GEORGIA DEPARTMENT OF EDUCATION

Kathy Cox, State Superintendent of Schools

Training for Georgia Performance Standards

Days 3 and 4: Classroom Implementation

Participant's Guide
Grade 8 Mathematics

We will lead the nation in improving student achievement.

Table of Contents

Table of Contents 2
Acknowledgements 3
Use of This Guide 3
Agenda 4
Module Goal 5
Module Objectives 5
GPS and the Standards-Based Education Process 6
"Math Lab Raided" 7
Heartbeat Activity 8
A Staircase Task 10
Math Lab Lesson: A Staircase Task 11
Water Pump Task 12
Roles of Teachers and Students 14
What we should see in a standards-based mathematics classroom 15
Positive and Negative Expectations 16
Glossary of Instructional Strategies 17
General Categories of Instructional Strategies 24
Matching Instructional Formats to Achievement Targets 25
Teaching for Breadth and Depth 26
WHERETO: Making Instructional Decisions 27
Permission Forms for Student Work 30
Recommended Readings/Viewings: Instruction 32
Suggested Web Sites for Instruction 33
Mathematics Resources 36

Acknowledgements

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

For more information on this or other GPS training, you may go to the math webpage through the Georgia Department of Education website under Curriculum and Instruction or use the direct link http://www.gadoe.org/ci_services.aspx?PageReq=CIServMath .

Use of This Guide

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.

Agenda

Introduction

- Review of Stages One and Two
- Overview of the Training

Describing the Standards-Based Classroom

- "Math Lab Raided" Activity
- Heartbeat Activity
- A Staircase Task
- What We Should See in a Lesson
- Strategies

Facilitating the Standards-Based Classroom

- Water Pump
- Quote Activity
- Student Involvement and Cooperation

Designing Lessons

- Crossing the River
- The Big Picture
- Putting it all together
- Designing lessons

Action Plan for Redelivery

Module Goal

Demonstrate a deep understanding of the new Georgia Performance Standards and the standards-based education approach, through thoughtful determination of learning goals for specific units of instruction, development of a balanced assessment plan that includes formative and summative assessments, and the design of instruction that will provide students with the knowledge, skills, and understandings necessary to achieve the learning goals. This goal shall be measured by student performance on progress monitoring and on standardized criterion-referenced tests.

Note that the goal will not be reached by any single day of training. It will take preparation and follow up to master this goal.

Module Objectives

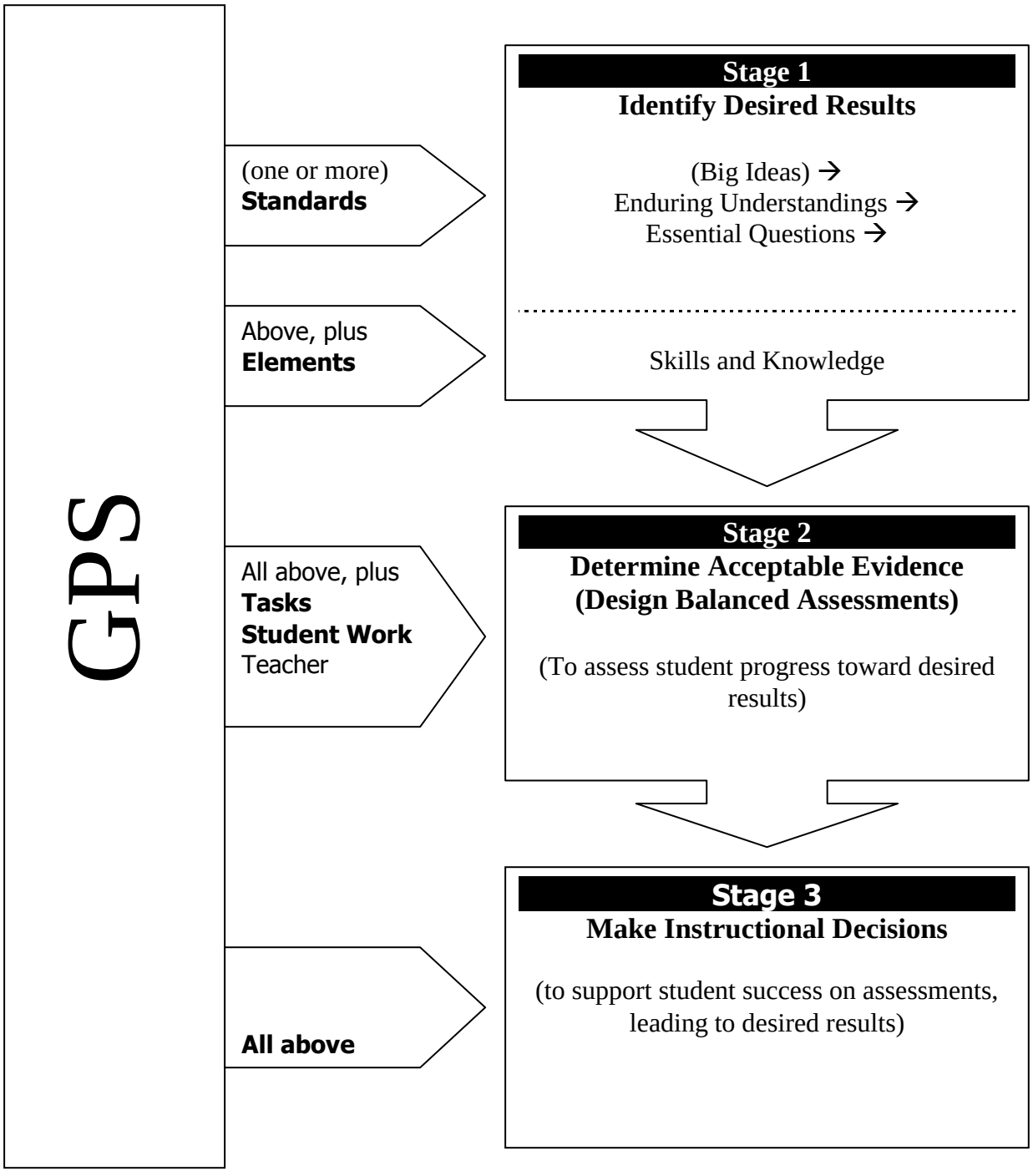
By the end of day four of training, participants will be able to:

1. Identify methods to create an environment that fosters student involvement and cooperation in all classroom activities.

2. Describe what a standards-based mathematics classroom looks like and how to choose appropriate instructional strategies.

3. Design lessons that will support the acquisition of content within the eighth grade framework and help students master the standards.

GPS and the Standards-Based Education Process



Albertville, AL Math Lab Raided

Albertville Police, responding to an anonymous tip, found an active math lab inside a school on Tuesday morning.

The police chief said one of his officers "…received information that there was an active hands-on math class being taught at the school. With that information, the K-9 officer, two other officers, and another official went to that address and located the math lab."

In the classroom at the school at the time officers arrived, were two fulltime teachers. Upon questioning, both admitted to attending unauthorized out-of-district teacher training from northeastern and midwestern publishers' consultants on hands-on math.

The chief added that containers of Unifix blocks and Cuisenaire rods were found, along with several boxes of controlled TI graphing calculators, were also discovered. The chief said, "We are also investigating some data analysis software found at the location, which was reportedly stolen in Georgia from a GPS math workshop. No one has been officially charged in that matter yet, but it is under investigation," the chief said.

Officer Matt Fitzgerald, who recently completed a specialized manipulatives-handling and other cognitively-hazardous materials training course, was called in to assist in reducing a hazardous situation and clearing the crime scene. Students were given circa-1975 Laidlaw Spectrum drill-and-practice workbooks to begin their de-programming and break their dependency on counters and other visual aids.

The Marshall County Educational Enforcement Unit (MCDEU) was also called to the scene. The director said, "It was a fairly large setup."

Portions of the illicit lab were, according to Phillips, in several rooms of the school, including a stock room and the library.

While there were no children involved with the incident, there were apparently several other teachers, including two new teachers, who were apparently being encouraged to participate in the illicit activities.

All four suspects were placed in the Marshall County Correctional Facility on various bond amounts, all of which were large hard-to-factor 5-digit prime numbers. One of the suspects was given a no-bond for failure to appear on an unrelated charge of encouraging student questions.

The chief expressed his gratitude at the fine police work of his officers and the MCDEU that led to the arrests of the four individuals and dismantling of the illegal lab.

Heartbeat Activity

You and your partner are going to measure and compare your pulse rates. One of you will be the timer and the other will count their own number of heart beats per period of time. First, count the number of beats in 10 seconds, then 20 seconds, then for 40 seconds recording data for each time. Then swap roles and record the second set of data.

Plot your points. Use your data or your plot to estimate the number of beats that would occur in 25 seconds, in 60 seconds, and in 120 seconds. How did you make your estimates? Why did you choose this method?

Time	No. of beats

This page is for scrap work or notes.

A Staircase Task

(Mathematic Teacher February 2004)

A same-color staircase is made from Cuisenaire rods. Each time that a rod is added to the staircase, it is offset by the space of a 1 unit rod. The rods that are used to make the staircase are 3 units in length.

A. What is the surface area and volume of a staircase that is 3 units tall?

B. Predict the volume and surface area of a staircase that is 5 units high. Find the actual surface area and volume, and compare them with your answer. Explain any discrepancies that you found.

C. What will the volume and surface area be when you add the hundredth rod?

D. Develop a general method or rule that can be used to determine the volume and surface area for any number of rods. Explain your thinking.

Challenge:

E. How would changing the color of the rods affect your results? Verify your answer by completing A-D for a different color. Were the results what you predicted? If not, explain where your thinking was off

F. How would changing the way the stairs were made affect your results? For example, allowing different colors of rods to be used to make the stairs. Describe how you would change the way the stairs were made and complete A-D with this new pattern. Were the results what you predicted? If not, explain where your thinking was off.

This page is for scrap work or notes.

Water Pump

(Mathematic Teaching in the Middle School September 2005)

Suppose you turn a pump on and let it run to empty the water out of a pool. The amount of water in the pool (W, measured in gallons) at any time (T, measured in hours) is given by the following equation: W = -350(T – 4).

Answer each of the questions below and explain how you used the equation to do so.

A. How many gallons of water are being pumped out each hour?

B. How much water was in the pool when the pumping started?

C. How long will it take for the pump to empty the pool completely?

D. Write an equation that is equivalent to w - -350(T – 4). What does this second equation tell you about the situation?

E. Describe what the graph of the relationship between W and T looks like.

This page is for scrap work or notes.

Role of the Teacher in a Standards-Based Classroom

- Plan authentic learning experiences.
- Provide solid foundations in math to promote application of skills and knowledge
- Talk less, listen more.
- Circulate through the classroom, facilitating math discussions.
- Provide clarification when necessary.
- Ask questions that encourage reasoning and making connections.
- Provide clarification when necessary.
- Ask questions that encourage reasoning and making connections.
- Establish classroom procedures to promote effective management of small groups of differentiated learners.
- Participate in ongoing assessments of all learners.

Role of the Student in a Standards-Based Classroom

- Work individually, in pairs, or small groups to complete a task.
- Gather data, share ideas, look for patterns, make conjectures, and utilize problem-solving strategies.
- Explore mathematical relationships and make connections to real life experiences.
- Ask questions and look for solutions.
- Explore mathematical relationships and make connections to real life experiences.
- Ask questions and look for solutions.

What should we see in a standards-based mathematics classroom?

- Warm-up
  -connected to the lesson
  -starts students thinking in right direction

- Mini lesson, opening, setting the stage
  -checks for prior knowledge
  -reviews needed skills
  -left in view for quick access during work period

- Work period, Activity period
  -rigorous mathematics
  -use of previously learned concepts in service of new ideas
  -collaboration and verbalization
  -process skills
  -individual accountability

- Summary, Closing
  -presentation and comparison of different approaches
  -students commenting on and questioning the approaches of other students
  -teacher guiding the discussion, if necessary, to solidify concepts, skills and procedures to be learned
  -clarifying of misconceptions

Positive Expectations	Negative Expectations
People that expect to achieve success are constantly prepared for opportunities to become successful.	People that expect to be unsuccessful are constantly looking for reasons, evidence, and explanations of why they fail.
"All students can learn and mine will achieve to their fullest potential!"	"These eighth graders can't even add, much less divide!"
"I am a good teacher, and know that I can motivate every one of my students to do their very best."	"My students don't want to learn. They just come to school to see their friends."
"I love to learn new things that I can try out in my classroom."	"Going to those GPS trainings are so boring. I have better things to do with my time."

Some Suggested Classroom Procedures

Remember to ***explain*** them clearly, ***practice*** them until they be come routines, and ***reinforce*** them as needed.

Entering the classroom	Coming to attention	Exchanging papers
Getting to work immediately	When absent	Returning student work
What to do if tardy	Working cooperatively	Passing in papers
End-of-class dismissal	Changing groups	Moving about the room
Indicating whether understand	Keeping notebook	Going to the library
Participating in discussions	Going to the office	Headings on papers
When need paper or pencil	Need help or conferencing	When finish early
Keeping desk orderly	Knowing the day's schedule	After an interruption
Checking out materials	Finding assignment directions	Asking a question
Listening/responding to questions	Walking in the hall during class time	When a school-wide announcement is made
Fire drill	When get sick	Saying "thank you"
When visitors are in the room	When teacher is out of room	Re-arranging desks/furniture

Adapted from *How to be an Effective Teacher: The First Days of School* by Harry K. Wong & Rosemary T. Wong, page 193

Glossary of Instructional Strategies

Assigned Questions - Assigned questions are those prepared by the teacher to be answered by individuals or small groups of students. Students discuss their responses with one another or with the teacher. Particular positions or points-of-view should be supported by evidence. In some instances, it may be desirable for students to generate their own set of questions.

Brainstorming- Brainstorming is a large or small group activity which encourages children to focus on a topic and contribute to the free flow of ideas. The teacher may begin by posing a question or a problem, or by introducing a topic. Students then express possible answers, relevant words and ideas. Contributions are accepted without criticism or judgment.

Case Study - Case studies are stories or scenarios, often in narrative form, created and used as a tool for analysis and discussion. Cases are often based on actual events which add a sense of urgency or reality. Case studies have elements of simulations but the students are observers rather than participants. A good case has sufficient detail to necessitate research and to stimulate analysis from a variety of viewpoints or perspectives. They place the learner in the position of problem solver. Students become actively engaged in the materials discovering underlying issues, dilemmas and conflict issues.

Circle of Knowledge - A circle of knowledge is a strategy that acts as a framework for effective discussions. The teacher poses a question to the whole class, and the students move into small groups to examine the issue before returning to the large group for further discussion.

Cloze Procedures - Cloze procedure is a technique in which words are deleted from a passage according to a word-count formula or various other criteria. The passage is presented to students, who insert words as they read to complete and construct meaning from the text. This procedure can be used as a diagnostic reading assessment technique.

Computer Assisted Instruction - Computer-assisted instruction (CAI) refers to any instructional program in which the computer performs, manages, or supports some or all of the teacher/provider functions.

Concept Attainment - Concept Attainment is an indirect instructional strategy that uses a structured inquiry process. It is based on the work of Jerome Bruner. In concept attainment, students figure out the attributes of a group or category that has already been formed by the teacher. To do so, students compare and contrast examples that

contain the attributes of the concept with examples that do not contain those attributes. They then separate them into two groups. Concept attainment, then, is the search for and identification of attributes that can be used to distinguish examples of a given group or category from non-examples.

Concept Mapping - A concept map is a special form of a web diagram for exploring knowledge and gathering and sharing information. Concept mapping is the strategy employed to develop a concept map. A concept map consists of cells that contain a concept, item or question and links. The links are labeled and denote direction with an arrow symbol. The labeled links explain the relationship between the nodes. The arrow describes the direction of the relationship and reads like a sentence.

Concept Formation - Concept formation provides students with an opportunity to explore ideas by making connections and seeing relationships between items of information. This method can help students develop and refine their ability to recall and discriminate among key ideas, to see commonalities and identify relationships, to formulate concepts and generalizations, to explain how they have organized data, and to present evidence to support their organization of the data involved.

Cooperative Learning - Cooperative learning is an instructional strategy that simultaneously addresses academic and social skill learning by students. It is a well-researched instructional strategy and has been reported to be highly successful in the classroom.

Correspondence Lessons - Correspondence education has a long history. Before the advent of the computer age, correspondence schooling meant print correspondence. Today, however, correspondence education is delivered through a variety of technologies: audio, video and computer.

Debates - Debating is a structured contest of argumentation in which two opposing individuals or teams defend and attack a given proposition. The procedure is bound by rules that vary based on location and participants. The process is adjudicated and a winner is declared. Debating is a foundational aspect of a democratic society.

Demonstrations - A demonstration refers to a teacher activity and talk that shows students "how"; [demonstrations] apply primarily to skills and processes and are useful for helping students acquire procedural knowledge.

Didactic Questions - tend to be convergent, factual, and often begin with "what," "where," "when," and "how." They can be effectively used to diagnose recall and comprehension skills, to draw on prior learning experiences, to determine the extent to which lesson objectives were achieved, to provide practice, and to aid retention of information or processes. Teachers should remember that didactic questions can be simplistic, can encourage guessing, and can discourage insightful answers or creativity. However, effectiveness of this method can be increased by the appropriate addition of "why" questions, and the occasional use of "what if" questions.

Direct Instruction - a highly structured instructional approach.

Drill and Practice - promotes the acquisition of knowledge or skill through repetitive practice. It refers to small tasks such as the memorization of spelling or vocabulary words, or the practicing of arithmetic facts and may also be found in more supplicated learning tasks or physical education games and sports. Drill-and-practice, like memorization, involves repetition of specific skills, such as addition and subtraction, or spelling. To be meaningful to learners, the skills built through drill-and-practice should become the building blocks for more meaningful learning.

Essays - Essays are research-backed statements of opinion on arguable topics.

Experiments - Experiments involve creating a test of a hypothesis where variables have been identified and then specifically identifying one or more of those variables that causes the effect.

Experiential Learning - Experiential learning is inductive, learner centered, and activity oriented. Personalized reflection about an experience and the formulation of plans to apply learning to other contexts are critical factors in effective experiential learning. The emphasis in experiential learning is on the process of learning and not on the product.

Explicit Teaching - Explicit teaching involves "six teaching functions: daily review, presenting new material, conducting guided practice, provide feedback and correctives, conduct independent practice, weekly and monthly review.

Field Observations - Field observations refer to observations made of naturally occurring phenomena by students outside the classroom.

Games - Games are structured learning activities that include conflict, control, and rules for winning and terminating the activities.

Guides for Reading, Listening, Viewing - Guides for reading, listening, and viewing refer to providing leading questions, diagrams, or statements to assist students in focusing on the important ideas within text, lecture, media, or other presentations.

Independent Learning - Independent study refers to the range of instructional methods which are purposefully provided to foster the development of individual student initiative, self-reliance, and self-improvement. In addition, independent study can include learning in partnership with another individual or as part of a small group.

Indirect Instruction - indirect instruction is mainly student-centered. Indirect instruction seeks a high level of student involvement in observing, investigating, drawing inferences from data, or forming hypotheses. It takes advantage of students' interest and curiosity, often encouraging them to generate alternatives or solve problems. In indirect instruction, the role of the teacher shifts from lecturer/director to that of

facilitator, supporter, and resource person. The teacher arranges the learning environment, provides opportunity for student involvement, and, when appropriate, provides feedback to students while they conduct the inquiry (Martin, 1983).

Interviewing - Interviewing, a meeting during which information is obtained by one person from another, is an excellent means for students to gain an insight into another's worldview. Effective interviewing begins with the development of basic skills and thorough preparation. Students may be the interviewer or the interviewee, depending upon the skill set being developed and the information sought.

Graphic Organizers - A graphic organizer is a visual communication tool that uses visual symbols to express ideas and concepts, to convey meaning. A graphic organizer often depicts the relationships between facts, terms, and or ideas within a learning task. It is often referred to as a "map" because it can help teachers and students "map out" their ideas in a visual manner. There are many similar names for graphic organizers including: knowledge maps, concept maps, story maps, cognitive organizers, advance organizers, or concept diagrams.

Inquiry - Inquiry learning provides opportunities for students to experience and acquire processes through which they can gather information about the world. This requires a high level of interaction among the learner, the teacher, the area of study, available resources, and the learning environment.

Interactive Instruction - Interactive instruction relies heavily on discussion and sharing among participants. Students can learn from peers and teachers to develop social skills and abilities, to organize their thoughts, and to develop rational arguments. The interactive instruction strategy allows for a range of groupings and interactive methods. It is important for the teacher to outline the topic, the amount of discussion time, the composition and size of the groups, and reporting or sharing techniques. Interactive instruction requires the refinement of observation, listening, interpersonal, and intervention skills and abilities by both teacher and students.

Lab Groups - Lab groups are cooperative learning groups in an experimental setting.

Learning Activity Pack - A learning activity package (LAP) refers to a planned series of activities that involve the student in exploring a topic, skill, or concept.

Learning Centers - A classroom with learning centers offers various stations at which individuals or groups of students may complete selected tasks or activities. The activities are designed to accommodate a variety of learning styles and challenge the multiple intelligences.

Learning Contracts - Learning contracts provide a method of individualizing instruction and developing student responsibility. They permit individual pacing so that students may learn at the rate at which they are able to master the material. Learning contracts can be designed so that students function at the academic levels most suitable

to them and work with resource materials containing concepts and knowledge that are appropriate to their abilities and experiences. Although this method focuses on the individual, learning contracts also provide an opportunity for students to work in small groups. The teacher may select this approach for some students to support them as they learn to work independently.

Mastery Lecture - Mastery lecture is a type of direct instruction. A significant amount of information can be communicated in a relatively short period of time. The quality of a lecture improves when audio and visual aids are incorporated and if interaction between the teacher and the students is facilitated.

Model Building - Model building involves the students in the design and construction of a theory, concept, or object.

Nonlinguistic Representation – an imagery mode of representation that is expressed as mental pictures and physical sensations such as smell, taste, touch, kinesthetic association, and sound, or in graphic, kinesthetic, or musical forms or products.

Panel - Several experts sit around a table and discuss a topic; they may field questions from an audience. Learners may prepare questions in advance for panelists.

Peer Practice - Peer practice involves each student rehearsing skills or conceptual information with a peer.

Problem-Solving - Learners start a topic by solving a problem that incorporates the concepts of the module. Have participants work in teams to solve a scenario. Begin the presentation with the problem-solving exercise and then debrief the exercise by highlighting important points in the presentation.

Reading for Meaning - To read for meaning, students must simultaneously utilize clues from all cueing systems. Readers bring knowledge and past experiences to the reading task to construct interpretations and to determine if the print makes sense to them. It is easier for readers to understand print when the content is relevant to their personal experiences. Familiar content and topics convey meaning or clues through the semantic cueing system. When students are comfortable and familiar with the content of a passage, they can predict upcoming text and take greater risks in reading. Research has repeatedly shown that fluent readers risk more guesses when interacting with unfamiliar print than poorer readers. They derive more meaning from passages than readers who frequently stop to sound or decode words by individual phonemes or letters.

Reciprocal Teaching - Reciprocal teaching refers to an instructional activity that takes place in the form of a dialogue between teachers and students regarding segments of text. The dialogue is structured by the use of four strategies: summarizing, question generating, clarifying, and predicting. The teacher and students take turns assuming the role of teacher in leading this dialogue.

Reflective Discussion - Reflective discussions encourage students to think and talk about what they have observed, heard or read. The teacher or student initiates the discussion by asking a question that requires students to reflect upon and interpret films, experiences, read or recorded stories, or illustrations. As students question and recreate information and events in a film or story, they clarify their thoughts and feelings. The questions posed should encourage students to relate story content to life experiences and to other stories. These questions will elicit personal interpretations and feelings. Interpretations will vary, but such variances demonstrate that differences of opinion are valuable.

Research Projects - Research projects are very effective for developing and extending language arts skills as students learn in all subject areas. While doing research, students practice reading for specific purposes, recording information, sequencing and organizing ideas, and using language to inform others.

Role Playing - Taking on roles and interacting in groups actively involves students in learning opportunities. By taking on a perspective other than their own, students begin to appreciate the beliefs, wants and needs, and motivations of others while trying to find creative and effective solutions to challenges.

Simulation - Simulations are instructional scenarios where the learner is placed in a "world" defined by the teacher. They represent a reality within which students interact. The teacher sets the parameters of this "world" in which students interact to aquire knowledge and understanding. Debriefing is an essential component of simulation. Simulations are in a way a lab experiment where the students themselves are the test subjects. They experience the reality of the scenario and gather meaning from it.

Socratic Seminar – A Socratic seminar allows students to reach deeper understanding of complex texts or issues through rigorously thoughtful dialogue. Unlike debate, the purpose here is not to win or lose but to arrive at understanding.

Structured Overview - A structured overview refers to organizing and arranging topics or concepts to make them meaningful to students.

Surveys - A survey is a research instrument which involves the asking of questions of a group of individuals. Creating and administering a survey, as well as analyzing the data collected, are all excellent opportunities for students to be active learners.

Synectics - The term Synectics from the Greek word *synectikos* which means "bringing forth together" or "bringing different things into unified connection." Since creativity involves the coordination of things into new structures, every creative thought or action draws on synectic thinking. Synectic thinking is the process of discovering the links that unite seemingly disconnected elements. It is a way of mentally taking things apart and putting them together to furnish new insight for all types of problems. It is a creative problem solving technique which uses analogies.

Tutorial Groups - Tutorial groups are set up to help students who need remediation or additional practice, or for students who can benefit from enrichment. Tutorial groups provide for greater attention to individual needs and allow students to participate more actively. Peer tutoring occurs when a student (the tutor) is assigned to help other students (the learners). The roles played by teacher, tutor, and learner must be explained and expectations for behavior must be outlined.

General Categories of Instructional Strategies

Direct Instruction: Instructional strategies that involve a high degree of teacher control.

Compare & Contrast
Cues, Questions, & Advance Organizers*
Demonstrations
Didactic Questions
Drill and Practice
Explicit Teaching
Graphic Organizers
Guides for Reading, Listening, Viewing
Identifying Similarities and Differences*
Mastery Lecture
Reinforcing Effort & Providing Recognition*
Setting Objectives & Providing Feedback*
Summarizing & Note Taking*
Structured Overview

Experiential Learning: Instructional strategies where students learn by doing or experiencing authentic or simulated situations.

Conducting Experiments
Field Observations
Field Trips
Model Building
Surveys
Modeling
Nonlinguistic Representations*
Role Playing
Games
Simulations
Synectics

Independent Learning: Instructional strategies during which students work independently, sometimes at their own rate on self-selected assignments or topics.

Assigned Questions
Computer Assisted Instruction
Correspondence Lessons
Essays
Graphic Organizers
Homework and Practice*
Learning Activity Package
Learning Centers
Learning Contracts
Reports
Research Projects
Summarizing and Note Taking*

Indirect Instruction: Instructional strategies where the teacher establishes the learning situation or task, but the students determine the direction and/or solution.

Case Studies
Concept Attainment
Concept Formation
Concept Mapping
Close Procedures
Generating & Testing Hypotheses*
Graphic Organizers
Inquiry
Problem Solving
Reading for Meaning
Reciprocal Teaching
Reflective Discussion

Interactive Instruction: Instructional strategies that involve students working with other students and/or the teacher to move toward the learning goals.

Brainstorming
Circle of Knowledge
Cooperative Learning*
Debates
Interviewing
Laboratory Groups
Panels
Peer Practice
Problem Solving
Role Playing
Socratic Seminars
Tutorial Groups

* Marzano, Pickering, and Pollock note that incorporating these nine strategies into instruction can improve student achievement across all content areas and grade levels. http://www.learn-line.nrw.de/angebote/greenline/lernen/downloads/nine.pdf

Matching Instructional Formats to Achievement Targets

	Direct Instruction	Experiential Learning	Independent Learning	Indirect Instruction	Interactive Instruction
Knowledge/ Information	Strategies such as direct instruction, graphic organizers, structured overview, etc., can convey facts or information to students.	Experiential strategies may be structured to allow students to arrive, inductively or deductively, at rules or principles.	Strategies such as assigned questions, learning activity packages or centers, reports, or research projects allow students to obtain facts, etc.	Strategies such as concept attainment or concept forma-tion, reading for meaning, recip-rocal teaching, and inquiry allow students to arrive at rules or principles.	Strategies such as discussion, interviewing, or tutorial groups can provide students with information or help them to review rules, etc.
Skills/ Processes	Modeling can introduce or demonstrate skills or processes, but other, more student-directed strategies are needed as well.	Modeling, games, conducting experiments, etc., can introduce skills/processes or provide practice.	Essays, learning activity packages or centers, or research projects, etc., can provide opportunities for application or practice.	Instructional strategies that involve problem solving often provide the opportunity to acquire skills or practice processes.	Cooperative learning groups, debates, role playing, or laboratory groups, etc., work well.
Thinking & Reasoning	Modeling can introduce or demonstrate thinking and reasoning processes, but other, more student-directed strategies are needed as well.	Most experiential strategies work well here, especially roll playing, games, experiments, and simulations.	Some, such as certain essay topics, learning activity packages or centers, or research projects, work better than others.	Strategies such as working with case studies, concept map-ping, inquiry, problem solving, etc., work well with thinking and reasoning targets.	Most interactive instructional strategies work with these targets, but especially problem solving and Socratic Seminars.
Communication	Not the best strategies for providing students with opportunities to acquire or practice communication skills.	Good when oral, written, or other forms of expression are included, such as reporting field observations, role playing, or simulations.	Again, essays or other strategies that involve oral, written, or other forms of expression can provide the opportunity to learn communication skills.	Reciprocal teaching, reflective discussion, or other strategies that involve oral, written, or other forms or expression work well.	By definition, interactive instructional strategies include opportunities to learn or practice communication skills.

Teaching for Breadth and Depth

For Depth	Breadth
Unearth it ➢ Make assumptions explicit ➢ Clarify points of view ➢ Bring light to the subtle, the misunderstood, the not obvious, the controversial, the obscure, the problematic, the missing, and the lost ➢ *Analyze it* ➢ Separate into parts ➢ Inspect and examine ➢ Dissect, refine, and qualify ➢ Question ➢ Test ➢ Challenge ➢ Doubt ➢ Critique *Prove it* ➢ Argue ➢ Support ➢ Verify ➢ Justify *Generalize it* ➢ Subsume specifics under a more encompassing idea ➢ Compare and contrast	*Connect it* ➢ Link discrete and diverse ideas, facts, and experiences *Picture it* ➢ Make concrete and simple ➢ Represent or model in different ways *Extend it* ➢ Go beyond the given to implications ➢ Imagine "what if?"

Adapted from Grant Wiggins and Jay McTighe. *Understanding by Design.* ASCD. 1998.

WHERETO: Making Instructional Decisions

Stage 3—Learning Plan Teaching and Learning Activities:

In Stage 3 we consider the instructional strategies and learning experiences needed to achieve the desired results (Stage 1) as reflected in the assessment evidence to be gathered (Stage 2). The activities are planned to develop the targeted understandings and the knowledge and skills identified in Stage 1 *and* to equip students for the performances of learning specified in Stage 2. The acronym WHERETO summarizes key elements to consider when designing an effective and engaging learning plan.

To what extent is the learning plan effective and engaging? Consider: Will the students….

W O Know ***w**here* they're going (the learning goals), ***w**hy* (reason for learning the content), and ***w**hat* is required of them (unit goal, performance requirements, and evaluative criteria)?

H O Be ***h**ooked*—engaged in digging into the Big Ideas (e.g., through inquiry, research, problem-solving, experimentation)?

E O Have adequate opportunities to ***e**xplore* and ***e**xperience* Big Ideas and receive instruction to ***e**quip* them for the required performances?

R O Have sufficient opportunities to ***r**ethink, **r**ehearse, **r**evise,* and ***r**efine* their work based upon timely feedback?

E O Have an opportunity to ***e**valuate* their work and set future goals?

Consider the extent to which the learning plan is

T O ***T**ailored* and flexible to address the interests and learning styles of all students.

O O ***O**rganized* and sequenced to maximize engagement and effectiveness.

(Understanding by Design Professional Development Workbook, ASCD, 2004, p. 212

Crossing the River

(Mathematic Teaching in the Middle School January 2001)

Eight adults and two children need to cross a river. A small boat is available that can hold one adult, or one or two children.

There are three possibilities:

1) **1 adult in the boat**
2) **1 child in the boat**
3) **2 children in the boat**

Everyone can row the boat.

A. How many one-way trips does it take for them all to cross the river? Explain your thinking.

B. Can you describe how to work it out for 2 children and any number of adults?

C. Show how your rule works out for 100 adults?

D. What happens to the rule if there are different numbers of children? For example: 8 adults and 3 children? 8 adults and 4 children?

E. Write a rule for finding the number of trips needed for A adults and C children.

F. If one group of adults and children took 27 trips. How many adults and children were in the group? Is there more than one solution? Why or why not?

This page is for scrap work or notes.

Permission Forms for Student Work

CONSENT AND ASSIGNMENT

This Consent and Assignment (the "Assignment") is effective when signed by the undersigned Georgia educator ("Educator") and is between Educator and the Georgia Department of Education (the "GDOE"). For good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties agree:

1. GDOE gratefully acknowledges the contribution Educator is hereby making to GDOE of the original work product (the "Work Product") created, developed, worked on or revised by Educator in connection with GDOE's Georgia Performance Standards Project (the "Project"). So that GDOE may fully use the Work Product in any manner it sees fit, including making copies, modifications and derivative works, Educator hereby fully and unconditionally transfers, assigns and conveys to GDOE all of Educator's copyright, ownership interests and other intellectual property rights in the Work Product (collectively, the "Intellectual Property Rights"). Educator further agrees that GDOE may publicly recognize and acknowledge Educator's contribution to, and involvement in, the Project.

2. This Assignment is governed by Georgia law, can only be amended if both parties do so in writing, is assignable solely by GDOE and supersedes any contrary oral or written agreement or understanding. Educator grants to GDOE the power and authority to execute any documentation deemed necessary by GDOE to register or protect the Work Product or Intellectual Property Rights therein or complete the full transfer of the Work Product and Intellectual Property Rights to GDOE which is the purpose of this Assignment.

"Educator"
Name:

Signature:

_____

Print:

_____

"GDOE"

Georgia Department of Education

By: _____

Title: _____

Date: _____

CONSENT AND ASSIGNMENT

This Consent and Assignment (the "Assignment") is effective when signed by the undersigned legal guardian ("Guardian") on behalf of the Guardian and minor Georgia student named below ("Student"), and is among Guardian, Student and the Georgia Department of Education (the "GDOE"). For good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties agree:

1. GDOE gratefully acknowledges the contribution Student and Guardian are hereby making to GDOE of the original work product (the "Work Product") created, developed, worked on or revised by Student. So that GDOE may fully use the Work Product in any manner it sees fit in connection with GDOE's Georgia Performance Standards Project (the "Project"), including making copies, modifications and derivative works, Guardian on behalf of Guardian and Student (and their heirs and successors) hereby fully and unconditionally transfer, assign and convey to GDOE all of Student's and Guardian's copyright, ownership interests and other intellectual property rights in the Work Product (collectively, the "Intellectual Property Rights"). Guardian further agrees that GDOE may publicly recognize and acknowledge Student's contribution to, and involvement in, the Project.

2. This Assignment is governed by Georgia law, can only be amended if both parties do so in writing, is assignable solely by GDOE and supersedes any contrary oral or written agreement or understanding. Student grants to GDOE the power and authority to execute any documentation deemed necessary by GDOE to register or protect the Work Product or Intellectual Property Rights therein or complete the full transfer of the Work Product and Intellectual Property Rights to GDOE which is the purpose of this Assignment.

"Guardian"

Signature:

_____

Print Name:

_____

Guardian's Relationship to Minor:

_____

Print Minor's Name:

_____

"GDOE"

Georgia Department of Education

By: _____

Title: _____

Date: _____

Recommended Readings/Viewings: Instruction

Note: A more general list of resources for the standards-based education process is contained in the materials for Day one of training.

Marzano, Robert J., Debra J. Pickering, and Jane E. Pollock. *Classroom Instruction That Works: Research-Based Strategies for Increasing Student Achievement*. Alexandria, VA: ASCD, 2001.
Using a meta-analysis of thousands of research studies, Marzano, et al., clearly answer the question, "Which instructional techniques are *proven* to work?" They provide 13 proven strategies that all teachers can use, and they explain the research in a clear, practical manner.

Marzano, R., et al. *A Handbook for Classroom Instruction That Works*. Alexandria, VA: ASCD, 2001.
A perfect resource for self-help or school study groups, this handbook makes it much easier to apply the teaching practices outlined in *Classroom Instruction That Works*. The authors guide the reader through the nine categories of instructional strategies that are most likely to maximize student achievement and provide everything needed to use the strategies quickly in classrooms. The book includes the following: exercises to check understanding; brief questionnaires to reflect on current beliefs and practices; tips and recommendations to implement the strategies; samples, worksheets, and other tools to help plan classroom activities; and rubrics to assess the effectiveness of the strategies with students.

Marzano, Robert J. *Classroom Management That Works: Research-Based Strategies for Every Teacher*. Alexandria, VA: ASCD, 2003.
The authors analyze research from more than 100 studies on classroom management to answer the questions, "How does classroom management affect student achievement?" and "What techniques do teachers find most effective?" The authors provide action steps, along with real stories of teachers and students, to guide teachers in implementing the research findings.

Schifter, D., & Fosnot, C.T. (1993). *Reconstructing mathematics education: stories of teachers meeting the challenge of reform.* New York: Teachers College Press. (ISBN: 0807732052)
The authors describe teachers who confront their own concept of mathematics by doing real mathematics themselves. There are also many insights into the classrooms to which these teachers return. If you feel a bit threatened by the call for change, this is a book that can give you some company.

Strong, R., H. Silver, and M. Perini. *Teaching What Matters Most: Standards and Strategies for Raising Student Achievement*. Alexandria, VA: ASCD, 2001.

This practical book about the responsibility educators have to teach what matters most includes many examples of educators throughout the nation who have been successful in increasing student performance on state and national assessments. The authors also explore three changes that must take place to achieve this goal: responsible standards, responsible strategies, and responsible assessment practices.

Van de Walle, John. Elementary and Middle School Mathematics: *Teaching Developmentally*. Boston, MA: Pearson Education, Inc. 2004.
A resource for those who are investigating the teaching of mathematics at the elementary and middle school levels. The emphasis is on student-centered problem solving.

Wiggins, Grant, and Jay McTighe. *Understanding by Design*. Alexandria, VA: ASCD, 1998.
This book explains the "backward design" process that is the backbone of standards-based education. The book explains both the underlying principles and the process teachers can use to put them into practice.

Wiggins, Grant, and Jay McTighe. *Understanding by Design Study Guide*. Alexandria, VA: ASCD, 2000.
This companion book to *Understanding by Design* provides discussion questions, graphic organizers, and summaries to support faculty study groups that are exploring *Understanding by Design*.

Wiggins, Grant, and Jay McTighe. *Understanding by Design Professional Development Workbook*. Alexandria, VA: ASCD, 2004.
This companion book to *Understanding by Design* is chock-full of templates and examples to help teachers put the process into place.

Suggested Web Sites for Instruction

http://ims.ode.state.oh.us/ODE/IMS/Lessons/Default.asp
This web site, created by the Ohio Department of Education, provides guidelines for planning standards-based instruction and for designing standards-based units and lessons.

http://pareonline.net
Practical Assessment, Research and Evaluation (PARE) is an on-line journal supported, in part, by the Department of Measurement, Statistics, and Evaluation at the University of Maryland. Its purpose is to provide education professionals access to refereed articles that can have a positive impact on assessment, research, evaluation, and teaching practice.

http://users.edte.utwente.nl/lanzing/cm_home.htm
This web site provides an overview of concept mapping that might be useful for determining those concepts and processes that fit together for units of instruction.

http://www.greece.k12.ny.us/instruction/ela/6-12/BackwardDesign/Overview.htm
This page on the Greece Central School District of New York web site offers multiple resources related to instructional planning using the standards-based education process.

http://www.greece.k12.ny.us/instruction/ela/6-12/Curriculum%20Mapping/Index.htm
This page on the Greece Central School District of New York web site offers multiple templates that can be modified and used to assist in mapping concepts into units of instruction.

http://www.lkwash.wednet.edu/lwsd/html/programs/curriculum/modelunits_t.asp
This web site published by the Lake Washington School District includes a sample planning guide, a unit planning template, and several sample unit plans. GPS need to be unpacked through stages 1 and 2 before employing these templates.

http://www.learn-line.nrw.de/angebote/greenline/lernen/downloads/nine.pdf
This article lists, explains, and provides examples of nine instructional strategies, identified by Marzano, Pickering, and Pollock, that improve student achievement across all content areas and grade levels.

http://www.pbs.org/pbsyou/about.html
This PBS web site provides information about free, televised, adult education courses in everything from dramatic literature to cooking. Anyone teaching a new course or just wanting to revisit particular content topics might find this site useful.

http://www.rmcdenver.com/useguide/lessons/examples.htm?
This site provides sample lessons/units based on the Texas state standards.

http://www.sasked.gov.sk.ca/docs/policy/approach/instrapp05.html
This excellent article from Curriculum and Instruction Branch, Saskatchewan Education, 2220 College Avenue, Regina, Saskatchewan, provides information teachers may find helpful about matching instructional strategies to desired learning goals.

http://64.233.179.104/search?q=cache:FWPY3QS1C6wJ:www.pls.uni.edu/tws/rubricsamples/IDM2.pdf+Making+Instructional+Decisions&hl=en
This web site provides two anecdotal examples of teachers using assessment of student learning to make instructional decisions.

http://www.techtrekers.com/

This site provides information about simulations, web quests, and other strategies and activities that can provide students with opportunities to learn.

www.pals.sri.com

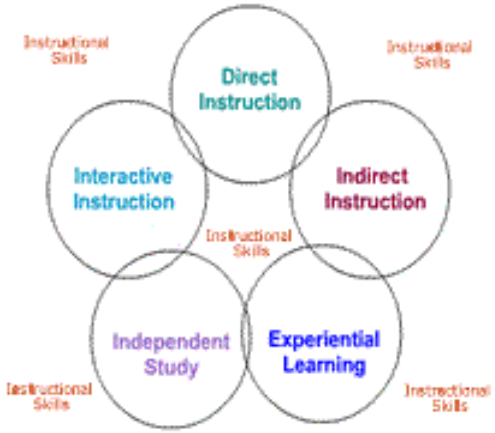
PALS is an on-line, standards-based, continually updated resource bank of science performance tasks indexed via the National Science Education Standards (NSES) and various other standards frameworks.

www.teachersbridge.org

This excellent site, created by a consortium of Georgia educators and other professionals in education, provides teaching resources, online learning communities, and much more.

http://www.sasked.gov.sk.ca/docs/policy/approach/instrapp02.html

This article provides an overview of four foundations for instructional decision-making, as well as information on appropriate teacher reflection about the practice of instructional decision-making in the classroom.



http://olc.spsd.sk.ca/DE/PD/instr/index.html

http://www.saskschools.ca/curr_content/onlineteach/op/home/index.htm

Mathematics Resources

Teacher Resources:

Brooks, J. G. & Brooks, M. G. (1993). *In search of understanding: The case for the constructivist classroom.* Alexandria, VA: Association for Supervision and curriculum Development. (ISBN: 0130606626)
Though not a book about teaching mathematics, this is a readable and informative book on teaching in a constructivist manner. Examples span all curricular areas and all grades.

Fosnot, C. T. (Ed.). (1996). *Constructivism: Theory, perspectives, and practice.* New York: Teachers College Press. (ISBN: 0807745707)
The first section of this book develops the theory of constructivism through three readable chapters. The next five chapters examine the application of constructivist theory in different disciplines. Deborah Schifter provides the perspective on teaching mathematics. The final section includes four chapters on classroom practice. You will not find this book overly theoretical or hard to read. At the same time, Fosnot's book is not exactly a light read. You will be challenged and rewarded.

Lester, R. K. & Charles, R. I. (Eds.) (2004). *Teaching mathematics through problem solving: Grades 6-12.* Reston, VA: National Council of Teachers of Mathematics.
This is an important and valuable publication from the council. Topics include "Mathematics as Sense Making," "Designing and Selecting Tasks," "How to Problematize the Curriculum," "Listening to Children," "Problem solving with Technology," and "Problem Posing." The 17 chapters, all written by top authors in the field, provide an in-depth examination o using a problem-based approach to teaching for understanding. The voices of teachers are also included in short reflections by those who have worked to make teaching through problem solving a success in their classrooms.

A Collection of Math Lessons. Marilyn Burns and Bonnie Tank. Math Solutions Publications: Sausalito, CA. 1999.

The Big Book of Books and Activities -- An Illustrated Guide for Teachers, Parents and Anyone Who Works with Kids! Dinah Zike. Dinah-Might Adventures, LP: San Antonio, TX.

Big Book of Math Graphics Every Teacher Needs! Dinah Zike. Dinah-Might Adventures, LP: San Antonio, TX.

http://www.gadoe.org/ci_services.aspx?PageReq=CIServMath
The Georgia Department of Education Mathematics webpage has links to the standards, the frameworks, and many other valuable websites.

www.gradebook.org/Mathematics.htm
Mathematics Department World Wide Web Resources for Mathematics Education. * New Directions and Issues in Pedagogy ... Links to lesson plans, materials, videos, manipulatives, discussion groups

http://www.mathsolutions.com