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This book is dedicated, gratefully,
to
the hard-working Core Knowledge preschool teachers
who have gone for so long without this book.

sample pages
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Dear Reader,

If you are going to be a Core Knowledge Preschool teacher or parent – congratulations! The program is well tested and follows the most advanced consensus in the psychological literature. Over the past decade, the Core Knowledge Preschool Sequence has had outstanding success in preparing all children from the most to the least advantaged for school.

Building on the experiences of the most effective preschools over the world, the Core Knowledge program is not reluctant, any more than young children are, to start the preliminaries of literacy, ethics, subject matters, and good manners, in a carefully sequenced way. The most striking feature of the program is its definite content curriculum including songs like “You Are My Sunshine,” traditional rhymes like “Peter, Peter Pumpkin Eater,” well-known stories, including some from Aesop’s fables, legends and stories about America’s past, and non-fiction books like Abe Lincoln and Me, and “My First Farm Book,” and Let’s Read About Martin Luther King, along with classical instrumental music such as Bizet’s Prelude to Carmen, Debussy’s “Cakewalk,” Mozart’s variations on the tune for “Twinkle, Twinkle, Little Star,” and works of art like Mondrian’s Broadway Boogie Woogie.

This specification of definite content in a definite sequence has a triple purpose. It builds knowledge and vocabulary, makes children familiar with common touchstones that other people in society know about; and it offers a systematic, acculturative shortcut for children who come from immigrant families and disadvantaged circumstances to learn the same things that children from more advantaged circumstances learn at home.

One of the great advantages of a knowledge-based approach to the many skills a preschooler needs to learn is that, although children vary greatly in the speed with which they pick up fine motor and procedural skills, there is more uniformity in their ability to comprehend and remember pictures, songs, and stories. So, although children may be receiving individual attention in their procedural learnings, the class as a whole can be moving right along in the building of knowledge and vocabulary.

The great advantage of the carefully sequenced Core Knowledge approach to schooling in all grades is that knowledge builds cumulatively and engagingly from week to week and year to year. Cognitive psychology has shown us that skills such as creativity, imaginativeness, cooperation, and critical thinking are really knowledge-based skills. They depend on specific knowledge. And that is especially true of the prime skill gained in preschool, which is language comprehension. A special strength of the Core Knowledge program in all the grades is that it builds up knowledge and language comprehension cumulatively year by year, starting in earliest years. It makes optimal use of school time, which is next to children, the most precious commodity in education.

Sincerely,

E. D. Hirsch, Jr.
Chairman, Core Knowledge® Foundation
Professor Emeritus, The University of Virginia
Acknowledgments

Collaboration has been a hallmark of the creation of this publication. Some of those named here already know the depth of our gratitude; others may be surprised to find themselves thanked publicly for assistance they gave quietly and freely. To all collaborators, named and unnamed, we are deeply grateful.

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Introduction

About This Book

The Core Knowledge Foundation has written this teacher handbook to help you teach the Core Knowledge Preschool Sequence. The skills of the Preschool Sequence and the content of Teacher Handbook are based on research and best practice in early childhood education. Throughout this book, the DAP icon is used to denote aspects of the Preschool Sequence and Teacher Handbook that illustrate developmentally appropriate practice. This numeric portion of this icon indicates the page within Developmentally Appropriate Practice in Early Childhood Programs Serving Children from Birth through Age 8 (Copple & Bredekamp, 2009) on which you will find a corresponding statement about developmentally appropriate practice.

In the sections that follow, you will be introduced to the other key elements of the handbook. Our purpose is not only to guide you through the hand-book, but also to introduce you to some other significant resources and help you teach the Core Knowledge Preschool Sequence to your class.

Organization of the Handbook

Each section in the Preschool Sequence and Teacher Handbook begins in the same way. The following pages describe what you will find each section.

Subject Opener

- Introduction
  The introduction to each chapter provides an overview of key ideas or content in the chapter including the importance of the chapter content to the development of young children.

- Best Practices
  Three best practices are provided for each content area chapter. These best practices are informed by standards for, research regarding, and common practice in early childhood classrooms.

Chapter Sections

- The Big Idea
  The Big Idea documents the central idea of the section.

- What Preschoolers Need to Learn
  For each content area chapter or section, the learning goals from the Preschool Sequence are presented. These broad goals comprise one or more individual skills that are listed in the skills section of the chapter or section.

- What Children Will Learn in Kindergarten
  For each content area chapter or section a glimpse of topics that Core Knowledge teachers will cover in the kindergarten year is provided. Clear understanding of these kindergarten goals allows preschool teachers to support a smooth transition to kindergarten. Preschool teachers can clearly see, from this
information, how knowledge and skills developed in preschool become the prior knowledge for continued learning in kindergarten. Careful consideration of the kindergarten goals also offers preschool and kindergarten teachers a unique opportunity to collaborate on joint projects with the older peers modeling skills and knowledge for younger children.

**Language of Instruction**

The words listed in this section include terms that knowledgeable and competent individuals generally use to talk about the particular subject. While not comprehensive or exhaustive, the lists provide a starting point, a suggested sampling of the precise vocabulary to which young children should be exposed. For information on how to use the language of instruction, see the Oral Language chapter.

**Cross-Curricular Connections**

The cross-curricular connections tables provide suggestions of skills or content from other subject areas that align with the content or skills of the current chapter or section. The cross-curricular skills or content may be taught or reviewed in conjunction with the skills or content from the current subject area chapter. Children learn through a process of building schemas and connections based upon prior knowledge. Children can only build these schemas through connecting their current experiences with previous ones. In other words, prior knowledge is the base or foundation on which new knowledge is constructed. Effective teachers recognize when connections to prior knowledge can be made. These teachers use cross-curricular connections to present related information in a variety of situations and contexts.

**At a Glance**

The most important ideas from the chapter are listed in the At a Glance section.

**Skills**

The Skills section lists the Preschool Sequence skills for each content area. The skills are divided into two levels representing the approximate developmental abilities of three- to four-year olds (Level I skills) and four- to five-year olds (Level II skills). Level I skills appear in the left column, and level II skills appear in the right column. Within the skills table, the **Critical Skill** icon is used to denote critical skills. Critical skills are the most important skills to assess, as they provide the best understanding of how children are progressing with the skills in the Preschool Sequence.

The skill numbering convention includes:

- **I or II**, indicating level I and level II skills, respectively
- **Two uppercase letters**, indicating the content area that includes the skill
- **A number**, indicating the sequence or order of the skill within the domain

Some skills end in a lowercase letter, indicating that this skill has both a level I component and a level II component, a and b, respectively.

For example, the skill number I-OL9.18a is a level I oral language skill with a corresponding level II skill (II-OL9.18b).
**Oral Language Skills**

Oral language skills are the foundation for literacy and social skills. Although the Oral Language chapter includes a complete list of oral language, these skills cross all content areas. Development of oral language skills and vocabulary can be effectively addressed within the context of a variety of activities in all parts of the classroom routine and across all content areas. For this reason, a subset of oral language skills has been included in the chapters for each content area. These skills were chosen for their suitability or relation to the content area covered in each chapter.

**What Teachers Need to Know**

This section provides you with background information about specific subjects. Effective teachers recognize that the more background they have, the better able they will be to guide children’s learning.

**Teaching Ideas**

Included in the margins of each chapter are teaching ideas and cross-curricular teaching ideas. The Core Knowledge Foundation does not require teachers to follow any particular teaching strategy when covering the topics in the Preschool Sequence. The teaching ideas in the margins presented are only suggestions.

**Scaffolding**

Scaffolding is a collaborative process between teacher and learner, with the teacher initially providing high support and direction for the novice learner, gradually decreasing assistance as the child gains greater mastery of a task. Strategies for scaffolding skills and content from the sequence are discussed in detail in the Scaffolding section of the Using the Preschool Sequence chapter. Relevant scaffolding examples are provided for each content area within the Preschool Sequence.

**Assessment**

Assessment takes place across all aspects of the daily routine and throughout all elements of the Preschool Sequence. Each content area chapter in this handbook provides suggestions for “what to look for” and “when to look” to assess skills from the content area.

**Resources**

At the end of each subject area section are lists of some books and other resources that may be useful in teaching the skills of the content area. The resources listed under “For children” are intended to be read aloud to children and made available to children through their own choice. The resources listed under “For teachers” are intended to provide teachers with examples and ideas for planning instructional activities.
Core Knowledge Resources for Preschool

In addition to this publication, the Core Knowledge Foundation offers a variety of resources for preschool programs and parents of preschoolers.

For Teachers

- **Core Knowledge Preschool Assessment Tool (CK-PAT)**
  The Preschool Assessment Tool (CK-PAT) is designed to measure and document the individual progress of children in Core Knowledge preschool programs. It enables teachers to enter data for each child and for each of the goals and objectives of the Preschool Sequence. Assessment strategies include direct observation, portfolio collection, and assessment activity probes, all with evaluation and rating criteria. The assessments meet the standards mandated by various state programs and by Head Start. Reports and graphs for individuals, the class, or the entire center or agency can be generated with the click of a button.

- **Preschool Assessment Kit**
  The Preschool Assessment Kit includes printed copies of the Preschool Assessment Tool and assessment activities from the rating criteria to assess each of the critical skills found in the Core Knowledge Preschool Sequence. The kit includes all materials and manipulatives needed for assessment.

- **Preschool Daily Schedule Cards**
  This set of nineteen colorful cards depicts daily activities in the preschool schedule designed especially for use by Core Knowledge preschool programs. Activities portrayed include arrival, breakfast, circle time, small group time, read-aloud, cleanup, outside play, lunch, rhythm and movement, and many more. Cards are printed on heavy duty glossy paper for easy display.

- **The Stop and Think Songbook Social Skills CD**
  Fifteen lively and engaging original songs are designed to reinforce the Stop and Think approach and the Core Knowledge early childhood social skills. Songs include “Stop and Think,” “Listening,” “Using a Friendly Voice,” “Following Directions,” “Taking Your Turn,” “Answering a Question,” “Interrupting,” “Accepting Consequences,” “Using Brave Talk,” and “Asking to Share.” Lyrics included with CD.

- **The Core Knowledge Social Skills Posters**
  These fourteen durable full-color posters complement the Stop and Think Songbook. The front of each poster shows preschool children modeling specific social skills and lists the actions that are described in the songs. The back includes the lyrics of the corresponding song. Although designed for the Core Knowledge preschool program, teachers in early elementary grades have found the posters inspire good citizenship and social skills in their classrooms as well.

- **Core Knowledge Preschool and Kindergarten Music CD**
  Enlightened educators understand that a well-rounded instructional program introduces students to the masterpieces of art and music that are part of our shared cultural inheritance. Core Knowledge makes available carefully selected musical masterworks on CD for preschool and kindergarten teachers. The world’s greatest music, including quintessentially American masterworks of blues, jazz, and musical theater, are offered in a convenient set for use by teachers and students.

- **Knowledge Tree Preschool Kits**
  These kits, aligned with the Core Knowledge Preschool Sequence, are available exclusively through Knowledge Tree. The kits cover phonological awareness, read-alouds, oral language, math, science, social skills, movement and music, and visual arts. Attractively designed to add dramatic visual appeal to the classroom, the kits contain books, flannel boards, story cards, posters, magnetic boards, sound devices and musical instruments, play phones and play money, costumes, science tools, art supplies, and many other aids to teaching and learning. For more information, call 1-800-331-0994 or visit www.theknowledgetree.com.
Introduction

Scholastic Core Knowledge Classroom Preschool Library

This library, available from Scholastic contains 40 titles (2 copies of each) that support the content areas of the Preschool Sequence as well as popular thematic units for the preschool classroom. The teacher guide that accompanies the books includes extension activities for each book aimed at developing vocabulary, phonological awareness, print knowledge, concept development, and comprehension. For more information, call 1-800-724-6527 or visit www.scholastic.com/coreknowledge.

For Parents

What Your Preschooler Needs to Know: Read-Alouds to Get Ready for Kindergarten
Edited by E. D. Hirsch, Jr., and Linda Bevilacqua

If you are wondering how to get your child ready for kindergarten, this is the book for you. Beloved stories and favorite poems—"The Three Little Pigs," the African folktale, "Why Flies Buzz," Jack Prelutsky's tongue twisters—and many, many more beautifully illustrated selections open new and wondrous worlds to children. Sidebars throughout the book help parents engage the child by suggesting questions to ask, games to play, and connections to make. This is the latest addition to the well-known series What Your K through 6 Grader Needs to Know that has sold over 35 million copies. Like other volumes in the series, it encourages children to explore visual arts, music, history, and science. In this single volume children will encounter in the midst of great fun, many of the cultural references and the background knowledge they will need for later reading success. Two accompanying activity books make this read-aloud anthology an even more valuable resource for ensuring that children have the nourishment they need at such a developmentally important stage.

What Your Preschooler Needs to Know Activity Books
Book 1 for Ages 3–4 and Activity Book 2 for Ages 4–5
Edited by Linda Bevilacqua and Susan T. Hitencroft

Why not make picking up toys a fun number game? Need a child-friendly muffin recipe to go along with "Do You Know the Muffin Man?" Can a visit to the grocery store provide your child a chance to practice speaking in full sentences? Can reading "Goldilocks" together become a way to develop predictive reasoning skills? Do practicing simple line strokes get little hands ready for writing? Can a treasure hunt for certain shapes and colors turn the dreaded museum visit into a delightful one? These colorfully illustrated books can answer these questions and many more. Each volume has 25 weeks of activities sequenced to relate to the stories, information, and skills presented in What Your Preschooler Needs to Know. The activities also align with the topics and skills covered in the Core Knowledge Preschool Sequence used in outstanding preschool centers across the country. Both books take an enjoyable approach to developing skills in the content areas of oral language, emergent literacy, math, science, social skills, music, visual art, and movement and coordination, but Level 2 has more emphasis on activities leading toward independence and autonomy.

Beyond the Teacher Handbook: Some Additional Strategies for Success

Although reading this book will provide you with the basic knowledge you will need to teach the Preschool Sequence, there are many other things you can do to improve your teaching of Core Knowledge. Here are a few strategies we've learned from successful Core Knowledge teachers and schools over the past decade:

Participate in Professional Development

The Core Knowledge Foundation provides a range of support services for those interested in implementing the Core Knowledge Preschool Program. Professional Development is available in a variety of options. Call the Core Knowledge Foundation to find out which option will work best for your school. A list of available professional development modules for Core Knowledge preschools appears on page xiii.
Collaborate with Resource Teachers

If you have resources teachers—art, music, physical education, media and technology specialists, special education or ELL teachers—work with them to enhance and connect their lessons and activities with the topics you are teaching. The most successful Core Knowledge schools are the ones in which the curriculum is implemented and supported by all key staff members. These schools frequently implement cross-curricular activities involving both classroom teacher and resource teachers targeting the same content and skills.

Get Parents Involved

Look for ways to get parents and caregivers involved. Core Knowledge is a popular curriculum with many adults, not only because it is academically rich, but also because it is very explicit. If you share the relevant sections of the Preschool Sequence and/or your yearlong plan with the adults at home, they will know what is happening at school and may be able to help you in various ways. Some may have knowledge of a particular subject that they would be willing to share with the children; others may be willing to assist the teacher with classroom activities or to talk with children at home about the topics they have been studying at school. The Preschool Sequence and yearlong plan, when shared, can become a link that enables parents, caregivers, and teachers to work together.

Involve Local Groups and Businesses

Businesses and other outside groups may be able to visit classes to talk about topics that relate to what they do, or they may be able to donate services or materials. One Core Knowledge school in Texas contacted a local tile company when the school was preparing to do a unit on mosaics. The tile company offered them thousands of bits of broken tile. The school got its mosaic materials for free, and the company got a tax write-off! With a little creativity you can accomplish a lot!

Visit the Core Knowledge Web Site

The official Web site of the Core Knowledge Foundation, www.coreknowledge.org, contains a wealth of information about Core Knowledge, as well as lesson plans, resources to build on, discussion forums, newsletters, and other teacher resources.

Attend the Core Knowledge National Conference

Held in the fall each year, the conference attracts several thousand Core Knowledge teachers who learn about Core Knowledge, attend lectures and workshops on topics in the Sequence, and share instructional units and lesson plans.

Available Professional Development

Getting Started

This unit introduces participants to relevant research and theory, gives an overview of Core Knowledge, and provides information on implementation of the Preschool Sequence. Some of the topics addressed include:

- similarities and differences between the Core Knowledge Preschool program and participant's own existing program.
- features of a well-organized physical classroom environment.
- features of a well-organized classroom schedule and routine.
- effective transition strategies.
- creation of complete lesson plans that incorporates the Core Knowledge goals and objectives, as well as address specific activities for large and small group instruction, read-alouds, and center time activities.
Introduction

Autonomy, Social Skills, and Work Habits
This unit introduces participants to relevant research and theory, identifies behavior management techniques, provides information on teaching social skills and conflict resolution to young children, and helps the participant put it all together. Some of the topics addressed include:

- factors that affect social competence.
- techniques for assessing children's autonomy, social skills, and work habits.
- successful group management techniques.
- steps of the Stop & Think social skills approach and how to best teach the program to young children. Stop & Think is a social skills training program developed by Project ACHIEVE.
- use of a “Peace Table” for conflict resolution.

Assessment and Planning to Address Children’s Learning Needs
This unit introduces the participant to relevant research and theory, introduces and instructs the participant in use of the CK-PAT, and demonstrates effective assessment skills. Some of the topics addressed include:

- characteristics of effective assessment for instructional planning purposes.
- the assessment-instruction cycle.
- use of effective direct observation skills in completing anecdotal records.
- various assessment and observation tools, including focus questions, checklists, webs, participation charts, activity probes, and portfolio collection.
- use of the CK-PAT to gather student data, generate various reports, and plan for individual students.

Using Children's Literature and Writing to Develop Language and Literacy Skills
This unit introduces participants to relevant research and theory, gives in-depth instruction on incorporating children's literature into the classroom, and provides the participant with skills for creating a print-rich environment. Some of the topics addressed include:

- techniques for assessing children's early literacy skills.
- steps used to teach a new nursery rhyme, poem, or finger play.
- steps of the STORY technique for reading fiction books to preschoolers; steps of the INFO technique reading non-fiction books to preschoolers; and how to conduct morning message and language experience activities with preschoolers.
- developmental stages of writing.
- methods for scaffolding and facilitating journal writing.

Phonological Awareness, ABCs, and More
This unit introduces the participant to relevant research and theory, provides critical phonological awareness activities, and provides instruction in the ABCs. Some of the topics addressed include:

- trends in reading achievement in NAEP data over the last ten years, as well as possible explanations for these results and critical preschool literacy experiences that support early literacy.
- techniques for assessing phonological awareness and letter knowledge.
- materials and activities using music and sounds to increase general sound awareness.
- materials and activities that build increasingly sophisticated phonological awareness.
- skills in rhyming, blending, and segmentation of words, identifying initial sounds, and counting phonemes.
- a sequence of steps, activities, and materials to teach letter names and sounds.
Oral Language Skills
This unit introduces the participant to relevant research and theory, identifies listening materials and activities, and provides the participant with a range of talking techniques and strategies. Some of the topics addressed include:

- current research findings concerning the stages of early language development, factors influencing early development, as well as the correlation of language competence to future academic success.
- techniques for assessing oral language skills.
- materials and activities to build receptive language skills.
- techniques, materials, and activities to build narrative, explanatory, and predictive language, as well as vocabulary.
- strategies for working with English language learners (ELLs).

Mathematics and Number Sense / Orientation in Time and Space
This unit introduces the participant to relevant research and theory and identifies and demonstrates how to plan and teach math to preschoolers. Some of the topics addressed include:

- research findings on young children's intuitive understanding of mathematical concepts and how this relates to classroom instruction.
- how preschoolers construct mathematical understanding.
- mathematics, time, and space goals and objectives of the Preschool Sequence.
- techniques for assessing mathematical, spatial, and temporal skills.
- materials and activities to develop mathematical reasoning skills.

Scientific Reasoning and Knowledge
This unit introduces the participant to relevant research and theory and identifies and demonstrates how to plan and teach science to preschoolers. Some of the topics addressed include:

- the steps of the scientific reasoning cycle.
- techniques for assessing scientific knowledge and reasoning skills.
- key concepts and background knowledge necessary to teach the science goals of the Preschool Sequence (human physical and sensory characteristics, needs, stages of development and life cycle; animal characteristics, needs, stages of development and life cycle; plant characteristics and parts, needs, stages of development and life cycle; air; water; light).
- the types of language, questions, and strategies to be used by the teacher during each phase of the scientific reasoning process.
- components of a coherent series of preschool science experiences/lessons, specifying activities and materials, on a selected science topic from the Preschool Sequence.

Movement, Coordination, and Music
This unit introduces the participant to relevant research and theory, movement and coordination activities, and methods for incorporating music into the classroom. Some of the topics addressed include:

- basic elements of movement.
- differences between free, modeled, and guided movement activities.
- techniques for assessing movement, coordination, and music skills.
- movement sessions that incorporate a variety of activities addressing the goals of the Preschool Sequence.
- materials and activities that use music and sounds to increase sound awareness and discrimination.
Introduction

**Visual Arts**
This unit introduces the participant to relevant research and theory, techniques for using a range of art media, and methods of talking about art. Some of the topics addressed include:

- developmental stages of children's drawings.
- techniques to document the development of children's art skills.
- techniques and activities using the following media: collage, painting, drawing, printing, sculpture, sewing.
- works of art and artists included in the *Preschool Sequence* and describe preschool level art activities that could be associated with each work of art.
- questions that can be used to encourage children to talk about their own art creations and the individual works of art in the *Preschool Sequence*.

**Fine-tuning Your Core Knowledge Implementation**
This unit introduces participants to strategies to enhance their implementation of the Core Knowledge curriculum. Some of the topics addressed include:

- research regarding preschool play experiences and their support for language and literacy development.
- guidelines for implementing a language- and literacy-rich dramatic play environment.
- elements of center time that can be adjusted to foster concept development and sequence goals, objectives, and skills.
- analysis of props and materials available at each center to determine how learning in each center can be enhanced.
- activities to extend learning within each center and strategies to informally assess children's progress during center time.

**Leadership Training for Administrators of Core Knowledge Preschools**
This unit is designed to provide preschool leaders and administrators with the knowledge and skills they will need to promote and sustain implementation of the Core Knowledge preschool program. Some of the topics addressed include:

- basic tenets associated with Core Knowledge as an educational reform model for preschool through grade 8.
- strategies for evaluating the progress of implementation of the *Preschool Sequence*.
- strategies for mentoring and providing support to teachers implementing the *Preschool Sequence*.
- preliminary findings about the effectiveness of the Core Knowledge preschool model and implications for one's own program.
- strategies for aligning the *Preschool Sequence* with state and other standards.
- potential obstacles to successful implementation of the *Preschool Sequence* and strategies for remediation of the obstacles.

**How This Book Relates to the Sequence for Grades K-8**
The skills and knowledge in the *Preschool Sequence* are designed to correlate with the existing Core Knowledge Sequence for Grades K-8. The *Preschool Sequence* provides a solid, coherent foundation for the content that children will encounter in kindergarten in a school following the Core Knowledge Sequence for Grades K-8.

In a few specific instances, the Preschool Sequence overlaps the content already in the Sequence for Grades K-8. Ideally, of course, all children entering kindergarten would come prepared with the kinds of experiences and knowledge described in the *Preschool Sequence*. But in reality this is not the case – thus, the occasional overlap. For your reference, please note that skills or knowledge in the *Preschool Sequence*, also included in the Sequence for Grades K-8, are identified here by a skill number beginning with K (for kindergarten skills) or a (#) next to content titles, with the number in the parentheses designating the grade level at which the material is included in the Sequence for Grades K-8.
Mathematical Reasoning and Number Sense

I. Patterns and Classification
II. Geometry and Measurement
III. Numbers and Number Sense
IV. Computation
V. Money

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Mathematical Reasoning and Number Sense in Preschool

Young children seem to be naturally drawn to touching, manipulating, and examining the objects they find around them. The goals of this section build upon this curiosity and desire to explore. In the context of experiences with concrete objects and then with pictures, the child is asked to recognize similarities and differences, classify objects and shapes, recognize and create patterns in sequences of objects, and make comparisons among objects, using simple measurement skills. Children are also asked to quantify small groups of objects, to count and to demonstrate a basic understanding of addition and subtraction as “putting together” and “taking away.” In each instance, the child is asked to move from the concrete experience to representing knowledge symbolically using mathematical language, such as “more than,” “less than,” “longer,” “shorter,” number words (“three” and “four”), numerical symbols (“3” and “4”), and so on. The Preschool Sequence addresses the areas of math recommended by the National Council of Teachers of Mathematics (NCTM), including Patterns and Classification, Geometry and Measurement, Numbers and Number Sense, Computation, and Money. The Orientation in Space chapter is devoted to spatial language and relationships, and the Orientation in Time chapter is devoted to temporal language and concepts which are a content areas also recommended by NCTM.
Best Practices in Mathematical Reasoning

Mathematically Rich Environments

There has been much focus in the past decade on creating “literacy-rich” early childhood environments. Mathematical richness is also important to the development of young children. A mathematically rich classroom environment includes concrete manipulatives, like blocks, collections, and measuring tools, that allow children to experiment with mathematical concepts such as quantity and number sense, measurement, patterns, and computation. A mathematically rich environment also includes manipulatives like dominoes, graphs, and dice to support the development of symbolic representation. A mathematically rich environment includes numerals posted where children can see them. These visual displays include real-world uses of numbers (calendars, graphs, schedules, recipes). Finally, the environment includes materials, activities, and dramatic play opportunities that allow children to see how math is used in real-life situations like going to the grocery store, baking cookies, or building a bird house.

Engaging Higher-Order Thinking Skills

Activities that encourage children to problem solve, sequence, compare and contrast, predict, experiment, and brainstorm engage higher-order thinking skills. Using strategies and activities that engage higher-order thinking skills, teachers can focus on and assess children’s understanding of a concept, rather than focusing on the instruction. For children, engaging higher-order thinking skills ensures that they learn both the concepts and how to apply them.

Focus on Mathematical Language

Early childhood mathematics activities should also focus on the development of young children’s mathematical language. Effective teachers model mathematical language and engage children in the use of mathematically relevant vocabulary during instructional opportunities and throughout the day. The language of instruction sections in the Mathematical Reasoning chapter provide examples of this mathematical language and relevant vocabulary. Many children understand the underlying concepts during activities, but lack the necessary language to explain their thinking. Challenging children to discuss their thinking and explain their problem-solving procedures helps them expand their mathematical vocabulary and extend their conceptual understanding.
I. Patterns and Classification

The Big Idea

Objects can be classified and sorted based on various attributes, including size, color, and shape. Children can recognize and predict patterns using pictures and objects.

What Preschool Children Need to Learn

› Sort and classify objects or pictures of objects
› Duplicate and continue linear patterns

What Children Will Learn in Kindergarten

› Patterns and classification
› Establish concepts of likeness and difference by classifying and sorting objects according to various attributes
› Define a set by the common property of its elements
› Indicate items that do not belong to a set
› Recognize patterns and predict the extension of a pattern
› Extend a sequence of ordered concrete objects

Language of Instruction

<table>
<thead>
<tr>
<th>Teacher and Children</th>
<th>Classification</th>
<th>different</th>
<th>same</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Teacher Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>math</td>
</tr>
<tr>
<td>mathematics</td>
</tr>
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<tr>
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<tr>
<td>Patterns</td>
</tr>
<tr>
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<tr>
<td></td>
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<tr>
<td></td>
</tr>
</tbody>
</table>

At a Glance

The most important ideas for you are:

› Objects can be sorted and classified by attributes, including color, shape, and size.
› Descriptive language can be used to describe the attributes used to sort and classify objects.
› Objects can be compared and described as the same or different.
› Patterns can be created by alternating one or more attributes.
Cross-Curricular Connections

### Scientific Reasoning

<table>
<thead>
<tr>
<th>II-SC1.10</th>
<th>Classify images of animals according to habitat or environment in which they generally live: Lake/river, ocean, farm, forest (woods), jungle.</th>
</tr>
</thead>
</table>

### Orientation in Time

<table>
<thead>
<tr>
<th>I-OT2.1</th>
<th>Classify and describe images of everyday activities according to the time of day with which they are associated (day-night, morning-afternoon-evening).</th>
</tr>
</thead>
</table>

### Music

<table>
<thead>
<tr>
<th>I-MU2.3a</th>
<th>Imitate clapping pattern sequences of no more than three claps/pattern.</th>
</tr>
</thead>
<tbody>
<tr>
<td>II-MU2.3b</td>
<td>Imitate clapping pattern sequences of at least four claps/pattern that vary in tempo, number and length of pause between claps, etc.</td>
</tr>
</tbody>
</table>

---

**Skills**

### Level I

<table>
<thead>
<tr>
<th>Goal: Sort and classify objects or pictures of objects</th>
</tr>
</thead>
</table>

### Level II

<table>
<thead>
<tr>
<th>II-MR1.1b</th>
<th>Identify pair of objects or pictures as the same or different, with different pairs increasingly similar, varying only in one or more minor detail(s) and with images becoming more abstract, symbolic.</th>
</tr>
</thead>
</table>

#### I-MR1.1a

- Critical Skill

- Identify pairs of objects as the same or different, with different pairs varying in gross details.

#### I-MR1.2a

- Critical Skill

- Given a sample object/pictures and verbal description of the selection criteria, sort objects/pictures according to a single criterion: Sort objects by color.

#### I-MR1.3a

- Given a sample object/pictures and verbal description of the selection criteria, sort objects/pictures according to a single criterion: Sort objects by shape.

#### I-MR1.4

- Given a sample object/pictures and verbal description of the selection criteria, sort objects/pictures according to a single criterion: Sort by size (small-medium-large).

#### I-MR1.5

- Given a sample object/pictures and verbal description of the selection criteria, sort objects/pictures according to a single criterion: Sort by function.

#### I-MR1.6

- Indicate whether an object belongs to a given collection.

#### II-MR1.7

- Classify by size.
## I. Patterns and Classification

(continued)

<table>
<thead>
<tr>
<th>Level I</th>
<th>Level II</th>
</tr>
</thead>
<tbody>
<tr>
<td>II-MR1.8</td>
<td>Classify by function.</td>
</tr>
<tr>
<td>II-MR1.9</td>
<td>Classify by other conceptual categories.</td>
</tr>
<tr>
<td>II-MR1.10</td>
<td>Verbally label the single common attribute or characteristic of a group of objects or pictures.</td>
</tr>
<tr>
<td>II-MR1.11</td>
<td>Verbally label the difference or criteria used for classification of several groups of objects or pictures.</td>
</tr>
<tr>
<td>II-MR1.12</td>
<td>Select an object or picture according to a description that includes two properties.</td>
</tr>
<tr>
<td>II-MR1.13</td>
<td>Use the criteria along the horizontal and vertical axes of a double entry table to complete the interior squares of the table.</td>
</tr>
</tbody>
</table>

**Goal: Duplicate and continue linear patterns**

<table>
<thead>
<tr>
<th>I-MR2.1</th>
<th>Duplicate a pattern of 6-10 objects in which one property is alternated.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-MR2.2</td>
<td>Match objects arranged in a pattern with corresponding pattern card.</td>
</tr>
<tr>
<td>I-MR2.3</td>
<td>Continue a complex, two-color pattern of objects represented by a pattern card.</td>
</tr>
<tr>
<td>I-MR2.4</td>
<td>Continue a given pattern of 5 objects, represented by actual objects or a pattern card, in which one property is alternated (color, size, shape).</td>
</tr>
</tbody>
</table>
Oral Language Skills in Patterns and Classification

The goals in this chapter are well suited to addressing the following sample of oral language skills. For a complete list of the skills in the oral language domain, see the Oral Language chapter.

<table>
<thead>
<tr>
<th>Level I</th>
<th>Level II</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I-OL5.1a</strong></td>
<td><strong>II-OL5.1b</strong></td>
</tr>
<tr>
<td><strong>I-OL9.7</strong></td>
<td><strong>II-OL9.9b</strong></td>
</tr>
<tr>
<td>Critical Skill</td>
<td>Critical Skill</td>
</tr>
<tr>
<td>Point to colors: black, blue, brown, green, orange, purple, red, white, yellow.</td>
<td>Point to a circle, a square, a triangle, and a rectangle.</td>
</tr>
<tr>
<td><strong>I-OL9.8</strong></td>
<td><strong>II-OL9.9b</strong></td>
</tr>
<tr>
<td>Critical Skill</td>
<td>Critical Skill</td>
</tr>
<tr>
<td>Name colors: black, blue, brown, green, orange, purple, red, white, yellow.</td>
<td>Name a circle, square, triangle, and a rectangle.</td>
</tr>
<tr>
<td><strong>I-OL9.9a</strong></td>
<td><strong>II-OL9.9b</strong></td>
</tr>
<tr>
<td>Critical Skill</td>
<td>Critical Skill</td>
</tr>
<tr>
<td>Point to a circle, a square, and a triangle.</td>
<td>Point to a circle, a square, a triangle, and a rectangle.</td>
</tr>
<tr>
<td><strong>I-OL9.10a</strong></td>
<td><strong>II-OL9.10b</strong></td>
</tr>
<tr>
<td>Critical Skill</td>
<td>Critical Skill</td>
</tr>
<tr>
<td>Name a circle, square, and triangle.</td>
<td>Name a circle, square, triangle, and a rectangle.</td>
</tr>
<tr>
<td><strong>I-OL9.13</strong></td>
<td><strong>II-OL9.15</strong></td>
</tr>
<tr>
<td>Critical Skill</td>
<td>Critical Skill</td>
</tr>
<tr>
<td>Point to sensory attributes (sweet-salty; loud-quiet; hard-soft; rough-smooth; hot-cold; wet-dry).</td>
<td>Understand increasingly precise vocabulary (adjectives-describing words).</td>
</tr>
<tr>
<td><strong>I-OL9.14</strong></td>
<td><strong>II-OL9.18a</strong></td>
</tr>
<tr>
<td>Critical Skill</td>
<td>Critical Skill</td>
</tr>
<tr>
<td>Use sensory attributes (sweet-salty; loud-quiet; hard-soft; rough-smooth; hot-cold; wet-dry).</td>
<td>Demonstrate understanding of spatial words (in-out; in front of-behind; at the top of-at the bottom of; under-over; in a line/row; up-down).</td>
</tr>
<tr>
<td><strong>I-OL9.18a</strong></td>
<td><strong>II-OL9.18b</strong></td>
</tr>
<tr>
<td>Critical Skill</td>
<td>Critical Skill</td>
</tr>
<tr>
<td>Demonstrate understanding of spatial words (in-out; in front of-behind; at the top of-at the bottom of; under-over; in a line/row; up-down).</td>
<td>Show understanding of spatial words (there-here; in-on; in front of-behind; at the top of-at the bottom of; under-over; above-below; next to-in the middle of; near-far; inside-outside; around-between; up-down; high-low; left-right; front-back).</td>
</tr>
<tr>
<td><strong>I-OL9.19a</strong></td>
<td><strong>II-OL9.19b</strong></td>
</tr>
<tr>
<td>Critical Skill</td>
<td>Critical Skill</td>
</tr>
<tr>
<td>Use spatial words (in-out; in front of-behind; at the top of-at the bottom of; under-over; in a line/row; up-down).</td>
<td>Use spatial words (there-here; in-on; in front of-behind; at the top of-at the bottom of; under-over; above-below; next to-in the middle of; near-far; inside-outside; around-between; up-down; high-low; left-right; front-back).</td>
</tr>
<tr>
<td><strong>II-OL9.33</strong></td>
<td></td>
</tr>
</tbody>
</table>

Understand increasingly precise vocabulary (adjectives-describing words).
I. Patterns and Classification

What Teachers Need to Know

Background

In our daily lives, we are constantly organizing and sorting items into groups. We put all our crayons in one bin and markers in another bin. We put books on one shelf and blocks on another. At home, we place some clothes in drawers, but hang others in a closet. Identifying properties of objects and deciding which ones belong in certain groups may seem very easy. However, these skills must be developed and practiced at an early age. Children must learn the idea of “same” and “different” and develop the ability to distinguish between various attributes. Once they've mastered these skills, children can begin to recognize and even predict patterns using pictures and objects with different attributes. These fundamental concepts are vital to early mathematical development.

Classification

It is important for teachers to differentiate between sorting and classifying. Sorting is a precursor to classifying. When sorting objects, only one attribute within a collection is considered. For example, given a collection of blue, red, and yellow blocks, a child can sort the yellow blocks. The child would find all the yellow blocks in the collection and put them together, leaving the other blocks in the original collection. There are always only two categories to sorting, items that possess the attribute and items that do not possess the attribute. In the example above, the two categories are “yellow” and “not yellow.”

When classifying objects, there may be several attributes or categories involved. For example, to classify the blocks by color, a child would separate the collection into several smaller collections, each containing blocks of only one color. There are always two or more categories with classification. In the example above, the categories are “blue,” “red,” and “yellow.”

Sorting is a precursor to classifying, and both sorting and classifying require the ability to differentiate between same and different.

Patterns

The ability to recognize and analyze patterns provides children with the foundation for later algebraic thinking. When patterns can be identified, order and predictability can be used to make algebraic predictions and inferences that extend beyond the available data (Clements & Samara, 2004).

When introducing the concept of patterns to children, begin with a simple pattern that alternates only one property. Children can experiment with the concept of pattern by duplicating an alternating pattern that has been created for them using concrete objects like blocks, counting bears, or tiles. Children can begin to create their own patterns by matching concrete objects to a pattern illustrated on a card. Once they are proficient with matching the pattern, introduce the idea of extending the pattern beyond the quantity depicted on the card and then extending a pattern for which no pattern card is provided.
Once children have sufficiently practiced using manipulatives and pattern cards to recognize and extend simple patterns, introduce more abstract forms of patterning. Drawing patterns or describing them verbally are more difficult tasks for young children because the pattern can’t be moved around. Remember that children should be able to duplicate these abstract patterns before they can extend them.

From a purely mathematical point of view, there are no absolutely incorrect answers to the question “What comes next in this pattern?” As an example, ask yourself what should come next in a pattern that starts out as ABC.

Should the next symbol be A, so that the pattern continues as ABCABCABC, or should the next symbol be D, so that the pattern continues as ABCDABCDABCD? There are many possible answers to this question. That is because, as asked, the question is ambiguous. It is important not to be too rigid about patterns. Allow children the opportunity to explain their thinking, or carefully explain to them what the rule for a particular pattern is.

---

**Teaching Idea**

Fill the sensory table with several boxes of colored straws at the beginning of the week. Tie four pairs of scissors to the legs of the table and allow the children to snip the straws all week. As you interact with the children at the sensory table, you can make patterns with the straw pieces or discuss their colors and lengths. At the end of the week, move the cut-up pieces to a table and string the patterned straw necklaces.

---

**Scaffolding**

Scaffolding strategies occur on a continuum with high support at one end, low support at the other end, and varying levels of support in between. Although the examples below demonstrate only high support and low support, effective teachers adjust support along the continuum to meet the needs of individual children.

**Materials**

Effective teachers vary the materials they use in order to tailor tasks and activities to meet each child’s individual needs.

**Concrete to Abstract**

Use of concrete materials provides children with more support than use of abstract representations. The examples below illustrate how effective teachers meet the needs of individual children through manipulation of materials from concrete to abstract.

<table>
<thead>
<tr>
<th>Concrete High Support</th>
<th>Abstract Low Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use objects such as beads, counting bears, or blocks to create a pattern.</td>
<td>Create patterns on paper with paint, markers, or crayons.</td>
</tr>
<tr>
<td>Classify colored objects such as counting bears or Unifix® cubes using matching colored bowls. The color of the bowls provides an additional cue (or scaffold) to support children.</td>
<td>Classify colored objects such as counting bears or Unifix® cubes by moving the objects to separate piles.</td>
</tr>
</tbody>
</table>

**Fewer Choices to More Choices**

Offering fewer choices provides children with more support than offering more choices. The examples below illustrate how effective teachers meet the needs of individual children through manipulation of the choices provided.
I. Patterns and Classification

### Different Choices to Similar Choices

Offering choices that are distinctly different provides children with more support than offering choices that have some similarities. The examples below illustrate how effective teachers meet the needs of individual children through manipulation of the similarity of the choices.

<table>
<thead>
<tr>
<th>Different Choices</th>
<th>Similar Choices</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Support</td>
<td>Low Support</td>
</tr>
<tr>
<td>Create an alternating pattern of red bears and blue blocks.</td>
<td>Create an alternating pattern of red bears and blue bears.</td>
</tr>
<tr>
<td>Classify a group of circle, square, and triangle tiles by shape.</td>
<td>Classify a group of square and rectangle tiles by shape.</td>
</tr>
</tbody>
</table>

### Many Cues and Models to Fewer Cues and Models

Offering many cues or models provides children with more support than offering fewer cues or models. The examples below illustrate how effective teachers meet the needs of individual children through manipulation of the number of cues or models provided.

<table>
<thead>
<tr>
<th>Many Cues and Models</th>
<th>Few Cues and Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Support</td>
<td>Low Support</td>
</tr>
<tr>
<td>Create a pattern of green and yellow counting bears using a pattern card that illustrates a pattern of green and yellow counting bears.</td>
<td>Create a pattern of green and yellow counting bears without a pattern card.</td>
</tr>
<tr>
<td>Classify red, green, and yellow blocks by color using red, green, and yellow bowls.</td>
<td>Classify red, green, and yellow blocks by color using white bowls.</td>
</tr>
</tbody>
</table>

### Ordered to Random/Unordered

Working with materials that are ordered provides children with more support than working with materials that are unordered. The examples below illustrate how effective teachers meet the needs of individual children through manipulation of the orderliness of the materials.

<table>
<thead>
<tr>
<th>Ordered Materials</th>
<th>Unordered Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Support</td>
<td>Low Support</td>
</tr>
<tr>
<td>Create a pattern of green and yellow counting bears beginning with a pile of green bears and a pile of yellow bears.</td>
<td>Create a pattern of green and yellow counting bears beginning with a single pile that contains both green and yellow bears.</td>
</tr>
</tbody>
</table>
Responses

Effective teachers vary the language they use and the type of responses they elicit, in order to tailor tasks and activities to meet each child’s individual needs.

Receptive to Expressive

Receptive responses, such as nodding or pointing provide children with more support than expressive responses that require children to verbalize a response. The examples below illustrate how effective teachers meet the needs of individual children by altering the type of response expected.

Receptive Response

High Support

“Point to a bear that could come next in our pattern.”

Expressive Response

Low Support

“Tell me what color the next bear in the pattern should be.”

Feedback

Effective teachers vary the specificity and timing of the feedback they provide, in order to tailor tasks and activities to meet each child’s individual needs.

Feedback at Each Step to Feedback at the End

Feedback provided at each step of a multi-step task provides children with more support than providing feedback only at the end of the task. The examples below illustrate how effective teachers meet the needs of individual children by altering the frequency of the feedback provided.

Step-by-Step Feedback

High Support

“That’s right. A green bear comes after a yellow bear. What color comes after the green bear?”

Summative Feedback

Low Support

“Good job! You created a pattern of green and yellow bears.”

More Specific to Less Specific

Specific feedback helps children to clarify or expand their knowledge. The examples below illustrate how effective teachers meet the needs of individual children by altering the specificity of the feedback provided.

More Specific

High Support

“You put all the triangles together, and all the circles together, and all the squares together. You classified the tiles by shape!”

Less Specific

Low Support

“Good job! You classified all the tiles by shape.”
I. Patterns and Classification

Assessment

What to Look For

Young children begin to sort and classify in their play at an early age. They may stack all the blocks in one pile and all the toy animals in another. Keep an eye out for children sorting and piling. Through interaction and modeling, you can help them extend these concepts to classifying. Look for children engaged in play with collections of all sorts (e.g., buttons, blocks, counting bears, crayons, pretend food) and notice whether any categories exist in their organization of the collection.

Children may need some exposure to the concept of patterns. Look for children to use repetition in their play and work products. Through interaction and modeling, you can help them transition from repetition to patterning. Look for children engaged in art and drawing activities involving colors or shapes and notice the repetition and patterning strategies they use with these materials. Look for children engaged in play with collections (e.g., buttons, blocks, counting bears, beads) and notice repetition and patterning in the organizational strategies they use with these materials.

When to Look

Sort and classify objects or pictures of objects

- Look for and discuss children piling and sorting at the manipulative and block centers. Do children have organizational (or sorting) criteria for their piles? Can children separate one particular type of an item from all the others (e.g., remove all the blue Unifix® cubes from a multi-colored pile)?
- Center time cleanup requires sorting and classifying on a daily basis. Watch how well children sort and classify during this task. Do they put all the Legos® together and all the counting bears together? Do they put markers with markers and crayons with crayons? Do the toy dishes go on the dish shelf and the toy food in the food bin?
- Set up sorting activities at the dramatic play center. Can children sort the laundry? Can children sort mittens from gloves? Can children categorize forks from spoons? Can children sort and categorize pretend groceries on the shelves?

Duplicative and continue linear patterns

- Look for and discuss patterns in children's artwork. Have they used colors or shapes to create a pattern?
- Look for and discuss the pattern of the daily schedule. Do you do the same things in the same order each day? Can children identify what will come next in the schedule pattern?
- Once you have progressed to a monthly calendar, observe how well children extend patterns as you use one symbol, shape, or colored cut out for odd days on the calendar and another symbol, shape, or colored cutout for even days.
- See if children can line up in a pattern during transitions. Can the children create a boy-girl-boy-girl-boy pattern or a taller-shorter-taller-shorter-taller pattern as they line up?
- Look for and discuss patterns in music and movement activities. Although they are more abstract, patterns can be created from sound (e.g., loud-soft-loud-soft-loud) and movement (e.g., hop-jump-hop-jump-hop).

Resources

The titles listed below are offered as a representative sample of materials and are not a complete list of all resources.

For children —

- *Pair of Socks*, by Stuart J. Murphy and illustrated by Lois Ehlert (HarperCollins, 1996). When socks go missing, you have to be able
to recognize their patterns to find their mates. Paperback, 40 pages, ISBN 0064467031. Knowledge Tree Core Knowledge Math Kit.


**For teachers —**


- *Much More Than Counting: More Whole Math Activities for Preschool and Kindergarten*, by Sally Moomaw and Brenda Hieronymus. (Redleaf Press, 2002). “This remarkable sequel to More Than Counting is the perfect resource for those interested in providing a developmentally appropriate math curriculum for young children. The unique blend of theory and practice makes this a perfect text for the preschool and primary classroom teacher as well as for the teacher-in-training. The authors’ considerable knowledge of child development and pedagogy has enabled them to provide suggestions and strategies which will permit all children to have opportunities for constructing mathematical concepts.” (Ellen Lynch, Asst. Professor of Early Childhood Education, University of Cincinnati). Paperback, 308 pages, ISBN 1884834663. Knowledge Tree Core Knowledge Math Kit.

- *Show and Tell: Representing and Communicating Mathematical Ideas in K-2 Classrooms*, by Linda Schulman Dacey and Rebeka Eston. (Math Solutions Publications, 2002). “This useful and compelling book demonstrates how students in kindergarten through grade 2 deepen their mathematical ideas and understanding when they are encouraged to represent and communicate their thinking. Numerous classroom vignettes and reflective comments provide a model for how “show and tell” can enhance teaching and improve children’s learning. The many examples of student work will inspire teachers to adopt such an approach.” (Amazon.com Product Description). These lessons may need modification for the preschool classroom. Paperback, 240 pages, ISBN 0941355500.


*Mathematical Reasoning and Number Sense*