PRE-KINDERGARTEN

MATH CORE CONTENT

2007

STANDARD 4.1 (NUMBER AND NUMERICAL OPERATIONS) ALL STUDENTS WILL DEVELOP NUMBER SENSE AND WILL PERFORM STANDARD NUMERICAL OPERATIONS AND ESTIMATIONS ON ALL TYPES OF NUMBERS IN A VARIETY OF WAYS.

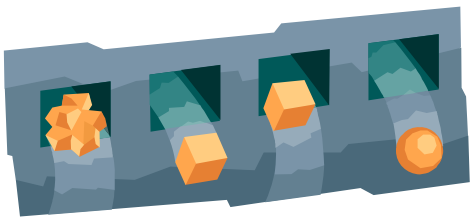
Expectation

1. Children will demonstrate an understanding of number and numerical operations

Descriptive Statement: Numbers and arithmetic operations are what most of the general public think about when they think of mathematics; and, even though other areas like geometry, algebra, and data analysis have become increasingly important in recent years, numbers and operations remain at the heart of mathematical teaching and learning. Facility with numbers, the ability to choose the appropriate types of numbers and the appropriate operations for a given situation, and the ability to perform those operations as well as to estimate their results, are all skills that are essential for modern day life.

Pre- School Teaching Practices

1. Make materials and books that promote number exploration accessible to the children (e.g., collections of small objects, cash registers with money, number puzzles, counting books and games, egg cartons and plastic eggs, etc.).
2. Encourage children to compare numbers frequently through questions and graphing (e.g., "Are there more people riding in the bus or in the airplane you made?" "Are there more people here whose favorite color is yellow or more who like green?")
3. Integrate purposeful counting experiences throughout other learning opportunities (e.g., taking attendance, following the rule to stay three steps behind another person climbing the ladder of the slide).
4. Encourage and support individual attempts to learn to count numbers. Encourage counting to 30+.
5. Provide children opportunities to use estimation skills during daily activities by asking interesting and relevant questions (e.g., "How many strips of paper will you need for the bird's tail?").
6. Model addition for children by using counting to combine numbers (e.g., "Maria has two blocks and Justin has three. There are five blocks altogether: 1,2,3,4,5.").
7. Model subtraction for children by using counting to separate numbers (e.g., "There are five cars on the carpet: 1,2,3,4,5. Three cars are red and two are blue. I am putting the two blue cars in the basket. There are three red cars left on the carpet.").
8. Foster one-to-one correspondence throughout the day (e.g., select a child to give out placemats and napkins at mealtimes, give each child a bag or basket of materials at small-group time, return containers of play dough to labeled shelves, etc.).

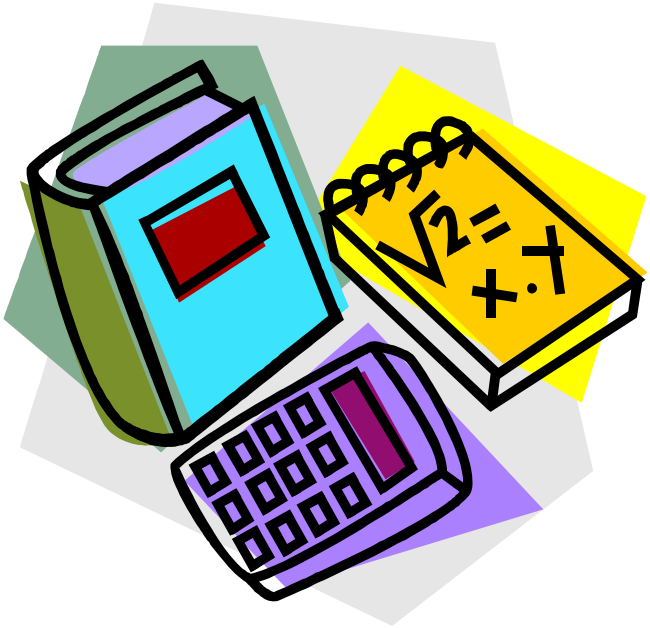


Number Sense. Number sense is an intuitive feel for numbers and a common sense approach to using them. It is a comfort with what numbers represent that comes from investigating their characteristics and using them in diverse situations. It involves an understanding of how different types of numbers, such as fractions and decimals, are related to each other, and how each can best be used to describe a particular situation. It subsumes the more traditional category of school mathematics curriculum called numeration and thus includes the important concepts of place value, number base, magnitude, and approximation and estimation.

Outcomes

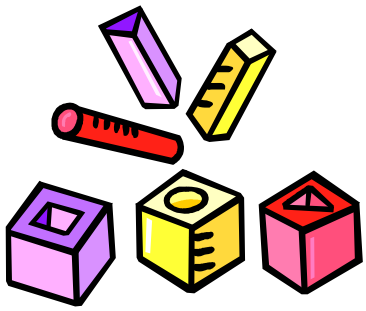
- ❑ One to one correspondence (e.g. places one placemat at each place, gives each child one cookie, places one animal in each truck, hands out manipulatives to be shared with a friend saying, “One for you and one for me.”
- ❑ Learns to say the counting numbers
- ❑ Recognizes and names some written numerals
- ❑ Discriminates numbers from other symbols in the environment (e.g. street signs, license plates, room numbers, clock…)
- ❑ Spontaneously counts for own purposes (e.g. counting blocks, cars, beads, napkins…)
- ❑ Compares numbers in different contexts (e.g. using words such as more and less)

Numerical Operations. Numerical operations are an essential part of the mathematics curriculum, especially in the elementary grades. Students must be able to select and apply various computational methods, including mental math, pencil-and-paper techniques, and the use of calculators. Students must understand how to add, subtract, multiply, and divide whole numbers, fractions, decimals, and other kinds of numbers. With the availability of calculators that perform these operations quickly and accurately, the instructional emphasis now is on understanding the meanings and uses of these operations, and on estimation and mental skills, rather than solely on the development of paper-and-pencil proficiency.



Outcomes

- ❑ Adds two groups of concrete objects by counting the total (e.g. three blue pegs, three yellow pegs, and six pegs together.
- ❑ Subtracts one group of concrete objects from another by taking some away and then counting the remainder (e.g. “I have four carrots sticks. I am eating one. Now I have 3.)



Estimation. Estimation is a process that is used constantly by mathematically capable adults, and one that can be easily mastered by children. It involves an educated guess about a quantity or an intelligent prediction of the outcome of a computation. The growing use of calculators makes it more important than ever that students know when a computed answer is reasonable; the best way to make that determination is through the use of strong estimation skills. Equally important is an awareness of the many situations in which an approximate answer is as good as, or even preferable to, an exact one. Students can learn to make these judgments and use mathematics more powerfully as a result.

Outcomes

- ❑ Uses estimation as a method of approximating an appropriate amount (e.g. at snack time, deciding how many napkins to take from a large pile for the group, determining number of blocks to use when building structures.

Number and operation skills continue to be a critical piece of the school mathematics curriculum and, indeed, a very important part of mathematics. But, there is perhaps a greater need for us to rethink our approach here than to do so for any other curriculum component. An enlightened mathematics program for today's children will empower them to use all of today's tools rather than require them to meet yesterday's expectations.

STANDARD 4.2 (GEOMETRY AND MEASUREMENT) ALL STUDENTS WILL DEVELOP SPATIAL SENSE AND THE ABILITY TO USE GEOMETRIC PROPERTIES, RELATIONSHIPS, AND MEASUREMENT TO MODEL, DESCRIBE AND ANALYZE PHENOMENA.

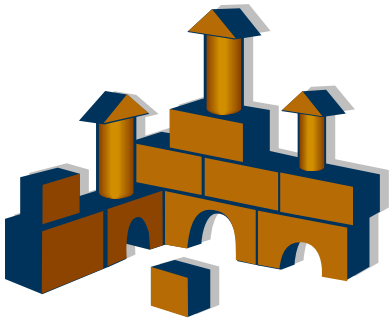
Expectation

2. Children develop knowledge of spatial concepts – e.g. shapes and measurement

Descriptive Statement: Spatial sense is an intuitive feel for shape and space. Geometry and measurement both involve describing the shapes we see all around us in art, nature, and the things we make. Spatial sense, geometric modeling, and measurement can help us to describe and interpret our physical environment and to solve problems.

Pre- School Teaching Practices

1. Provide materials both indoors and outdoors, for children to develop a spatial and geometric sense (e.g., items to fill and empty, fit together and take apart, arrange and shape; materials that move; tunnels to crawl through; photos and pictures that show different views).
2. Use everyday experiences to foster understanding of spatial sense (e.g., talk about locations in the school, map the classroom).
3. Use positional words such as over, under, behind, in front of and up to describe the relative position of items and people and encourage the children to use them (e.g., "Michael is sitting next to Ana." "I see that you used yellow paint under the blue stripe on your painting." "Sam is putting his bears under the bowl." "The car is on the right.").
4. Provide standard and nonstandard measurement materials both indoors and outdoors (e.g., unit blocks, inch cubes, rulers, cups, buckets, balance scales, water and sand tables, etc.).
5. Provide opportunities for children to explore the differences between two- and three-dimensional shapes and constructions (e.g., faces of attribute blocks, balls, blocks of all shapes, boxes, beads, etc.).
6. Introduce the vocabulary relating to two-dimensional and three-dimensional shapes and constructions (circle, sphere, square, cube, triangle, rectangular prism, pyramid etc.).
7. Help children to explore symmetry in their block constructions and in photographs and designs.



Geometric Properties. This includes identifying, describing and classifying standard geometric objects, describing and comparing properties of geometric objects, making conjectures concerning them, and using reasoning and proof to verify or refute conjectures and theorems. Also included here are such concepts as symmetry, congruence, and similarity.

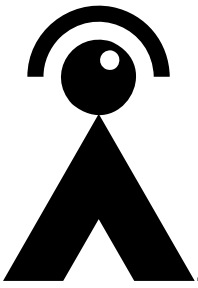
Outcomes

- ❑ Uses positional words in a functional way (e.g. “I put red blocks on top of the cabinet.”
- ❑ Identifies basic shapes in the environment (e.g. circle, square, triangle, cube, sphere)

Transforming Shapes. Analyzing how various transformations affect geometric objects allows students to enhance their spatial sense. This includes combining shapes to form new ones and decomposing complex shapes into simpler ones. It includes the standard geometric transformations of translation (slide), reflection (flip), rotation (turn), and dilation (scaling). It also includes using tessellations and fractals to create geometric patterns.

Outcomes

- ❑ Makes three-dimensional constructions and models (e.g. sculptures that have depth and width.)
- ❑ Makes connections between two-dimensional and three dimensional forms (circles-sphere, square-cube, triangle-pyramid

 .)

Units of Measurement. Measurement helps describe our world using numbers. An understanding of how we attach numbers to real-world phenomena, familiarity with common measurement units (e.g., inches, liters, and miles per hour), and a practical knowledge of measurement tools and techniques are critical for students' understanding of the world around them.

Outcomes

- ❑ Uses standard and nonstandard measurement units (e.g. measuring body length with unifix cubes, using a tape measure to gauge height of block construction, counting the number of cups it takes to fill a bucket with water.
- ❑ Uses vocabulary to describe distances (e.g. “It was a really long walk to the playground.”
- ❑ Uses vocabulary to describe directional concept (e.g. “Watch me climb up the ladder and slide down.”

STANDARD 4.3 (PATTERNS AND ALGEBRA) ALL STUDENTS WILL REPRESENT AND ANALYZE RELATIONSHIPS AMONG VARIABLE QUANTITIES AND SOLVE PROBLEMS INVOLVING PATTERNS, FUNCTIONS, AND ALGEBRAIC CONCEPTS AND PROCESSES.

Expectation

3. Children understand patterns, relationships and classifications

Descriptive Statement: Algebra is a symbolic language used to express mathematical relationships. Students need to understand how quantities are related to one another, and how algebra can be used to concisely express and analyze those relationships. Modern technology provides tools for supplementing the traditional focus on algebraic procedures, such as solving equations, with a more visual perspective, with graphs of equations displayed on a screen. Students can then focus on understanding the relationship between the equation and the graph, and on what the graph represents in a real-life situation.

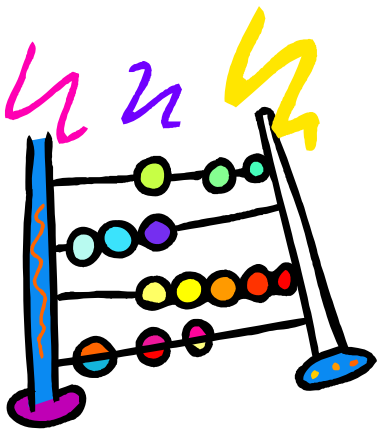
Preschool Teaching Practices

1. Provide materials for children to sort, classify and order (e.g., buttons, beads, colored craft sticks, bowls and trays and computer games with patterns to create or extend).
2. Create a simple pattern and ask children to repeat or insert missing elements (e.g., "I made a pattern in my tower: red block, blue block, red block, blue block. What color block should go next?").
3. Call attention to patterns in the environment, including visual and non-visual patterns (e.g., stripes on a child's shirt, flowers outside, songs and chants).
4. Plan and set up activities involving various types of patterns (e.g., songs, musical instruments, transition signals and activities).

Patterns. Algebra provides the language through which we communicate the patterns in mathematics. From the earliest age, students should be encouraged to investigate the patterns that they find in numbers, shapes, and expressions, and, by doing so, to make mathematical discoveries. They should have opportunities to analyze, extend, and create a variety of patterns and to use pattern-based thinking to understand and represent mathematical and other real-world phenomena.

Outcomes

- ❑ Sorts objects in groups (e.g. separate basket of collected items into piles pinecones, acorns, twigs.)
- ❑ Describes objects by characteristics it does or does not possess (e.g. This button doesn't have holes)
- ❑ Seriates objects according to various properties including size, number, length, heaviness, texture – rough or smooth, loudness.)
- ❑ Classifies objects by sorting them into subgroups by one or more attributes (e.g. sorting counting bears by colors into trays, separating a mixture of beans by individual size and shape)
- ❑ Identifies patterns in the environment (e.g. "Look at the rug. It has a circle, than a number, then a letter…."
- ❑ Represents patterns in a variety of ways (e.g. stringing beads red/green/red/green/red/green, arranging buttons big/bigger/biggest, singing songs that follow a simple pattern



STANDARD 4.4 (DATA ANALYSIS, PROBABILITY, AND DISCRETE MATHEMATICS) ALL STUDENTS WILL DEVELOP AN UNDERSTANDING OF THE CONCEPTS AND TECHNIQUES OF DATA ANALYSIS, PROBABILITY, AND DISCRETE MATHEMATICS, AND WILL USE THEM TO MODEL SITUATIONS, SOLVE PROBLEMS, AND ANALYZE AND DRAW APPROPRIATE INFERENCES FROM DATA.

Expectation

4. Children develop knowledge of sequence and temporal awareness.

Descriptive Statement: Data analysis, probability, and discrete mathematics are important interrelated areas of applied mathematics. Each provides students with powerful mathematical perspectives on everyday phenomena and with important examples of how mathematics is used in the modern world. Two important areas of discrete mathematics are addressed in this standard; a third area, iteration and recursion, is addressed in Standard 4.3 (Patterns and Algebra).

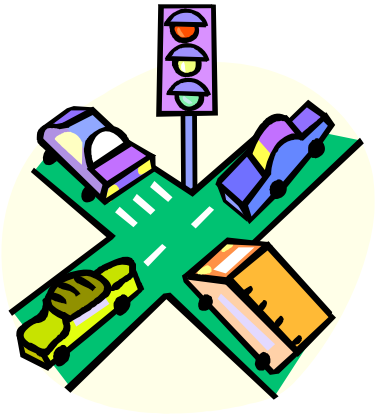
Preschool Teaching Practices

1. Provide and frequently refer to visual representations of the routines of the day (e.g., post pictures or photos of children that depict the daily schedule and note any changes that occur).
2. Describe series of events or directions and provide print to reinforce the concept (e.g., child puts on a smock, fills paint cup, paints picture, hangs picture to dry; describe steps to washing hands properly; follow class recipe).
3. Use sounds, songs or movements to signal transitions such as clean-up time.
4. Use words to describe movement and passage of time, such as morning, yesterday, tomorrow, shorter time, longer time, etc.

Discrete Mathematics—Systematic Listing and Counting. Development of strategies for listing and counting can progress through all grade levels, with middle and high school students using the strategies to solve problems in probability. Primary students, for example, might find all outfits that can be worn using two coats and three hats; middle school students might systematically list and count the number of routes from one site on a map to another; and high school students might determine the number of three-person delegations that can be selected from their class to visit the mayor.

Outcomes

- ❑ Describes the sequence of the daily routine and demonstrates understanding of basic temporal relations (e.g. “We will go outside after snack time.”
- ❑ Arranges pictures of events in temporal order (e.g. first, a photo of a child eating breakfast, second, a photo of a child getting on the bus, third, a photo of a child in the classroom.)
- ❑ Starts and stops on a signal. (e.g. freezing in position when the music stops



STANDARD 4.5 (MATHEMATICAL PROCESSES) ALL STUDENTS WILL USE MATHEMATICAL PROCESSES OF PROBLEM SOLVING, COMMUNICATION, CONNECTIONS, REASONING, REPRESENTATIONS, AND TECHNOLOGY TO SOLVE PROBLEMS AND COMMUNICATE MATHEMATICAL IDEAS.

Expectation

5. Children use mathematical knowledge to represent, communicate and solve problems in their environment.

Descriptive Statement: The mathematical processes described here highlight ways of acquiring and using the content knowledge and skills delineated in the first four mathematics standards.

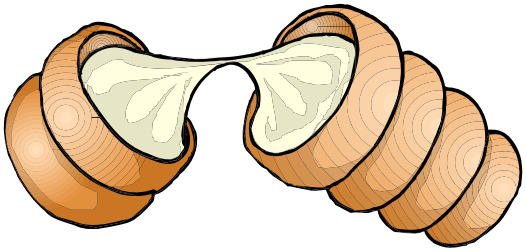
Preschool Teaching Practices

1. Encourage students to use mathematics as a communication tool by modeling mathematical vocabulary and symbolism (e.g., circle, square, equals, "what would happen if. ..?," same, different, more, fewer, takes longer, etc.).
2. Encourage students to use mathematical knowledge as a problem-solving tool by asking open-ended questions and asking for more information (e.g., "Tell me about what you did." "Would you use the same number again?" "What shape did you use?" "What size could you use that will make it stand up better?" "What were you thinking when you put this one over here?").
3. Encourage students to make connections between mathematics and other content areas and real-life situations (e.g., teacher says to Desiree, "Your name is longer than Sam's because it contains more letters." "You and Oxcheanna go home on the same bus, Number 14.").

Problem Solving. Problem posing and problem solving involve examining situations that arise in mathematics and other disciplines and in common experiences, describing these situations mathematically, formulating appropriate mathematical questions, and using a variety of strategies to find solutions. Through problem solving, students experience the power and usefulness of mathematics. Problem solving is interwoven throughout the grades to provide a context for learning and applying mathematical ideas.

Outcomes

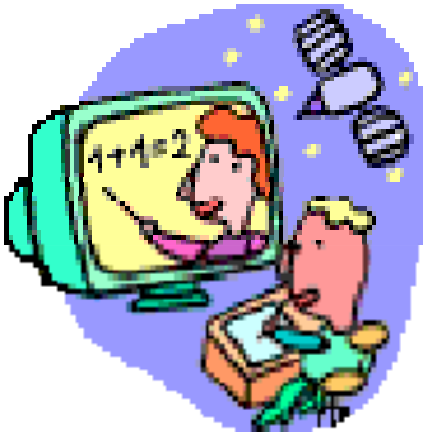
- ❑ Uses emergent mathematical knowledge as a problem-solving tool. (e.g. Maria notices John has more carrot sticks than she does. She says, “May I have some of yours. Then we will have the same amount.” Sheila decides to fill a bucket by using small cups of water when she realizes that she cannot fit the bucket under the faucet.”



Communication. Communication of mathematical ideas involves students' sharing their mathematical understandings in oral and written form with their classmates, teachers, and parents. Such communication helps students clarify and solidify their understanding of mathematics and develop confidence in themselves as mathematics learners. It also enables teachers to better monitor student progress.

Outcomes

- ❑ Uses mathematical terms when conversing with others. (e.g. "Which car is faster?" "My building is taller than yours." "I have more sand in my bucket."
- ❑ Describes how he/she solved mathematical problems in his/her own words



Connections. Making connections involves seeing relationships between different topics, and drawing on those relationships in future study. This applies within mathematics, so that students can translate readily between fractions and decimals, or between algebra and geometry; to other content areas, so that students understand how mathematics is used in the sciences, the social sciences, and the arts; and to the everyday world, so that students can connect school mathematics to daily life.

Reasoning. Mathematical reasoning is the critical skill that enables a student to make use of all other mathematical skills. With the development of mathematical reasoning, students recognize that mathematics makes sense and can be understood. They learn how to evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions, and recognize how those solutions can be applied.

Representations. Representations refers to the use of physical objects, drawings, charts, graphs, and symbols to represent mathematical concepts and problem situations. By using various representations, students will be better able to communicate their thinking and solve problems. Using multiple representations will enrich the problem solver with alternative perspectives on the problem. Historically, people have developed and successfully used manipulatives (concrete representations such as fingers, base ten blocks, geoboards, and algebra tiles) and other representations (such as coordinate systems) to help them understand and develop mathematics.

Technology. Calculators and computers need to be used along with other mathematical tools by students in both instructional and assessment activities. These tools should be used, not to replace mental math and paper-and-pencil computational skills, but to enhance understanding of mathematics and the power to use mathematics. Students should explore both new and familiar concepts with calculators and computers and should also become proficient in using technology as it is used by adults (e.g., for assistance in solving real-world problems).