

Success in an Elementary Mathematics Classroom

All activities involved in a student's mathematics education should be based on an engaging mathematics instruction developed in a learning environment that is based on understanding and exploration. Students at all grade levels should have opportunities for exploration and discourse while performing worthwhile tasks derived from a focused curriculum. Emphasis is on the opportunity to solve problems while being able to communicate reasoning and reflections about these connections. Students need to be exposed to models and to be in a position to interpret the real-life role that mathematics plays in their everyday lives.

According to the National Council of Teachers of Mathematics (NCTM) Standards, all students are to receive quality mathematics instruction, supported by the principle that they are capable of learning mathematics through equity, curriculum, teaching, learning, assessment, and technology.

Effective mathematics teaching should involve the following six elements addressed by the NCTM:

- worthwhile mathematics tasks
- teacher's role in discourse
- student's role in discourse
- tools for enhancing discourse
- the learning environment
- the analysis of teaching and learning

Activities in mathematics education should adhere to the consensus that students need to learn mathematics with understanding in order to build on the foundation of their experience and prior knowledge.

Aside from standards associated with the five strands, (1) number sense, concepts, and operations, (2) measurement, (3) geometry and spatial sense, (4) algebraic thinking, and (5) data analysis and probability, focus should be placed on problem solving, reasoning and proof, communication and reflection, and connections and reflections in order to model and interpret the real-life role which mathematics plays in our everyday lives.

In grades K-2, students should be developing their basic mathematics foundation that centers on curiosity and exploration of patterns, shapes, numbers, and space.

Success in an Elementary Mathematics Classroom (continued)

It is the responsibility of the primary teacher to provide instruction that fosters understanding and stimulation. Students should be encouraged to problem-solve and reason as they explore and discover.

To complement the nurturing "mathematics" environment, the use of manipulatives is encouraged in order to provide the introduction of real student understanding. This foundation of understanding can then be "layered" with both new and prior knowledge as the abstract becomes concrete. Teachers should infuse literature into the curriculum, since this element will contribute to mathematical understanding and connection.

Communication and reflection should be encouraged to make these connections real. To promote problem solving and critical thinking, the following activities are recommended:

- the use of manipulatives
- interactive bulletin boards
- journals
- vocabulary words and pictures
- portfolios
- access to technology

Success Using Literature Connections in the Primary Classroom

At a time when the demonstration of academic achievement is imperative to a school's success, the need for proven instructional strategies increases. One such strategy is the alignment of subject areas.

The alignment of instruction across the curriculum is a critical tool for students as well as teachers. The integration of subject areas reinforces the students' development of content-based concepts, as well as addressing the issue of time management for teachers. For primary grades (PreK-2), the impact of this alignment is even more pronounced. The integration of subject matter is greatly advanced through the inclusion of literature supplements into individual content areas.

This K-2 resource guide contains suggested primary-level lessons that have been correlated to the Florida Sunshine State Standards to better prepare students in the curriculum area of mathematics. It was created to assist primary teachers in the development of mathematics concepts via the use of literature as a bridge. Some of the benefits of using the identified literature connections are listed below:

- Class discussion of the literature piece provides an informal means of identifying students' prior knowledge.
- Students' reading/language art skills are further developed and enhanced.
- Students' awareness of mathematics topics through indirect mathematics instruction is intensified.
- Students' are more open to content instruction due to an increased interest level (curiosity is piqued by the use of stories and poems).
- Stories and poems are often real world-based.
- Literature can span several age groups depending on desired content goals.
- Students can often articulate or demonstrate comprehension by acting out or re-creating a story.
- Students can better relate to and retain information in story form as opposed to isolated facts.

Best Practices of Effective Mathematics and Science Classrooms

An effective mathematics and science program must provide appropriate instruction, high expectations, and the same standards for all students. The content should be challenging and stimulating for everyone and based on the assumption that all students can achieve these standards if given adequate opportunities to learn. The mathematics and science programs must be responsive to the demands of a technological society and the needs of an increasingly diverse population. Innovative, active learning experiences for the students are desired over the more traditional, passive learning. The mathematics and science program should foster conceptual convergence of the sciences, mathematics, and technology with other disciplines. Current research delineates several specific instructional strategies that ought to be present for exemplary mathematics and science programs.

Mathematics and Science Essential Components Appropriate for All Grade Levels

Preparing Students for Learning and Prior Knowledge Assessment

Teachers should inquire about students' understandings of concepts before sharing their own understandings about the topic. The technique of "frontloading" to elicit prior knowledge related to real-life experiences and applications can create a direct connection to the content for students.

Strategies: using graphic organizers (Concept Mapping, KWL) showing a video clip, providing a demonstration, or using literature.

Developing Active Learners

Students can become active learners by providing opportunities for them to construct their own understanding. These situations should require students to organize, classify, interpret, and draw conclusions about real-life mathematical and scientific problems. Students must communicate their ability to problem-solve through oral, written, and physical demonstrations.

Strategies: using open-ended questions, real-life scenarios to solve, and paradoxes.

Teaching to Diversity

Teachers, as the facilitators of the learning, should provide a variety of activities that address learning, language, and cultural differences. Activities within the classroom should include a variety of cultures, learning styles, and multiple intelligence. This will help students become aware that there are different ways of knowing and learning.

Strategies: using graphic organizers such as concept mapping or KWL; incorporating verbal/linguistic, logical/mathematical, body/kinesthetic, visual/spatial, and

musical/rhythmic activities; providing opportunities to work individually as well as in small and large groups.

Orchestrating Collaborative Discourse

There should be encouragement of student discourse within the classroom through students engaging in dialogue, both with the teacher and especially with one another. Teachers should encourage and accept student autonomy and initiative by allowing student responses to drive lessons, shift instructional strategies, and alter the lesson plans. The ways of representing, thinking, discussing, agreeing, and disagreeing is central to what students learn about mathematics and science.

Strategies: posing questions and tasks that elicit, engage, and challenge thinking; asking students to clarify and justify issues; providing teacher elaboration during discussions.

Vary the Instructional Format

A variety of instructional formats should be used in classrooms to make sense of the content and to construct meanings from new situations. Mathematics classrooms should foster the use of manipulatives whenever possible to teach concepts, while science classrooms should provide the opportunity for inquiry-based instruction. Instead of traditional lecture-type instruction, opportunities should be provided for small-group work, individual exploration, peer instruction, and whole-class discussion.

Strategies: using manipulatives, hands-on activities, and technology-based activities.

Use of the Learning-Cycle Instructional Model

Teachers need to develop techniques that move their students from concrete to abstract concepts through frequent use of the learning-cycle model. First, the teacher provides an opportunity for students to generate questions and hypotheses through an open-ended discovery activity. This is followed by the concept introduction lesson(s) provided by the teacher. Finally, students must be provided with opportunities to demonstrate their understanding of the learned concept by transferring it successfully to other situations through solving a scenario or by doing a demonstration or project.

Strategies: posing scenarios to be solved.

Integrated Teaching

Multi- and interdisciplinary activities should be included within the classroom that provides connections for students. Students must recognize the various roles mathematics and science play in real life. The connection and application of mathematics and science will motivate, give meaning to, and reinforce student learning. These activities should involve students in critical thinking, process skills, and product development.

Strategies: giving authentic problems to solve, bridging.

Best Practices (continued)

Critical Thinking and Higher-Order Questioning

Use effective, open-ended questioning techniques that encourage student inquiry. Encourage students to pose their own questions, evaluate the information presented, and make informed decisions about the information. Examples would include "How would you solve a similar situation?" or "What criteria would you use to . . . ?"

Strategies: *elaborating, analyzing, hypothesizing, and evaluating*

Continuous Assessment of the Learning

Assessment should reflect how and what is being taught. It should be embedded at various points in the lesson to guide the instructional planning and pacing. There is a clear alignment between curriculum, instruction, and how students are assessed.

Strategies: *assigning performance tasks and essays, maintaining portfolios, using video presentations, and demonstrations.*

Promotion of Collegiality

Teacher collaboration is essential for effective teaching practices. Teachers should collaborate to establish long-range plans, prioritize curriculum, share best practices, mentor, and model lessons for each other.

Strategies: *incorporating team, departmental, and grade -level planning; participating in study groups, peer coaching, and mentoring.*

Sunshine State Standards-Related Websites That Support Teaching and Learning the SSS

<http://www.firn.edu/doe/>

This is the home page for the Florida Department of Education and a source for many resources on assessment.

<http://www.firn.edu/doe/sas/fcat.htm>

This is the FCAT homepage. It contains links to many resources such as FCAT sample items, *FCAT Item Specifications*, FCAT brochures for educators and parents, and frequently-asked questions about FCAT.

<http://www.fcatexplorer.com/>

FCAT Explorer helps students practice the *Sunshine State Standards* as assessed by FCAT. There is a management system for teachers or parents that tracks a student's performance. A sign-in name and password are required. Fourth-grade reading and fifth-, eighth-, and tenth-grade math are currently available. Other grades and subject are under development.

<http://osi.fsu.edu/wavseries/index.html>

The "Ride the Wave Series" is a set of user-friendly flyers on "hot topics" being addressed by school improvement teams and the school community.

http://www.miamisci.org/www/education_resources.php

This site contains links to many teacher resources.

<http://www.ibinder.uwf.edu/steps/welcome.cfm>

This site, created by the Educator Performance Institute of the University of West Florida (UWF) and the Panhandle Area Center for Educational Enhancement offers a wealth of professional development resources including many illustrative instructional activities aligned to the *Sunshine State Standards*.

<http://www.beaconlc.org/beacon>

BEACON houses a variety of educational resources to be used by students, teachers, parents, and others involved in developing and implementing curriculum based on the *Sunshine State Standards*.

Sunshine State Standards-Related Websites That Support Teaching and Learning the SSS (continued)

<http://www.itrc.ucf.edu/sss/>

The Florida Instructional Technology Resource Center (ITRC) at the University of Central Florida (UCF) created this Website to direct educators to resources for teaching the *Sunshine State Standards*.

<http://www.figurethis.org/index40.htm>

Figure This! Mathematics Challenges for Families provides interesting mathematics activities that middle-school students can explore at home with their families. Figure This! has family-support materials, including information on how to prepare students for continuing education and suggestions regarding how to help them with math homework. To use this site, you may need to download and install Macromedia Flash Player and Shockwave Player as well as Adobe Acrobat Reader.

<http://matti.usu.edu/nlvm/nav/index.html>

The National Library of Virtual Manipulates website is a collection of uniquely interactive, web-based virtual manipulatives or concept tutorials for mathematics instruction, mostly in the form of Java applets, with a K-8 emphasis. However, the site has interactive applets for all five strands from grades K through grades 12. To access the National Library website, you must use a Java-enabled web browser.

<http://math.rice.edu/~lanius/pres/map/>

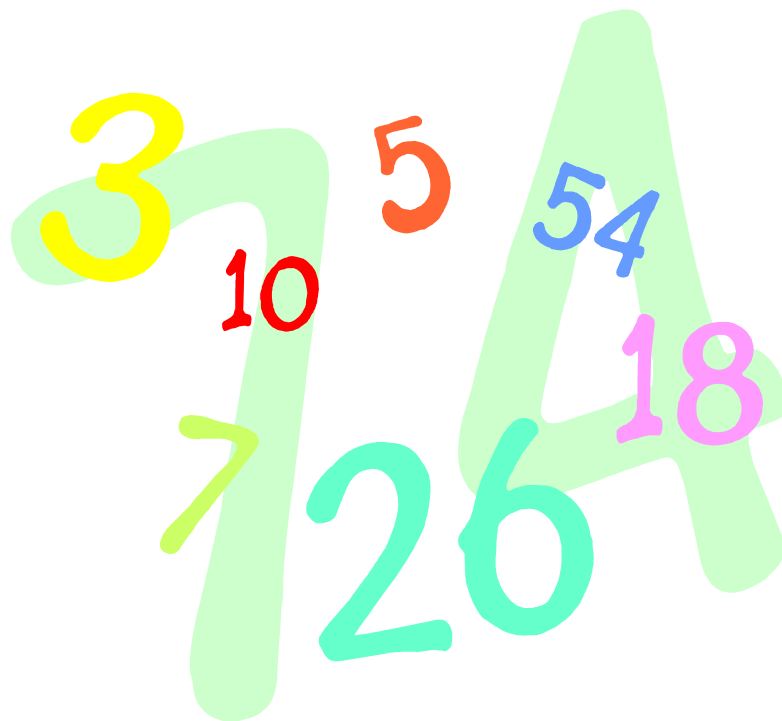
Cynthia Lanius, a Houston, Texas, mathematics teacher, provides her own lessons on fractals and map-making at this sites.

<http://www.learner.org>

Helping schools and communities improve their math and science education programs is the mission of the Annenberg/CPB Math and Science Project.

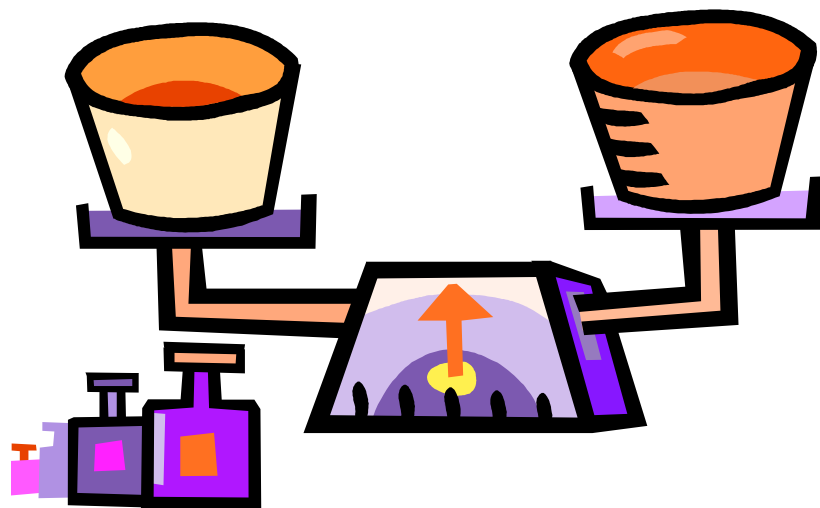
Strand A

Number Sense, Concepts,
and Operations



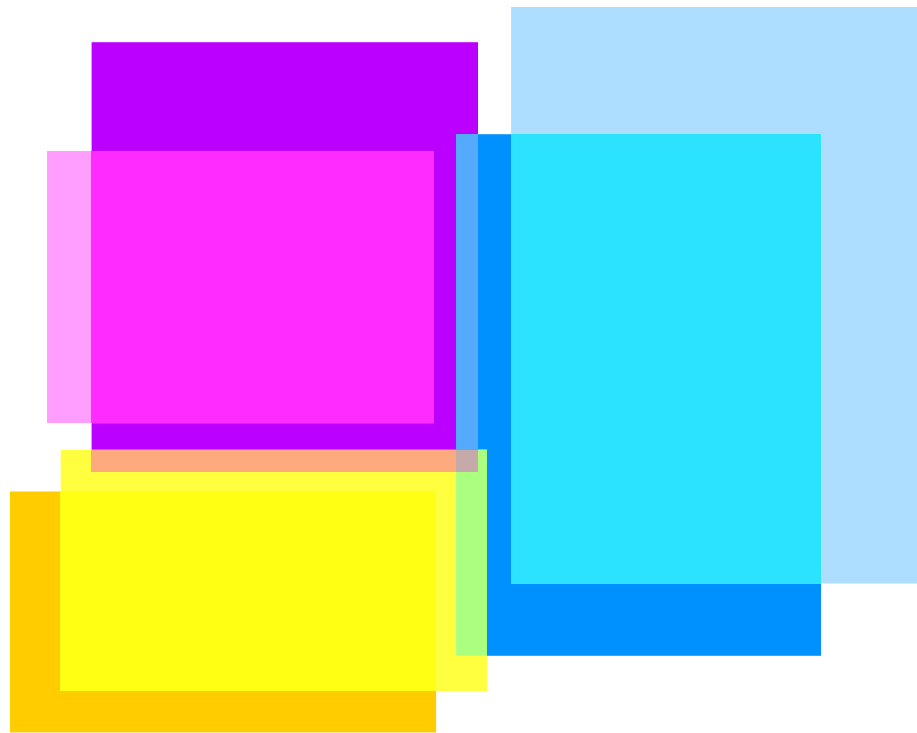
Strand B

Measurement



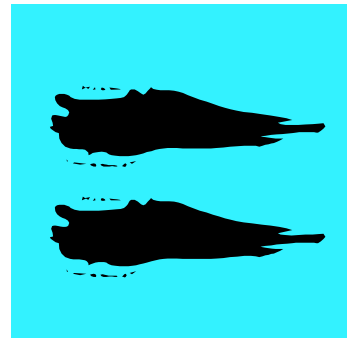
Strand C

Geometry and
Spatial Sense



Strand D

Algebraic Thinking



Strand E

Data Analysis and Probability

