st grade math).

K–2 Mathematics at a Glance

	Kindergarten	First Grade	Second Grade
Numbers and Operations	• Counting, Comparing, Estimating, Money • Modeling Addition and Subtraction	• Counting, Comparing, Estimating, Money • Place Value • Addition and Subtraction, Inverse Relationships • Number Theory: Division, Patterns, Fractions	• Place Value to 4 Digits, Money • Multi-Digit Addition and Subtraction • Concepts of Multiplication • Comparing Fractions • Equality and Inequality
Measurement	• Classification • Calendar Time, Ordering Events, Telling Time	• Comparing and Ordering Length, Weight, Capacity • Telling Time, Using a Calendar, Sequencing	• Measuring, Estimating, Comparing Length • Telling Time • Measuring and Estimating Temperature
Geometry	• Identifying, Combining, Comparing 2-D and 3-D Shapes • Positional Relationships • Patterns	• 2-D and 3-D Constructions • Spatial Reasoning • Classification of Shapes	• Classification of 2-D and 3-D Shapes • 2-D and 3-D Spatial Reasoning
Data Analysis and Probability	• Questioning, Collecting Data, Making Graphs	• Creating Tables and Graphs	• Creating and Interpreting Tables and Graphs
Process Skills	Problem Solving, Arguments, Language of Mathematics, Interconnectivity, Communication	Problem Solving, Arguments, Language of Mathematics, Interconnectivity, Communication	Problem Solving, Arguments, Language of Mathematics, Interconnectivity, Communication

K-2 Mathematics GPS

K-12 Mathematics Introduction
The Georgia Mathematics Curriculum focuses on actively engaging the students in the development of mathematical understanding by using manipulatives and a variety of representations, working independently and cooperatively to solve problems, estimating and computing efficiently, and conducting investigations and recording findings. There is a shift towards applying mathematical concepts and skills in the context of authentic problems and for the student to understand concepts rather than merely follow a sequence of procedures. In mathematics classrooms, students will learn to think critically in a mathematical way with an understanding that there are many different ways to a solution and sometimes more than one right answer in applied mathematics. Mathematics is the economy of information. The central idea of all mathematics is to discover how knowing some things well, via reasoning, permit students to know much else—without having to commit the information to memory as a separate fact. It is the connections, the reasoned, logical connections that make mathematics manageable. As a result, implementation of Georgia's Performance Standards places a greater emphasis on problem solving, reasoning, representation, connections, and communication.

Kindergarten

By the end of kindergarten, students will understand small numbers, quantities, and simple shapes in their everyday environment. They will also count, compare, describe and sort objects, and develop a sense of properties and patterns. Students will begin to understand measurement through the direct comparison of objects, money by making fair trades with coins and the concept of time by experiencing a daily schedule.
Instruction and assessment should include the use of manipulatives and appropriate technology. Topics should be represented in multiple ways including concrete/pictorial, verbal/written, numeric/data-based, graphical, and symbolic. Concepts should be introduced and used in the context of real world phenomena.

MKN. Numbers and Operations

Students will correctly represent the number and order of objects using numbers and understand them.

MKN1. Students will connect numerals to the quantities they represent.
a. Count a number of objects up to 30.
b. Produce models for number words through ten.

c. Write numerals through 20 to label sets.
d. Sequence and identify using ordinal numbers (1st-10th).
e. Compare two or more sets of objects (1-10) and identify which set is equal to, more than, or less than the other.
f. Estimate quantities using five and ten as a benchmark. (e.g. 9 is one five and four more. It is closer to two fives or one 10 than it is to one five.).
g. Use informal strategies to share objects equally (divide) between two to three people or sets.
h. Identify coins by name and value (penny, nickel, dime, and quarter).
i. Count out pennies to buy items that together cost less than 30 cents.
j. Make fair trades involving combinations of pennies and nickels or pennies and dimes.

MKN2. Students will use representations to model addition and subtraction.
a. Use counting strategies to find out how many items are in two sets when they are combined.
b. Build number combinations up to 10 (e.g., 4 and 1, 2 and 3, 3 and 2, 4 and 1 for five) and for doubles to 10 (3 and 3 for six).
c. Use objects, pictures, numbers, or words to create, solve and explain story problems for two numbers that are each less than 10.

MKM. Measurement

Students will explore quantitative situations involving distance, length, capacity, weight, time, and temperature.

MKM1. Students will group objects according to common properties such as color, shape, texture, or number.
a. Compare and order objects on the basis of length.
b. Compare and order objects on the basis of capacity.
c. Compare and order objects on the basis of height.
d. Compare and order objects on the basis of weight.

MKM2. Students will understand the measurement of calendar time.
a. Know the names of the days of the week.
b. Know the months of the year.
c. Know the four seasons.

MKM3. Students will tell time as it relates to a daily schedule.
a. Order daily events.
b. Tell the time when daily events occur, such as lunch, to the nearest hour.

c. Know the name of the day of the week when weekly events occur in class.

MKG. Geometry

Students will recognize and name basic geometric shapes and spatial relationships.

MKG1. Students will correctly name simple two and three-dimensional figures, and recognize them in the environment.
a. Recognize and name the following basic two-dimensional shapes: triangles, rectangles, squares, and circles.
b. Recognize and name the following three-dimensional shapes: spheres (balls), and cubes.
c. Observe concrete objects in the environment and represent the objects using basic shapes, such as drawing a representation of a house using a square together with a triangle for the roof.
d. Combine basic shapes into basic and more complicated shapes, and will decompose basic shapes into combinations of basic shapes.
e. Compare geometric shapes and identify similarities and differences of the following two and three-dimensional shapes: triangles, rectangles, squares, circles, spheres, and cubes.

MKG2. Students will understand basic positional relationships.
a. Identify when an object is beside another object, above another object, or below another object.
b. Identify when an object is in front of another object, behind another object, inside another object or outside it.

MKG3. Students will identify, create, extend, and transfer patterns from one representation to another using actions, objects, and geometric shapes.
a. Identify a missing shape within a given pattern of geometric shapes.
b. Extend a given pattern, and recognize similarities in different patterns.

MKD. Data Analysis and Probability

Students will pose questions and gather data about themselves and their surroundings.

MKD1. Students will pose information questions, collect data, organize, and record results using objects, pictures, and picture graphs.

MKP. Process Skills

Students will apply mathematical concepts and skills in the context of authentic problems and will understand concepts rather than merely follow a sequence of procedures. The students will use the process standards as a way of acquiring and using content knowledge.

MKP1. Students will solve problems that arise in mathematics and in other contexts.
a. Solve non- routine word problems using the strategy act out the problem or use objects.
b. With the use of manipulatives, solve routine word problems related to all appropriate kindergarten math standards.

MKP2. **Students will investigate, develop, and evaluate mathematical arguments.**

MKP3. **Students will use the language of mathematics to express ideas precisely.**

MKP4. Students understand how mathematical ideas interconnect and build on one another and apply mathematics in other content areas.

MKP5. Students will create and use pictures, manipulatives, models, and symbols to organize, record, and communicate mathematical ideas.

Terms/Symbols:
numbers through 30, set, longer, shorter, heavier, lighter, morning, afternoon, evening, yesterday, today, tomorrow, days of the week, months of the year, seasons, triangle, rectangle, square, circle, sphere, cube, beside, above, below, in front of, behind, inside, outside, more, less, equal.

Grade 1

By the end of grade one, students will understand and use the concept of ones and tens in the place value number system. The students will add and subtract small numbers with ease. They will represent quantity with numbers, models, diagrams, and number sentences. They will begin to use tools for measuring and observe, create, and decompose geometric shapes and solve simple problems including those involving spatial relationships. The students will pose questions, record data, and interpret simple charts and picture graphs.
Instruction and assessment should include the use of manipulatives and appropriate technology. Topics should be represented in multiple ways including symbolic, verbal/written, numeric/data-based, graphical, and concrete/pictorial. Concepts should be introduced and used in the context of real world phenomena.

Concepts/Skill to Maintain
Number words
Ordinal numbers
Equivalence
Basic geometric shapes
Positional words
Calendar time
Estimating—using 10 as a benchmark
Name and value of coins

M1N. Number and Operations

Students will understand how to represent numbers, and be able to add and subtract small numbers.

M1N1. Students will estimate, model, compare, order, and represent whole numbers up to 100.
a. Represent numbers less than 100 using a variety of models, diagrams, and number sentences. Represent numbers larger than 10 in terms of tens and ones using counters and pictures.
b. Correctly count and represent the number of objects in a set using numerals.
c. Compare small sets using the terms greater than, less than, and equal to (<, >, =).
d. Understand the magnitude and order of numbers up to 100 by making ordered sequences and representing them on a number line.

e. Exchange equivalent quantities of coins by making fair trades involving combinations of pennies, nickels, dimes, and quarters and count out a combination needed to purchase items less than a dollar.
f. Identify bills ($1, $5, $10, $20) by name and value and exchange equivalent quantities by making fair trades involving combinations of bills and count out a combination of bills needed to purchase items less than twenty dollars.

M1N2. Understand place value notation for the numbers between 1 and 100. (Discussions may allude to 3-digit numbers to assist in understanding place value.)
a. Determine which multiple of ten a given number is nearest (rounding) using tools such as a sequential number line or hundreds chart to assist in estimating.
b. Represent collections of less than 30 objects with 2-digit numbers and understand the meaning of place value. (Make sure that students, when given a number like 27 initially describe it as 2 tens and 7 ones, and only later use standard language, twenty-seven, when talking about the number.)

M1N3. Students will add and subtract numbers less than 100 as well as understand and use the inverse relationship between addition and subtraction.
a. Identify one more than, one less than, 10 more than, and 10 less than a given number.
b. Skip-count by 2's, 5's, and 10's forward and backwards – to and from numbers up to 100.
c. Compose/decompose numbers up to 10 --"break numbers apart", e.g., 8 is represented as 4 + 4, 3 + 5, 5 + 2 + 1, and 10-2). Decompose numbers between 11 and 19 as one ten and the appropriate number of ones.
d. Understand a variety of situations to which subtraction may apply: taking away from a set, comparing two sets, and determining how many more or how many less.
e. Understand addition and subtraction number combinations using strategies such as counting on, counting back, doubles and making tens.
f. Know the single-digit addition facts to 18 and corresponding subtraction facts with understanding and fluency. (Use strategies such as relating to facts already known, applying the commutative property, and grouping facts into families.)
g. Apply addition and subtraction to 2 digit numbers without regrouping (e.g. 15 + 4, 80-60, 56 + 10, 100-30, 58 + 5).
h. Solve and create word problems involving addition and subtraction to 100 without regrouping. Use words, pictures and concrete models to interpret story problems and reflect the combining of sets as addition and taking away or comparing elements of sets as subtraction.

M1N4. Students will count collections of up to 100 objects by dividing them into equal parts and represent the results using words, pictures, or diagrams.
a. Use informal strategies to share objects equally between two to five people.
b. Build number patterns, including concepts of even and odd, using various concrete representations. (Examples of concrete representations include a hundreds chart, ten grid frame, place value chart, number line, counters, or other objects.).
c. Identify, label and relate fractions (halves, fourths) as equal parts of a whole using pictures and models.

M1M. Measurement

Students will measure basic quantitative attributes of concrete objects.

M1M1. Students will compare and/or order the length, weight, or capacity of two or more objects by using direct comparison or a nonstandard unit.
a. Directly compare length, weight, and capacity of concrete objects.
b. Estimate and measure using a non-standard unit that is smaller than the object to be measured.
c. Measure with a tool by creating a "ruled" stick, tape, or container by marking off ten segments of the repeated single unit.

M1M2. Students will develop an understanding of the measurement of time.
a. Tell time to the nearest hour and half hour and understand the movement of the minute hand and how it relates to the hour hand.
b. Begin to understand the relationship of calendar time by knowing the number of days in a week and months in a year.
c. Compare and/or order the sequence or duration of events (e.g., shorter/longer and before/after).

M1G. Geometry

Students will understand the concepts of basic geometric shapes and spatial relationships of concrete objects.

M1G1. Students will study and create various two and three-dimensional figures and identify basic figures (squares, circles, triangles, and rectangles) within them.
a. Build, draw, name, and describe triangles, rectangles, pentagons, and hexagons.

b. Build, represent, name, and describe cylinders, cones, and rectangular prisms (objects that have the shape of a box).
c. Create pictures and designs using shapes, including overlapping shapes.

M1G2. Students will compare, contrast, and/or classify geometric shapes by the common attributes of position, shape, size, number of sides, and number of corners.

M1G3. Students will arrange and describe objects in space by proximity, position, and direction (near, far, below, above, up, down, behind, in front of, next to, and left or right of).

M1D. Data Analysis and Probability

Students will pose questions, collect, organize and interpret data about themselves and their surroundings.

M1D1. Students will create simple tables and graphs and interpret them.
a. Interpret tally marks, picture graphs and bar graphs.
b. Organize and record data using objects, pictures, tally marks, and picture graphs.

M1P. Process Skills

Students will apply mathematical concepts and skills in the context of authentic problems and will understand concepts rather than merely following a sequence of procedures. The student will use the process standards as a way of acquiring and using content knowledge.

M1P1. Students will solve problems that arise in mathematics and in other contexts.
a. Solve non- routine word problems using the strategy make a picture or diagram and continue to develop the strategy act out or use objects learned in kindergarten.
b. Solve single step routine word problems related to all appropriate first grade math standards.

c. Determine the operation(s) needed to solve a problem.
d. Determine the most efficient way to solve a problem (mentally, paper/pencil, or calculator).

M1P2. Students will investigate, develop, and evaluate mathematical arguments.

M1P3. Students will use the language of mathematics to express ideas precisely.

M1P4. Students understand how mathematical ideas interconnect and build on one another and apply mathematics in other content areas.

M1P5. Students will create and use pictures, manipulatives, models, and symbols to organize, record, and communicate mathematical ideas.
Terms/Symbols:
place value—ones, tens, hundreds, greater than, less than, equal to, fewer than, more than, sum/add, difference/subtract, coins—penny, nickel, dime, quarter, compare/contrast, length, weight, estimate, hexagon, cylinder, cone, rectangular prism, <, >, =, +, -, even, odd, tally mark

Grade 2

By the end of grade two, students will understand place value and number relationships in addition and subtraction and use simple concepts of multiplication. They will measure length with appropriate units and determine perimeter. Students will classify shapes and see relationships among them by recognizing their geometric attributes. They will know the relationships of time and count back change. The students will collect, analyze, and interpret data using bar graphs and Venn diagrams.
Instruction and assessment should include the use of manipulatives and appropriate technology. Topics should be represented in multiple ways including symbolic, verbal/written, numeric/data-based, graphical, and concrete/pictorial. Concepts should be introduced and used in the context of real world phenomena.

Concepts/Skill to Maintain
Fluency with single digit addition/subtraction facts to 18
Fair trades with coins or bills
Duration and sequence of events
Number patterns-skip count, odd/even
Fact families
Fractions.halves, fourths
Tally marks
Picture graphs
Estimation.rounding to nearest ten

M2N. Numbers and Operations

Students will further develop their understanding of numbers - including fractions - and how to represent them. The students will understand and apply addition, subtraction and multiplication through concrete manipulation and perform basic calculations.

M2N1. Students will understand the place value representation of whole numbers through four digits.
a. Represent numbers using a variety of models, diagrams, and number sentences (e.g., 4703 represented as 4,000 + 700 + 3, and units, 47 hundreds + 3, or 4,500 + 203).
b. Understand the relative magnitudes of numbers using 10 as a unit, 100 as a unit, or 1000 as a unit. Represent 2-digit numbers with drawings of tens and ones and 3-digit numbers with drawings of hundreds, tens, and ones.
c. Use money as a medium of exchange. Count back change and use decimal notation and the dollar and cent symbols to represent a collection of coins and currency.

M2N2. Students will build fluency with multi-digit addition and subtraction.
a. Correctly add and subtract two whole numbers up to three digits each with regrouping.
b. Understand and use the inverse relation between addition and subtraction to solve problems and check solutions.
c. Use mental math strategies such as benchmark numbers to solve problems.
d. Use basic properties of addition (commutative, associative, and identity) to simplify problems (e.g. 98 + 17 by taking two from 17 and adding it to the 98 to make 100 and replacing the original problem by the sum 100 + 15).
e. Estimate to determine if solutions are reasonable for addition and subtraction.

M2N3. Students will understand multiplication, multiply numbers, and verify results.
a. Understand multiplication as repeated addition.
b. Use repeated addition, arrays, and counting by multiples (skip counting) to correctly multiply 1-digit numbers and construct the multiplication table.
c. Use the multiplication table (grid) to determine a product of two numbers.
d. Use repeated subtraction, equal sharing, and forming equal groups to divide large collections of objects and determine factors for multiplication.

M2N4. Students will understand and compare common fractions with small denominators.
a. Model, identify, label, and compare fractions (thirds, sixths, eighths, tenths) as a representation of equal parts of a whole or of a set.
b. Know that when all fractional parts are included, such as three thirds, the result is equal to the whole.

M2N5. Students will represent and interpret quantities and relationships using mathematical expressions including equality and inequality signs (=, <, >).
a. Include the use of boxes or ___ to represent a missing value.
b. Represent problem solving situations where addition, subtraction or multiplication may be applied using mathematical expressions.

M2M. Measurement

Students will understand length, time, and temperature and choose an appropriate tool to measure them.

M2M1. Students will know the standard units of inch, foot, yard, and metric units of centimeter and meter and measure length to the nearest inch or centimeter.
a. Compare the relationship of one unit to another by measuring objects twice using different units each time.
b. Estimate lengths, and then measure to determine if estimations were reasonable.
c. Determine an appropriate tool and unit for measuring.

M2M2. Students will tell time to the nearest five minutes and know relationships of time such as the number of minutes in an hour and hours in a day.

M2M3. Students will estimate, then measure, temperature (Fahrenheit) and determine if estimations were reasonable.

M2G. Geometry

Students will understand basic and compound geometric shapes together with the elements from which they are composed.

M2G1. Students will describe and classify plane figures (triangles, square, rectangle, trapezoid, quadrilateral, pentagon, hexagon, and irregular polygonal shapes) according to the number of edges and vertices and the sizes of angles (right angle, obtuse, acute).

M2G2. Students will describe and classify solid geometric figures (prisms, cylinders, cones, and spheres) according to such things as the number of edges and vertices and the number and shape of faces and angles.
a. Recognize the (plane) shapes of the faces of a geometric solid and count the number of faces of each type.
b. Recognize the shape of an angle as a right angle, an obtuse or acute angle.

M2G3. Students will describe the change in attributes as two and threedimensional shapes are cut and rearranged.

Students will pose questions, collect, organize, and interpret data about themselves and their surroundings.

M2D1. Students will create simple tables and graphs and interpret their meaning.
a. Organize and display data using picture graphs, Venn diagrams, bar graphs, and simple charts/tables to record results.

b. Know how to interpret picture graphs, Venn diagrams, and bar graphs.

M2P. Process Skills

Students will apply mathematical concepts and skills in the context of authentic problems and will understand concepts rather than merely following a sequence of procedures. The students will use the process standards as a way of acquiring and using content knowledge.

M2P1. Students will solve problems that arise in mathematics and in other contexts.
a. Solve non- routine word problems using the strategies of use or look for a pattern or guess and check as well as all strategies learned in previous grades.
b. The student will solve single step routine word problems related to all appropriate second grade math standards.
c. Determine the operation(s) needed to solve a problem.
d. Determine the most efficient way to solve a problem (mentally, paper/pencil, or calculator).

M2P2. Students will be able to investigate, develop, and evaluate mathematical arguments.

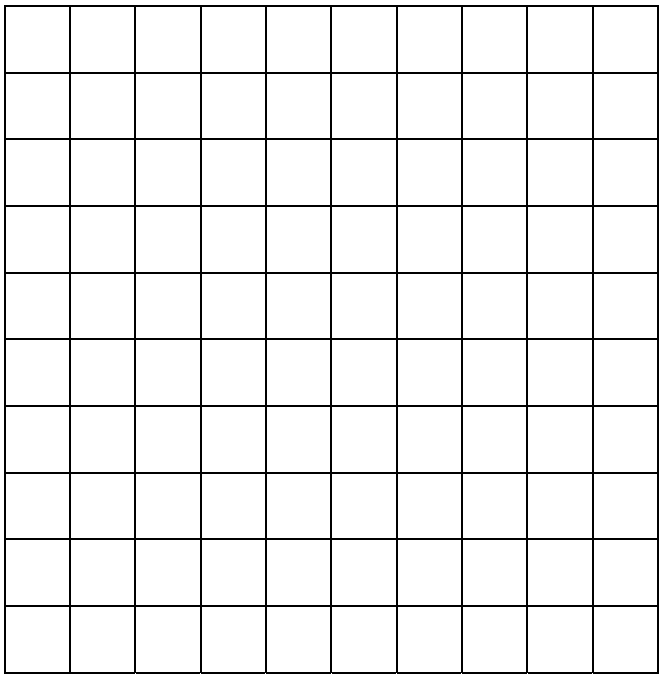
M2P3. **Students will be able to use the language of mathematics to express ideas precisely.**

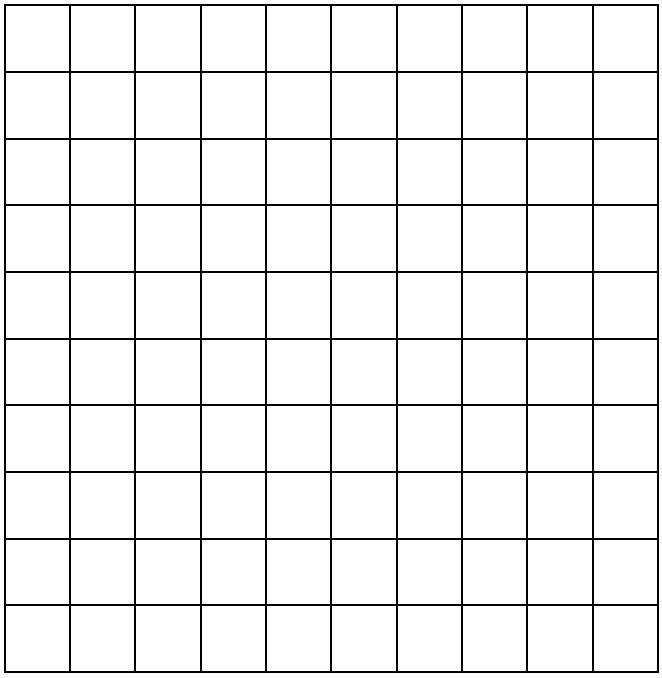
M2P4. Students understand how mathematical ideas interconnect and build on one another and apply mathematics in other content areas.

M2P5. Students will be able to create and use pictures, manipulatives, models, and symbols to organize, record, and communicate mathematical ideas.

Terms/Symbols:
place value.thousands, sum, difference, product, multiply, regroup, array, numerator, denominator, inch, foot, yard, centimeter, meter, quadrilateral, right angle, obtuse, acute, edge, face, vertex/vertices, prism, perimeter, plane, >, <, =, ≠, +, -, x, minute, hour, Venn diagram

Grids

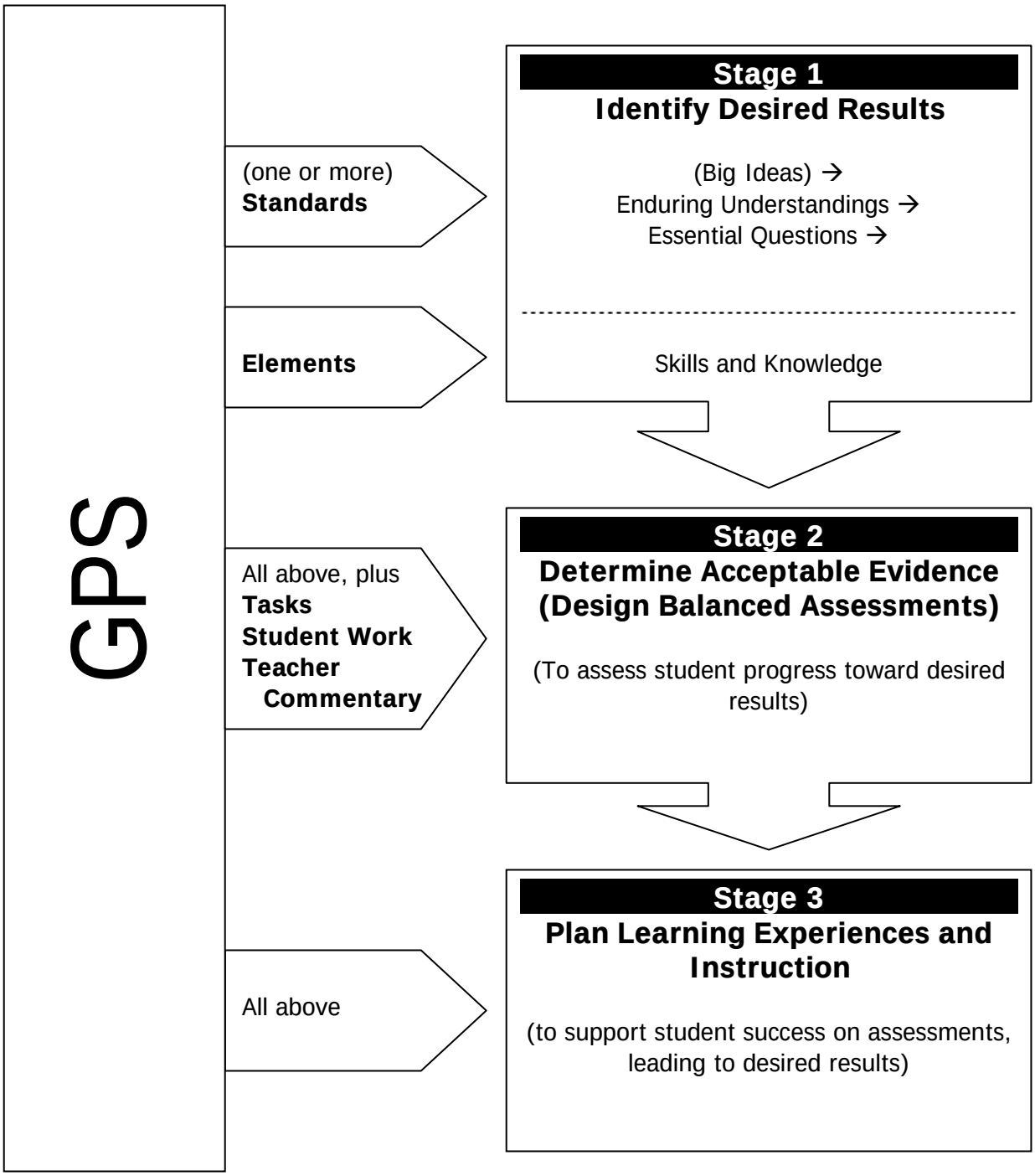




Phase-in Plan

Grade	Math Training	Math Teaching
K	**05-06**	**06-07**
1	**05-06**	**06-07**
2	**05-06**	**06-07**
3	06-07	07-08
4	06-07	07-08
5	06-07	07-08
6	04-05	05-06
7	05-06	06-07
8	06-07	07-08

GPS and the Unit Design Process



Identifying Desired Results of a Standard

Standard/Elements (underline big ideas, add as needed)	
Enduring Understandings	
Essential Questions	
Skills and Knowledge	

A Big Idea…

…Provides a "conceptual lens" for organizing content. A Big Idea refers to core concepts, principles, theories, and processes that should serve as the focal point of the curricula, instruction, and assessment. Big Ideas reflect expert understanding and anchor the discourse, inquiries, discoveries, and arguments in a field of study. They provide a basis for setting curriculum priorities to focus on the most meaningful content.

…Serves as an organizer for connecting important facts, skills, and actions. Big Ideas function as the "conceptual Velcro" for a topic of study. They connect discrete knowledge and skills to a larger intellectual frame and provide a bridge for linking specific facts and skills. A focus on these larger ideas helps students to see the purpose and relevance on content.

…Transfers to other contexts. Discrete facts do not transfer. Big Ideas are powerful because they embody transferable ideas, applicable to other topics, inquiries, context, issues, and problems. Because we can never cover all the knowledge on a given topic, a focus on the Big Ideas helps to manage information overload. Big Ideas provide the conceptual through lines that anchor a coherent curriculum.

…Manifests itself in various ways within disciplines. Big Ideas are typically revealed through one or more of the following forums: a core concept (e.g., adaptation), a focusing theme (e.g., man's inhumanity to man), an ongoing issue or debate (e.g., liberal vs. conservative), a puzzling paradox (e.g., poverty amidst plenty), an important process (e.g., writing process), an authentic problem or persistent challenge (e.g., illiteracy, voter apathy), an illuminating theory (e.g., Manifest Destiny), an underlying assumption (e.g., the markets are rationale), or differing perspectives (e.g., terrorist vs. freedom fighter).

…Requires uncoverage because it is an abstraction. A Big Idea is inherently abstract. Its meaning is not always obvious to students, and simply covering it (i.e., the teacher or textbook defining it) will not ensure student understanding. "Coverage" is unlikely to cause genuine insight; understanding must be earned. Thus, the idea must be uncovered—its meaning discovered, constructed or inferred by the learners, with the aid of the teacher and well-designed learning experiences.

How to identify big ideas: Read the standard thoroughly. Underline the big ideas in the standard. Make additional notes as needed. Note that this is just a stepping stone in the process; once you have turned your Big Ideas into enduring understandings, you do not need to write them down.

An Enduring Understanding…

…Involves the big ideas that give meaning and importance to facts. Enduring understandings are made up of the concepts, principles, and theories that weave many facts into revealing and useful patterns. They involve the (few) organizing priority ideas that enable us to make sense of past lessons, conduct current inquiry, and create new knowledge.

…Can transfer to other topics, fields, and adult life. Such understandings endure in that they enable us to make vital and informative connections in our learning—as students and as adults. For example, the idea that "might does not make right" applies to both playground disputes and international diplomacy.

…Is usually not obvious, often counter-intuitive, and easily misunderstood. An understanding is an inference, not a fact. It is an insight derived from inquiry. Key understandings in intellectual fields (e.g., in physics: *Objects remain in motion at a constant velocity if no force acts on them*) often violate common sense and conventional wisdom. They are thus often prone to misunderstanding by students. These understandings therefore cannot be covered; they must be uncovered.

…May provide a conceptual foundation for basic skills. The skill-based teaching in mathematics, foreign language, and physical education does not seem to deal with "understanding." In most units, all skills derive their value from the strategic principles that help us know when and how to use the skill. The understandings also justify the use of skills (e.g., the student who can explain why you should use a bent-arm pull in swimming free style) and enable the student to extend the use of the skill to new situations (e.g., the use of bent-arm pull in back stroke).

…Is deliberately framed as a generalization—the "moral of the story." An understanding is a generalization derived from inquiry. It is the specific insight that should be inferred from study of the topic (not just the stating of the topic)—what we want the student leaving the study to realize. Note: The enduring understanding of a unit might be that there is no single agreed-upon understanding, or that people disagree about how the issues, facts, or text should be understood.

How to identify enduring understandings: Frame them as full-sentence generalizations starting with "The student will understand that…" Avoid statements that are vague or trite. It may help to think about common mis<u>mis</u>understandings about the topic. Enduring understandings may be overarching (beyond the specifics of the unit) or topical.

Essential Questions…

…Have no simple "right" answer; they are meant to be argued. Essential questions yield inquiry and argument—a variety of plausible responses, not straightforward facts that end the matter. They should *uncover* rather than cover the subject's puzzles and perspectives. They should result in conclusions drawn by the learner, not recited facts. Like enduring understandings, they may be topical or overarching.

Examples: Does art reflect culture or help shape it? What makes a great story?

…Are designed to provoke and sustain student inquiry, while focusing learning and final performances. Essential questions work best when they are designed and edited to be thought provoking to students, engaging them in sustained, focused inquiries that culminate in important performance. They involve the counterintuitive, the visceral, the whimsical, the controversial.

Examples: Does food that is good for you have to taste bad? Are censorship and democracy compatible?

…Often address the conceptual or philosophical foundations of a discipline. They reflect the most historically important issues, problems, and debates in a field of study.

Examples: What is a proof? Nature or nurture? Can fiction reveal truth?

…Raise other important questions. Essential questions lead to other important questions within, and sometimes across, subject boundaries.

Example: In nature, do only the strong survive? (Leads to questions such as, "What is strength? Are insects strong, since they are survivors?)

…Naturally and appropriately recur. The same important questions are asked and asked again throughout one's learning.

Example: What makes a book "great?"

…Stimulate vital, ongoing rethinking of big ideas, assumptions, and prior lessons. They force us to ask deep questions about the nature, origin, and extent of our understanding.

Example: (In light of fractions, place value, irrationals, and negative square roots) what is a number?

How to develop essential questions: Two to five per unit is reasonable. Put them in language appropriate to students. Use them as organizers for the unit, making the "content" answer the questions. Sequence questions so they lead naturally from one to another. Share essential questions with other teachers to ensure curricular coherence.

Skills and Knowledge

Knowledge. Getting students to construct meaning, organize information, and (selectively) store information. This includes

- Vocabulary
- Terminology
- Definitions
- Key factual information
- Formulas
- Critical details
- Important events, people
- Sequence and timelines
- Rules
- Laws
- Principles
- Concepts

Skills. Getting students to demonstrate the ability to do something. These may be very simple, discrete operations, or more complex creative ones. This includes

- Actions, procedures, and processes
- Basic skills—decoding, arithmetic computation
- Psychomotor skills—running, swimming a back stroke, playing an instrument
- Study skills
- Communication skills—listening, speaking, writing
- Thinking skills—comparing, inferring, analyzing, interpreting
- Research, inquiry, investigation skills
- Interpersonal/group skills

Verbs to use when stating skills and knowledge. These are samples only:

- Demonstrate
- Derive
- State
- Describe
- List
- Design
- Express
- Induce
- Instruct
- Create
- Critique
- Compare/contrast
- Evaluate
- Illustrate
- Judge
- Make meaning of
- Make sense of
- Use
- Model
- Predict
- Prove
- Show
- Synthesize
- Justify
- Choose
- Imagine
- Assess
- Write
- Draw
- Translate
- Adapt
- Build
- Determine
- Perform
- Solve
- Test

How to develop skills and knowledge statements: Look at the enduring understandings, essential questions, and elements. Ask yourself, "What skills and knowledge do students need in order to reach this goal?" Start each skill/knowledge statement with a verb.

Redelivery Action Plan

Directions: Complete the following chart to shape your team's work before day two of training. Here are some questions to consider:

- What do we need?
- What do we have?
- How can we obtain needed information or resources?
- What can we develop as a team?
- What is our plan for completing the work and learning together?

Step / Activity	Who	By When	How	Resources and Ideas

Field Assignment

- **Redeliver Day 1: How to Identify Desired Results of a Standard**
- **Day 2 will focus on determining acceptable evidence.**
- **Use the standard you chose today. Make a list of ways to assess a student's understandings of those big ideas, enduring understandings, and essential questions.**
- **What evidence is necessary? How good is good enough?**

Resources

Each school received one copy of each book listed below at the beginning of the previous school year. This box of books was addressed to the principal of the school.

Hayes Jacobs, Heidi. *Mapping the Big Pictures: Integrating Curriculum and Assessment K-12.* Alexandria, VA: Association for Supervision and Curriculum Development. 1997.

Marzano, Robert J. *Transforming Classroom Grading.* Alexandria, VA: Association for Supervision and Curriculum Development. 2000.

Marzano, Robert J. *What Works in Schools: Translating Research into Action.* Alexandria, VA: Association for Supervision and Curriculum Development. 2003.

Marzano, Robert J., Debra Pickering, and Jay McTighe. *Assessing Student Outcomes: Performance Assessment Using the Dimensions of Learning Model.* Alexandria, VA: Association for Supervision and Curriculum Development. 1993.

Marzano, Robert J, Debra J. Pickering, and Jane E. Pollock. *Classroom Instruction That Works: Research-Based Strategies for Increasing Student Achievement.* Alexandria, VA: Association for Supervision and Curriculum Development. 2001.

Marzano, Robert J, Jana Marzano, & Debra Pickering. *Classroom Management That Works: Research-Based Strategies for Every Teacher.* Alexandria, VA: Association for Supervision and Curriculum Development. 2003.

Strong, Richard W., Harvey F. Silver, and Matthew J. Perini. *Teaching What Matters Most: Standards and Strategies for Raising Student Achievement.* Alexandria, VA: Association for Supervision and Curriculum Development. 2001.

Tomlinson, Carol Ann. *How to Differentiate Instruction in Mixed-Ability Classrooms, 2nd edition.* Alexandria, VA: Association for Supervision and Curriculum Development. 2001.

Wiggins, Grant and Jay McTighe. *Understanding by Design.* Alexandria, VA: Association for Supervision and Curriculum Development. 1998.

Wiggins, Grant and Jay McTighe. *Understanding by Design Study Guide.* Alexandria, VA: Association for Supervision and Curriculum Development. 2000.

Professional Organizations

National Council of Teachers of Mathematics—NCTM—http://www.nctm.org
Georgia Council of Teachers of Mathematics—GCTM—http://www.gctm.org
National Science Teachers Association—NSTA—http://www.nsta.org
Georgia Science Teachers Association—GSTA—http://www.georgiascienceteacher.org

Web Sites

Early Numeracy Research Project—http://www.sofweb.vic.edu.au/eys/num/ENRP/wholeschdes/

General Numeracy—http://www.teachingideas.co.uk/maths/contents.htm
This section contains number activities; shape, space and measurement activities; and data handling activities.

Illuminations—http://illuminations.nctm.org/index.asp

Intermath—www.intermath-uga.gatech.edu/
InterMath is a collaborative effort between The University of Georgia, CEISMC - Georgia Institute of Technology, and regional technology centers in the state of Georgia. Development of InterMath is funded by the National Science Foundation.

Math Forum—http://mathforum.org/library/resource_types/professional
This site provides a comprehensive list of professional organizations dealing with mathematics, along with Web sites and brief descriptions.

National Library of Virtual Manipulatives— http://nlvm.usu.edu/en/nav/vlibrary.html

Units (incorporating Learning Focused components). Connected Learning—http://www.title3.org/
BOCES is a cooperative service organization that helps school districts save money by pooling resources and sharing costs.

Mathematics/Numeracy Resources

Andrews, A. G., Trafton, P.R. *Little kids-powerful problem solvers: math stories from a kindergarten classroom.* Portsmouth, NH: Heinemann. 2002.

Burns, M. *About teaching mathematics: a K-8 resource*. Sausalito, CA: Math Solutions Publications. 2000.

Carpenter, T. P., Franke, M. L., Levi, L. *Thinking mathematically: integrating arithmetic and algebra in elementary school.* Portsmouth, NH: Heinemann. 2003.

Cuevas, G. *Reaching all students with mathematics*. Reston, VA: National Council of Teachers of Mathematics, 1993.

Improving achievement in mathematics and science. Educational Leadership. February, 2004. (entire issue)

Kallik, B., Brewer, R. *How to assess problem-solving skills in mathematics.* New York, NY: Scholastic Professional Books. 1997.

Mirra, Amy J. *Administrator's guide: how to support and improve mathematics education in your school*. Reston, VA: National Council of Teachers of Mathematics. 2003

Principles and Standards for School Mathematics. Reston, VA: National Council of Teachers of Mathematics. 2000.

Steen, L. *Why numbers count: quantitative literacy for tomorrow's America*. New York: The College Board. 1997.

Sullivan, P., Lilburn, P. *Good questions for math teaching: why ask them and what to ask (K-6)*. Sausalito, CA: Math Solutions Publications. 2002.

Sutton, J., Krueger, A*. EDThoughs: what we know about mathematics teaching and learning*. McREL, 2002.

Van de Walle, J. A. *Elementary and middle school mathematics: teaching developmentally, fifth edition*. New York, NY: Longman Press. 2004.

Glossary

CONTENT STANDARDS:	Content standards state the purpose and direction the content is to take, and are generally followed by elements. Content standards define what students are expected to know, understand, and be able to do.
CURRICULUM DOCUMENT:	The Georgia Performance Standards document is the curriculum document that contains all standards that should be learned by all students.
ELEMENTS:	Elements are part of the content standards that identify specific learning goals associated with the standard.
PERFORMANCE STANDARDS:	Performance standards define specific expectations of what students should know and be able to do and how well students must perform to achieve or exceed the standard. Georgia's performance standards are composed of four components: content standards, tasks, student work, and teacher commentary.
PROCESS STANDARDS:	Process standards define the means used to develop patterns of thought and behavior that lead to conceptual understanding.
STANDARD:	Something set up and established by authority as a rule for the measure of quantity, weight, extent, value, or quality.
STANDARDS-BASED EDUCATION:	In standards-based classrooms, standards are the starting point for classroom instruction that ensures high expectations for all students.
STRAND:	A strand is an organizing tool used to group standards by content. For example, the English language arts curriculum contains strands of reading, writing, listening, speaking, and viewing. K-5 science curriculum contains a life science strand, physical science strand, and an earth science strand.
STUDENT WORK:	Examples of successful student work are included to specify what it takes to meet the standard and to enable both teachers and students to see what meeting the standard "looks like."

TASKS:	Keyed to the relevant standards, tasks provide a sample performance that demonstrates to teachers what students should know and be able to do during or by the end of the course. Some tasks can serve as activities that will help students achieve the learning goals of the standard, while others can be used to assess student learning; many serve both purposes. Although the Georgia Performance Standards include tasks, teachers may develop their own tasks.
TEACHER COMMENTARY:	Teacher commentary is meant to open the pathways of communication between students and the classroom teacher as well as within faculty in order to ensure consistency within assessment and expectations. Commentary shows students why they did or did not meet a standard and enables them to take ownership of their own learning.

Selected Terms/Symbols

Bar Graph	A graph in which quantities are represented by bars.
Cone	A three-dimensional figure with a circular base and vertex.
Cylinder	A three-dimensional figure with two parallel and congruent curves (usually circles) as bases, which are joined by a curved surface.
Decompose	To break a number up into other numbers.
Geometric Figure	A shape formed by a combination of points, lines, curves, or surfaces.
Geometric Solid	A three- dimensional shape or object, such as a sphere or a cube.
Line Symmetry	A figure that can be folded along a line so that the two halves match exactly has line symmetry.
Multiple	The product of a whole number and any whole number. A multiple of 16 is 64 (4*16=64).
Net	A two- dimensional shape that can be folded into a three- dimensional figure is a net of that figure.
Non-Routine Problem	A word problem that requires a variety of strategies in order to solve.
Pictograph	A graph that uses pictures or symbols to represent data.
Rotational Symmetry	A geometrical transformation in which a figure is moved rigidly around a fixed point. Some figures are unchanged by certain rotations.
Venn Diagram	A picture that illustrates the relationships between two or more sets.

Learning Journal

Please take a few minutes and share your thoughts on the following four areas.

Important things I've learned or had reaffirmed. . .	Today's experiences have left me feeling. . .
Questions I want answered now. . .	What I will do when I return to my workplace. . .