Professional Development Guide

Implementing the Prekindergarten Curriculum Guidelines for Mathematics and Science

Texas Center for Reading and Language Arts
College of Education, The University of Texas at Austin
Texas Education Agency

www.texasreading.org

Implementing the Prekindergarten Curriculum Guidelines for Mathematics and Science

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Introduction

This professional development guide is based on the Prekindergarten Curriculum Guidelines. These guidelines provide a means to align prekindergarten programs with the Texas Essential Knowledge and Skills (TEKS) curriculum, and are intended to assist educators in making informed decisions about curriculum content and implementing a comprehensive curriculum that prepares children for success in later grades.

Organization and Content of the Professional Development Guide

This guide contains speaker notes, color transparencies, handouts, copies of transparencies in notes view for participants (in Handout section), reprints, and suggested activities to support the application of the Prekindergarten Curriculum Guidelines for Mathematics and Science to classroom practice.

TheSpeaker Notes section provides detailed information and suggested strategies designed to enhance presentation of the content. Snapshots of the presentation transparencies are presented alongside the accompanying speaker notes. Information that appears on the transparency is bulleted and bolded in the speaker notes (see Sample Speaker Notes Page, opposite). When a transparency describes a session activity, the required materials are listed at the bottom of the corresponding speaker note page. This information is also provided in table format in the introductory section (see Activities and Handouts Chart).

Resources and References

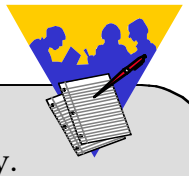
The last section includes a set of handouts that correlate the Prekindergarten Curriculum Guidelines for Mathematics and Science with other resources. First they are aligned with the Kindergarten Texas Essential Knowledge and Skills (TEKS), and then they are correlated to national standards developed by the National Council for Teachers of Mathematics and the National Research Council. The final resource is a glossary of terms used in math and science. References follow the glossary.

Children's Books

Request participants to bring their favorite books for teaching Mathematics and Science to preschool children. The suggested activities based on these books draw on participants' knowledge and expertise and offer opportunities for practice.

SAMPLE SPEAKER NOTES PAGE

This icon indicates an activity



Each trainer notes page corresponds to a transparency.

- **Information in bold and preceded by a bullet is listed verbatim on the transparency. Please be sure to cover all of these points.**

Directives for the trainer are highlighted, in italics.

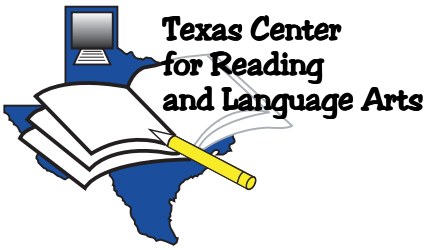
Citations are listed below the notes.

#1: Title of Transparency

- List of handouts and materials for this transparency

Activities and Handouts Chart		
Trans-parency	**Activity / Discussion**	**Trainer Materials and Handouts**
3	Participants complete a self assessment.	Handout 1: "Self Assessment"
8	*Jigsaw Activity* Base group members become experts on one area of the Guidelines and share information through a billboard activity.	Reprint: Prekindergarten Curriculum Guidelines Handout 2: "Jigsaw Activity: Mathematics and Science Guidelines" Materials: • Chart paper, 7 sheets • Markers for each chart • Timer, music, or bell
10	List participants' responses to the question: What are some ways that you scaffold instruction?	Materials: • Blank transparency • Transparency marker
11	Provide six minutes to read through the handout.	Handout 3: "Actively Engage Children in Math and Science Experiences"
14	Suggest that participants read through the handouts.	Handout 4: "Correlating Learning Centers to the Prekindergarten Curriculum Guidelines" Handout 5: "Block Activities to Develop Math and Science Skills"
15	With partners, participants list materials for centers, using a "Growing Things" theme.	Materials: • Sticky notes 4"X4" or larger • Chart paper
16	Suggest that participants read through the handout at their convenience.	Handout 6: "Teaching Through Daily Routines: Counting"
20	Participants select a book and complete the handout on reading books emphasizing math and science concepts.	Handout 7: "Reading Books Two Ways"
21	Participants read the handout and discuss how to implement the suggested strategies.	Handout 8: "Teaching English as a Second Language Through Math and Science"

Trans-parency	Activity / Discussion	Trainer Materials and Handouts
22	Suggest that participants read through the handouts at their convenience.	Handout 9: "Scaffolding During Conversations and Discussions" Handout 10: "Questions to Stimulate Thinking and Encourage Discussion"
24	Provide two minutes to read through the handout.	Handout 11: "Demonstration Script: Mixing Colors"
27	Suggest that participants read through the handout at their convenience.	Handout 12: "Graphic Organizers and Data Collection"
28	Participants read the handout and identify one area they want to emphasize more in their teaching.	Handout 13: "Features of Effective Math and Science Instruction"
29-35	*A Day in the Life of a Prekindergarten Teacher* story	
36	Trainers model how to use the Features Checklist. Participants evaluate the practices in the Miss Patience story according to the features of effective instruction identified in the content of this session.	Handout 14: "Features Checklist" Materials: • Transparency marker • Blank transparency
37	Participants evaluate the practices in the Miss Patience story according to the features of effective instruction identified in the content of this session.	Handout 13: "Features of Effective Math and Science Instruction" Handout 14: "Features Checklist" Handout 15: "A Day in the Life of a Prekindergarten Teacher" Handout 16: "Features Checklist" (Classroom Master)
38	Participants design an activity incorporating graphic organizers, discussion, transitions, learning center materials.	Handout 17: "Implementing the Mathematics and Science Prekindergarten Curriculum Guidelines" Handout 18: "Lesson Plan"



The Texas Center for Reading and Language Arts
http://www.texasreading.org

The Texas Center for Reading and Language Arts (TCRLA) provides leadership to Texas educators through its partnership with the Texas Education Agency (TEA) and the Education Service Centers (ESCs). Its mission is to (a) enhance the knowledge, skills, and practices of educators in implementing the state curriculum—the Texas Essential Knowledge and Skills (TEKS); and to (b) enhance educators' knowledge base in reading. The Center works through five organizational units: professional development, research, evaluation, special education in reading, and family literacy.

Supplemental Resources

Additional products based on the Prekindergarten Curriculum Guidelines include the following:

Video (33:21)—

- *Implementing the Texas Prekindergarten Curriculum Guidelines* (2001)

Booklet—

- *Activities to Implement the Prekindergarten Curriculum Guidelines* (2001)

Professional Development Guides—

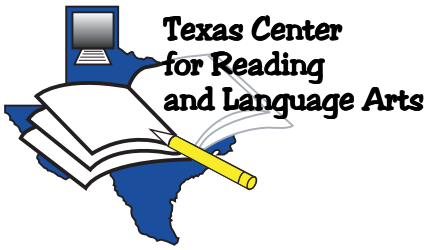
- *Implementing the Prekindergarten Curriculum Guidelines for Language and Early Literacy Part 1: Language Development* (2000)

- *Implementing the Prekindergarten Curriculum Guidelines for Language and Early Literacy Part 2: Early Literacy* (2000)

- *Implementing the Prekindergarten Curriculum Guidelines for Social Studies* (2001)

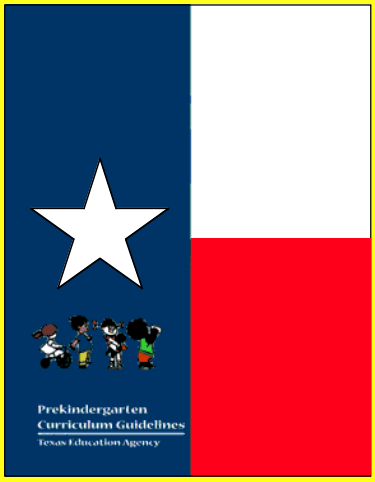
Professional Development Guide

Implementing the Prekindergarten Curriculum Guidelines for Mathematics and Science



Contents

Implementing the Prekindergarten Curriculum Guidelines for Mathematics and Science



Orient participants to the materials provided for this session, including:

- *Presentation transparencies in notes-view format*
- *Handouts*
- *Reprint section*
- *Resource and reference section*

Session Overview

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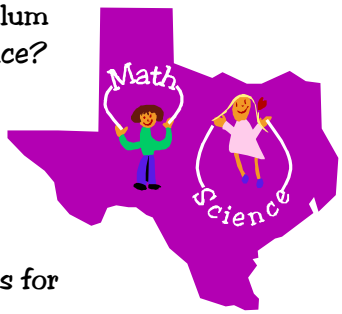
- What are the Prekindergarten Curriculum Guidelines for Mathematics and Science?
- What are the features of effective instruction for these two areas?
- How can you implement the Prekindergarten Curriculum Guidelines for Mathematics and Science in your classroom?



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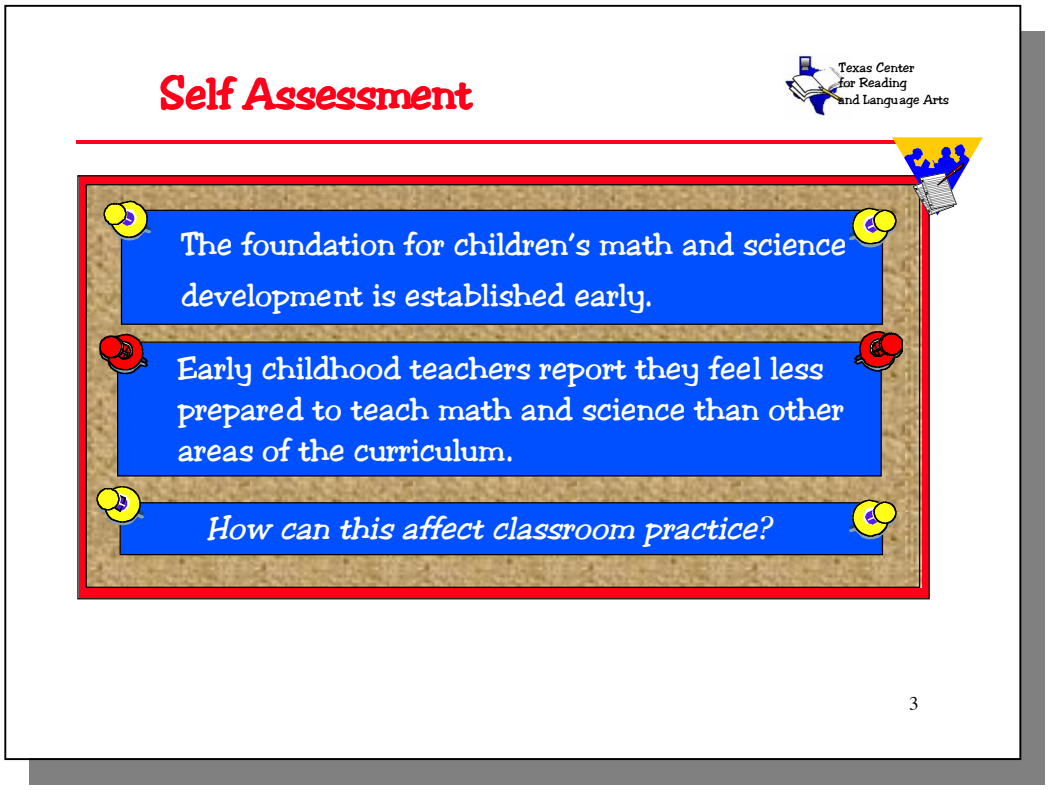
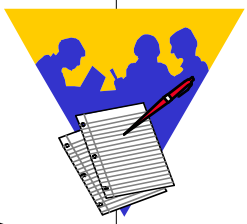
#2: Session Overview

Welcome to Implementing the Prekindergarten Curriculum Guidelines for Mathematics and Science.

Today we will answer three basic questions:

- **What are the Prekindergarten Curriculum Guidelines for Mathematics and Science**?
- **What are the features of effective instruction for these two areas?**
- **How can you implement the Prekindergarten Curriculum Guidelines for Mathematics and Science in your classroom?**


Self Assessment
Texas Center for Reading and Language Arts
The foundation for children's math and science development is established early.
Early childhood teachers report they feel less prepared to teach math and science than other areas of the curriculum.
How can this affect classroom practice?
3



#3: Self Assessment

- **The foundation for children's math and science development is established early.**
- Yet, **early childhood teachers report** that **they feel less** confident and **prepared to teach math and science than other areas of the curriculum**.
- **How can this** (a teacher's lack of confidence about knowledge and skills in a specific subject area) **affect classroom practice?**

Elicit a few general responses from the audience. Answers may vary.

Teachers' feelings of confidence about their expertise in mathematics and science directly affect the emphasis on these subjects in their classrooms.

This, in turn, impacts the quality and richness of children's experiences.

Think about how you teach math and science in your preschool classroom and what you want to know. Take 5 minutes to complete Handout 1: "Self Assessment."

Allow 5 minutes.

Keep the thoughts you've recorded foremost in your minds as we work together.

Fradd & Lee, 1995; National Committee on Science Education Standards and Assessment (NCSES), 1996; Patton & Kokoski, 1996

- Handout 1: "Self Assessment"

Diversity

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- The three- and four-year-old children who enter your prekindergarten classrooms have diverse knowledge and experiences.
- Their current knowledge and skills serve as a starting point for new experiences and instruction.

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#4: Diversity

- **The three- and four-year-old children who enter your prekindergarten classrooms have diverse knowledge and experiences.**

  Some children are at the beginning of the learning continuum, while others are further along.

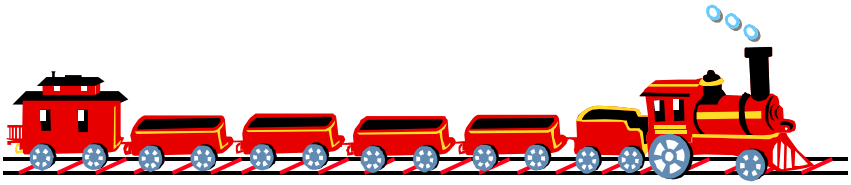
  The instructional practices that we discuss today are designed to help you meet the needs of all the prekindergarten children in your classrooms.

- **Their current knowledge and skills serve as the starting point for new experiences and instruction**.

  Extend learning and appropriately challenge each and every child.

  For example, children with disabilities may need accommodations and modifications. Children whose first language is not English need instruction presented in a manner they can understand, with their native language serving as a foundation for knowledge acquisition.

Features of Effective Math and Science Instruction



- build on the Prekindergarten Curriculum Guidelines,
- scaffold children's learning,
- actively engage children in math and science experiences,
- make connections across content areas, and
- monitor children's progress.

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#5: Features of Effective Math and Science Instruction

Research has identified broad-based principles of effective teaching.

- During this session, we'll examine **features of effective instruction in math and science**.

The five components are:

- **build on the Prekindergarten Curriculum Guidelines,**
- **scaffold children's learning,**
- **actively engage children in math and science experiences,**
- **make connections across content areas, and**
- **monitor children's progress.**

You will notice that the train graphic is used throughout this section. As each feature of effective instruction is discussed in detail, an icon that represents that feature is added to the train.

For example, the icon that represents the first feature , "Build on the Prekindergarten Curriculum Guidelines," is the Texas flag. Other icons include a blue triangle for scaffolding instruction, a pile of rocks for actively engaging children in math/science experiences, a wheel for connecting the content areas, and a clipboard for monitoring progress.

Build on the Prekindergarten Curriculum Guidelines

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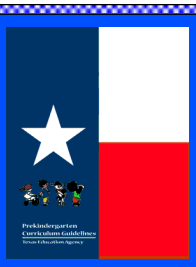

- ✓ Articulate what 3- and 4-year-olds need to know and be able to do.
- ✓ Provide a means to align a prekindergarten curriculum with the Texas Essential Knowledge and Skills.
- ✓ Assist educators in making informed decisions about curriculum content and implementation.

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#6: Build on the Prekindergarten Curriculum Guidelines

- The first feature is **build on the Prekindergarten Curriculum Guidelines.** Guidelines were developed to be used at the discretion of each school district to:
  - **articulate what 3- and 4-year-olds need to know and be able to do**,
  - **provide a means to align a prekindergarten curriculum with the Texas Essential Knowledge and Skills,** and
  - **assist educators in making informed decisions about curriculum content and implementation.**

These guidelines can help you provide the type of instruction that prepares children for success in later grades.

Build on the Prekindergarten Curriculum Guidelines

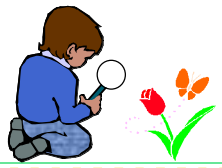
Texas Center for Reading and Language Arts

"Curriculum is the way content is delivered: it includes the structure, organization, balance, and presentation of the content in the classroom."

National Science Education Standards, 1996, p. 22

The guidelines address the content for preschool children to learn and the accomplishments that they can achieve.

- Language and Early Literacy
- Mathematics
- Science
- Social Studies
- Fine Arts
- Health and Safety
- Personal and Social Development
- Physical Development
- Technology Applications



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#7: Build on the Prekindergarten Curriculum Guidelines

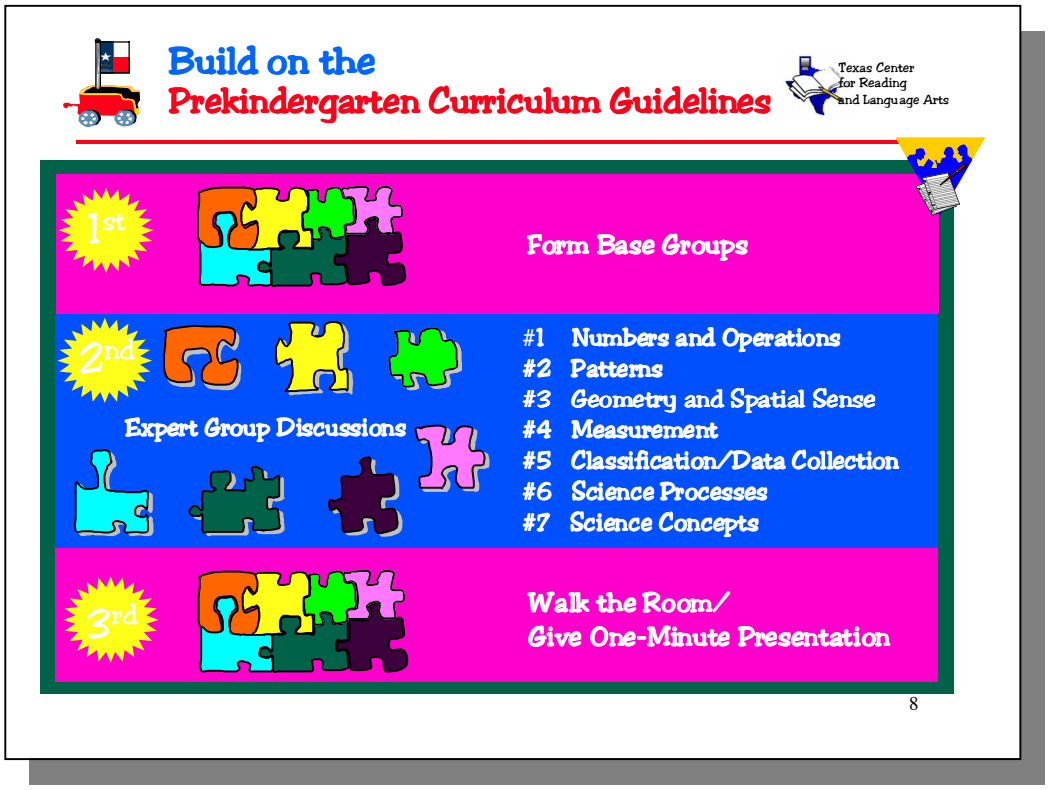
- The National Science Education Standards define curriculum as **"...the way content is delivered: it includes the structure, organization, balance, and presentation of the content in the classroom."**

- The **guidelines** are organized to **address** both **the content for preschool children to learn and** the competencies, or **accomplishments, that they can achieve**. The guidelines describe a comprehensive and integrated curriculum with interplay between language, early literacy, and other areas of development.

They are organized into broad areas, including:

- **Language and Early Literacy,**
- **Mathematics,**
- **Science,**
- **Social Studies,**
- **Fine Arts,**
- **Health and Safety,**
- **Personal and Social Development,**
- **Physical Development,** and
- **Technology Applications.**

NCSES, 1996



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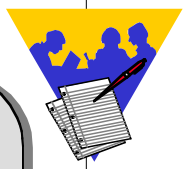


#8: Build on the Prekindergarten Curriculum Guidelines

Find your reprint of the Prekindergarten Curriculum Guidelines so we can examine them through a jigsaw activity. There are five topic areas for math and two topic areas for science.

- First, we'll **form base groups.** Let's number off one through seven. Remember your number.

(*Some participants may need to join another table so that each group will have seven people.)*

- People with the same number will meet at a poster to become informed about one of the guidelines. Then they will return to the base group and share their knowledge.

Point to each chart to designate areas for base group to meet.

#1's–Numbers and Operations, #2's–Patterns, #3's–Geometry and Spatial Sense, #4's–Measurement, #5's–Classification and Data Collection, #6's–Science Processes, and #7's–Science Concepts.

- Use the directions on Handout 2: "Jigsaw Activity: Mathematics and Science Guidelines" to guide your **expert group discussion**.

  Then use the chart paper to create a billboard advertising your topic. Summarize your group's discussion. You will have 15 minutes. Afterwards, the experts will report back to their base group. Are there any questions?

  Break into your expert groups. You have 15 minutes to create your billboard.

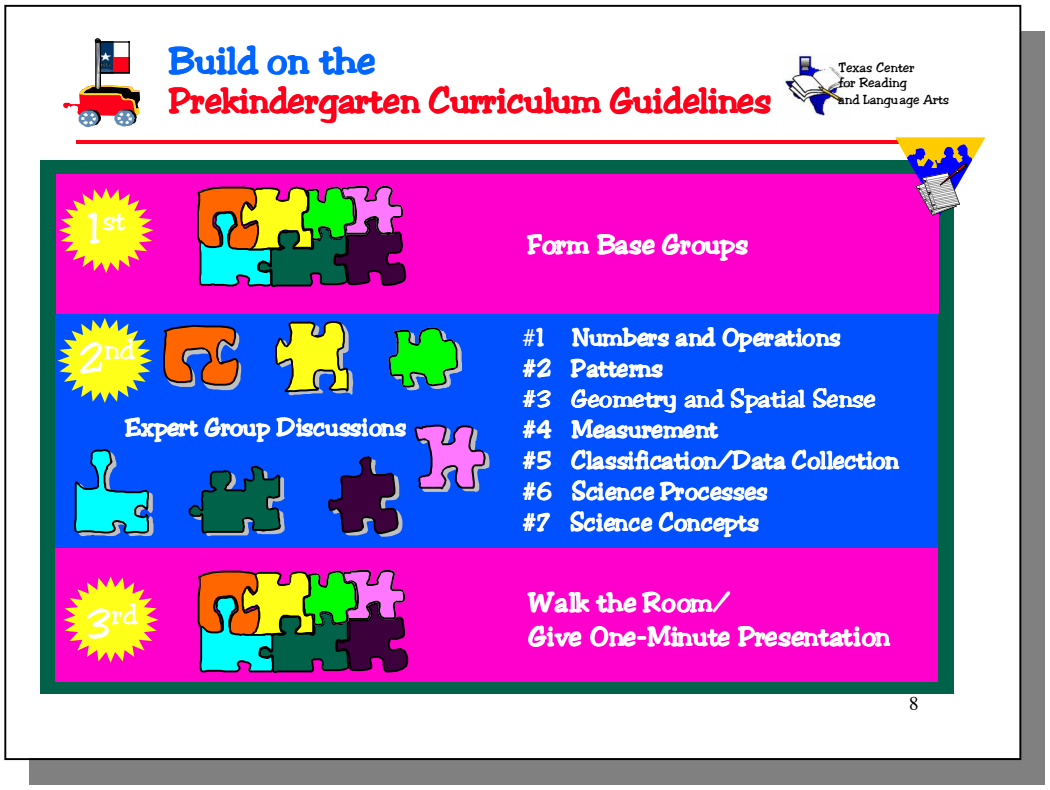
Allow approximately 15 minutes.

- Now, quickly reconvene with your base groups at these locations.

(Continued on next page)

- Reprint: Prekindergarten Curriculum Guidelines
- Handout 2: "Jigsaw Activity: Mathematics and Science Guidelines"
- Chart Paper: 7 sheets posted around the room, labeled 1 through 7 with topics
- Markers for each chart
- Timer, music, or bell

Continued


Build on the
Prekindergarten Curriculum Guidelines
Texas Center for Reading and Language Arts
1st
Form Base Groups
2nd
Expert Group Discussions
#1 Numbers and Operations
#2 Patterns
#3 Geometry and Spatial Sense
#4 Measurement
#5 Classification/Data Collection
#6 Science Processes
#7 Science Concepts
3rd
Walk the Room/
Give One-Minute Presentation
8

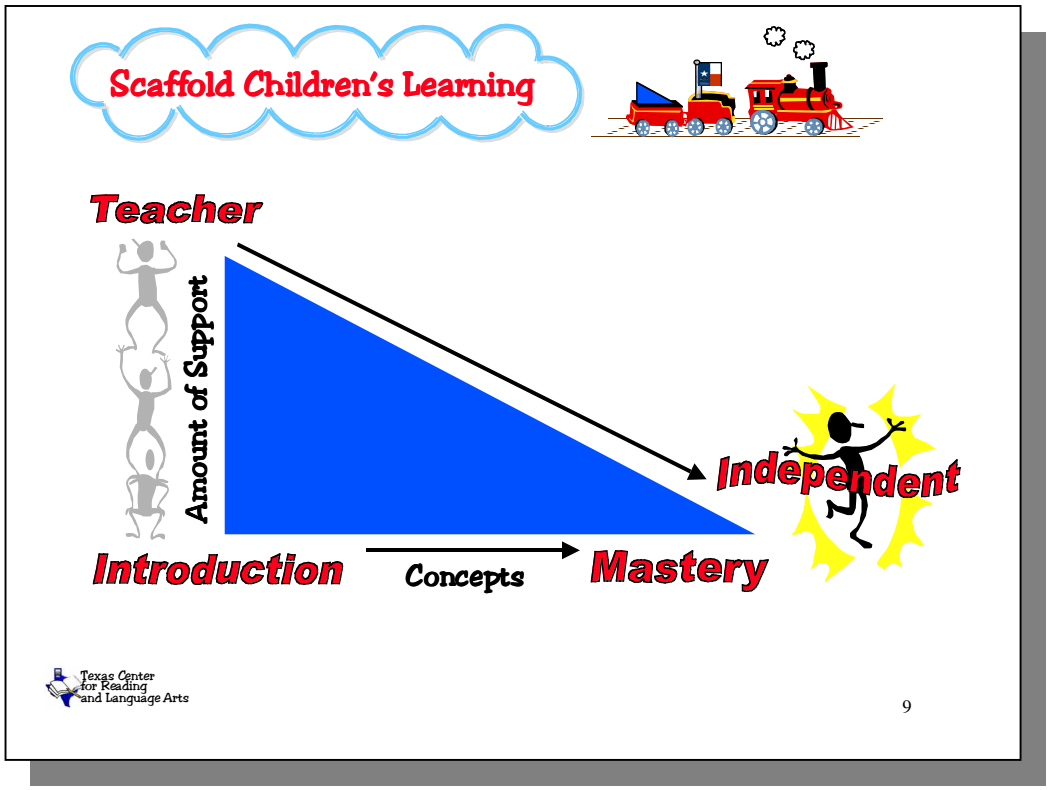
(Continued from previous page)

Assign groups to begin at different billboards.

- As a group, **walk the room** to review the Prekindergarten Guidelines for Mathematics and Science.
- When you reach your expert group's billboard, **give a one-minute presentation** of your topic to your base group. Rotate in a clockwise direction to the next billboard when you hear the signal.

Allow 2 minutes at each billboard. Use a timer, music, or bell to denote rotation. Have participants return to their seats at the end of the activity.

- Reprint: Prekindergarten Curriculum Guidelines
- Handout 2: "Jigsaw Activity: Mathematics and Science Guidelines"
- Chart Paper: 7 sheets posted around the room, labeled 1 through 7 with topics
- Markers for each chart
- Timer, music, or bell


Scaffold Children's Learning
Teacher
Amount of Support
Independent
Introduction
Concepts
Mastery
Texas Center for Reading and Language Arts
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- The next feature of effective math and science instruction is **scaffold children's learning**.

  Just as a scaffold is used for a temporary support during building construction, scaffolded instruction serves as a temporary support for children.

  Scaffolding is extending and adjusting support (e.g., teacher's language, tasks, materials, group size) for children so they are challenged and able to develop new skills and concepts.

  Support is given when children need it.

Point to the word, "Teacher," on the transparency.

When introducing a concept or skill, the level of teacher support is high.

As you read the next statement, slide your finger down the edge of the triangle.

The amount and type of support is gradually reduced as children become more proficient with specific concepts and skills.

Use scaffolding with all children as they are learning new math and science concepts and skills.

Texas Center for Reading and Language Arts (TCRLA), 2000b

Scaffold Children's Learning

Texas Center for Reading and Language Arts

Teachers scaffold instruction by:

- Explaining
- Modeling
- Verifying and clarifying

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- General ways to **scaffold instruction** include:

  - **Explaining**–giving explicit statements to help children understand what is being learned and why, when, and how.

  - **Modeling**–showing or demonstrating how one feels, thinks, or acts in a given situation and encouraging children to do the same.

    Modeling includes thinking aloud to help children understand thought processes by talking through the steps of a task as it is completed.

  - **Verifying and clarifying**–checking for understanding and adding additional information as children practice new skills and participate in challenging activities.

Place the blank transparency on the overhead projector.

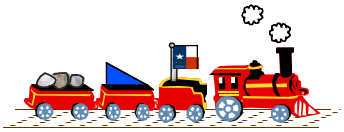
What are some specific ways that you scaffold instruction?

Record participants' responses on the right-hand side of the transparency. Responses may include: prompting, giving clues, using manipulatives, providing physical support, modifying the activity, asking questions, and providing feedback.

TCRLA, 2000a

- 1 blank transparency
- Transparency marker

Actively Engage Children in Math and Science Experiences



Provide opportunities for children to:

- investigate and solve problems,
- observe, count, measure, compare, and classify,
- explore patterns, shapes, numbers, and space,
- gather and organize information, and
- communicate findings.

Texas Center for Reading and Language Arts

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#11: Actively Engage Children in Math and Science Experiences

- The third feature of effective instruction is **actively engage children in math and science experiences**.

- **Provide opportunities for children to:**

  - **investigate and solve problems;**
  - **observe, count, measure, compare, and classify;**
  - **explore patterns, shapes, numbers, and space;**
  - **gather and organize information; and**
  - **communicate findings.**

Many math and science concepts are developed in everyday activities and daily routines. For example, children learn about the concept of parts and whole when they build a tower with blocks and watch it fall.

Handout 3: "Actively Engage Children in Math and Science Experiences" describes classroom environments that promote learning math and science processes and skills. Take 6 minutes to read through this handout.

Allow 6 minutes.

Holt, 1993; Kilmer & Hofman, 1995; Lind, 1999; National Council of Teachers of Mathematics (NCTM), 2000; NCSES, 1996; Richardson & Salkeld, 1995

- Handout 3: "Actively Engage Children in Math and Science Experiences"

Actively Engage Children in Math and Science Experiences

Texas Center for Reading and Language Arts

- Small Groups
- Learning Centers
- Transitions
- Outdoor Learning

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Now let's look at four optimal settings for math and science experiences:

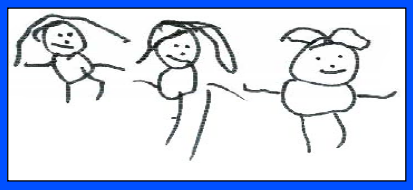
- **Small Groups,**
- **Learning Centers,**
- **Transitions,** and
- **Outdoor Learning.**

Actively Engage Children in Math and Science Experiences

Texas Center for Reading and Language Arts

Small Groups

Use different grouping formats to facilitate teacher and child interactions.



Frequently regroup children.

13

#13: Actively Engage Children in Math and Science Experiences

- Organizing instruction to actively engage children in math and science experiences includes **using different grouping formats to facilitate teacher and child interactions.**

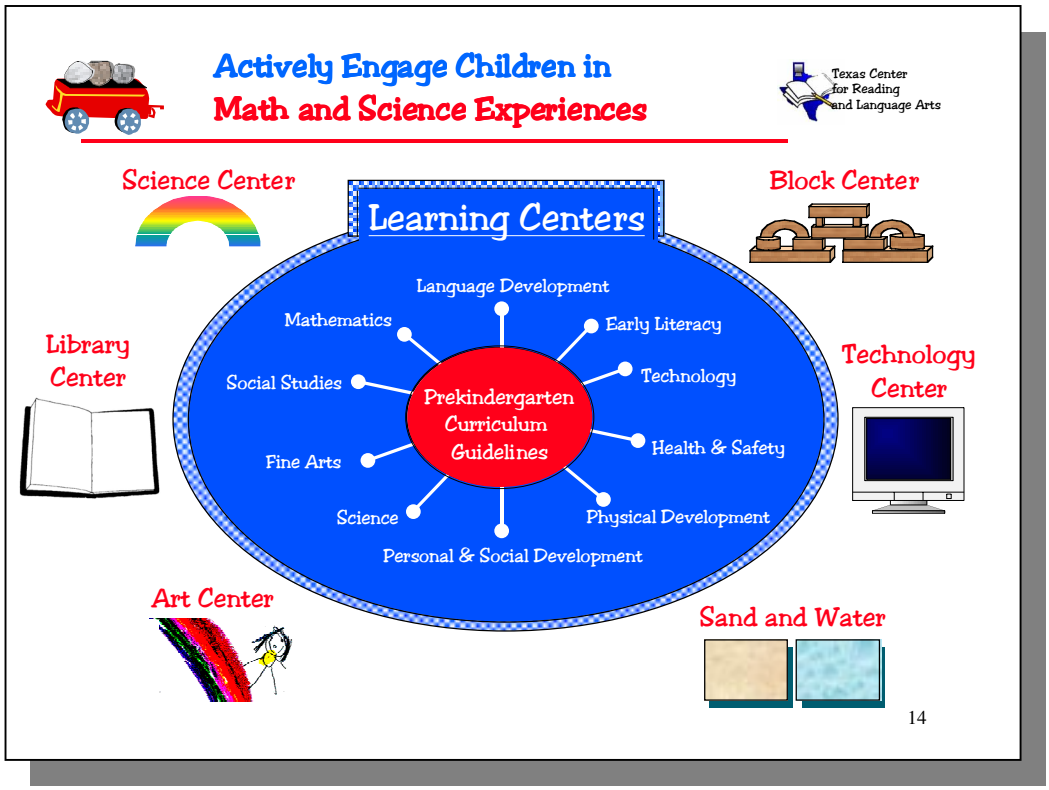
- Teacher-led groups provide children with opportunities to express what they know and receive immediate feedback from you and other children.

  Working with small groups of children helps you provide a high level of support to meet their instructional and emotional needs.

  While you teach one group, other children can work in small groups to complete tasks or activities. These activities provide opportunities for children to interact with one another as they practice and talk about what they are learning.

- **Frequently regroup children** so they can interact with different peers in a variety of math and science experiences.

Dickinson, 2001; Morrow, 2001


Actively Engage Children in
Math and Science Experiences
Texas Center for Reading and Language Arts
Science Center
Block Center
Learning Centers
Language Development
Mathematics
Early Literacy
Social Studies
Technology
Prekindergarten Curriculum Guidelines
Fine Arts
Health & Safety
Science
Physical Development
Personal & Social Development
Library Center
Technology Center
Art Center
Sand and Water
14

- **Learning centers** provide a setting for children to practice math and science skills and concepts.

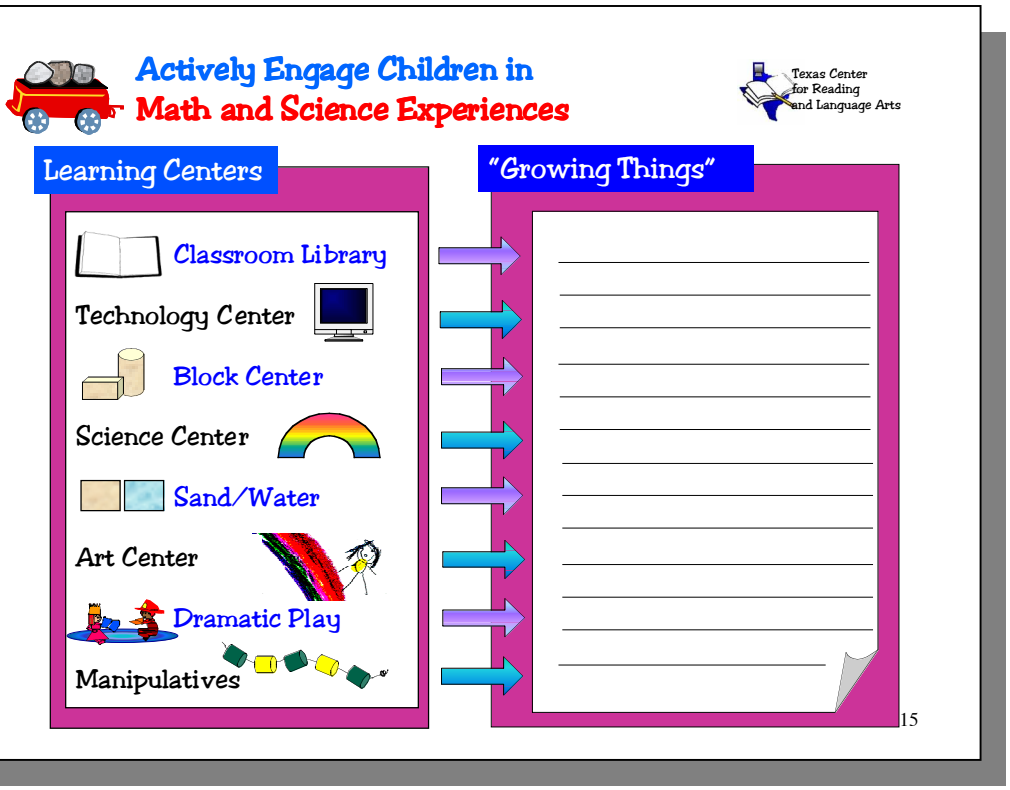
Quickly look at the ideas in Handouts 4 and 5.

"Correlating Learning Centers to the Prekindergarten Curriculum Guidelines" illustrates how to implement the guidelines in a variety of learning centers. Notice that Language and Early Literacy are addressed in every center.

"Block Activities to Develop Math and Science Skills" presents different accomplishments that can be addressed in one center.

Allow 2-3 minutes for participants to review handouts.

- Handout 4: "Correlating Learning Centers to the Prekindergarten Curriculum Guidelines"
- Handout 5: "Block Activities to Develop Math and Science Skills"


Actively Engage Children in
Math and Science Experiences
Texas Center for Reading and Language Arts
Learning Centers
"Growing Things"
Classroom Library
Technology Center
Block Center
Science Center
Sand/Water
Art Center
Dramatic Play
Manipulatives
15

Prepare and display chart paper with headings for each learning center.

- Let's think about ways to support math and science in the context of **learning centers**.

  Math-rich and science-rich environments are the result of careful planning on the teacher's part. Make sure that materials are interesting and are easily accessible to the children in your class. Provide ample time for children to explore and experiment in each center.

- With a partner, look at the centers on the transparency and list some of the math and science materials, props, and books needed in two of the centers for a **"Growing Things"** theme. Record one idea per sticky note, listing the center and materials.

  You have 5 minutes.

Provide 5 minutes.

Now post the notes on the appropriate poster as you leave for a short break. Take time to read the suggested materials listed on the charts during our breaks today.

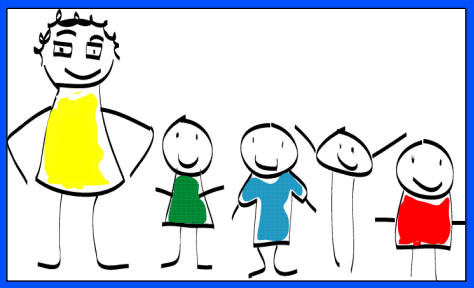
- Sticky notes 4"X4" or larger
- Chart paper

Actively Engage Children in Math and Science Experiences

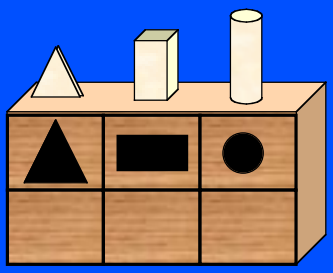
Texas Center for Reading and Language Arts

Daily Routines: Transition Times

Line Up: Patterns, Classification, Spatial Sense, Measurement



Clean Up: Sort and Categorize



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- Let's look at **transition times**.
- Integrating math and science experiences in **daily routines** helps children understand their value and importance in everyday life.
- As children **line up**, they can learn about:
    - **patterns** ("Let's line up in a pattern: boy, girl, boy, girl.");
    - **classification** ("If you are wearing red, line up behind Rico. If you are not wearing red, line up behind Becky.");
    - **spatial sense** ("Who is in front of you? Who is behind you? Who are you in front of? Who are you behind?"); and
    - **measurement.** ("Which line is longer?""How do you know?" "Who is taller?" "Line up from shortest to tallest.")
- As children **clean up**, they can **sort and categorize.** ("I'll pick up all the triangle shapes; you pick up the rectangles.")

Handout 6: "Teaching Through Daily Routines: Counting" demonstrates how counting can be incorporated into daily routines.

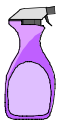
NCSES, 1996

- Handout 6: "Teaching through Daily Routines: Counting"

Actively Engage Children in Math and Science Experiences

Texas Center for Reading and Language Arts

Incorporate Outdoor Learning

in the classroom	and outdoors
   	

17

- Children also need experiences interacting with nature, observing and caring for living things, both **in the classroom and outdoors.**

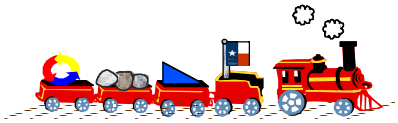
  Activities–such as going on a nature walk, observing the world after a rain, or looking under a rock–present opportunities to develop concepts and processes in science and math.

  For example, as children take care of classroom pets, they use their senses to observe and learn, and they begin to understand the needs of all living things.

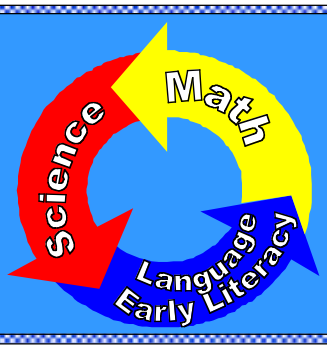
  As children collect leaves, rocks, and sticks on the playground to decorate a sand cake, they develop concepts about the natural and the constructed environment.

NCSES, 1996

Make Connections Across Content Areas



- Using math and science together
- Fostering language and literacy skills



Texas Center for Reading and Language Arts

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#18: Make Connections Across Content Areas

- The fourth feature of effective instruction involves **making connections across content areas.**

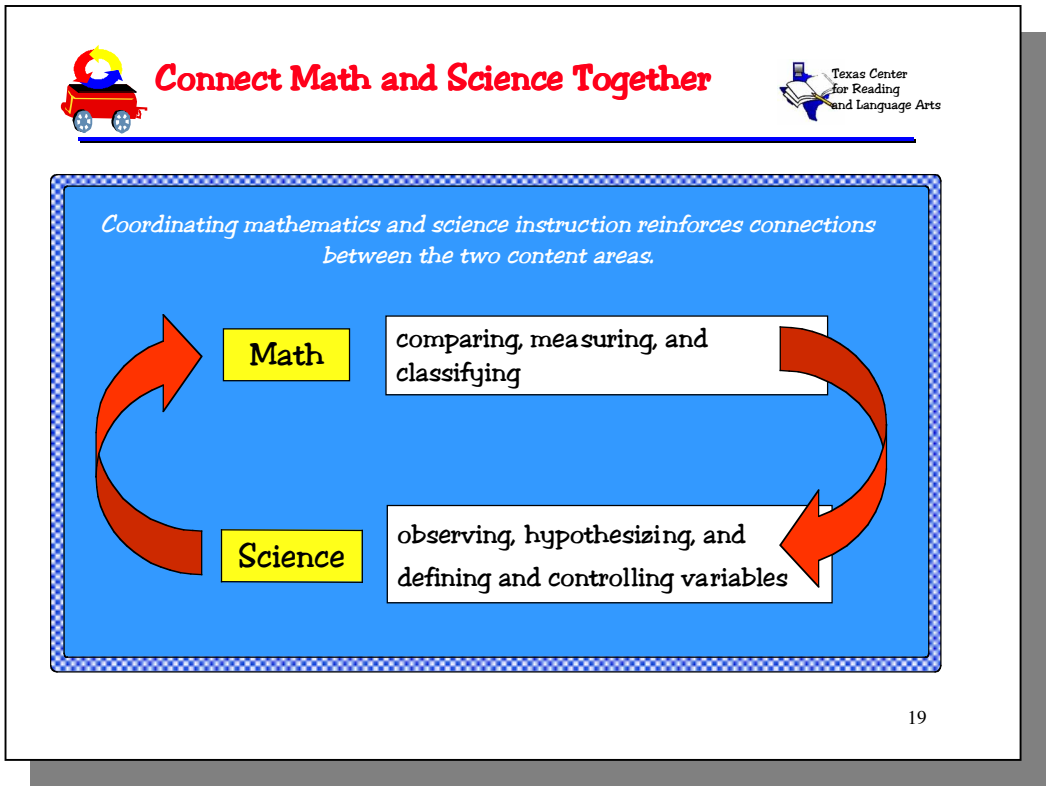
  Integrating the guidelines from different content areas helps children learn new concepts and skills. Many guidelines overlap. They involve children to apply math and science concepts or processes; to use language through listening, speaking, reading, and writing; or to express their ideas through art, music, and technology.

- In this section, we will look at two ways to make content area connections: **integrating math and science** and **linking language and literacy to math and science**.

- **Using math and science together** helps children solve problems and understand the world around them.

- **Fostering language and literacy skills** within these experiences helps children communicate their observations, draw conclusions, and make generalizations.

  Let's look at ways to help children see these connections.

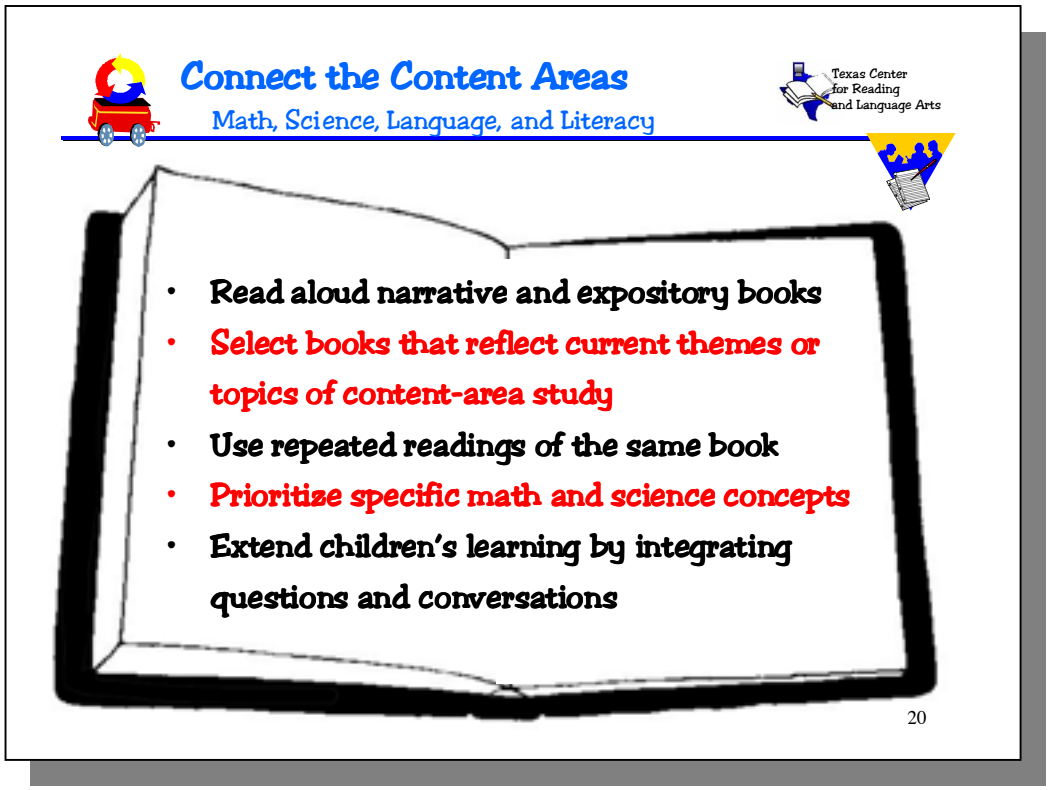

Connect Math and Science Together
Texas Center for Reading and Language Arts
Coordinating mathematics and science instruction reinforces connections between the two content areas.
Math
comparing, measuring, and classifying
Science
observing, hypothesizing, and defining and controlling variables
19

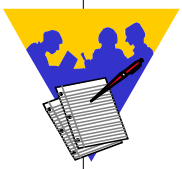
- The National Science Education Standards emphasize the importance of **coordinating mathematics and science instruction** to **reinforce the connections between the two content areas**.

- Fundamental **math** skills, such as **comparing, measuring**, and **classifying,** are used to solve science problems. **Science** skills, such as **observing, hypothesizing,** and **defining and controlling variables,** contribute to math understanding.

  For example, math and science concepts are integrated when children plant a seed and then measure its growth.

Basile, 1999; Lind, 1999; NCSES, 1996


Connect the Content Areas
Math, Science, Language, and Literacy
Texas Center for Reading and Language Arts
• Read aloud narrative and expository books
• Select books that reflect current themes or topics of content-area study
• Use repeated readings of the same book
• Prioritize specific math and science concepts
• Extend children's learning by integrating questions and conversations
20



#20: Connect the Content Areas

- Quality instruction in **math and science** occurs in environments that are rich in **language and literacy**.

  Literacy materials–such as books and other materials to read, and tools for writing–create interest, encourage interactions between adults and children, and develop oral language skills, vocabulary, and concepts in content areas.

- **Read aloud narrative** (or story) and **expository** (or information) **books** to provide a way to link language and literacy to both math and science.

- **Select books that reflect current themes or topics of content-area study.**

- **Use repeated readings of the same book**. Reading the same book more than once helps introduce and cover a variety of math and science concepts or skills over time.

- **Prioritize specific math and science concepts** to address during a reading session or activity.

- **Extend children's learning by integrating questions and conversations**.

  Find Handout 7: "Reading Books Two Ways."

  To illustrate how to coordinate the guidelines for math and science, select one of the books at your table. Working together, complete the handout. You have 9 minutes.

Allow 9 minutes.

Baroody, 2000; Dickinson, 2001

- Handout 7: "Reading Books Two Ways"

Connect the Content Areas

Math, Science, Language, and Literacy

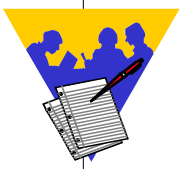
Texas Center for Reading and Language Arts

Lively discussions and conversations:

- enhance children's understanding of math and science
- encourage children to use "contextualized language" as they talk about what is happening during hands-on math and science experiences

Be sure to scaffold the discussion so English language learners can participate.

21



Now, let's look at the role discussion plays in math and science instruction.

- **Lively discussions and conversations are another way to enhance children's understanding of math and science.**

  Discussions or dialogues, sometimes called "learning conversations," challenge children and promote inquiry as teachers and peers share their experiences, explore understandings, and interact with one another.

- Incorporating discussions during hands-on math and science experiences **encourages children to use "contextualized language" as they talk about what is happening during hands-on math and science experiences.** Questioning, making predictions, and testing possibilities are learned first-hand as children solve problems and draw conclusions.

- **Be sure to scaffold the discussion so English language learners can participate.**

  Handout 8: "Teaching English as a Second Language Through Math and Science" provides a list of suggestions for making math and science comprehensible when working with children who are English language learners.

  With a partner, read and discuss the suggested strategies. Choose one idea and discuss how you can use it to facilitate math and science discussions and conversations with English language learners.

  You have 5 minutes.

Allow 5 minutes.

Morrow, 2001; NCSES, 1996; NCTM, 2000; Owens, 1999; Padrón, 1999; Schwartz & Brown, 1995

- Handout 8: "Teaching English as a Second Language Through Math and Science"

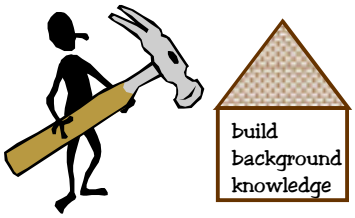
Connect the Content Areas

Math, Science, Language, and Literacy

Texas Center for Reading and Language Arts

To scaffold children's language and learning during conversations and discussions:

- Activate and build background or prior knowledge of content and topics.
- Ask open-ended questions.



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Find Handout 9: "Scaffolding During Conversations and Discussions."

- **To scaffold children's language and learning during conversations and discussions:**

  - **Activate and build background or prior knowledge of content and topics.**

    Tailor discussions and conversations around the experiences of the children in the group.

    Use objects, materials, and phenomena familiar to them, or ones that can be easily linked to something they already know in their homes, neighborhoods, and classrooms.

  - **Ask open-ended questions** such as those that begin with "why" or "how" to encourage children to put into words what they are thinking, doing, or observing.

    Stimulate children's thinking and hypothesizing: "How do you know that?" or "Can you show us how you learned that so we can think about it too?" These questions do not require a "right" or "wrong" answer.

  Help children draw conclusions.

  Accept a wide range of answers.

On Handout 10, different types of questions are presented that stimulate children's thinking and reasoning.

Dickinson, 2001; Kilmer & Hofman, 1995

- Handout 9: "Scaffolding During Conversations and Discussions"
- Handout 10: "Questions to Stimulate Thinking and Encourage Discussions"

Connect the Content Areas

Math, Science, Language, and Literacy

Texas Center for Reading and Language Arts

To scaffold children's language and learning during conversations and discussions:

- Use prompts to help children explain their answers and ask their questions.
- Restate and expand children's ideas using new vocabulary and syntax.
- Request clarification.
- Encourage children to talk with each other and ask each other questions.

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- **Use prompts to help children explain their answers and ask their questions.**

  Encourage children to provide reasons for their ideas and actions.

  Help children become aware of patterns in what they observe as they support their conclusions: "When you said, 'Rain makes the plants grow,' that reminds me of what we learned about people. What makes you grow?"

  Help them summarize their thinking and present their ideas in a logical sequence.

  Give sufficient wait time before rephrasing a question or requesting help from another child.

- **Restate and expand children's ideas using new vocabulary and syntax.**

  Model the use of extended language and rich vocabulary.

  Rephrase what a child has said, adding more complex grammar or vocabulary: "You said the water went into the clouds when you left it outside. In other words, the water evaporated."

- **Request clarification.**

  Extend their language by asking them to expand initial statements: "Tell me more about…" or "What do you mean by…"

- **Encourage children to talk with each other and ask each other questions.**

  Children play an important role in supporting each others' language development. Create opportunities for peer-to-peer conversations to occur throughout the day, such as during dramatic play and center time.

Holt, 1993; Lind, 1999; TCRLA, 1999; Weaver & Gaines, 1999; Westby, Dezale, Fradd, & Lee, 1999

Connect the Content Areas

Math, Science, Language, and Literacy

Texas Center for Reading and Language Arts

Graphic Organizers:

- integrate experiences in language, literacy, math, and science
- help children remember what they have learned
- link science processes with math skills
- promote language and literacy

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- **Graphic organizers** are another way that you can **integrate experiences in language, literacy, math, and science.**

- Graphic organizers **help children remember what they have learned**.

  Scaffold their learning by showing them ways to use graphic organizers to collect, represent, organize, and communicate ideas and information.

- Gathering and organizing data **links the science processes with math skills** as young children strive to understand situations and solve problems.

- Graphic organizers also **promote language and literacy.**

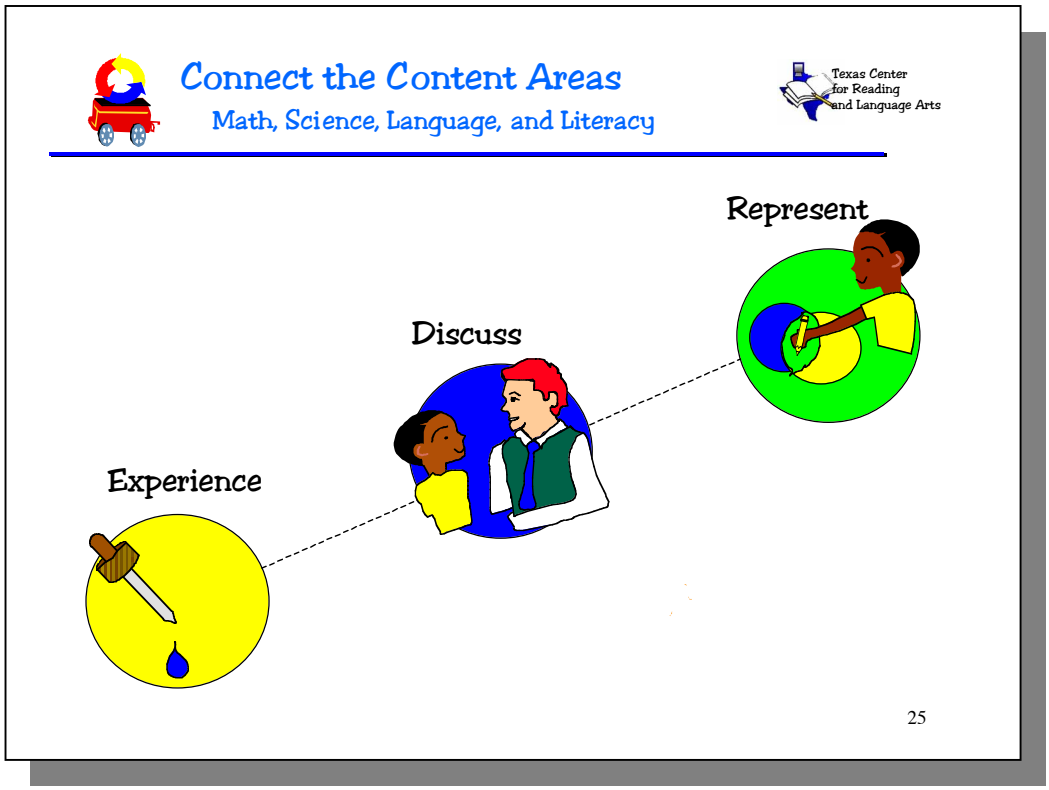
  Children discuss their thinking, listen to what others have to say, and write down or represent their experiences with words, diagrams, pictures, or mathematical symbols.

  Let's look at a lesson on mixing colors that combines a science experiment with a graphic organizer. Take 2 minutes to read Handout 11: "Demonstration Script: Mixing Colors."

Allow 2 minutes.

Copley, 2000; NCTM, 2000; Richardson & Salkeld, 1995

- Handout 11: "Demonstration Script: Mixing Colors"


Connect the Content Areas
Math, Science, Language, and Literacy
Texas Center for Reading and Language Arts
Represent
Discuss
Experience
25

After the demonstration, the activity continues as children experiment with colors and color mixing.

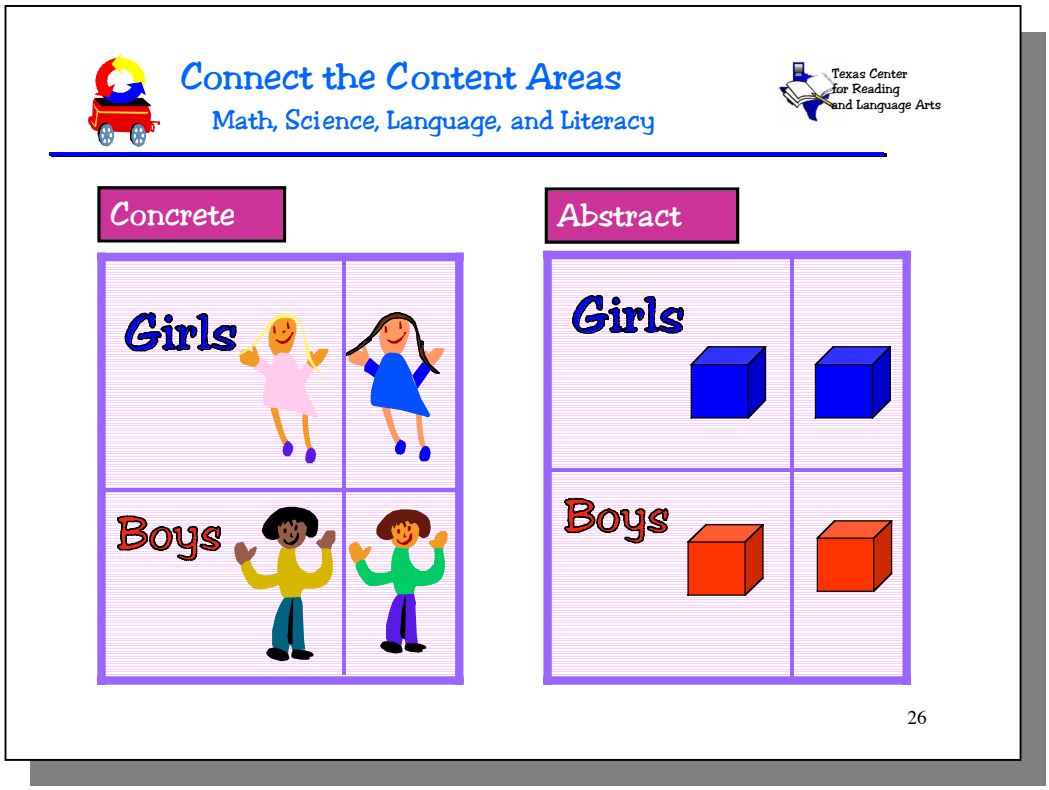
One of the science guidelines is to share observations and findings with others through pictures, discussions, or dramatizations.

After an experience, lead a discussion and create a graphic organizer. Working together to represent the experience can be as powerful as the investigation itself.

Keep the information clear and comprehensible so the graphic organizer can be used as an effective communication tool.

Children can refer back to it when talking about a past experience, using what is called "decontextualized language."

Copley, 2000; NCTM, 2000


Connect the Content Areas
Math, Science, Language, and Literacy
Texas Center for Reading and Language Arts
Concrete
Abstract
Girls
Boys
Girls
Boys
26

- Graphic organizers help preschool children move from **concrete** to **abstract** representations.

  Begin with activities that sort your class into groups by a single characteristic. For example,

  — ALL of the children wearing tennis shoes stand here.

  — Everyone in the class BUT Kristie is here today.

  These activities are sometimes referred to as "People Sorts."

  Teach children that the data collected in an activity such as a People Sort can be recorded. Create a floor graph for children to stand on by drawing a grid on a long piece of butcher paper. Children line up in one of two lines on the grid.

  —Are you a boy or a girl?

  —Did you bring your lunch or buy your lunch today?

  Teach children how to use the graph to represent the information gathered in a People Sort.

  Choose objects, pictures, or symbols to represent the children on the grid (e.g., blocks, beanbags, photographs, stickers, names).

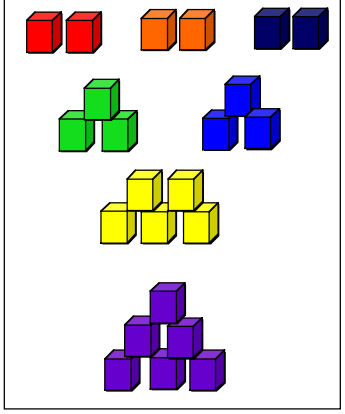
Copley, 2000; TCRLA, 1999

Connect the Content Areas

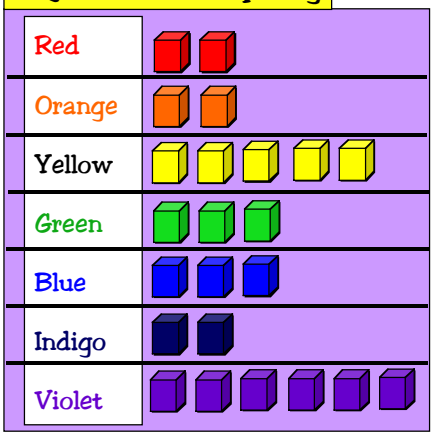
Math, Science, Language, and Literacy

Texas Center for Reading and Language Arts

Object Sort–Grouping



Object Sort–Graphing



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- **Grouping** by shared characteristics, the concept behind making sets, builds important math and science vocabulary, including "alike," "different," "more than," and "less than."

- Help children transfer the sets to **graphs**, beginning with real objects.

  Teach them to record data using written symbols to represent the objects.

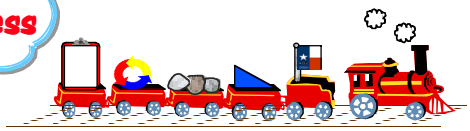
  Ask children to explain how and why they grouped the objects so you can understand their thinking. Provide time for children to answer questions from you and their peers.

  Through activities like these, children begin to learn about the power of content-related vocabulary.

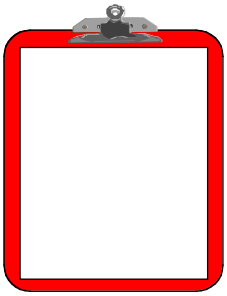
  Handout 12: "Graphic Organizers and Data Collection" provides more information about using graphic organizers with young children.

- Handout 12: "Graphic Organizers and Data Collection"

Monitor Children's Progress



Effective progress monitoring includes:



- observing, listening, and talking with children
- recording and reflecting on your observations
- adjusting instruction

28

#28: Monitor Children's Progress

- The fifth feature of effective instruction is to **monitor children's progress**. Sound instructional decisions are based upon assessment.

  For three- and four-year-old children, your assessment of their progress includes informal, systematic observation as they engage in appropriate activities.

  Document children's progress in a variety of ways and contexts using different forms of assessments, such as checklists, anecdotal records, portfolios, and interviews.

  Collect information on a regular basis to inform your instruction.

- **Effective progress monitoring includes:**
  - **observing, listening, and talking with children,**
  - **recording and reflecting on your observations, and**
  - **adjusting instruction.**

  Use the information you gather for individual children to reflect on the instruction you've provided. For example, ask yourself: "Do I need to reteach specific concepts?", "Does this child need more practice?", "Do I see evidence the children are generalizing what they have learned?"

  Let's review the five features of effective math and science instruction.

  Find Handout 13: "Features of Effective Math and Science Instruction."

  It gives additional information to help you incorporate the features in your instructional planning.

  Look at the handout quickly and identify one area that you would like to emphasize more in your teaching.

Call on 3-4 participants for what they identified and why.

Copley, 1999; Helm & Katz, 2001; NCSES, 1996; NCTM, 2000; Westby, Dezale, Fradd, & Lee, 1999

- Handout 13: "Features of Effective Math and Science Instruction"


Preparing for the Day
Texas Center for Reading and Language Arts
29

In the next activity, we will evaluate the math and science instruction of a fictitious prekindergarten teacher, Miss Patience.

Listen carefully for examples of effective teaching practices in the various activities. After the story, you will discuss and evaluate Miss Patience's instruction.

Read the story aloud:

A Day in the Life of a Prekindergarten Teacher

- It's spring and Miss Patience, a prekindergarten teacher, is in her classroom **preparing for the day** ahead. As she considers her lesson plans, she looks around the room to make sure everything is ready. Small group supplies and materials are organized. The environment is ready for learning!

Point to each picture on the slide as you read the descriptions.

The class is engaged in a study of "Growing Things," and the theme is reflected throughout the classroom:

– flowers in a planter are ready for children to mist;

– beans and sweet potatoes have sprouted bright green leaves;

– earthworms are crawling in a terrarium habitat; and

– fruits and vegetables are ready for print-making in the Art Center.

Throughout the day, Miss Patience plans to monitor the progress of all the children in her class. She uses a simple recording system: writing her notes on self-adhesive mailing labels attached to her observation clipboard. Miss Patience reflects on the four children she will closely observe during small groups and centers: Jorge, Christy, Mae, and Franklin.


Morning Routine and Greeting Circle
Texas Center for Reading and Language Arts
Sign In
We're Here Today
Greeting Circle
Center Time
Story Time
Small Groups
Outdoor Learning
Goodbye Circle
30

- As the children arrive at school, they quickly begin the **morning routine.** To check in, they write their names on either a light green or a dark green circle to form a caterpillar. Their circles extend an A-B pattern.

  Miss Patience says, "We have lots of new books in our classroom library. Look at the new set of books that are in the Math and Science baskets. Choose one while we're waiting for everyone to arrive."

  Miss Patience helps Jessie select a book to read and assists Jeffrey as he writes his name.

- In the **greeting circle**, the class sings songs and talks about their day. "Today," recites Cindy, the classroom helper for the day, "we're gonna do circle time and then we play in centers and then we're gonna work in groups and then we go outside and then it's time to say goodbye."

  "You did a great job telling us about our day, Cindy," says Miss Patience, "and I'm wondering if you can add more information. Tell us more. What can you tell us about storytime and small group time?"

  "Oh, yeah," says Cindy, "we're gonna read the carrot book and we're gonna learn about ladybugs."


Center Time
Texas Center for Reading and Language Arts
Menu at the Happy Café
$1 Pie
$2 Hot dog
$3 Hamburger
Here's our menu. What would you like today?
31

- **Center time** follows the morning circle.

  Miss Patience added props to the Home Center to build new math concepts: menus, a cash register, and some play money. Presto, the Home Center kitchen becomes a "real" restaurant.

  Miss Patience takes a series of pictures of the children playing restaurant. The pictures can be used for a sequencing activity later in the week.

  As she is putting away her camera, a discussion in the Block Center becomes louder. Miss Patience investigates.


Center Time
Texas Center for Reading and Language Arts
You're 5 blocks long!
32

Mae and Franklin are arguing about who is bigger.

"Hmmm," says Miss Patience, "I wonder how we can figure this out. Do you remember when we wanted to know how tall our plants grew?"

"Yes," Mae answers.

"What did we do?"

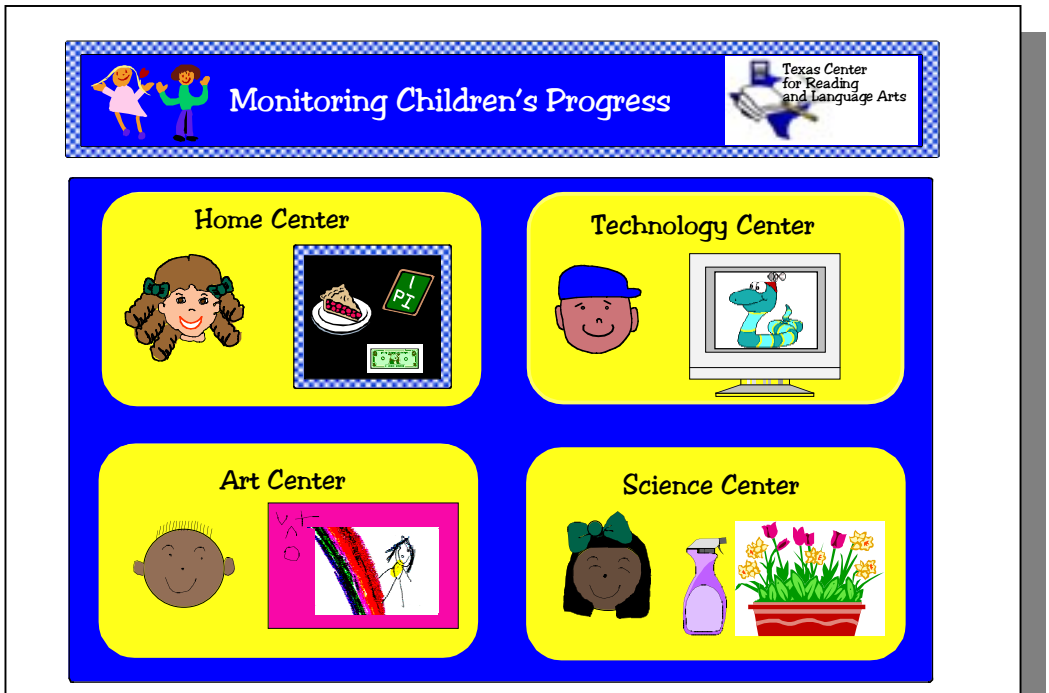
"We counted how many blocks high they were."

Franklin suggests, "Hey! Let's see how many blocks tall we are!"

The children begin to build a tower, but it keeps falling. Miss Patience models how to lie down beside a row of blocks on the floor. She explains how the blocks can be added or taken away.

Mae and Franklin lie down next to the blocks and compare their sizes.

Miss Patience notes on her observation clipboard: "Encourage using non-standard measurement tools such as crayons, blocks, shoes."


Monitoring Children's Progress
Texas Center for Reading and Language Arts
Home Center
Technology Center
Art Center
Science Center
33

#33: Monitoring Children's Progress

- During center time, Miss Patience **monitors children's progress**. Jorge, Kristie, Mae, and Franklin are in four different centers engaged in a variety of activities. She observes:

- Kristie is in the **Home Center** writing lunch orders on a receipt pad in the "restaurant."

- Franklin is in the **Technology Center** working on a program that helps him practice sorting, sequencing, observing, predicting, and constructing.

- Jorge is in the **Art Center** drawing a colorful picture.

- Mae is in the **Science Center** watering the plants. She notices some of the beans have sprouted and enthusiastically announces her observation. Mae is soon surrounded by her classmates who are just as excited.

  Miss Patience listens carefully, noting the applications of newly-learned concepts and vocabulary in the context of play.

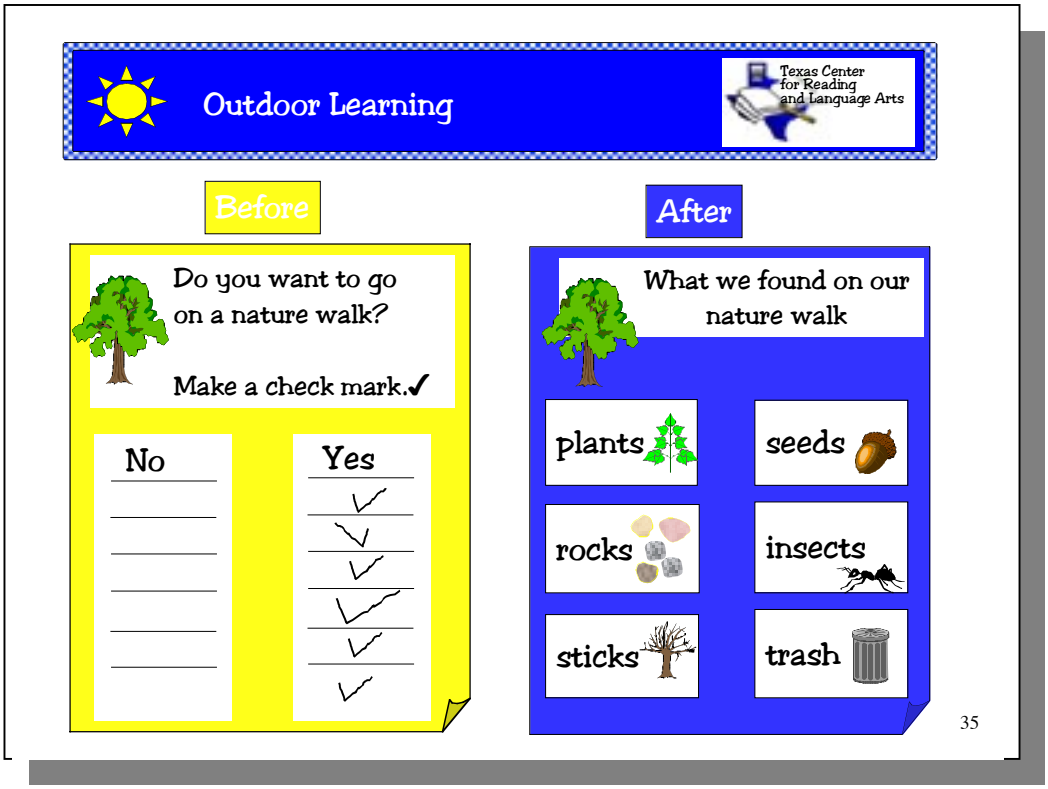

Storytime and Small Groups
Texas Center for Reading and Language Arts
Storytime
Small Groups
Observe Ladybugs
34

#34: Storytime and Small Groups

- After playing in learning centers, the children are ready for their favorite activity, **storytime**. Miss Patience reads a story about a child who takes care of a garden. She incorporates a flannel board activity to help children retell the story.

- **Small group** work follows storytime. Some children work with puzzles, others make block patterns, while some work with Miss Patience.

  Today Miss Patience's group is observing ladybugs. She models how to record their observations on a chart.


Outdoor Learning
Texas Center for Reading and Language Arts
Before
Do you want to go on a nature walk?
Make a check mark.✓
No
Yes
After
What we found on our nature walk
plants
seeds
rocks
insects
sticks
trash
35

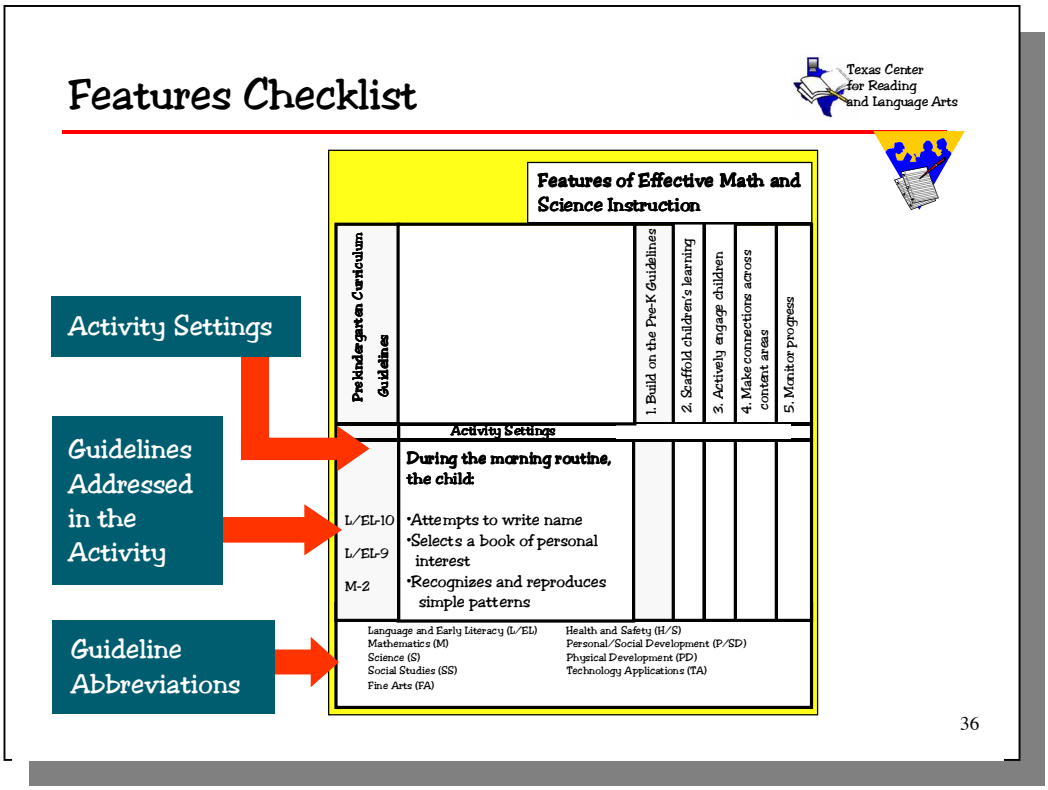
- When Small Group Time comes to a close, the class prepares for **Outdoor Learning**. One child suggests a nature walk instead of recess. The class votes to take a nature walk around the building.

  On today's walk, children notice puddles on the sidewalk and butterflies in the garden. Miss Patience engages the children in a lively discussion of the weather and the life cycle of the butterfly. Children use paper bags to collect rocks, acorns, twigs, and other treasures.

  After the walk, Miss Patience leads a discussion about the different items they collected on their nature walk. She models how to classify some of them. Tomorrow they will sort their individual collections.

  With the morning coming to a close, the children gather for Goodbye Circle. They review the day and plan for the next. The children give Miss Patience hugs and big smiles as they head out the door.

  After all the children have left, Miss Patience prepares for the next day as she reviews her notes and transfers comments to student files.



continued next page

- For our next activity, let's determine how the **features of effective instruction** were incorporated in the story.

  Look at Handout 14: "Features Checklist."

Point to each part of the checklist on the transparency as you explain it.

- In the left-hand column, the **Prekindergarten Curriculum Guidelines** have been correlated to specific events in the story. Each guideline area is coded, and specific guideline topics are numbered. An **abbreviation key** is located at the bottom of the page.

- The **five features of effective instruction** are listed from left to right.

- Next, the **activity settings**, such as **morning routine**, are identified. Bulleted items below each activity setting describe specific events in the story.

  To evaluate Miss Patience's instruction, review all the events for one activity setting. Then, look at each feature of effective instruction. Determine if it was incorporated in the setting. If the feature was addressed during any of the events, place a check mark in the box. All five features may not be present in one setting.

Place a blank transparency over the slide. Model how participants will use the handout and complete the activity.

- Let's read the events in the first **activity setting**, "**morning routine**": **attempts to write name, selects a book of personal interest,** and **recognizes and reproduces simple patterns**.

- Now, let's look at the features. The first feature is "**build on the guidelines**."

Point to the abbreviations in the left-hand column for "morning routine."

- As you can see, the guidelines addressed during "morning routine" are the **ninth and tenth topics in *Language and Early Literacy*** and the **second topic in *Mathematics***.

(Continued on next page)

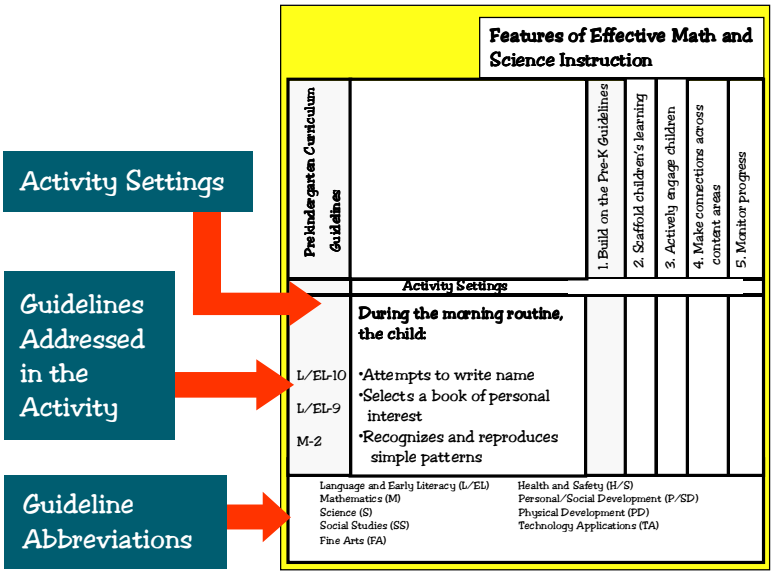
TCRLA, 1999

- Handout 14: "Features Checklist"
- Blank transparency
- Transparency markers

Continued

Features Checklist

Texas Center for Reading and Language Arts



36

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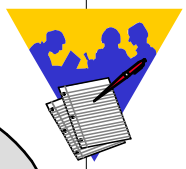


- Place one check mark in the box under "**Build on the Pre-K Guidelines**."

Place one large check mark in the first column on the transparency.

- Now let's evaluate the second feature. Did Miss Patience **scaffold children's learning**?

Allow time for participants to respond.

Miss Patience scaffolds learning by helping Jessie select a book and assisting Jeffrey in writing his name.

Place one check mark in the box.

Place one large check mark in this column on the transparency.

Are there any questions?

Lead participants through the remaining features for "morning routine" if they still need practice:

- Let's examine the third feature of effective instruction, "**actively engage children in math and science experiences**." What specifically occurred during the **morning routine** that addresses this feature?

Responses may include: a new set of books that reflect math and science concepts in the classroom library; children extend a pattern on the message board.

Place one check mark in this column.

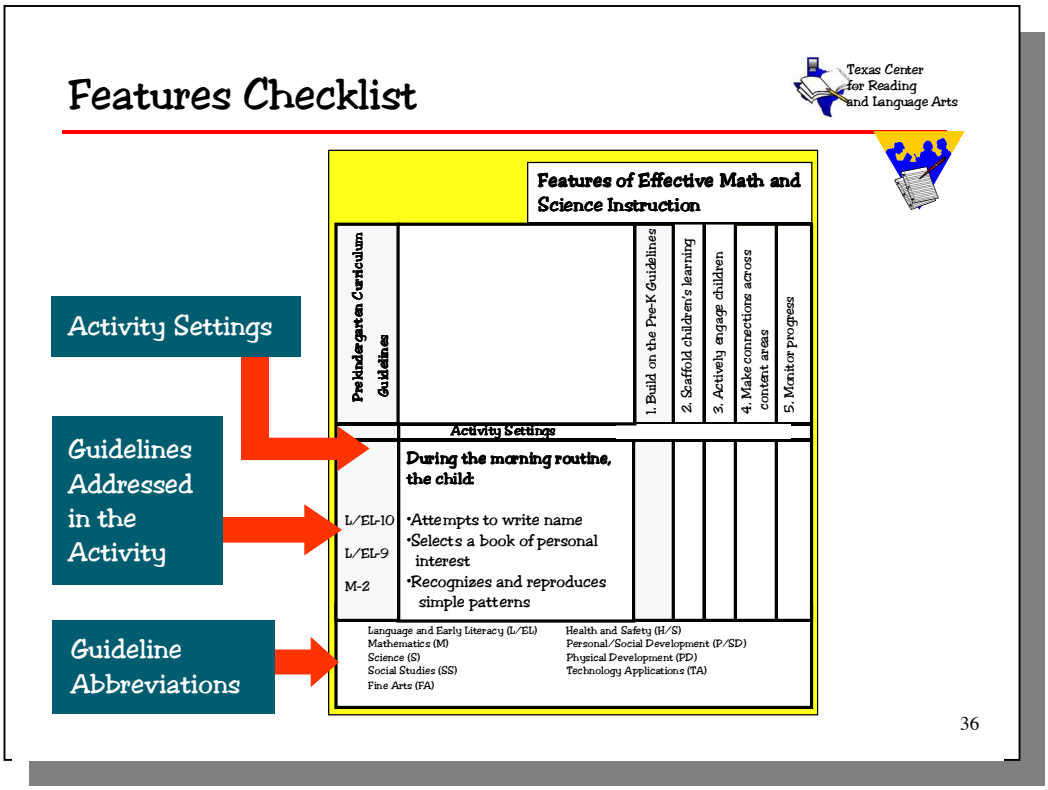
Place a check mark in this column on the transparency.

(Continued on next page)

TCRLA, 1999

- Handout 14: "Features Checklist"
- Blank transparency
- Transparency markers

Continued


Features Checklist
Texas Center for Reading and Language Arts
Features of Effective Math and Science Instruction
Prekindergarten Curriculum Guidelines
1. Build on the Pre-K Guidelines
2. Scaffold children's learning
3. Actively engage children
4. Make connections across content areas
5. Monitor progress
Activity Settings
Activity Settings
During the morning routine, the child:
L/EL-10
L/EL-9
M-2
•Attempts to write name
•Selects a book of personal interest
•Recognizes and reproduces simple patterns
Language and Early Literacy (L/EL)
Mathematics (M)
Science (S)
Social Studies (SS)
Fine Arts (FA)
Health and Safety (H/S)
Personal/Social Development (P/SD)
Physical Development (PD)
Technology Applications (TA)
Activity Settings
Guidelines Addressed in the Activity
Guideline Abbreviations
36

(Continued from previous page)

- Now the next feature is "**making connections across content areas**."

  Which event links both math and science?
  Answer: The signing-in procedure with its focus on patterns.

  How were math and science linked to literacy?
  Answer: Books reflecting math and science concepts; writing names on circles to sign in.

  Place one check mark in the box.

Place a check mark in this column on the transparency.

- Let's look at the final feature: Did Miss Patience **monitor children's progress?**

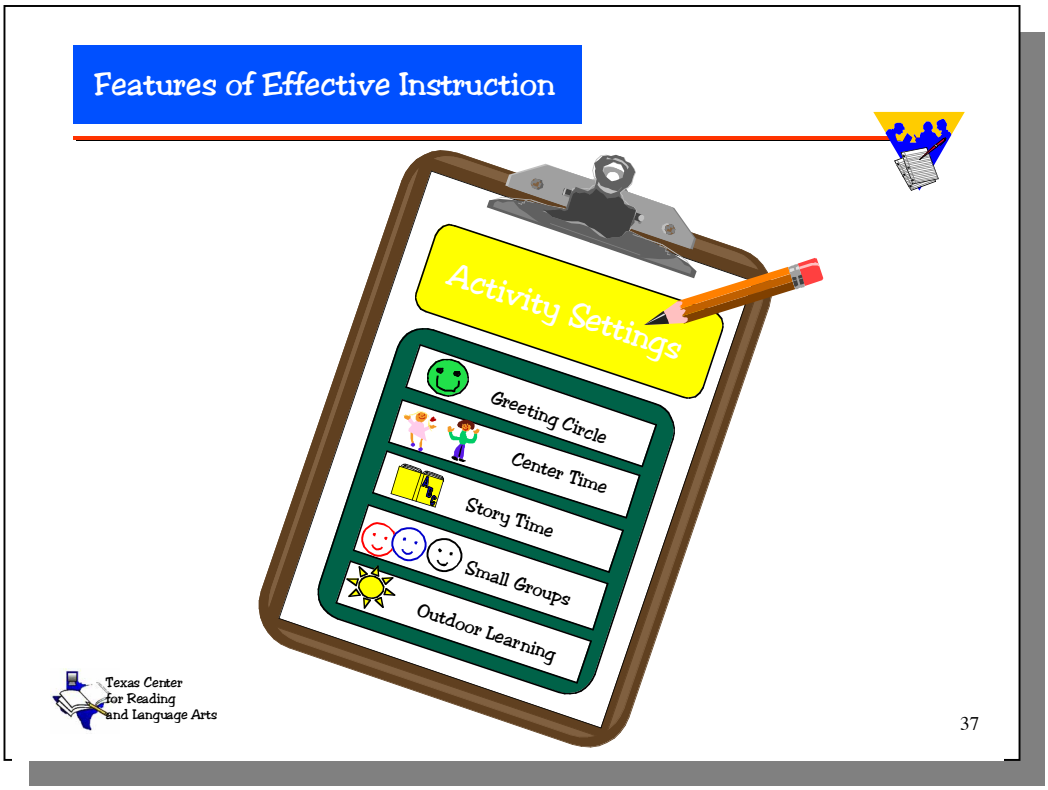
Allow time for participants to respond.

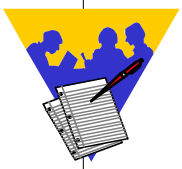
By noticing that two of the children needed help, she was not only scaffolding their learning, but she was also monitoring their progress. Place one check mark in this box.

Place a check mark in this column on the transparency.

TCRLA, 1999

- Handout 14: "Features Checklist"
- Blank transparency
- Transparency markers


Features of Effective Instruction
Activity Settings
Greeting Circle
Center Time
Story Time
Small Groups
Outdoor Learning
Texas Center for Reading and Language Arts
37



#37: Features of Effective Instruction Checklist

Now it's your turn.

Assign one table per activity setting. Start with greeting circle.

- Complete the checklist for your group's assigned **activity setting** using Handout 13: "Features of Effective Math and Science Instruction" and Handout 15: "A Day in the Life of a Prekindergarten Teacher."

Note: If you did not model all the features for "morning routine," ask groups to finish that section before they begin on the assigned setting.

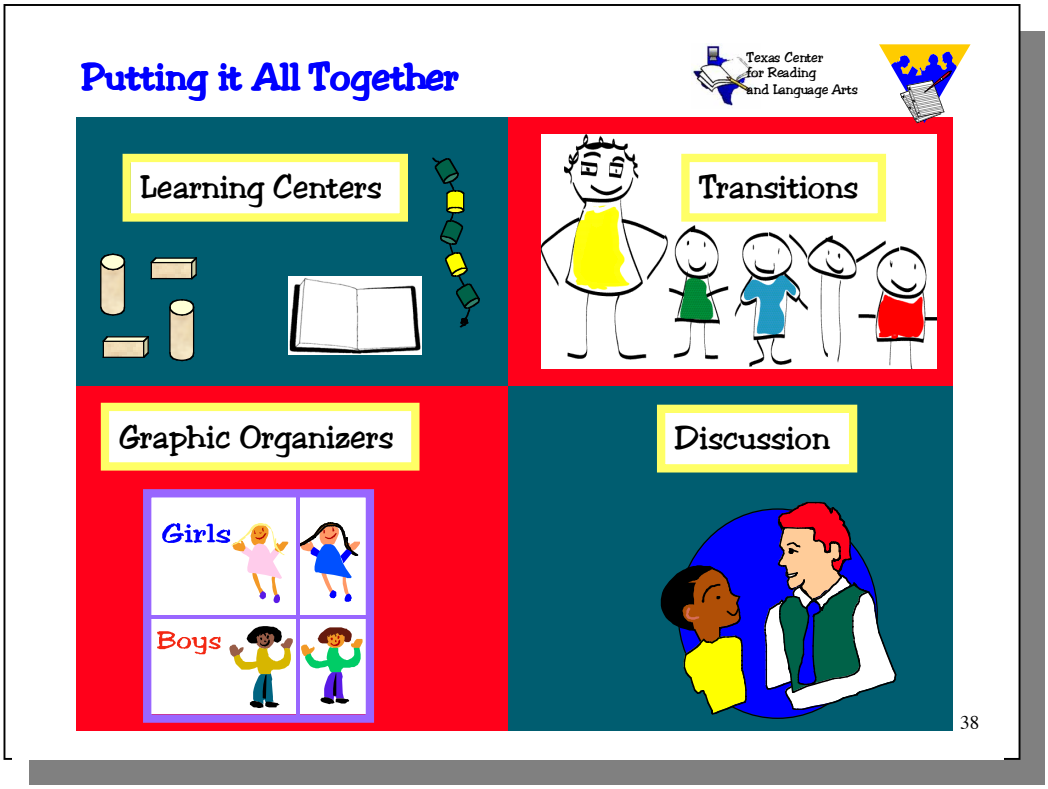
Are there any questions? You have 6 minutes.

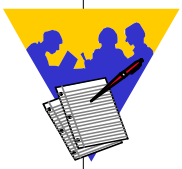
Allow 6 minutes.

Ask a volunteer from each table to provide an example of what was most effective and what was missing from their assigned activity setting.

Handout 16, a blank master checklist, is provided for you to use as you plan instruction in your classroom.

- Handout 13: "Features of Effective Math and Science Instruction"
- Handout 14: "Features Checklist"
- Handout 15: "A Day in the Life of a Prekindergarten Teacher"
- Handout 16: "Features Checklist" (Classroom Master)


Putting it All Together
Texas Center for Reading and Language Arts
Learning Centers
Transitions
Graphic Organizers
Girls
Boys
Discussion
38



#38: Putting It All Together

For our final activity, work individually or with a partner to develop a lesson plan that you can use with your children.

Use Handout 17: "Implementing the Mathematics and Science Prekindergarten Curriculum Guidelines" to help with your planning.

Use a book you brought from your classroom.

Complete Handout 18: "Lesson Plan." Skim the book to determine specific math and/or science concepts or skills to target.

In your lesson plan, include:

- a list of props, materials, books, and literacy tools you would include in two **learning centers**;
- **transition activities** that build math and/or science concepts or skills;
- a **graphic organizer** to support the discussion; and
- three open-ended questions to facilitate **discussion** or a learning conversation.

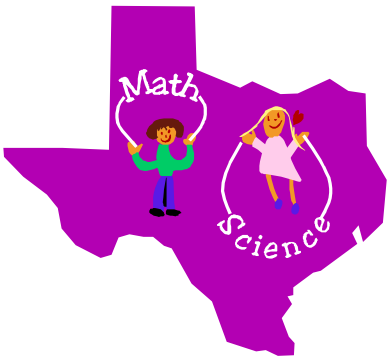
You have 10 minutes.

Provide 10 minutes.

- Handout 17: "Implementing the Mathematics and Science Prekindergarten Curriculum Guidelines"
- Handout 18: "Lesson Plan"

Summary

Texas Center for Reading and Language Arts



"Quality programs that provide challenging but achievable curriculum engage children in thinking, reasoning, and communicating with others."

Prekindergarten Curriculum Guidelines, p. 1

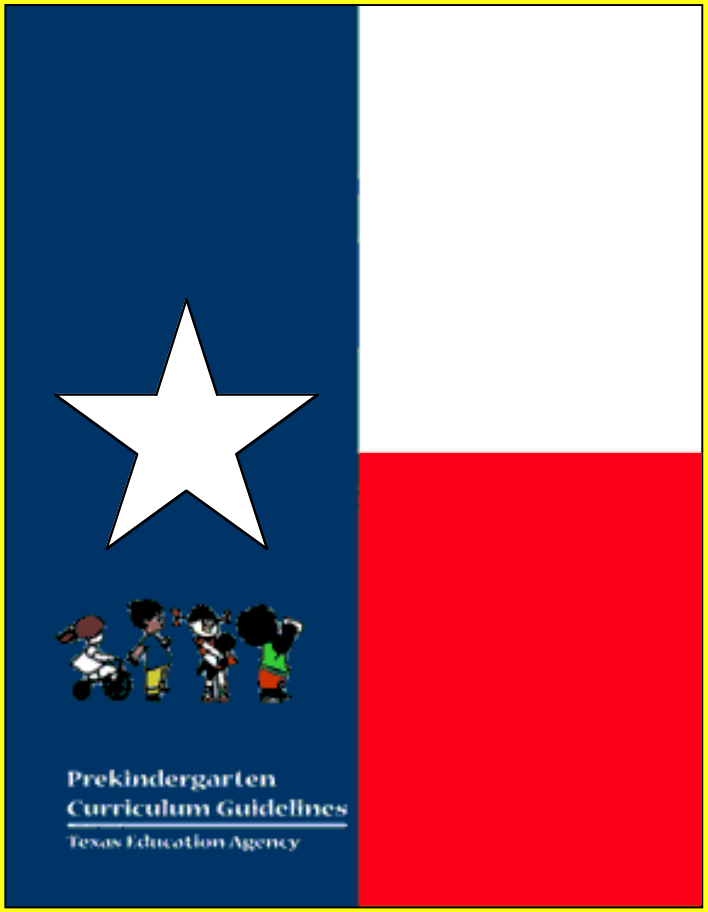
39

- **"Quality programs that provide challenging but achievable curriculum engage children in thinking, reasoning, and communicating with others."**

  Remember to incorporate the features of effective math and science instruction. With your direction and guidance, children will begin to develop math and science concepts and skills, as well as build connections across content areas.

Texas Education Agency, 1999

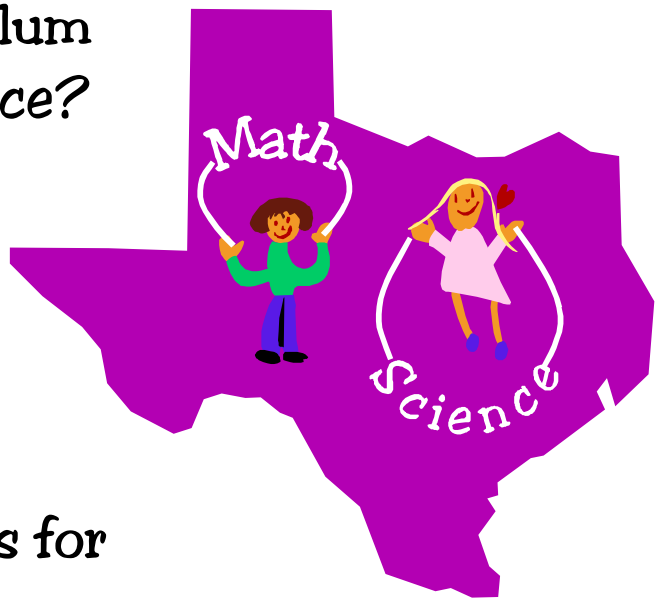
Implementing the Prekindergarten Curriculum Guidelines for Mathematics and Science



Session Overview

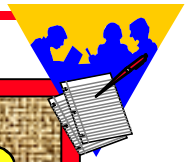
Texas Center for Reading and Language Arts

- What are the Prekindergarten Curriculum Guidelines for Mathematics and Science?
- What are the features of effective instruction for these two areas?
- How can you implement the Prekindergarten Curriculum Guidelines for Mathematics and Science in your classroom?



Self Assessment

Texas Center for Reading and Language Arts



The foundation for children's math and science development is established early.

Early childhood teachers report they feel less prepared to teach math and science than other areas of the curriculum.

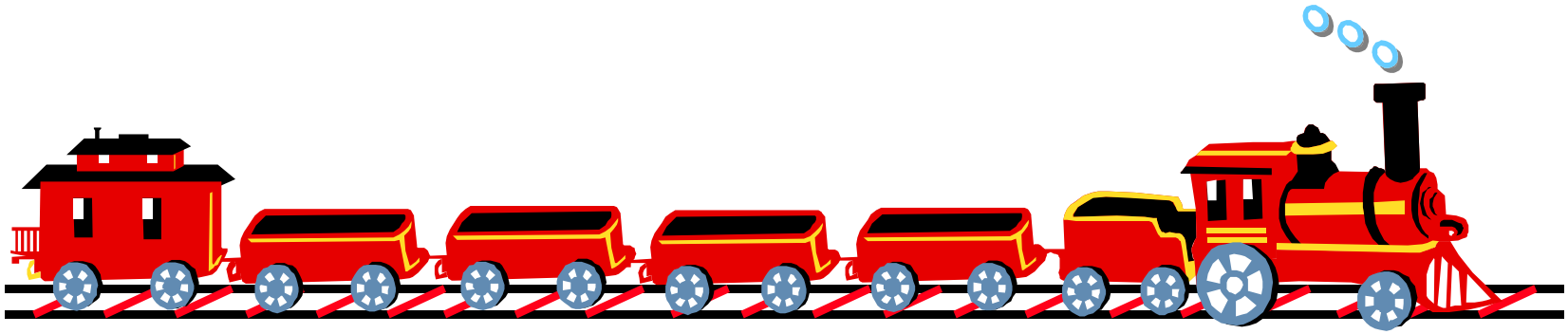
How can this affect classroom practice?

Diversity

Texas Center for Reading and Language Arts

- The three- and four-year-old children who enter your prekindergarten classrooms have diverse knowledge and experiences.
- Their current knowledge and skills serve as a starting point for new experiences and instruction.

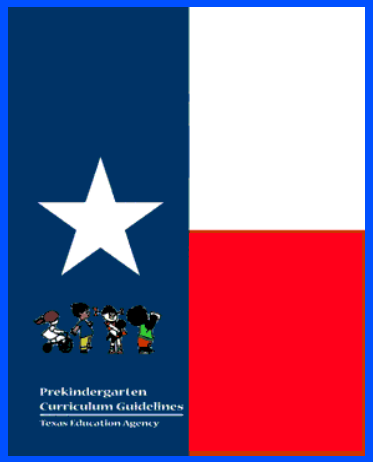
Features of Effective Math and Science Instruction



- build on the Prekindergarten Curriculum Guidelines,
- scaffold children's learning,
- actively engage children in math and science experiences,
- make connections across content areas, and
- monitor children's progress.

Build on the Prekindergarten Curriculum Guidelines

Texas Center for Reading and Language Arts



- ✓ Articulate what 3- and 4-year-olds need to know and be able to do.
- ✓ Provide a means to align a prekindergarten curriculum with the Texas Essential Knowledge and Skills.
- ✓ Assist educators in making informed decisions about curriculum content and implementation.

Build on the Prekindergarten Curriculum Guidelines

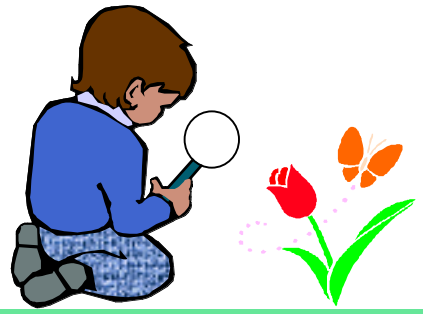
Texas Center for Reading and Language Arts

"Curriculum is the way content is delivered: it includes the structure, organization, balance, and presentation of the content in the classroom."

National Science Education Standards, 1996, p. 22

The guidelines address the content for preschool children to learn and the accomplishments that they can achieve.

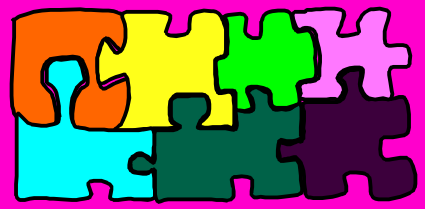
- Language and Early Literacy
- Mathematics
- Science
- Social Studies
- Fine Arts
- Health and Safety
- Personal and Social Development
- Physical Development
- Technology Applications



Build on the Prekindergarten Curriculum Guidelines

Texas Center for Reading and Language Arts

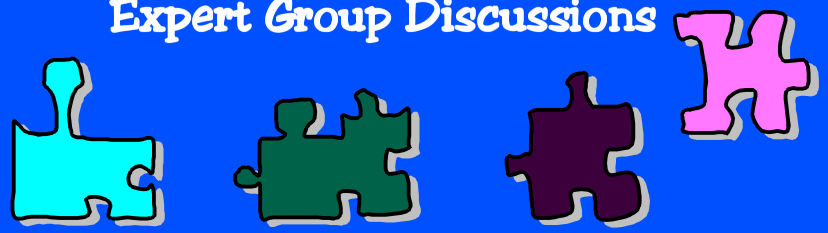
1st



Form Base Groups

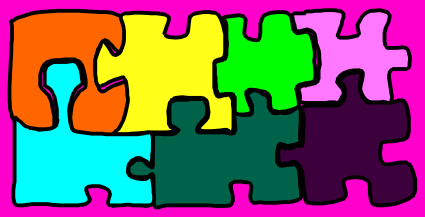
2nd

Expert Group Discussions



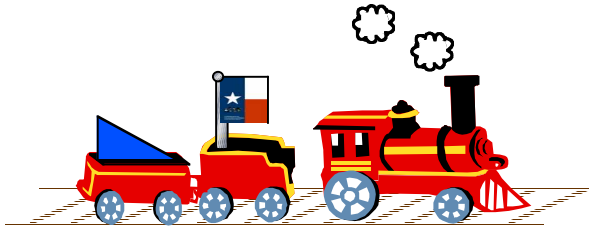
#1 Numbers and Operations
#2 Patterns
#3 Geometry and Spatial Sense
#4 Measurement
#5 Classification/Data Collection
#6 Science Processes
#7 Science Concepts

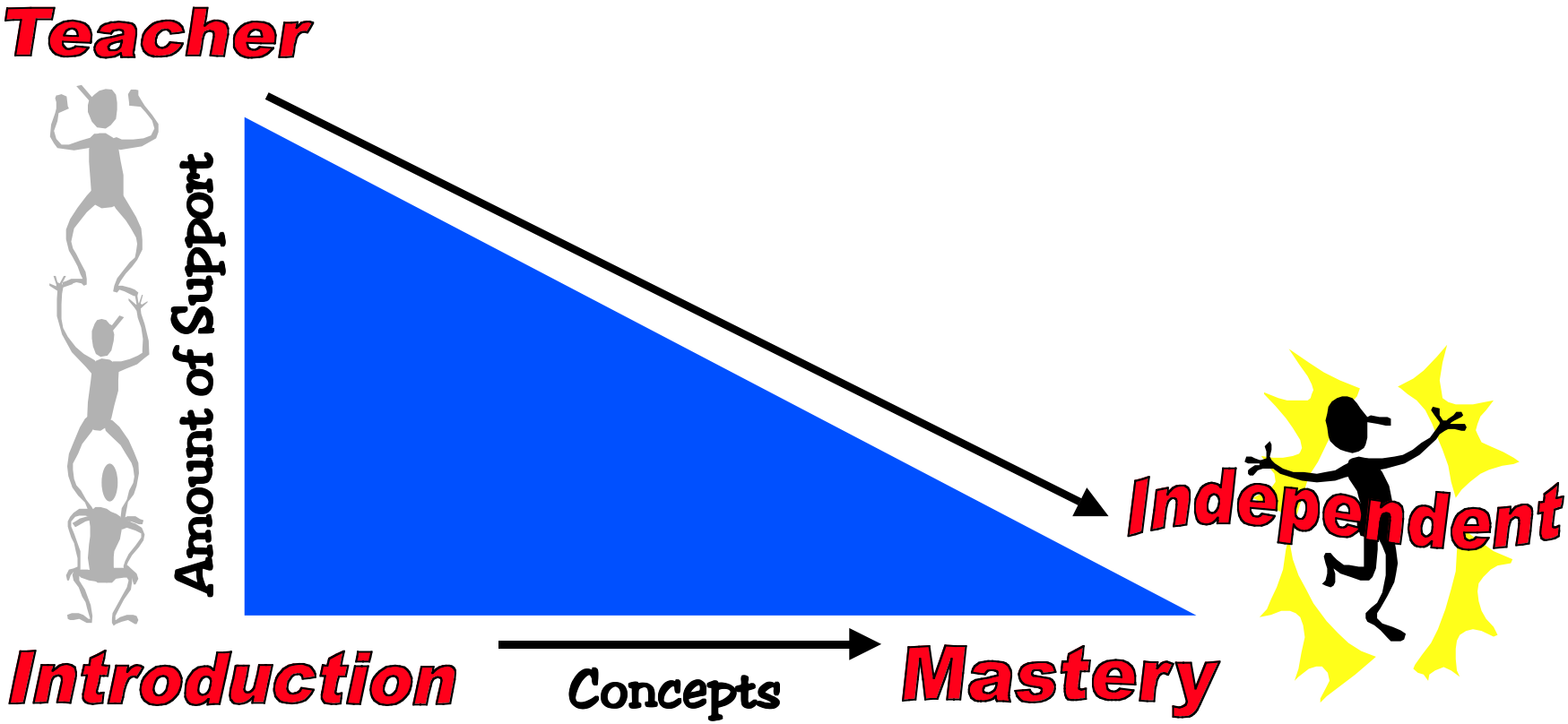
3rd



Walk the Room/
Give One-Minute Presentation

Scaffold Children's Learning





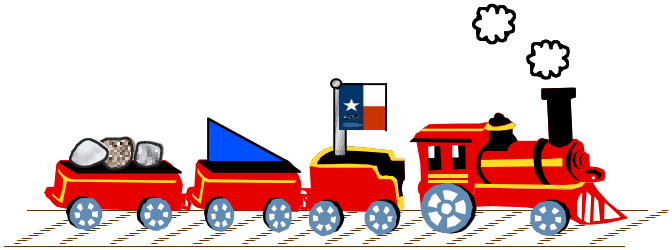
Scaffold Children's Learning

Texas Center for Reading and Language Arts

Teachers scaffold instruction by:

- Explaining
- Modeling
- Verifying and clarifying

Actively Engage Children in Math and Science Experiences



Provide opportunities for children to:

- investigate and solve problems,
- observe, count, measure, compare, and classify,
- explore patterns, shapes, numbers, and space,
- gather and organize information, and
- communicate findings.

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Actively Engage Children in Math and Science Experiences

Texas Center for Reading and Language Arts

- Small Groups
- Learning Centers
- Transitions
- Outdoor Learning

Actively Engage Children in Math and Science Experiences

Texas Center for Reading and Language Arts

Small Groups

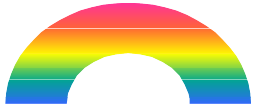
Use different grouping formats to facilitate teacher and child interactions.

Frequently regroup children.

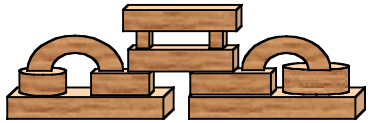
Actively Engage Children in Math and Science Experiences

Texas Center for Reading and Language Arts

Science Center



Block Center



Learning Centers

Language Development

Mathematics

Early Literacy

Social Studies

Technology

Prekindergarten Curriculum Guidelines

Fine Arts

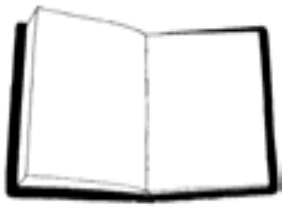
Health & Safety

Science

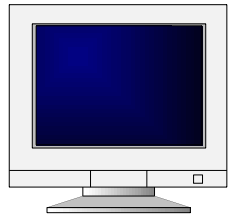
Physical Development

Personal & Social Development

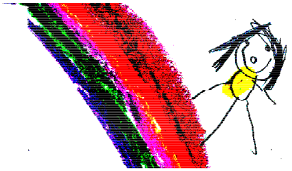
Library Center



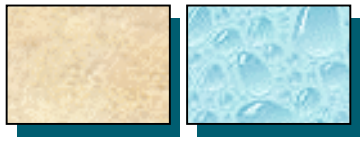
Technology Center



Art Center



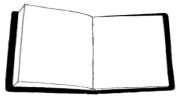
Sand and Water



Actively Engage Children in Math and Science Experiences

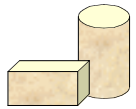
Texas Center for Reading and Language Arts

Learning Centers



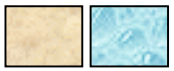
Classroom Library

Technology Center



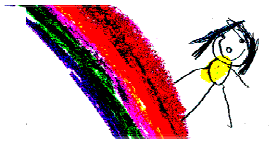
Block Center

Science Center

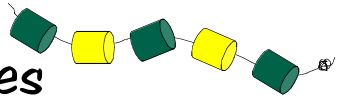


Sand/Water

Art Center



Dramatic Play

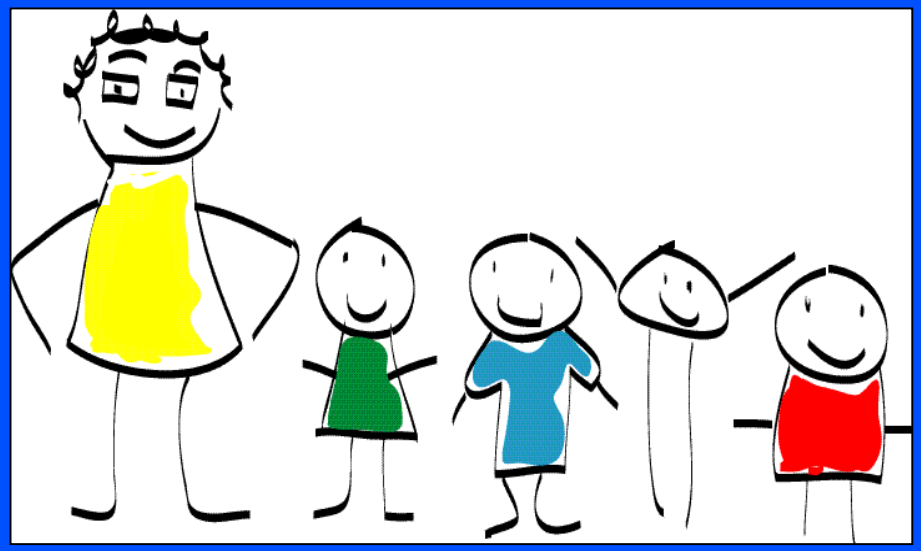


Manipulatives

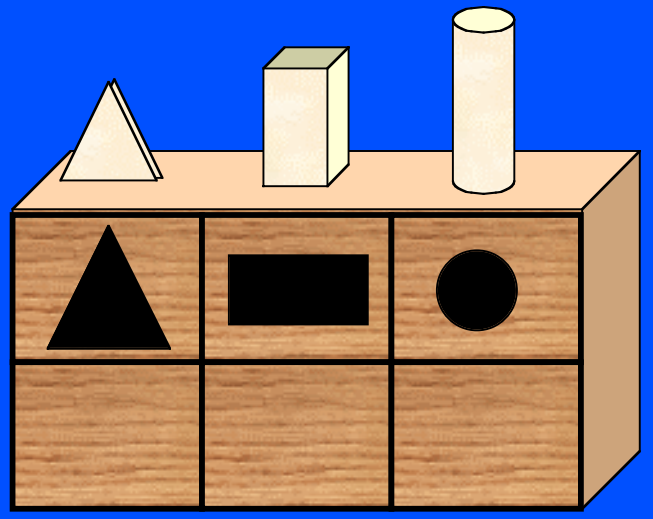
"Growing Things"

Daily Routines: Transition Times

Line Up: Patterns, Classification, Spatial Sense, Measurement



Clean Up: Sort and Categorize

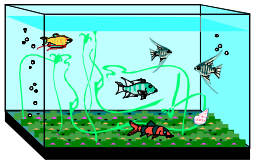


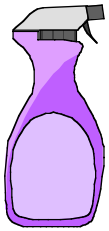
Actively Engage Children in Math and Science Experiences

Texas Center for Reading and Language Arts

Incorporate Outdoor Learning

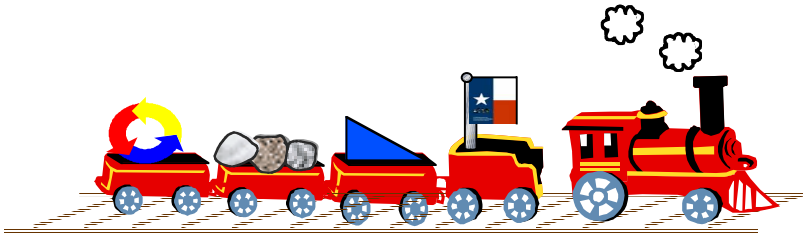
in the classroom



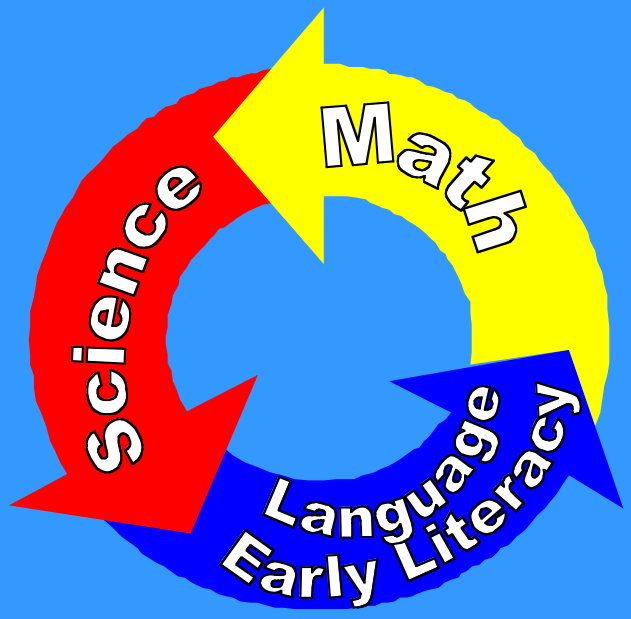


and outdoors

Make Connections Across Content Areas



- Using math and science together
- Fostering language and literacy skills



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Connect Math and Science Together

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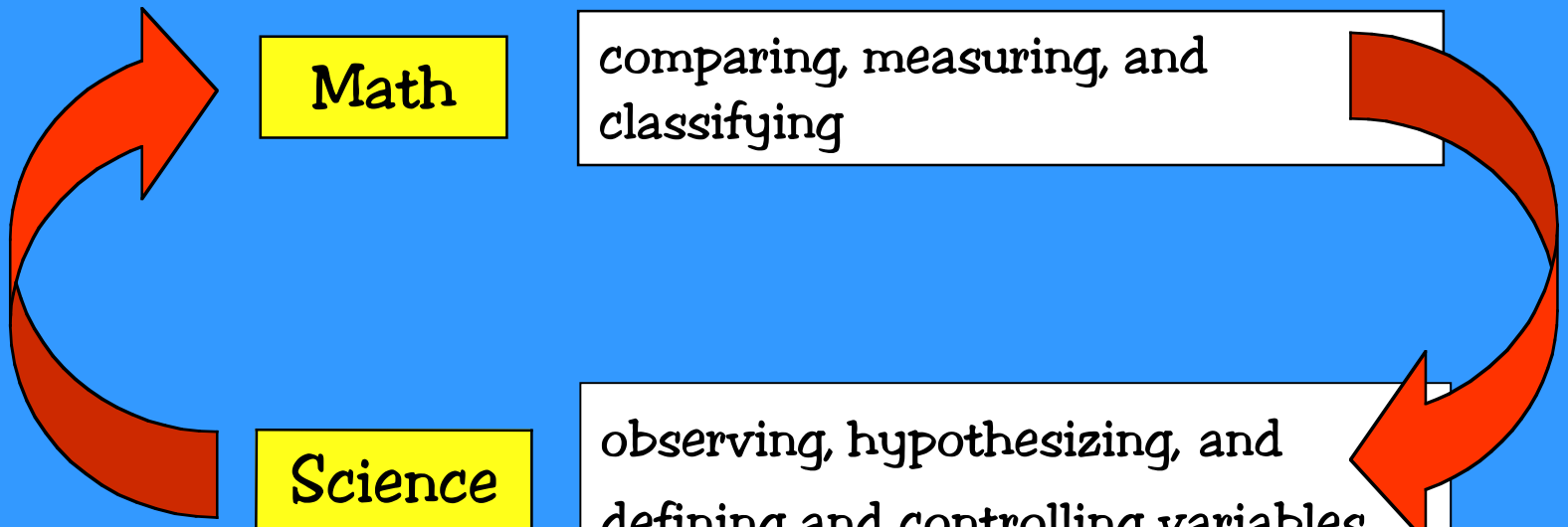
Coordinating mathematics and science instruction reinforces connections between the two content areas.



Connect the Content Areas

Math, Science, Language, and Literacy

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- Read aloud narrative and expository books
- Select books that reflect current themes or topics of content-area study
- Use repeated readings of the same book
- Prioritize specific math and science concepts
- Extend children's learning by integrating questions and conversations

Connect the Content Areas

Math, Science, Language, and Literacy

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Lively discussions and conversations:

- enhance children's understanding of math and science
- encourage children to use "contextualized language" as they talk about what is happening during hands-on math and science experiences

Be sure to scaffold the discussion so English language learners can participate.

Connect the Content Areas

Math, Science, Language, and Literacy

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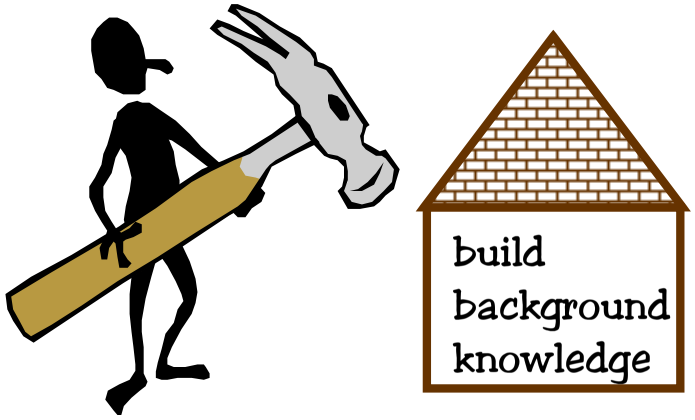
To scaffold children's language and learning during conversations and discussions:

- Activate and build background or prior knowledge of content and topics.

- Ask open-ended questions.



To scaffold children's language and learning during conversations and discussions:

- Use prompts to help children explain their answers and ask their questions.
- Restate and expand children's ideas using new vocabulary and syntax.
- Request clarification.
- Encourage children to talk with each other and ask each other questions.

Graphic Organizers:

- integrate experiences in language, literacy, math, and science
- help children remember what they have learned
- link science processes with math skills
- promote language and literacy

Connect the Content Areas

Math, Science, Language, and Literacy

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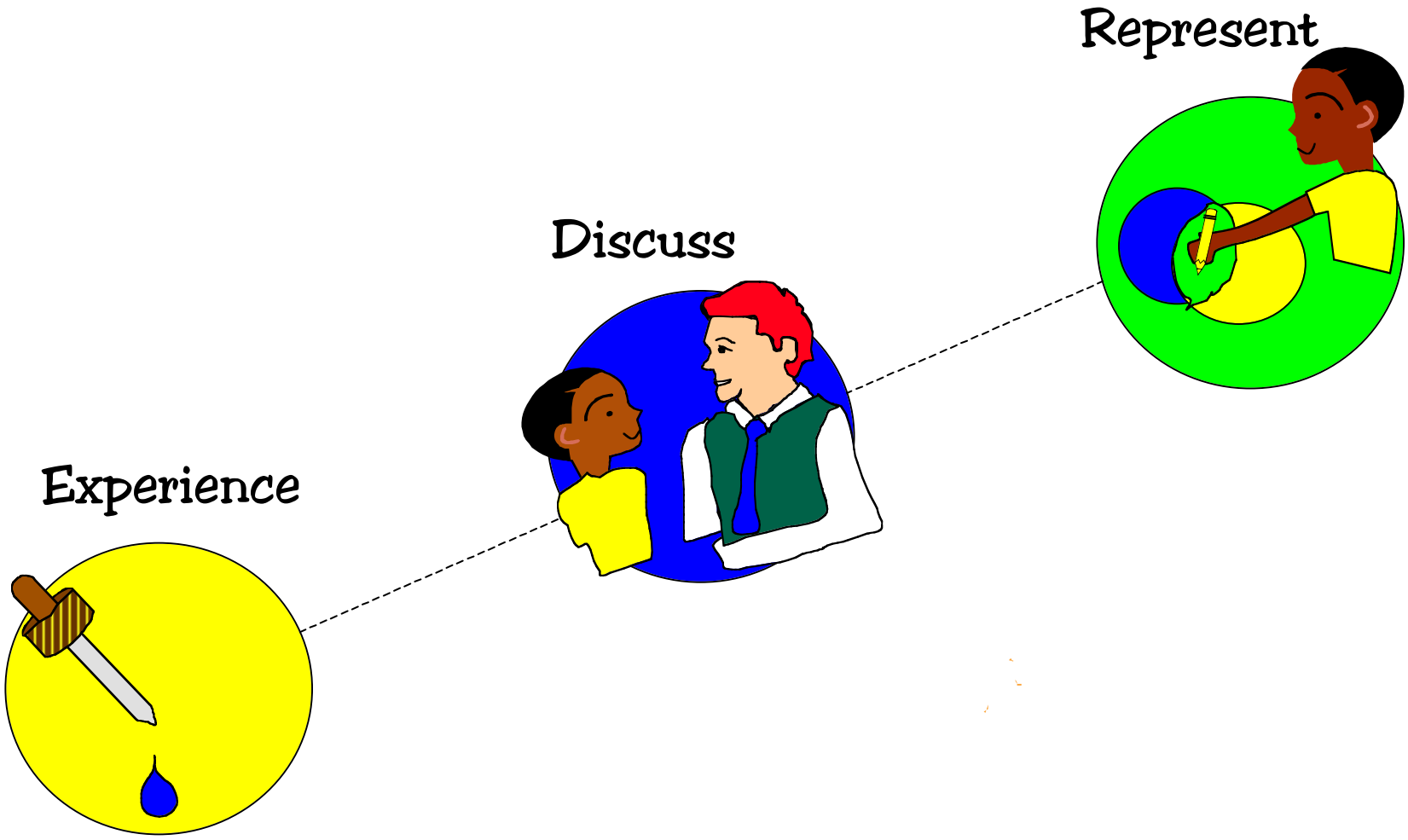

Connect the Content Areas

Math, Science, Language, and Literacy

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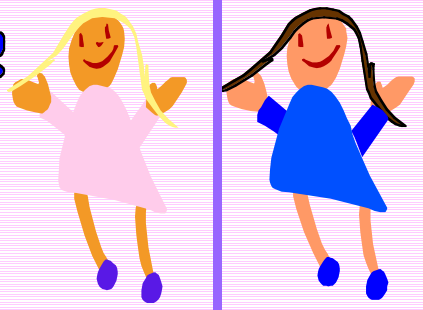
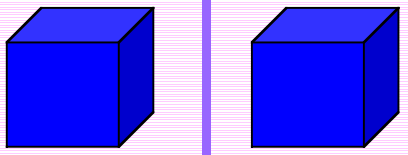
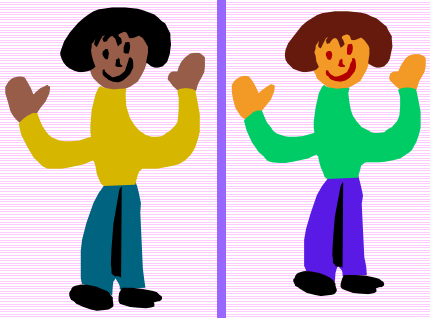
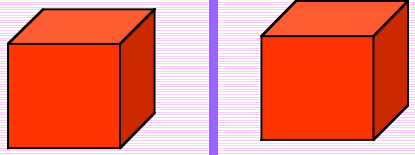
Concrete	Abstract
Girls 	Girls 
Boys 	Boys 

Connect the Content Areas

Math, Science, Language, and Literacy

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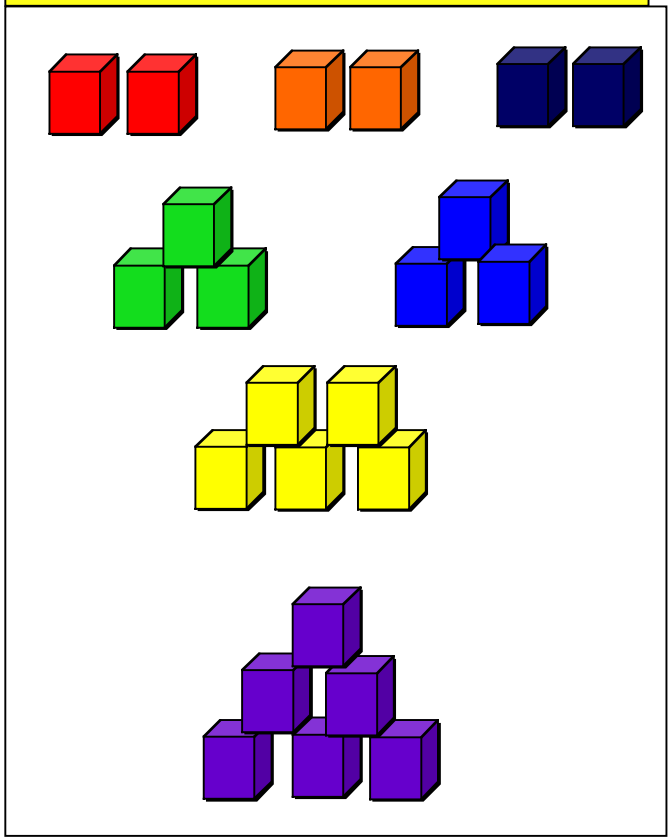
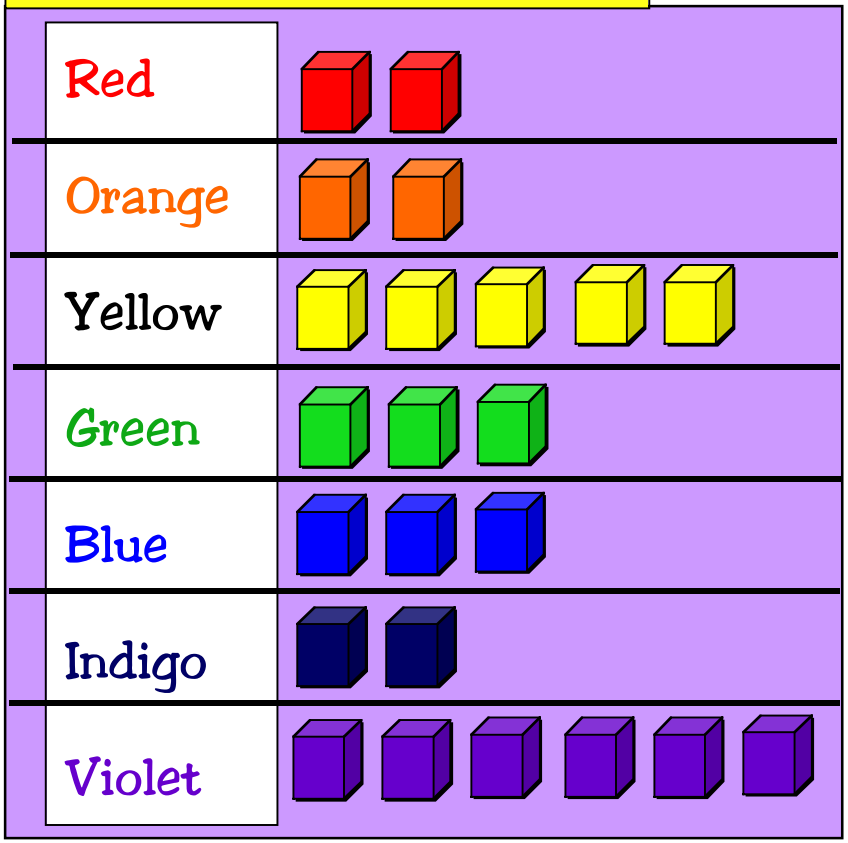
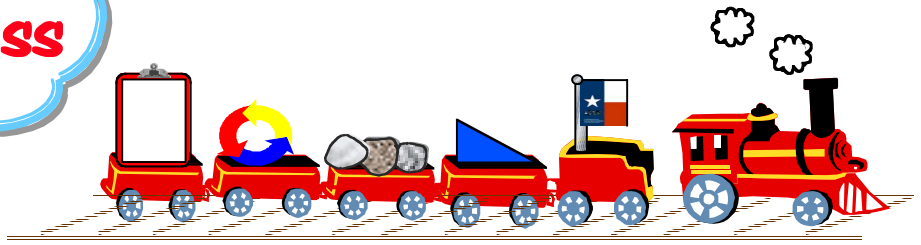
Object Sort–Grouping



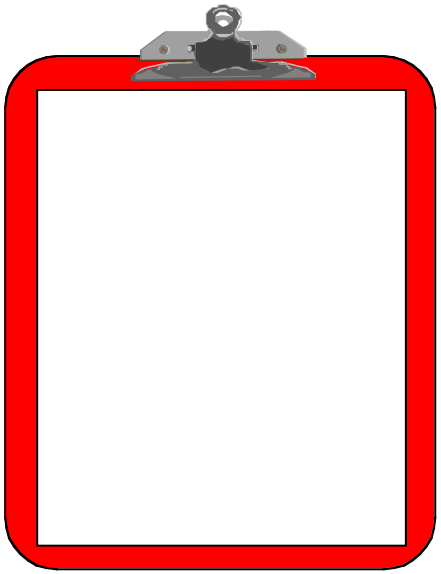
Object Sort–Graphing



Monitor Children's Progress



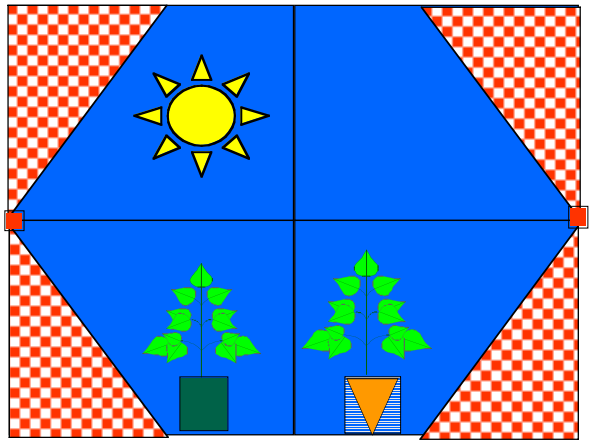
Effective progress monitoring includes:

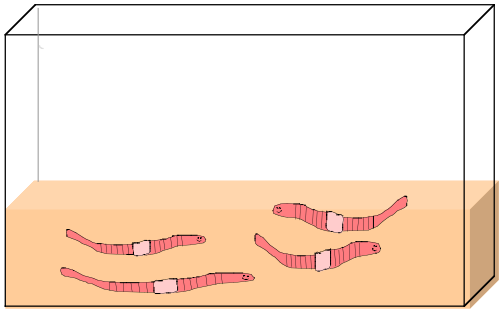


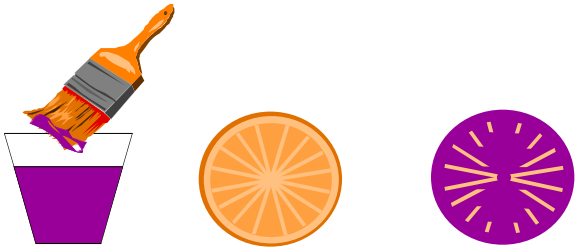
- observing, listening, and talking with children
- recording and reflecting on your observations
- adjusting instruction

Preparing for the Day

Texas Center for Reading and Language Arts







Morning Routine and Greeting Circle

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Sign In

- Greeting Circle
- Center Time
- Story Time
- Small Groups
- Outdoor Learning
- Goodbye Circle

Center Time

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Menu at the Happy Café

$1 Pie

$2 Hot dog

$3 Hamburger

Here's our menu. What would you like today?

Center Time

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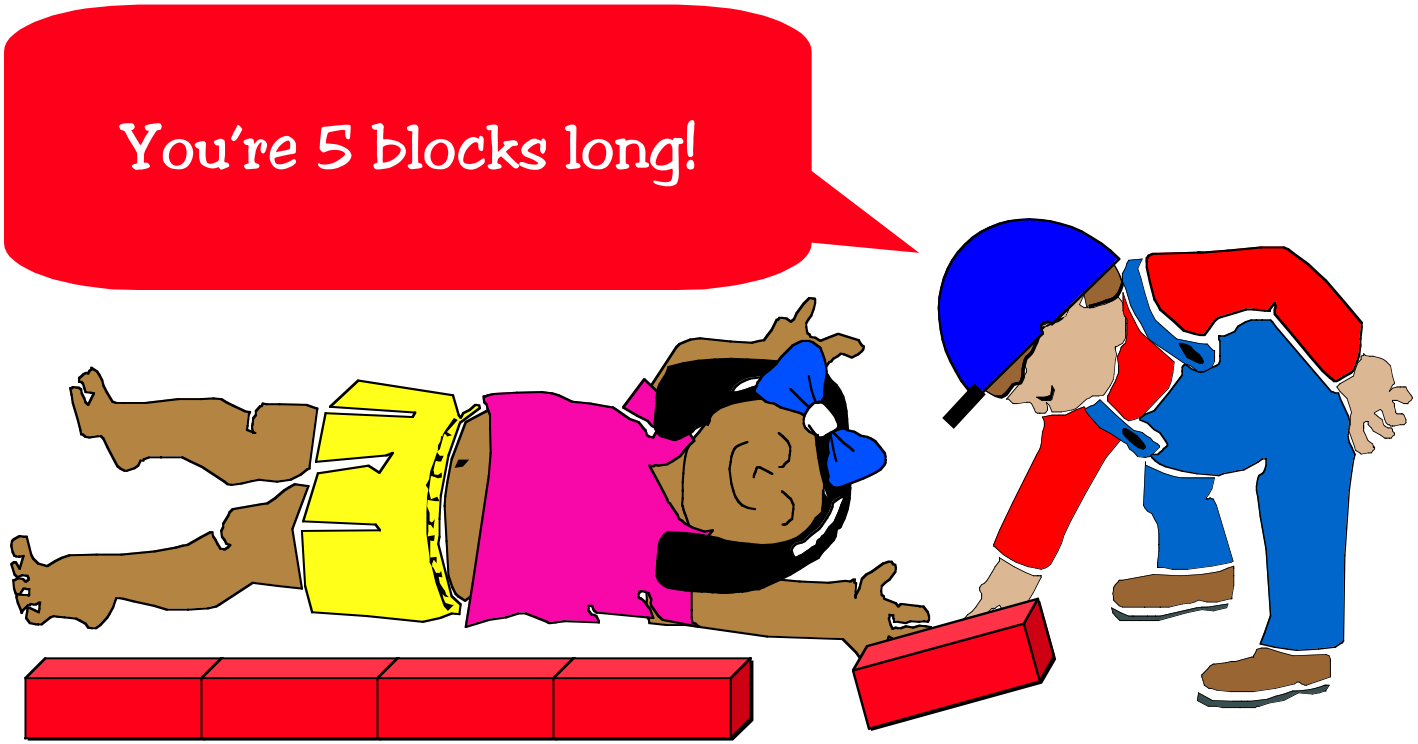

Monitoring Children's Progress

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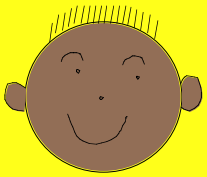
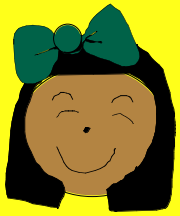
Home Center

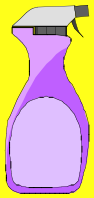
Technology Center

Art Center



Science Center





Storytime and Small Groups

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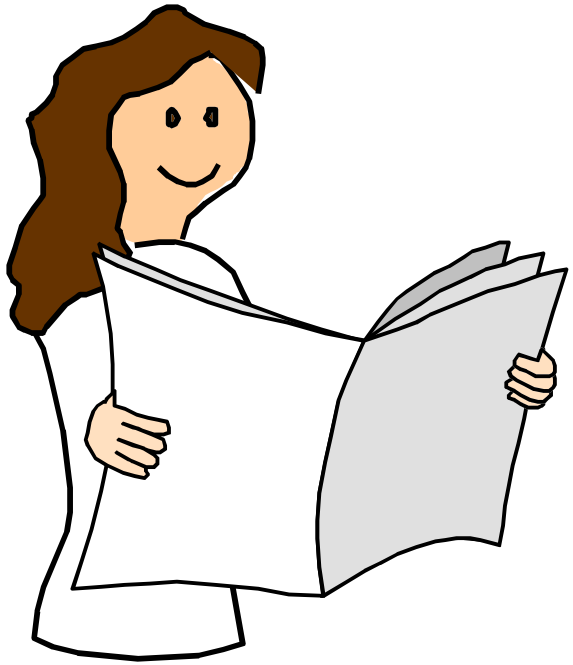
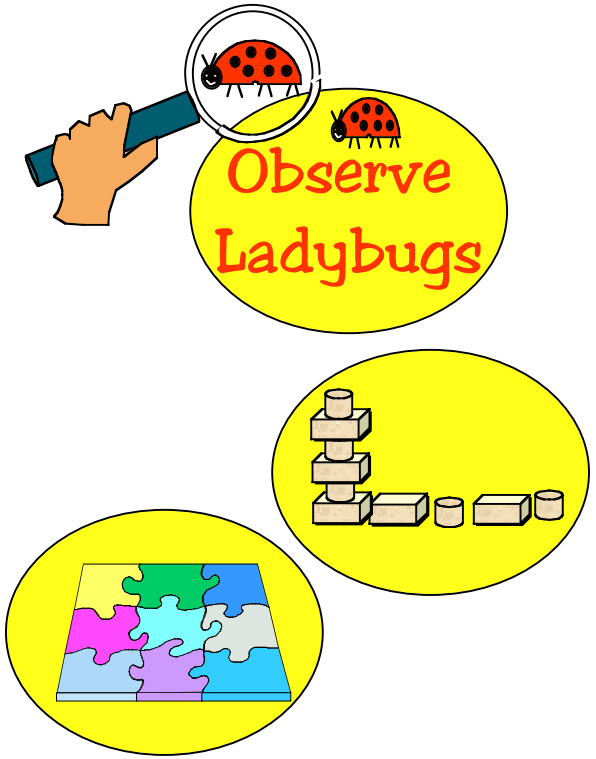
Storytime



Small Groups



Outdoor Learning

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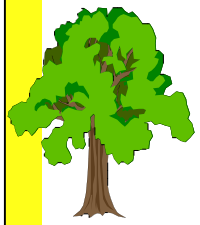
Before

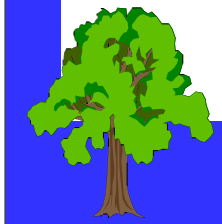


Do you want to go on a nature walk?

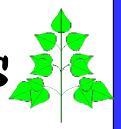
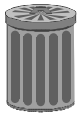
Make a check mark.✓

No	Yes
	✓
	✓
	✓
	✓
	✓
	✓

After



What we found on our nature walk

- plants 
- seeds 
- rocks 
- insects 
- sticks 
- trash 

Features Checklist

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Activity Settings

Guidelines Addressed in the Activity

Guideline Abbreviations

Features of Effective Math and Science Instruction

Prekindergarten Curriculum Guidelines		1. Build on the Pre-K Guidelines	2. Scaffold children's learning	3. Actively engage children	4. Make connections across content areas	5. Monitor progress
	Activity Settings					
L/EL-10 L/EL-9 M-2	**During the morning routine, the child:** •Attempts to write name •Selects a book of personal interest •Recognizes and reproduces simple patterns					

Language and Early Literacy (L/EL)
Mathematics (M)
Science (S)
Social Studies (SS)
Fine Arts (FA)
Health and Safety (H/S)
Personal/Social Development (P/SD)
Physical Development (PD)
Technology Applications (TA)

Features of Effective Instruction

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Putting it All Together

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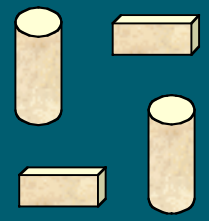
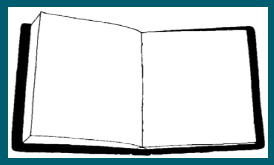
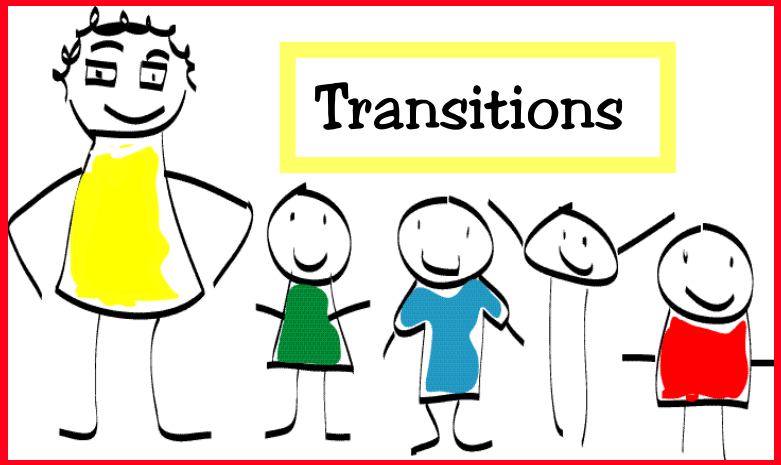
Learning Centers





Transitions



Graphic Organizers

Discussion

Summary

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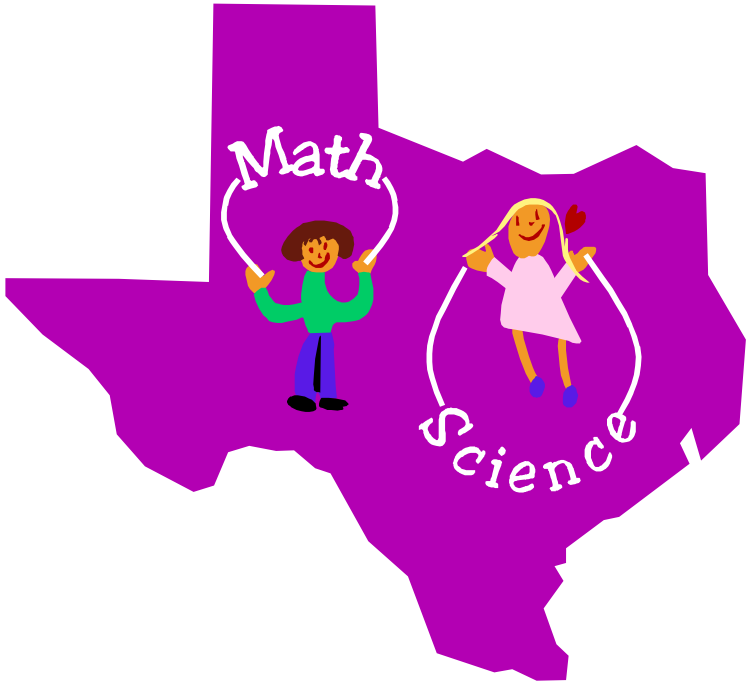


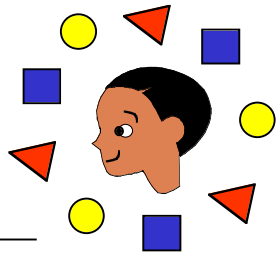
"Quality programs that provide challenging but achievable curriculum engage children in thinking, reasoning, and communicating with others."

Prekindergarten Curriculum Guidelines, p. 1

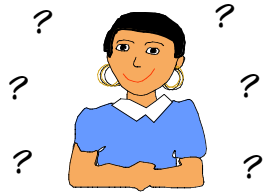
Self Assessment

Handout #1

1. What are some of the ways that you help children develop math and science concepts?



2. What questions do you have about teaching math and science?



Jigsaw Activity: Mathematics and Science Guidelines Handout #2

As you review the guidelines, think about the following questions:

- What is it?
- Why is it important?
- What are some examples of the accomplishments children will develop?

  (refer to bulleted items in guidelines)
- How can you summarize the topic?

Here is an example of a billboard from the Language and Early Literacy Guidelines for Phonological Awareness.

Phonological Awareness

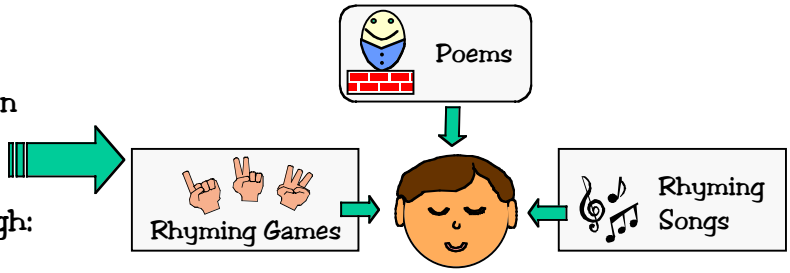
What is it? Phonological Awareness refers to children's understanding of the sounds of spoken language and how they can be segmented, combined, and manipulated.

Why is it important? Phonological awareness is linked to children's success as readers and writers and is a crucial step towards children's understanding of the alphabetic principle.

Examples:

The child: **·becomes sensitive to the sounds of spoken words;**
·participates in rhyming games, rhyming songs, and poems;
·begins to attend to the beginning sounds in familiar words.

Summary:
Preschool children begin to develop phonological awareness through:



Actively Engage Children in Math and Science Experiences

Handout #3
(1 of 2)

- Create a classroom environment where children encounter interesting mathematics and science wherever they turn.

- Provide opportunities for children to:
  - investigate and solve problems,
  - observe, count, measure, compare, and classify,
  - explore patterns, shapes, numbers, and space,
  - gather and organize information, and
  - communicate findings.

- Build and extend prior experiences and current interests of children.

- Make connections between prior learning and new learning. For example: "This is like the time when we made green eggs and ham. You wanted to add the eggs two at a time so you made sets that had two eggs each," or "Remember when everyone brought fruit for snack, and we put all the same kinds of fruit together? This time instead of fruit, let's put our shoes into groups."

- Make sure that materials used in explorations are interesting and easily accessible to the children in your class.

- Co-investigate with children until they are confident working on their own. Work alongside a child, sharing materials and providing support, such as adding language to the task by labeling, questioning, or commenting on a child's actions.

- Provide sufficient time for children to explore mathematical concepts.

- Present problems that challenge children.

- Provide hands-on activities that encourage children's active participation and involvement with their surroundings. As children explore, they are learning about new concepts and processes.

- Engage in spontaneous, as well as planned, activities. Help children see the relevance of science to their lives by having them investigate the world around them. Liking science can lead to positive attitudes about science in future grades.

- Explore a wide range of science concepts, such as body, food, water, clothing, shelter, weather, wind, sound, light, living and non-living things, and ecosystems.

Actively Engage Children in Math and Science Experiences

Handout # 3
(2 of 2)

- Early science experiences can develop concepts that will expand as children see patterns and consistency in the workings of nature.

- Ask open-ended questions. Ask children about their opinions, feelings, experiences, and responses. Challenge children to think. Use open-ended questions to prompt children to think aloud and use more elaborate language (What are you doing right now?), make predictions (What are you going to do next?), reflect on their actions (How did you know to do that?), and justify the choices they make (What made you decide to do it that way?).

- Provide opportunities at the end of activities for children to share their methods and findings with the class.

- Expect children to explain their thinking and give them many opportunities to talk and listen to their peers.

- Recognize that learning to analyze and reflect on what is said by others is essential to develop an understanding of both content and process.

- When it is difficult for young children to follow the reasoning of a classmate, scaffold their understanding by rephrasing with words that are easier to understand.

- Model the language of mathematics in the context of everyday conversations. "The side of the scale that goes up weighs less than the side that goes down."

- Provide different grouping arrangements for children as they explore and investigate. Sometimes children need to work independently, and other times they need to work in small groups to solve problems. Whole class discussions are appropriate settings for children to review and explain their experiences to others.

- Provide time for children to observe the results of their actions. Observation takes time and involves more than simply looking; it requires thinking, talking, explaining, and wondering.

Adapted from: Holt, B. (1993). *Science with young children* (Rev. ed.). Washington, DC: National Association for the Education of Young Children; Kilmer, S. J., & Hofman, H. (1995). Transforming science curriculum. In S. Bredekamp & T. Rosegrant (Eds.), *Reaching potentials: Transforming early childhood curriculum and assessment: Vol. 2* (pp. 43-63). Washington, DC: National Association for the Education of Young Children; Lind, K. K. (1999). Science in early childhood: Developing and acquiring fundamental concepts and skills. In American Association for the Advancement of Science, *Dialogue on early childhood science, mathematics, and technology education* (pp. 73-83). Washington, DC: Author; National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: Author; National Committee on Science Education Standards and Assessment. (1996). *National Science Education Standards.* Washington,DC: National Academy Press; Richardson, K., & Salkeld, L. (1995). Transforming mathematics curriculum. In S. Bredekamp & T. Rosegrant (Eds.), *Reading potentials: Transforming early childhood curriculum and assessment: Vol. 2* (pp. 23-42). Washington, DC: National Association for the Education of Young Children.

Correlating Learning Centers to the Prekindergarten Curriculum Guidelines

Handout # 4 (1 of 3)

Learning Center Opportunities	***Prekindergarten Curriculum Guidelines Addressed***
Art Provide opportunities for children to: • experiment with paint, crayons, clay, scissors, paper, and paste • express feelings and ideas • observe, create, and complete a project • learn and practice problem-solving skills • improve fine motor skills	· Fine Arts (Art) · Physical Development · Language and Early Literacy
Blocks (small unit and large floor) Provide children opportunities to develop: • social skills • problem-solving skills • fine and gross motor skills • planning skills • creative and imaginative play • classification and use of various sizes and shapes	· Personal and Social Development · Mathematics · Physical Development · Language and Early Literacy · Health and Safety
Dramatic Play/Home Living Provide children opportunities to develop: • role-playing activities • creative dramatic skills • social interaction • fine motor skills • language	· Language and Early Literacy · Fine Arts (Theatre) · Personal and Social Development · Physical Development · Social Studies
Library/Listening Provide opportunities for children to develop listening and visual skills by: • seeing words on the page • becoming familiar with letter forms • interpreting signs and symbols • enjoying books with narration and background music	· Language and Early Literacy · Fine Arts (Music) · Health and Safety

Correlating Learning Centers to the Prekindergarten Curriculum Guidelines

Handout #4 (2 of 3)

Learning Center Opportunities	***Prekindergarten Curriculum Guidelines Addressed***
Manipulatives Provide opportunities to develop fine motor skills through activities which encourage: • grasping, releasing, inserting, assembling, or disassembling • problem solving and working together • eye-hand coordination • development of concepts and generalizations	· Physical Development · Personal and Social Development · Language and Early Literacy
Mathematics Provide practice using mathematical concepts through the use of manipulative materials by: • categorizing • sequencing • observing, creating, and completing patterns • measuring • counting • practicing problem-solving skills	· Mathematics · Personal and Social Development · Physical Development · Language and Early Literacy · Science
Music Provide opportunities to: • use the body for self expression • learn to listen carefully • add new words to vocabulary • learn to respect and care for instruments • learn to communicate feelings	· Fine Arts (Music and Theatre) · Personal and Social Development · Language and Early Literacy · Physical Development

Correlating Learning Centers to the Prekindergarten Curriculum Guidelines

Handout # 4 (3 of 3)

Learning Center Opportunities	***Prekindergarten Curriculum Guidelines Addressed***
Science Provide opportunities for students to learn by encouraging: • problem solving and working together • directed inquiry activities using manipulative materials • development of concepts and generalizations • working with plants, animals, and insects • making collections • categorizing and grouping materials • performing simple experiments	· Personal and Social Development · Language and Early Literacy · Social Studies · Health and Safety · Science · Mathematics
Water/Sand Play Provide opportunities to: • measure and compare • perform simple experiments • play creatively • solve problems • develop fine motor skills	· Mathematics · Science · Personal and Social Development · Language and Early Literacy · Physical Development

Block Activities to Develop Math and Science Skills

Handout #5

Sorting and classifying	• Ask children to pick up all of one shape from the floor. • Provide a separate storage bin for each block shape.
Problem-solving/sequencing	• Create a simple block construction using various shapes. Ask children how they could create a structure like it. ("How many square blocks would you need?" or "What blocks would go on the bottom level?")
Knowledge of: • Equivalencies • Part/whole relationships • Shapes and patterns • Measurement • Number	• Show children that blocks can be put together to make other shapes. For example, four triangles can make a large square. • Take photographs of various block patterns and have children try to copy the patterns using blocks. • After building a structure with blocks, have children measure its height using number of blocks or measuring tape. • Give children task cards specifying a certain shape and number of blocks to use when putting blocks away. ("Put away three triangle blocks") • Give children several blocks and ask them to make a tower using a specific number of blocks.
Making comparisons or predictions	• Give two children two sets of identical blocks. Allow them to build structures with the blocks in different corners of the room, and then have them compare how their structures are different.
Using science vocabulary	• Encourage children to discuss the placement of blocks to help them develop comparative vocabulary, such as on top, between, on the bottom.
Observing and describing	• Have children observe a classmate's block construction and then describe to others what it looks like.
Experimenting with cause and effect	• Make a ramp with blocks, and have children roll a variety of objects down the ramp. Ask questions that encourage children to compare the objects. Discuss their similarities or differences. Make predictions about how a new object will roll down the ramp.
Experimenting with gravity and balance	• Encourage children to build towers as tall as possible. Discuss why their towers eventually get too tall to stand.

Adapted from Church, E. B., & Miller, K. (1990). *Learning through play: Blocks, a practical guide for teaching young children.* New York: Scholastic.

Teaching through Daily Routines: Counting

Handout # 6
(1 of 2)

This handout demonstrates how to teach counting in daily routines. Many other concepts included in the Prekindergarten Curriculum Guidelines can be similarly addressed throughout the day.

Daily Routine	Activities	• What Children Learn
Taking Attendance	As children arrive, they move their name and photograph on a chart display.	• One-to-one correspondence • Counting sets
Morning Circle	Count the number of days until a special event, such as a birthday or a field trip. As the special event gets closer, have children compare the number of days left to the number of days when they first started counting.	• Counting • Comparison of size
Management of Centers	Use a sign at each center to show how many children can be there at one time.	• One-to-one correspondence • Comparison of set size
Playing Inside	Count the number of blocks in a tower: "We're building a tower, we're building it tall, how many stack before it falls?"	• Counting • Stability of structure • Gravity and balance • Experimentation
Playing Outside	Have children count how many leaves they can hold in one hand.	• Comparing quantity • Use of quantifiers: "more," "fewer," "some"
Cleaning Up	Have children put away blocks according to their shape. ("I'll pick all the triangle shapes.")	• Sorting and making sets
Movement Activities	Musical Chairs; Duck, Duck, Goose; Johnny Works with One Hammer; One Potato, Two Potato; 1-2, Buckle My Shoe	• Counting • One-to-one correspondence • Comparison of set size

Teaching through Daily Routines: Counting

Handout # 6 (2 of 2)

Daily Routine	Activities	What Children Learn
Lining Up	• Make two lines, one with boys and the other with girls. Ask children, "Which line is longer? Which line is shorter? Why?"	• Comparing quantity • Use of quantifiers such as "longer" or "shorter"
Cooking Activities	• Count the number of teaspoons or cups in each step of a recipe. • Count the number of ingredients in a recipe. • Count the number of cookies on a cookie sheet or holes in a muffin tin. • Count how many spoonfuls it takes to fill a cup.	• Counting • Equivalencies
Music Activities	• Have children act out songs that count down from 5 to 1, such as "5 little ducks went swimming one day..." • Have children play counting games counting their own fingers ("1-2-3-4-5, I caught a fish alive, 6-7-8-9-10, I let him go again...")	• Counting • Large and small muscle control • Eye-hand coordination
Classification Activities	• Provide multiple activities to sort the children into groups, then count and compare group sizes.	• Sorting • Comparison of set size
Going Home	• Have children form a line for children who ride the bus home and a line for children who will be picked up by a parent, then compare the length of the lines.	• One-to-one correspondence • Sorting

Adapted from: Schwartz, S. L. (1995). En-chanting, fascinating, useful number. *Teaching children mathematics, 1*(8), 486-491; Watson, L. R., Layton, T. L., Pierce, P. L., & Abraham, L. M. (1994). Enhancing emerging literacy in a language preschool. *Language, speech, and hearing services in schools, 25*, 136-145.

Reading Books Two Ways

Handout #7

We want children to see math and science in use together, so they'll begin to develop an understanding of how the subjects reinforce each other.

Fundamental mathematics concepts—comparing, classifying, and measuring—can be applied to science problems. Science processes—observing, communicating, hypothesizing—are equally important for solving problems in math and science.

Select one of the books at your table.

What concepts or skills would you highlight if you were reading this book to emphasize science?

What concepts or skills would you highlight if you were reading this book to emphasize math?

How would you show children the link between math and science in this book?

Adapted from: Lind, K. K. (1999). Science in early childhood: Developing and acquiring fundamental concepts and skills. In American Association for the Advancement of Science, *Dialogue on early childhood science, mathematics, and technology education* (pp. 73-83). Washington, DC: Author; National Committee on Science Education Standards and Assessment. (1996). *National Science Education Standards*. Washington, DC: National Academy Press.

What Teachers Do	How To Do This
When possible, use children's home language to develop new concepts and skills.	Draw on all bilingual resources available. Involve bilingual teachers, paraprofessionals, parents, and other volunteers as needed.
Respect the non-verbal period of second language learning.	Encourage children to actively participate in a variety of ways. Allow children to observe without attempting communication in their new language. Ask children to "show me" rather than "tell me."
Show as you tell.	Use real life objects to demonstrate math and science concepts. Model new skills and concepts. Think out loud.
Scaffold learning through guided practice.	Model the use of extended language and rich vocabulary. For example, during "show and tell," describe your own "show and tell" object before children describe theirs. Ask questions and use prompts to help children reconstruct story events. Take what children say and rephrase it in a new way, adding more complex grammar or vocabulary. For example, if a child tells you, "Look, I made a teddy bear," you can respond by saying, "Yes, I see you made a bear with a big blue bow."

What Teachers Do	How To Do This
Teach key vocabulary.	Teach vocabulary in context. Use stories, pictures, charts, and graphs to teach vocabulary terms such as "observe" or "record." Emphasize the key vocabulary word. One way to do this is to put the key vocabulary word at the end of the sentence.
Integrate learning around meaningful themes or projects.	Select a broad theme in math or science, identify the specific guidelines to address, and plan appropriate activities together with children that integrate different areas of the Prekindergarten Curriculum Guidelines. For example, introduce the theme of "water" using a storybook or information book. Then, identify related songs, poems, chart stories, cassettes, or videos.
Encourage English language learners to teach words from their native language to their classmates—this will increase their confidence.	Ask English language learners to teach the class how to say new vocabulary words in their native language. For example, when learning about weather, they could teach the class how to say "rain" in their native language. The English language learner leads the class in naming common objects in the classroom, counting to 10, reciting the alphabet, nursery rhymes and songs. Encourage parent participation.

Adapted from: Padrón, Y. N. (1999). Improving opportunities and access to mathematics learning in the early years. In J. V. Copley (Ed.), *Mathematics in the early years* (pp. 191-197). Reston, VA: National Council of Teachers of Mathematics; Weaver, L. R., & Gaines, C. (1999). What to do when they don't speak English: Teaching mathematics to English-language learners in the early childhood classroom. In J. V. Copley (Ed.), *Mathematics in the early years* (pp. 198-204). Reston, VA: National Council of Teachers of Mathematics; Westby, C., Dezale, J., Fradd, S. H., & Lee, O. (1999). Teachers' roles in promoting science inquiry with students from diverse language backgrounds. *Educational Researcher, 28*(6), 614-620.

Scaffolding During Conversations and Discussions — Handout #9 (1 of 2)

To scaffold children's language and learning during conversations and discussions:

•Activate and build background or prior knowledge of content and topics.

Tailor discussions and conversations around the experiences of the children in the group.

Use objects, materials, and phenomena familiar to them or ones that can be easily linked to something they already know in their homes, neighborhoods, and classrooms.

Create an atmosphere that supports the idea that each child brings a different but equally important perspective.

•Ask open-ended questions such as those that begin with "why" or "how" to encourage children to put into words what they are thinking, doing, or observing.

Stimulate children's thinking and hypothesizing: "How do you know that?" or "Can you show us how you learned that so we can think about it too?" These questions do not require a "right" or "wrong" answer.

Help children draw conclusions based on what they have seen and done. Accept a wide range of answers.

•Use prompts to help children explain their answers and ask their questions.

Encourage children to provide reasons for their ideas and actions.

Help children become aware of patterns in what they observe as they support their conclusions.

Help them summarize their thinking and present their ideas in a logical sequence.

Give sufficient wait time before rephrasing a question or requesting help from another child.

Scaffolding During Conversations and Discussions — Handout #9 (2 of 2)

- **Restate and expand children's ideas using new vocabulary and syntax.**

  Model the use of extended language and rich vocabulary to help children develop content area vocabulary, as well as ways to communicate with others.

  Rephrase what a child has said, adding more complex grammar or vocabulary: "You said the water went into the clouds when you left it outside. In other words, the water evaporated."

- **Request clarification.**

  When you are not sure you understand what a child means, ask for a more complete explanation.

  Extend their language by asking them to expand initial statements: "Tell me more about..." or "What do you mean by..."

- **Encourage children to talk with each other and ask each other questions.**

  Children play an important role in supporting each others' language development. Create opportunities for peer-to-peer conversations to occur throughout the day, such as during dramatic play and center time.

Adapted from: Dickinson, D. K. (2001). Book reading in preschool classrooms: Is recommended practice common? In D. K. Dickinson & P. O. Tabors (Eds.), *Beginning literacy with language* (pp. 175-204). Baltimore: Paul H. Brookes; Holt, B. (1993). *Science with young children (Rev. ed.).* Washington, DC: National Association for the Education of Young Children; Kilmer, S. J., & Hofman, H. (1995). Transforming science curriculum. In S. Bredekamp & T. Rosegrant (Eds.), *Reaching potentials: Transforming early childhood curriculum and assessment: Vol. 2* (pp. 43-63). Washington, DC: National Association for the Education of Young Children; Lind, K. K. (1999). Science in early childhood: Developing and acquiring fundamental concepts and skills. In American Association for the Advancement of Science, *Dialogue on early childhood science, mathematics, and technology education* (pp. 73-83). Washington, DC: Author.; Texas Center for Reading and Language Arts. (1999). *Kindergarten teacher reading academy.* Austin, TX: Author; Weaver, L. R., & Gaines, C. (1999). What to do when they don't speak English: Teaching mathematics to English-language learners in the early childhood classroom. In J. V. Copley (Ed.), *Mathematics in the early years* (pp. 198-204). Reston, VA: National Council of Teachers of Mathematics; Westby, C., Dezale, J., Fradd, S. H., & Lee, O. (1999). Teachers' roles in promoting science inquiry with students from diverse language backgrounds. *Educational Researcher, 28*(6), 614-620.

Questions to Stimulate Thinking and Encourage Discussions

Handout #10

Observation questions:

Have you seen _____?
How does it look? Feel? Smell? Sound?

Classifying questions:

Which ones go together?

Comparing questions:

How are these the same?
Different?
Which things go together?

Relating questions:

What can you do to make it happen?
What happens when you _____?
When does it happen?

Quantifying questions:

How many?
How long?
How much?

Inferring questions:

What else can you think of that does this?
Why do you think that happens?

Organizing questions:

How can you put these in groups?

Applying questions:

How can you use what you learned?
How can it help people?

Communicating (representing) questions:

How can you show others what you learned?
What other ideas do you have?

Adapted from Kilmer, S. J., & Hofman, H. (1995). Transforming science curriculum. In S. Bredekamp & T. Rosegrant (Eds.), *Reaching potentials: Transforming early childhood curriculum and assessment: Vol. 2.* (pp. 43-63). Washington, DC: National Association for the Education of Young Children.

Demonstration Script: Mixing Colors

Handout #11

A preschool teacher models and explains a science experiment on mixing colors before children experiment on their own.

We are going to experiment with colors, to see what happens when two different colors mix together. For this experiment, we need water, food coloring, and an eyedropper. I've already added the food coloring to the water.

First I will squeeze a few drops of blue water using an eye dropper.

Next I will squeeze a few drops of yellow water next to the drops of blue water.

I wonder how I could make these two colors mix together? *(Possible suggestions might be to stir them up or mix with a spoon.)*

You came up with some very good suggestions, but I forgot to mention that I want to make these two colors mix together without using my hands. What can I do to make it happen? *(Possible suggestions are to jump up and down to shake the floor or blow on it to make the water droplets move.)*

I think I'll try blowing on the drop of blue water. I have a straw to help me blow. *(Blow very lightly so one drop gets close to the other.)*

What do you think will happen when the blue and yellow drops mix together? *(They'll make green!)*

Let's see if you're right. *(Blow until two drops join together.)*

Yes, you are exactly right. The blue drop of water and the yellow drop of water mixed together to make a new color, green.

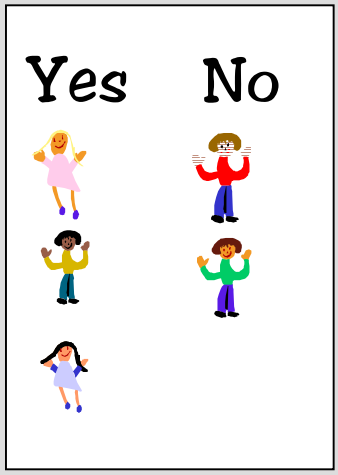
The food colors mix together and spread all around. We call that diffusion. Now it's your turn to experiment.

(This concludes the demonstration.)

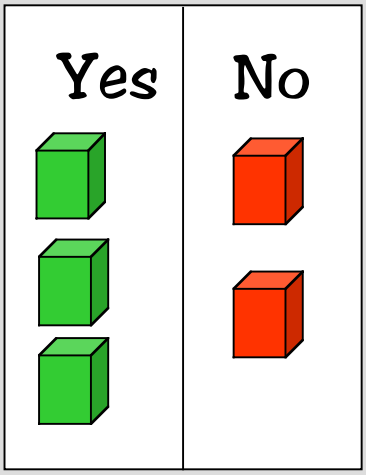
Adapted from: National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: Author; Copley, J. V. (Ed.). (2000). *The young child and mathematics*. Washington, DC: National Association for the Education of Young Children.

Graphic Organizers and Data Collection

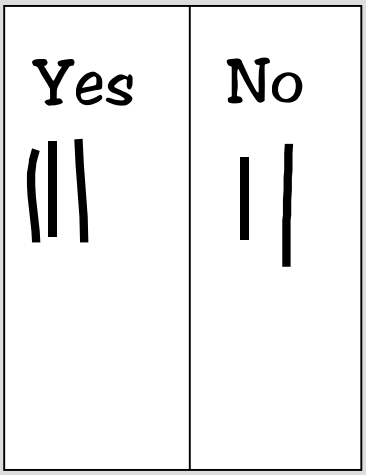
Handout #12



People-Sort Chart



Block Chart



Tally Chart

- Begin with real objects and move to abstract representations.
- Data collection begins with children manipulating real objects and then using abstract representations in chart forms.
- Data analysis is a way to help children answer their own questions.
- Yes/no questions such as, "Do you have a pet?"can be answered by sorting children into groups. As children become familiar with the process, move to using graphic organizers to represent the data, such as the chart examples above.
    - Begin with a people-sort chart.
    - Place photographs of children in the "yes" or "no" column depending on how they answer the question "Do you have a pet?"
    - Next, provide children with two blocks, one green and one red. Teach them that green represents "yes" and red represents "no." Children place a colored block on a chart to represent their answer. Blocks can be stacked, lined up, or counted.
    - To move to a more abstract representation of counting, yes/no questions can be answered by children recording their answers using tally marks or check marks.
- Involve children in the development and completion of charts.

Adapted from Copley, J. V. (Ed.). (2000). *The young child and mathematics*. Washington, DC: National Association for the Education of Young Children.

Features of Effective Math and Science Instruction — Handout #13 (1 of 3)

Build Instruction on the Prekindergarten Curriculum Guidelines

- Use children's current strengths and skills to develop lessons that help them reach the goals outlined in the Prekindergarten Curriculum Guidelines. The guidelines describe a comprehensive and integrated curriculum between math, science, language, early literacy, and other areas.

- Activities that promote one area of development often reinforce skills and concepts in other areas. For example, a lesson on using a prism can address the child accomplishment in Science Processes: "The child begins to perform simple investigations." When children are encouraged to explain what and why they think a science process happened, language development is also fostered.

Scaffold Children's Learning

- Scaffolding instruction means adjusting and extending instruction so children are challenged and able to develop new skills.

- Use scaffolding as an instructional tool with all children as they are learning new skills. Adjust the level of support as children achieve mastery.

- Build on children's prior experiences or background knowledge to help children link new knowledge to what they already know.

- Provide guidance and support while children are learning new concepts and skills. Model and explain procedures. For example, give a simple demonstration and explanation of how a prism works as children begin to experiment with refraction: "Look at how the light bends as it passes through a prism. I will move the prism around until I find the right angle for the light to pass through. Then we can see all the colors in the rainbow."

- Encourage further exploration by asking open-ended questions, such as:

    - What happens when you use the prism in bright sunlight?
    - What happens when you use it in the shade?
    - Why do you think that?

Features of Effective Math and Science Instruction — Handout #13 (2 of 3)

Actively Engage Children in Math and Science Experiences

- Provide math and science experiences that challenge thinking and encourage exploration and investigation. Encourage children to observe, think, talk, explain, and wonder.
- Point out examples of math and science in everyday activities to help children understand how they are used in their lives.
- Graphic organizers help children remember what they have learned. Scaffold learning by showing children ways to use graphic organizers to collect, represent, organize, and communicate ideas and information.
- Work with children in different settings, such as in learning centers, during transition times throughout the day, and outdoors. Use small groups to provide opportunities for all children to participate.

Make Connections Across Content Areas

- Provide opportunities for children to use math and science together to solve problems and to understand the world around them.
- Foster language and literacy skills within these experiences to help children communicate their observations, draw conclusions, and make generalizations.
- Teacher read alouds of narrative (or story) and expository (or information) books provide a way to link language and literacy to both math and science.
  - When selecting books for read alouds, reflect current themes or topics of content-area study.
  - Use repeated readings of the same book.
  - Prioritize specific math and science concepts to address during a reading session or activity. Reading the same book more than once helps introduce and cover a variety of math and science concepts or skills over time.
  - Extend children's learning by integrating questions and conversations.
- Discussions or dialogues, sometimes called "learning conversations," challenge students and promote inquiry.

Features of Effective Math and Science Instruction — Handout #13 (3 of 3)

- Incorporating discussions during hands-on math and science experiences encourages children to use "contextualized language" as they talk about what is happening. Questioning, making predictions, and testing possibilities are learned first-hand as they solve problems and draw conclusions.

- Using graphic organizers is another way that you can integrate experiences in language, literacy, math, and science.

- Gathering and organizing data links the science processes with math skills as young children strive to understand situations and solve problems.

- Children discuss their thinking, listen to what others have to say, and write down or represent their experiences with words, diagrams, pictures, or mathematical symbols.

Monitor Children's Progress to Inform and Guide Instruction

- Sound instructional decisions are based upon assessment. For three- and four-year-old children, assessment includes informal, systematic observation of children as they engage in appropriate activities.

- To effectively monitor children's progress, collect information on a regular basis to inform your instruction.

- Effective progress monitoring includes observing, listening, and talking with children, recording and reflecting on your observations, and adjusting instruction.

- Document children's progress in a variety of ways and contexts using different forms of assessments, such as checklists, anecdotal records, portfolios, and interviews.

Adapted from: Burns, M. S., Griffin, P., & Snow, C. E. (Eds.). (1999). *Starting out right: A guide to promoting children's reading success.* Washington, DC: National Academy Press; Copley, J. V. (Ed.). (2000). *The young child and mathematics*. Washington, DC: National Association for the Education of Young Children; Texas Center for Reading and Language Arts. (2000a). *First grade teacher reading academy*. Austin, TX: Author; Texas Center for Reading and Language Arts. (2000b). *Implementing the prekindergarten curriculum guidelines for language and early literacy. Part I: Language development.* Austin, TX: Author; Texas Center for Reading and Language Arts. (1999). *Kindergarten teacher reading academy.* Austin, TX: Author; Helm, J. H., Beneke, S., & Steinheimer, K. (1998). *Window on learning: Documenting young children's work.* New York: Teachers College Press; Helm, J. H., & Katz, L. G. (2001). *Young investigators: The project approach in the early years*. New York: Teachers College Press; National Committee on Science Education Standards and Assessment. (1996). *National Science Education Standards*. Washington, DC: National Academy Press; National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: Author; Westby, C., Dezale, J., Fradd, S. H., & Lee, O. (1999). Teachers' roles in promoting science inquiry with students from diverse language backgrounds. *Educational Researcher, 28*(6), 614-620.

		Features of Effective Math and Science Instruction				
Prekindergarten Curriculum Guidelines		1. Build on the guidelines	2. Scaffold children's learning	3. Actively engage children in math and science experiences	4. Make connections across content areas	5. Monitor children's progress
Activity Settings						
L/EL-10 L/EL-9 M-2	**During the Morning Routine, the child:** • attempts to write name • selects a book of personal interest • recognizes and reproduces simple patterns					
FA-2 L/EL-1 L/EL-4 M-4 M-5, S-1	**During Greeting Circle, the child:** • participates in classroom music activities and sings simple songs • listens to teacher and peers • asks questions and makes comments related to the topic of conversation • reviews the daily sequence of activities • uses simple data charts to record attendance					
P/SD-1, FA-3 M-1 P/SD-1 P/SD-2 S-1 M-4	**During Center Time, the child:** • expresses interest and self-direction in learning when choosing centers and materials • arranges sets of objects in one-to-one correspondence when playing restaurant • begins to be responsible for behavior and actions while playing in centers • responds to the suggestions of others during cooperative play • explores by manipulating materials with simple equipment (misting plant, for example) • begins to make size comparisons by measuring with blocks					

Prekindergarten Curriculum Guidelines Abbreviations

Language and Early Literacy (L/EL)
Mathematics (M)
Science (S)
Social Studies (SS)
Fine Arts (FA)
Health and Safety (H/S)
Personal /Social Development (P/SD)
Physical Development (PD)
Technology Applications (TA)

		Features of Effective Math and Science Instruction				
Prekindergarten Curriculum Guidelines		1. Build on the guidelines	2. Scaffold children's learning	3. Actively engage children in math and science experiences	4. Make connections across content areas	5. Monitor children's progress
	During Story Time, the child:					
L/EL-4	• begins to retell the sequence of a story					
L/EL-8	• enjoys listening to and discussing storybooks read aloud					
L/EL-9	• imitates the special language in storybooks and story dialogue, and uses it in retellings					
	During Small Group Time, the child:					
S-1	• gathers information about ladybugs using simple tools such as a magnifying lens					
S-1	• shows an interest in investigating ladybugs					
S-1	• explores by manipulating materials with simple equipment					
L/EL-1	• listens to and engages in conversations with others while working with the teacher and other classmates					
	During Outdoor Learning Time, the child:					
M-5	• participates in creating and using graphs					
L/EL-3	• refines and extends understanding of known words					
S-1	• sorts objects and organisms into groups and begins to describe how groups are organized					
S-2	• groups organisms and objects as living or nonliving					
M-5	• describes similarities and differences between objects					
M-1	• counts objects to five or higher					

Prekindergarten Curriculum Guidelines Abbreviations

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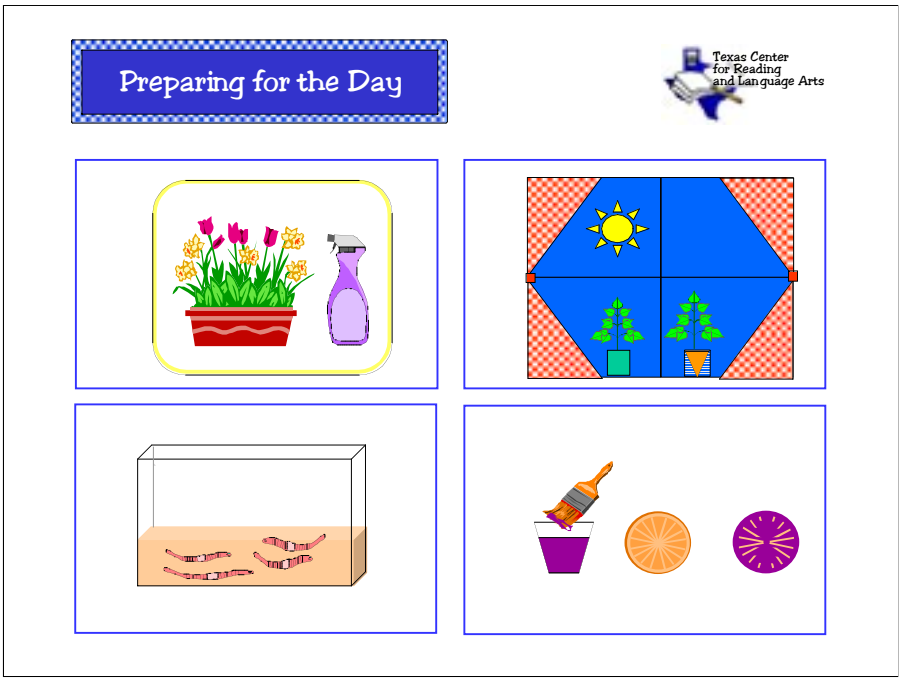
A Day in the Life of a Prekindergarten Teacher: Planning for Success

Handout #15 (1 of 7)

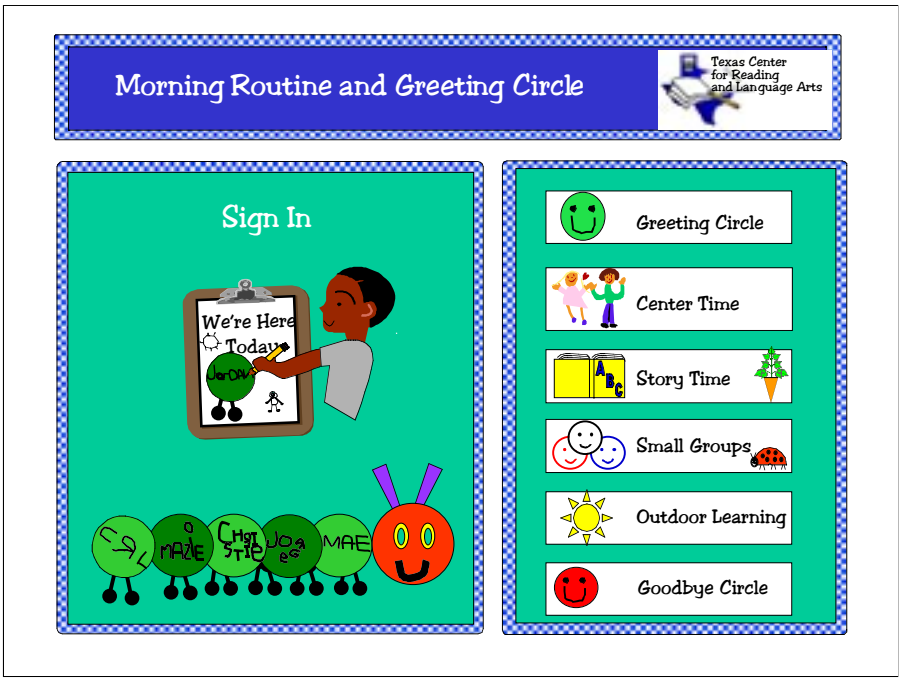


It's spring and Miss Patience, a prekindergarten teacher, is in her classroom preparing for the day ahead. As she considers her lesson plans, she looks around the room to make sure everything is ready. Small group supplies and materials are organized. The environment is ready for learning!

The class is engaged in a study of "Growing Things," and the theme is reflected throughout the classroom:

–flowers in a planter are ready for children to mist;
–beans and sweet potatoes have sprouted bright green leaves;
–earthworms are crawling in a terrarium habitat; and
–fruits and vegetables are ready for print-making in the Art Center.

Throughout the day, Miss Patience plans to monitor the progress of all her students. She uses a simple recording system: writing her notes on self-adhesive mailing labels attached to her observation clipboard. Miss Patience reflects on the four students she will closely observe during small groups and centers: Jorge, Christy, Mae, and Franklin.



As the children arrive at school, they quickly begin the morning routine. To check in, they write their names on either a light green or a dark green circle to form a friendly caterpillar. Their circles extend an A-B pattern.

Miss Patience says. "We have lots of new books in our classroom library. Look at the new set of books that are in the Math and Science baskets. Choose one while we're waiting for everyone to arrive."

Miss Patience helps Jessie select a book to read and assists Jeffrey as he writes his name.

In the greeting circle, the class sings songs and talks about their day. "Today," recites Cindy, the classroom helper for the day, "we're gonna do circle time and then we play in centers and then we're gonna work in groups and then we go outside and then it's time to say goodbye."

"You did a great job telling us about our day, Cindy," says Miss Patience, "and I'm wondering if you can add more information. Tell us more.What can you tell us about storytime and small group time?"

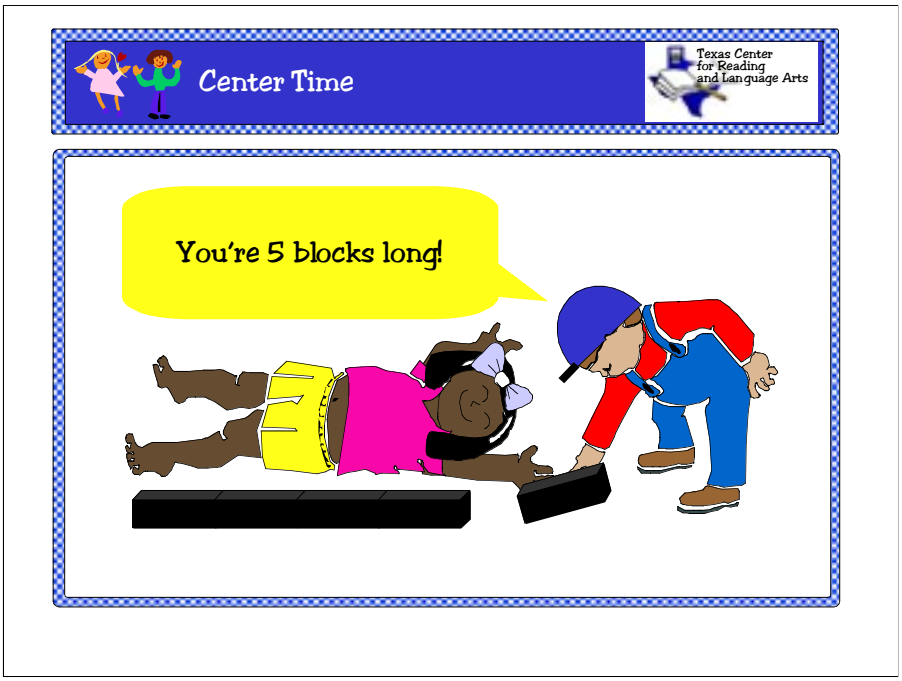
"Oh, yeah," says Cindy, "we're gonna read the carrot book and we're gonna learn about ladybugs."

Center Time follows the morning circle.

Miss Patience added props to the Home Center to build new math concepts: menus, a cash register, and some play money. Presto, the Home Center kitchen becomes a "real" restaurant.

Miss Patience takes a series of pictures of the children playing restaurant. The pictures can be used for a sequencing activity later in the week.

As she is putting away her camera, a discussion in the Block Center becomes louder. Miss Patience investigates.



Mae and Franklin are arguing about who is bigger.

"Hmmm," says Miss Patience, "I wonder how we can figure this out. Do you remember when we wanted to know how tall our plants grew?"

"Yes," Mae answers.

"What did we do?"

"We counted how many blocks high they were."

Franklin suggests, "Hey! Let's see how many blocks tall we are!"

The children begin to build a tower, but it keeps falling. Miss Patience models how to lie down beside a row of blocks on the floor. She explains how the blocks can be added or taken away.

Mae and Franklin lie down next to the blocks and compare their sizes.

Miss Patience notes on her observation clipboard: "Encourage using non-standard measurement tools such as crayons, blocks, shoes."

A Day in the Life of a Prekindergarten Teacher: Planning for Success

Handout #15 (5 of 7)

During Center Time, Miss Patience monitors children's progress. Jorge, Kristie, Mae, and Franklin are in four different centers engaged in a variety of activities. She observes:

- Kristie is in the Home Center writing lunch orders on a receipt pad in the "restaurant."
- Franklin is in the Technology Center working on a program that helps him practice sorting, sequencing, observing, predicting, and constructing.
- Jorge is in the Art Center drawing a colorful picture.
- Mae is in the Science Center watering the plants. She notices some of the beans have sprouted and enthusiastically announces her observation. Mae is soon surrounded by her classmates who are just as excited.

Miss Patience listens carefully, noting the applications of newly-learned concepts and vocabulary in the context of play.

A Day in the Life of a Prekindergarten Teacher: Planning for Success

Handout #15 (6 of 7)

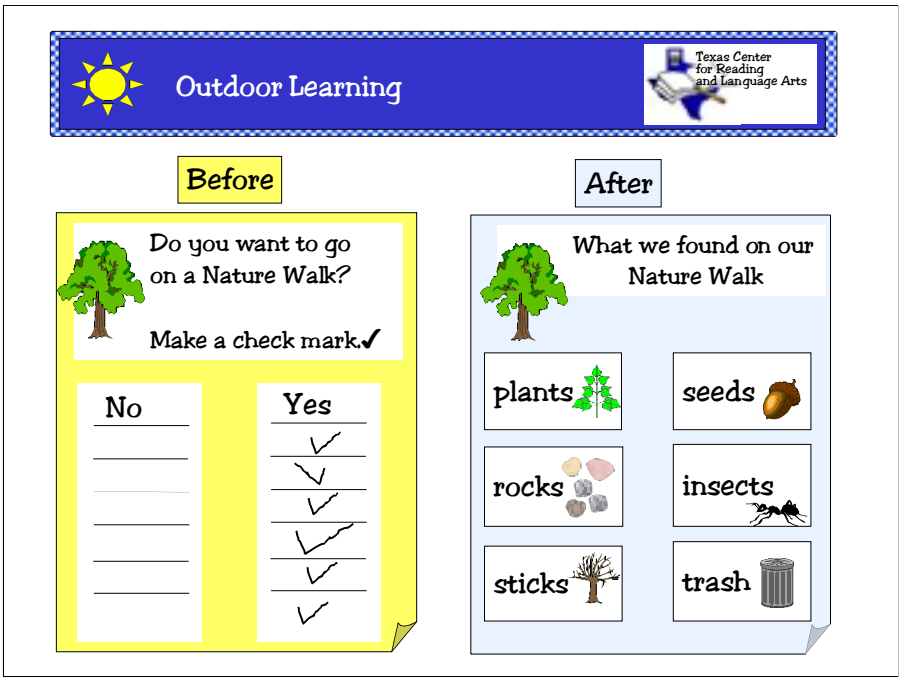
After playing in learning centers, the children are ready for their favorite activity, Storytime. Miss Patience reads a story about a child who takes care of a garden. She incorporates a flannel board activity to help children retell the story.

Small group work follows Storytime. Some children work with puzzles, others make block patterns, while some work with Miss Patience.

Today Miss Patience's group is observing ladybugs. She models how to record their observations on a chart.

A Day in the Life of a Prekindergarten Teacher: Planning for Success

Handout #15 (7 of 7)



When Small Group Time comes to a close, the class prepares for Outdoor Learning. One child suggests a Nature Walk instead of recess. The class votes to take a Nature Walk around the building.

On today's walk, children notice puddles on the sidewalk and butterflies in the garden. Miss Patience engages the children in a lively discussion of the weather and the life cycle of the butterfly. Children use paper bags to collect rocks, acorns, twigs, and other treasures.

After the walk, Miss Patience leads a discussion about the different items they collected on their Nature Walk. She models how to classify some of them. Tomorrow they will sort their individual collections.

With the morning coming to a close, the children gather for Goodbye Circle. They review the day and plan for the next. The children give Miss Patience hugs and big smiles as they head out the door.

After all the children have left, Miss Patience prepares for the next day as she reviews her notes and transfers comments to student files.

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Features Checklist

Handout #16

Classroom Master

Features of Effective Math and Science Instruction

Prekindergarten Curriculum Guidelines	**Activity Setting**	1. Build on the guidelines	2. Scaffold children's learning	3. Actively engage children in math and science experiences	4. Make connections across content areas	5. Monitor children's progress

Prekindergarten Curriculum Guidelines Abbreviations

Language and Early Literacy (L/EL)
Mathematics (M)
Science (S)
Social Studies (SS)
Fine Arts (FA)
Health and Safety (H/S)
Personal /Social Development (P/SD)
Physical Development (PD)
Technology Applications (TA)

Implementing the Mathematics and Science Prekindergarten Curriculum Guidelines

Teaching Suggestions:

- **Number and Operations** (arranging objects in one-to-one correspondence)
- **Patterns** (recognizing and reproducing simple patterns)
- **Geometry and Spatial Sense** (recognizing, describing, and naming shapes)
- **Measurement** (ordering two or three objects by size)
- **Classification and Data Collection** (sorting objects into groups)
- **Science Processes** (demonstrating safe practices and appropriate use of materials)
- **Science Concepts** (observing and describing properties of rocks, soil, and water)

Child Accomplishment: *The child arranges sets of concrete objects in one-to-one correspondence.*

Encourage children to compare sets of objects. Ask questions such as:

- How many _____ do we have?
- Do we have as many _____ as _____?
- Do we have too many ____?

Teaching Suggestions:

- Use a management system that supports the development of one-to-one correspondence in center time. Limit the number of children allowed in a center at one time.

- Provide activities for children to apply one-to-one correspondence, such as:
  - giving a sticker to each child in a group
  - placing one peg in each hole on a pegboard
  - setting the table in the Housekeeping Center for a certain number of family members
  - playing zoo with small sets of plastic animals, putting one in each cage (plastic strawberry baskets)
  - making playdough birthday cakes and putting one candle (popsicle stick) in each cake

- Provide opportunities for children to pass out materials to everyone in a group. Saying "Give just enough for everybody at the table" encourages a child to think logically in order to solve the problem. Telling the child, "Count 4 pairs of scissors and 4 crayons, and pass them out to each child" misses an opportunity for problem solving.

- When children forget to count themselves when passing out items to a group, have them talk to each other about possible solutions to the problem. Ask questions to stimulate dialogue, such as, "Does everyone agree?" The exchange of ideas between peers is an important part of learning mathematics.

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Adapted from Van de Walle, J.A. (1990). Concepts of number. In J. N. Payne (Ed.), *Mathematics for the Young Child* (pp. 63-88). Reston, VA: National Council of Teachers of Mathematics.

Child Accomplishment: *The child recognizes and reproduces simple patterns of concrete objects.*
Looking for patterns encourages children to use problem-solving skills, which are important in both science and math.

In order to work successfully with patterns, children must be able to:

- identify similarities and differences within a pattern
- identify when the first elements of a pattern begin to replicate themselves
- note how many elements are in a repeating group
- predict what comes next

Patterns can be based on different attributes, including:

- color (e.g., red, blue, green)
- number (e.g., two buttons, three buttons, two buttons, three buttons)
- position (e.g., horizontal craft stick, vertical craft stick, horizontal craft stick, vertical craft stick)

Children can also learn through movement patterns (clap your hands, slap your knees) and language patterns (pattern books, songs, and chants).

Teaching Suggestions:

- Create simple patterns with real objects and have children practice reading the patterns. Use readily available materials such as craft sticks, buttons, bottle caps, colored blocks, or interlocking cubes.
- Display patterns on an overhead projector using real objects. Have children reproduce a pattern using their own sets of the same materials.
- Play games with patterns, including "people patterns" in which children physically participate in a pattern. For example, have children arrange themselves in a standing/sitting pattern and then read the pattern together.
- Encourage children to create their own patterns.

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Adapted from Worth, J. (1990). Developing problem-solving abilities and attitudes. In J. N. Payne (Ed.), *Mathematics for the young child* (pp. 39-62). Reston, VA: National Council of Teachers of Mathematics.

Child Accomplishment: *The child begins to recognize, describe, and name shapes (e.g., circles, triangles, rectangles).*

Children learn about shapes through direct experiences with both two-dimensional and three-dimensional objects. Provide opportunities for children to manipulate models of geometric figures, such as attribute blocks or parquetry squares, and to draw, copy, and trace these materials. Help children to see that an object can change position and orientation, but that it doesn't change its shape.

Children need experiences with three-dimensional shapes, including geometric solids, such as spheres, cylinders, cubes, cones, and pyramids. Children do not need to learn the names of the solids, but should see how they relate to two-dimensional shapes. For example, when you trace the face of a rectangular block you draw a rectangle, and when you trace the end of a cylindrical block you draw a circle. Collect a number of recyclable boxes and containers, such as cardboard tubes from paper towels, baskets from strawberries, toothpaste boxes, and cereal boxes. As they explore the different shapes, children can sort the containers into groups, such as "rolls or doesn't roll," "stacks or doesn't stack," or "pointed top or flat top."

Teaching Suggestions:

- Have children find shapes in their environment (e.g., "What do you see that is shaped like a circle?").
- Play treasure-hunt games. Children gather shapes in the classroom according to a shape map and sort the shapes into groups.
- Cut out shapes from magazine pictures and make a collage or a chart.
- Read and discuss books about shapes.
- Provide a variety of geometric-shaped rubber stamps for children to use in print-making.
- Assemble a tub of pre-cut shapes for children to use in artwork. Ask children to find the shapes they would need to make a certain picture, such as a house, a train, or a boat.
- Provide different sizes and types of each shape so children learn that certain shapes have different forms. For example, triangles do not all look the same: some are "fat" (equilateral triangles), and some are "narrow" (isosceles triangles), but they are still triangles.

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Adapted from Bruni, J.V., & Seidenstein, R.B. (1990). Geometric concepts and spatial sense. In J. N. Payne (Ed.), *Mathematics for the young child* (pp. 203-228). Reston, VA: National Council of Teachers of Mathematics.

Child Accomplishment: *The child begins to order two or three objects by size (seriation), (e.g., largest to smallest). (Age 4)*

Seriation includes the ability to think about two or more things in relationship to each other.

Teaching Suggestions:

Children learn to use vocabulary such as *bigger* and *smaller* as they compare the sizes of items in a set. Comparing two items is easier than comparing three items, because the relationship is less complex. Begin with two items, and gradually build the number in the set until children can order several objects by size.

Provide opportunities for children to use:

- nesting cups
- stacking rings
- measuring cups
- sets of small, medium, and large objects
- different sized unit blocks
- sets of pots and pans or bowls that stack

Several of the classic fairy tales have sets of threes that can help develop the skill of ordering by size. Props from dramatic-play activities based on "The Three Bears" or "The Three Billy Goats Gruff," for example, can be used to provide experiences with seriation. Sets of three bowls can be arranged from smallest to largest and then from largest to smallest. Additional bowls can be added to encourage further comparisons of size.

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Adapted from Worth, J. (1990). Developing problem-solving abilities and attitudes. In J. N. Payne (Ed.), *Mathematics for the young child* (pp. 39-62). Reston, VA: National Council of Teachers of Mathematics.

Child Accomplishment: *The child sorts objects into groups by an attribute and begins to explain how the grouping was done.*

Classification is the process of grouping or sorting objects according to some systematic scheme. Classification is useful because it helps organize large numbers of objects into manageable sets. A set is a collection of objects with at least one shared characteristic.

Teaching Suggestions:

•Focus on an obvious characteristic, such as color, shape, or size.

- Color—have children sort buttons into piles of red buttons and blue buttons
- Shape—have children sort wooden unit blocks into sets of squares and triangles
- Size—have children place all the large balls in one tub and all the small balls in another
- Sink and float—have children sort objects by whether they sink or whether they float

•To simplify the task, select items that are obviously quite different. To increase the difficulty of the task, increase the number of items to sort or the level of abstraction involved. Encourage children to create their own classification system for groups of objects.

•To extend the classification activity, create a large floor grid (a clear shower curtain marked with colored tape, for example) and show children how the objects they sorted can be charted on a graph. "Put all the red apples in this row and the green apples in this row. Now we can count and compare the size of each group to see which one has more."

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Adapted from Lind, K. K. (1999). Science in early childhood: Developing and acquiring fundamental concepts and skills. In American Association for the Advancement of Science, *Dialogue on early childhood science, mathematics, and technology education* (pp. 73-83). Washington, DC: Author.

Child Accomplishment: *The child begins to demonstrate safe practices and appropriate use of materials.*

Children learn safe practices and appropriate use of materials when they are taught to care for equipment and to follow safety procedures. This requires careful planning by teachers. Before introducing any science activity, identify potential hazards, and have a plan in the event that an accident occurs. Careful consideration is given to potential risks such as heat sources, animals, plants, and machines.

Consider involving children when developing rules for appropriate use of materials. Some rules are non-negotiable, such as washing hands before handling food or utensils. Develop other rules depending on the activity and materials. Include limitations on the number of children involved in an activity at one time, the level of supervision required, and the appropriate use of equipment. Help children learn to use tools safely so they are not hurt.

Teaching Suggestions:

- Make sure that all classroom materials are non-toxic, clean, and in good condition. When glass is used in the classroom (e.g., aquariums and terrariums) be sure to check regularly for cracks or chips. Watch for sharp edges, slivers, and rust spots on all equipment. Replace materials when they show wear and tear.
- Read and follow directions and precautions with all science toys and equipment.
- Supervise anything that is hot, including kitchen appliances, hot plates, crock pots, and electric skillets.
- Closely supervise children around water, including ponds, pools, water tables, pails, and sinks. Children can drown in only a few inches of water.
- Provide safety goggles when children are using equipment that may cause splashes or splinters.
- Have adults inflate balloons, since this activity poses a choking risk to children.
- Supervise classroom pets while children handle them. Clean and disinfect cages regularly. Pay attention to the health of the animals, and obtain all pets from reliable sources.

Adapted from Holt, B. (1993). *Science with young children* (Rev. ed.). Washington, DC: National Association for the Education of Young Children.

Child Accomplishment: *The child observes and describes properties of rocks, soil, and water.*

Children learn to observe and describe properties of rocks, soil, and water through direct experiences with these materials. Observation involves more than looking at something and watching for change. For preschoolers, it requires the use of several senses at a time. Provide opportunities for children to handle rocks, sort through dirt, and pour water in order for them to learn about the materials' properties.

Observation requires that children focus their attention directly on a specific activity or object and have time to experience and process the information. Background experiences, interests, and culture affect how long children spend in observation and their eagerness to investigate, explore, and observe phenomena.

Teaching Suggestions:

- Teach children how to observe through looking, listening, touching, tasting, smelling, and then discussing their experiences. Record experiences in a number of ways, including using a tape recorder, dictating a story about the experience, role playing what happened, or drawing a picture and explaining what it represents.
- Observe children as they are involved in observations. Show you are interested in their investigation by watching what they do and providing support as needed.
- Talk with children about their experiences. Encourage them to describe their experiences: "What can you tell me about water? Can you tell me how it feels? How it tastes? What it looks like?"
- Let children share their observations with others. They may demonstrate what they learned (e.g., act out a seed's growth or a cloudburst) or simply tell about their experience. Provide time for children to ask each other questions.

Adapted from Holt, B. (1993). *Science with young children* (Rev. ed.). Washington, DC: National Association for the Education of Young Children.

Lesson Plan

Targeted math and/or science concepts or skills

Discussion or Learning Conversation

Write three open-ended questions to help children understand the targeted concepts or skills.

1.

2.

3.

Lesson Plan

Graphic Organizer

Learning Centers

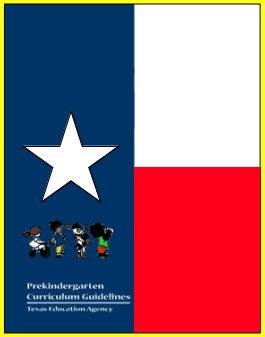
List materials, books, props, and literacy tools for two learning centers.

1.

2.

Transition Activities

Implementing the Prekindergarten Curriculum Guidelines for Mathematics and Science



Session Overview

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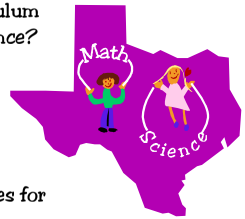
- What are the Prekindergarten Curriculum Guidelines for Mathematics and Science?
- What are the features of effective instruction for these two areas?
- How can you implement the Prekindergarten Curriculum Guidelines for Mathematics and Science in your classroom?



Notes

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Self Assessment

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The foundation for children's math and science development is established early.

Early childhood teachers report they feel less prepared to teach math and science than other areas of the curriculum.

How can this affect classroom practice?

3

Notes

Diversity

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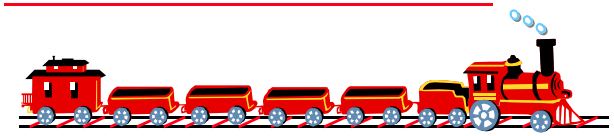
- The three- and four-year-old children who enter your prekindergarten classrooms have diverse knowledge and experiences.
- Their current knowledge and skills serve as a starting point for new experiences and instruction.

4

Notes

Features of Effective Math and Science Instruction



- build on the Prekindergarten Curriculum Guidelines,
- scaffold children's learning,
- actively engage children in math and science experiences,
- make connections across content areas, and
- monitor children's progress.

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Build on the Prekindergarten Curriculum Guidelines

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- ✓ Articulate what 3- and 4-year-olds need to know and be able to do.
- ✓ Provide a means to align a prekindergarten curriculum with the Texas Essential Knowledge and Skills.
- ✓ Assist educators in making informed decisions about curriculum content and implementation.

Notes

Notes

Build on the Prekindergarten Curriculum Guidelines

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"Curriculum is the way content is delivered: it includes the structure, organization, balance, and presentation of the content in the classroom."

National Science Education Standards, 1996, p. 22

The guidelines address the content for preschool children to learn and the accomplishments that they can achieve.

- Language and Early Literacy
- Mathematics
- Science
- Social Studies
- Fine Arts
- Health and Safety
- Personal and Social Development
- Physical Development
- Technology Applications

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Build on the Prekindergarten Curriculum Guidelines

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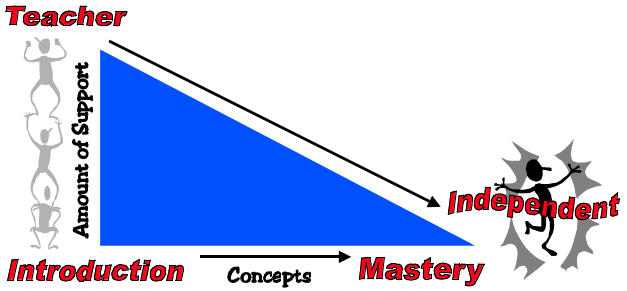
Scaffold Children's Learning



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Scaffold Children's Learning

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Teachers scaffold instruction by:

- Explaining
- Modeling
- Verifying and clarifying

Notes

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Actively Engage Children in Math and Science Experiences

Provide opportunities for children to:

- investigate and solve problems,
- observe, count, measure, compare, and classify,
- explore patterns, shapes, numbers, and space,
- gather and organize information, and
- communicate findings.

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Notes

Actively Engage Children in Math and Science Experiences

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- Small Groups
- Learning Centers
- Transitions
- Outdoor Learning

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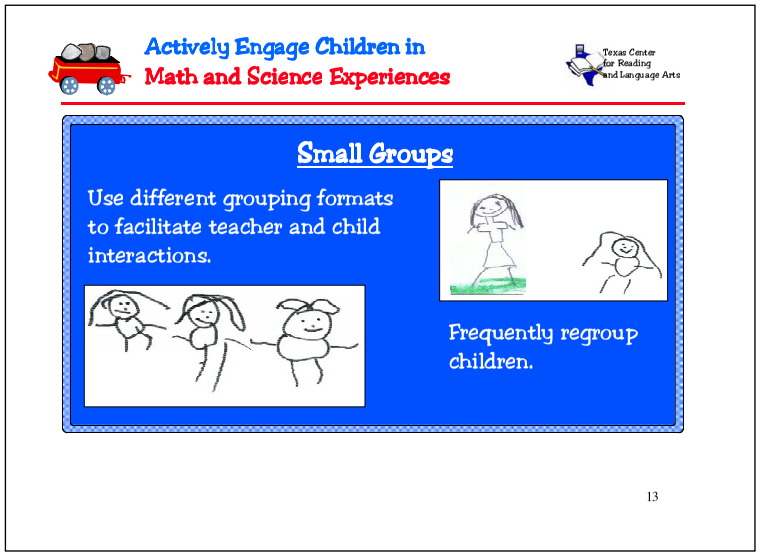
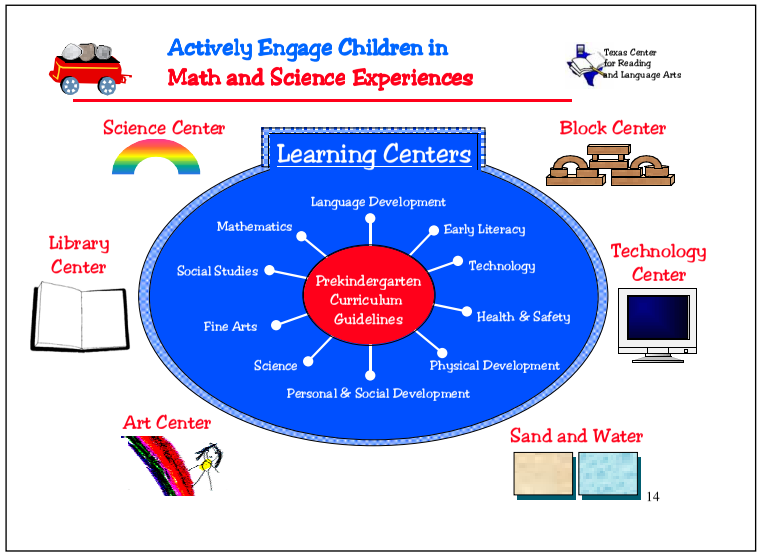

Actively Engage Children in
Math and Science Experiences
Texas Center for Reading and Language Arts
Small Groups
Use different grouping formats to facilitate teacher and child interactions.
Frequently regroup children.
13


Actively Engage Children in
Math and Science Experiences
Texas Center for Reading and Language Arts
Science Center
Block Center
Learning Centers
Language Development
Mathematics
Early Literacy
Social Studies
Technology
Prekindergarten Curriculum Guidelines
Fine Arts
Health & Safety
Science
Physical Development
Personal & Social Development
Library Center
Technology Center
Art Center
Sand and Water
14

Notes

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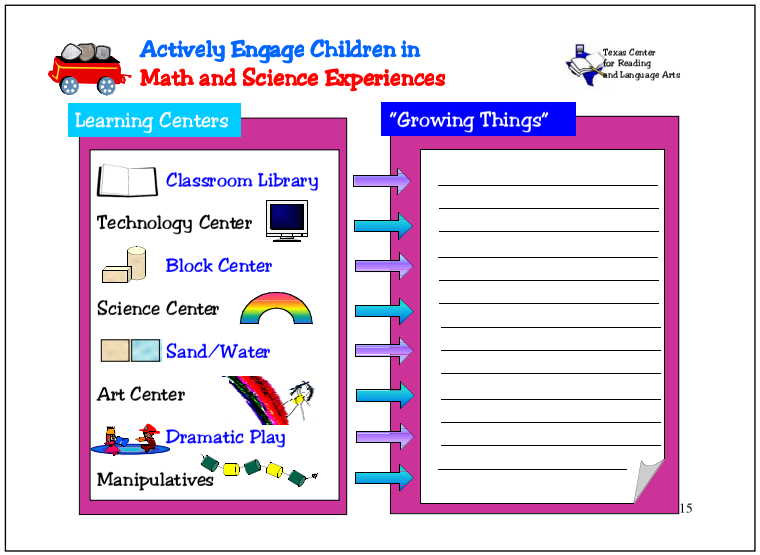
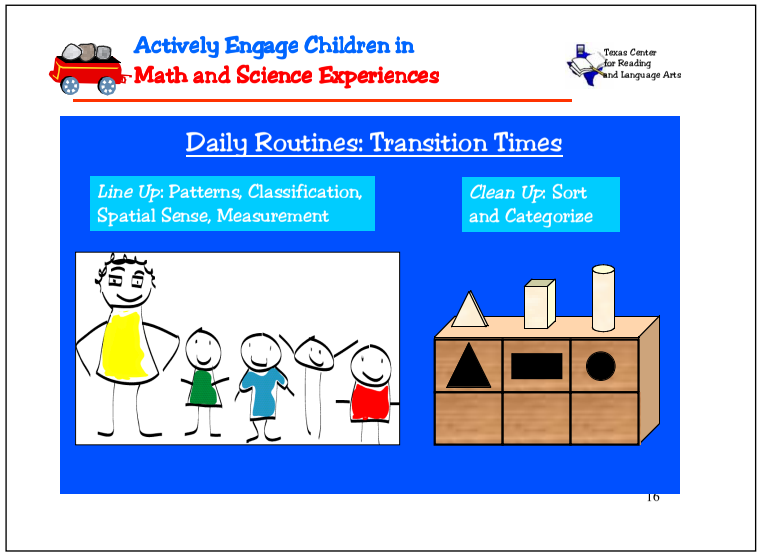

Actively Engage Children in
Math and Science Experiences
Texas Center for Reading and Language Arts
Learning Centers
"Growing Things"
Classroom Library
Technology Center
Block Center
Science Center
Sand/Water
Art Center
Dramatic Play
Manipulatives
15


Actively Engage Children in
Math and Science Experiences
Texas Center for Reading and Language Arts
Daily Routines: Transition Times
Line Up: Patterns, Classification, Spatial Sense, Measurement
Clean Up: Sort and Categorize
16

Notes

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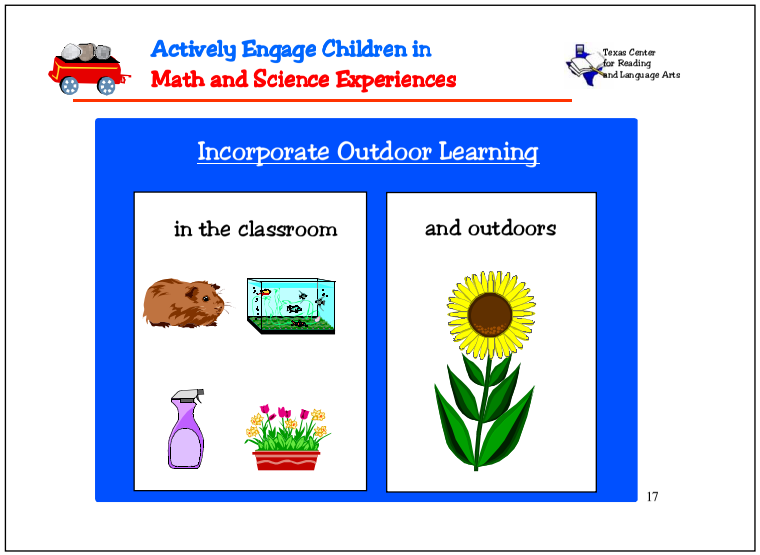
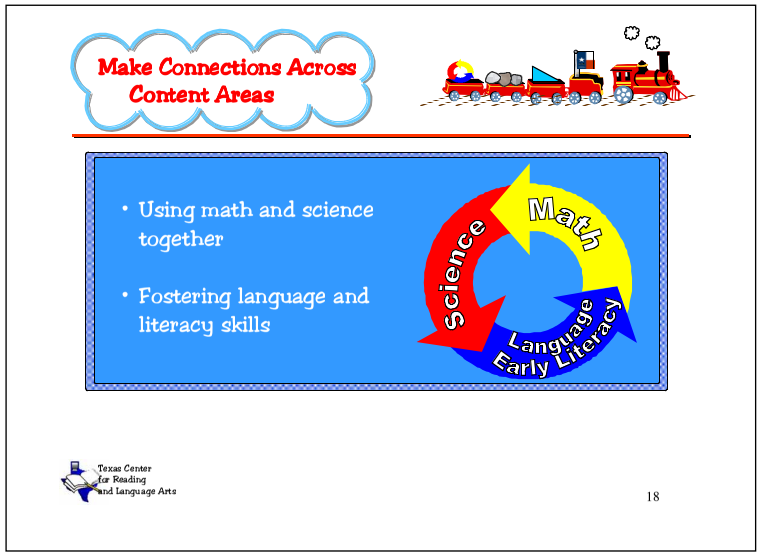
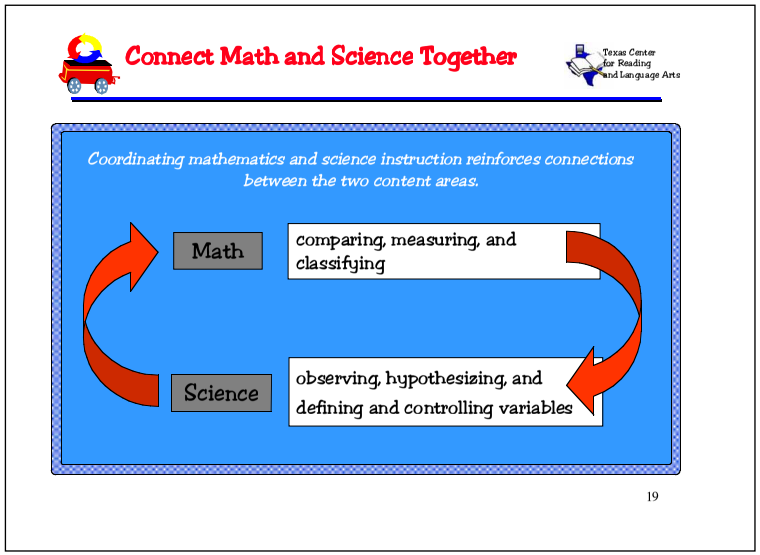

Actively Engage Children in
Math and Science Experiences
Texas Center for Reading and Language Arts
Incorporate Outdoor Learning
in the classroom
and outdoors
17


Make Connections Across Content Areas
• Using math and science together
• Fostering language and literacy skills
Science
Math
Language
Early Literacy
Texas Center for Reading and Language Arts
18

Notes

Notes


Connect Math and Science Together
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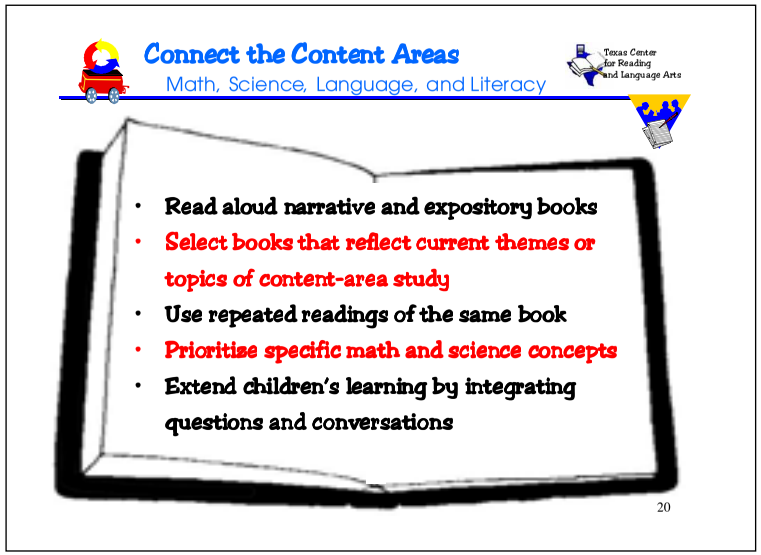
Coordinating mathematics and science instruction reinforces connections between the two content areas.
Math
comparing, measuring, and classifying
Science
observing, hypothesizing, and defining and controlling variables
19


Connect the Content Areas
Math, Science, Language, and Literacy
Texas Center for Reading and Language Arts
• Read aloud narrative and expository books
• Select books that reflect current themes or topics of content-area study
• Use repeated readings of the same book
• Prioritise specific math and science concepts
• Extend children's learning by integrating questions and conversations
20

Notes

Notes

Connect the Content Areas

Math, Science, Language, and Literacy

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Lively discussions and conversations:

- enhance children's understanding of math and science
- encourage children to use "contextualized language" as they talk about what is happening during hands-on math and science experiences

Be sure to scaffold the discussion so English language learners can participate.

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Notes

Connect the Content Areas

Math, Science, Language, and Literacy

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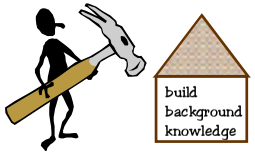
To scaffold children's language and learning during conversations and discussions:

- Activate and build background or prior knowledge of content and topics.
- Ask open-ended questions.



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Notes

Connect the Content Areas

Math, Science, Language, and Literacy

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To scaffold children's language and learning during conversations and discussions:

- Use prompts to help children explain their answers and ask their questions.
- Restate and expand children's ideas using new vocabulary and syntax.
- Request clarification.
- Encourage children to talk with each other and ask each other questions.

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Notes

Connect the Content Areas

Math, Science, Language, and Literacy

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Graphic Organizers:

- integrate experiences in language, literacy, math, and science
- help children remember what they have learned
- link science processes with math skills
- promote language and literacy

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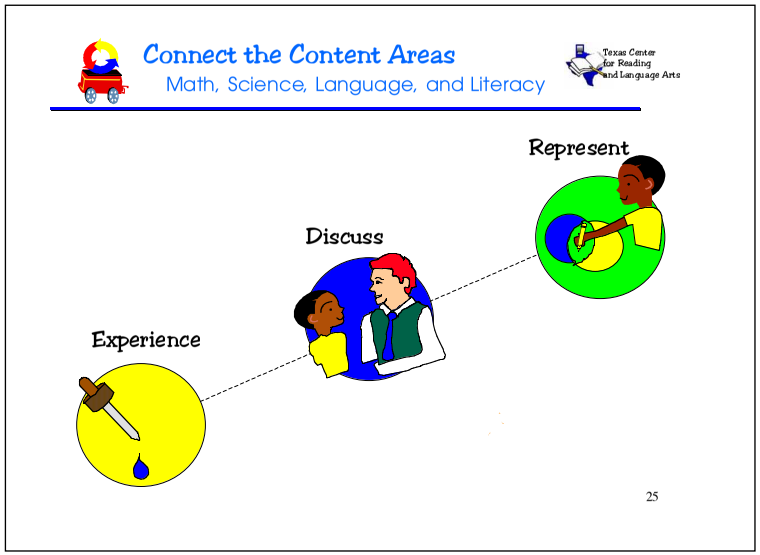
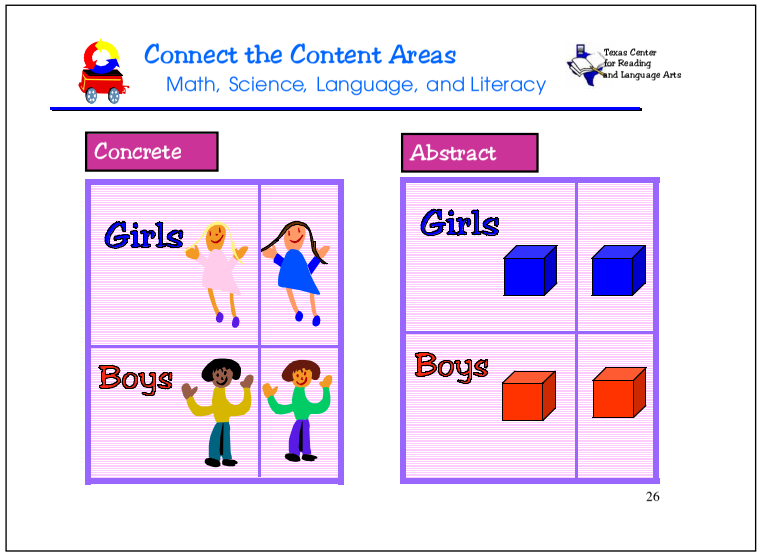
Notes


Connect the Content Areas
Math, Science, Language, and Literacy
Texas Center for Reading and Language Arts
Represent
Discuss
Experience
25


Connect the Content Areas
Math, Science, Language, and Literacy
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Concrete
Abstract
Girls
Boys
Girls
Boys
26

Notes

Notes

Connect the Content Areas

Math, Science, Language, and Literacy

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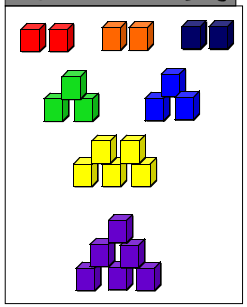
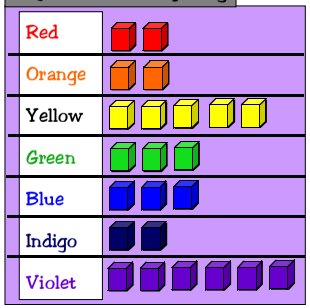
Object Sort–Grouping



Object Sort–Graphing



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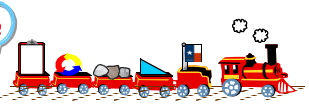
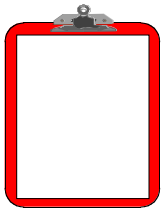
Monitor Children's Progress



Effective progress monitoring includes:



- observing, listening, and talking with children
- recording and reflecting on your observations
- adjusting instruction

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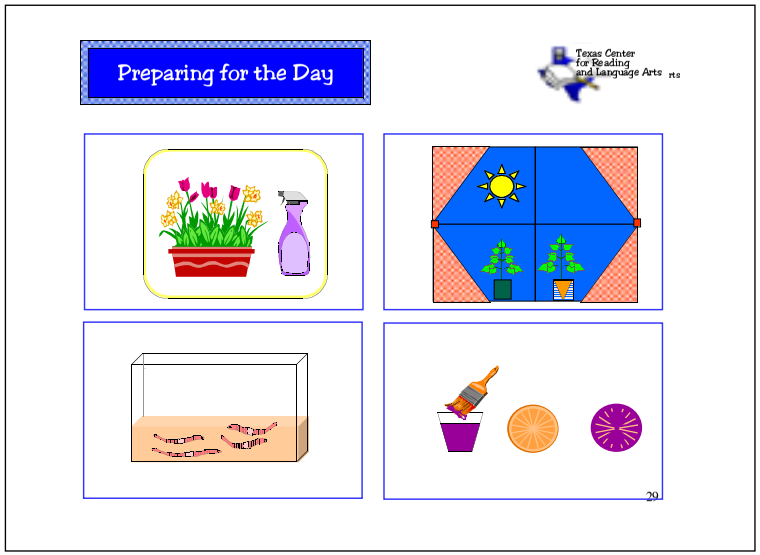
Notes

Notes


Preparing for the Day
Texas Center for Reading and Language Arts
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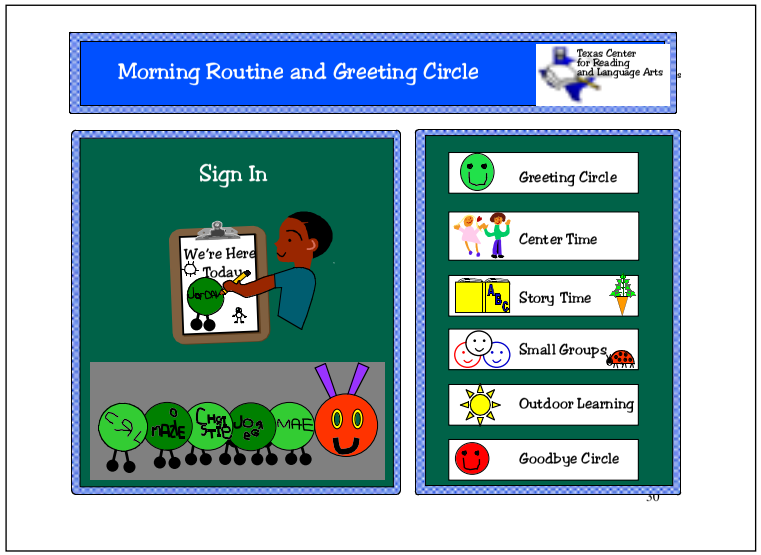
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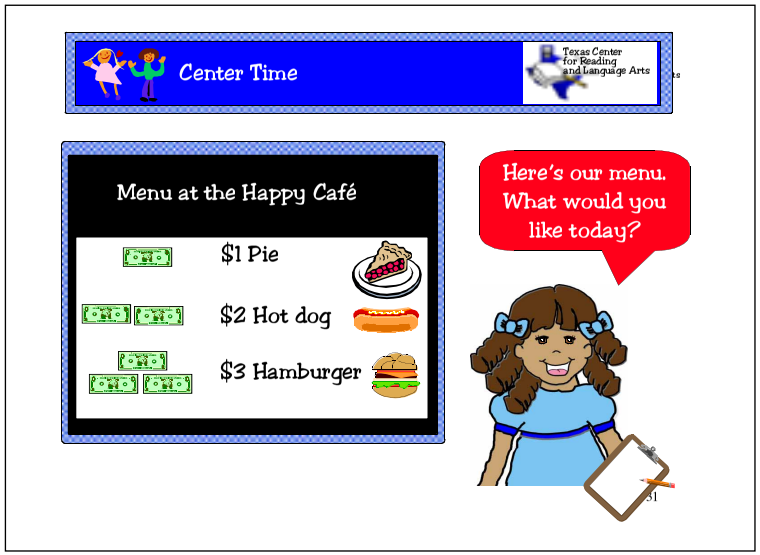
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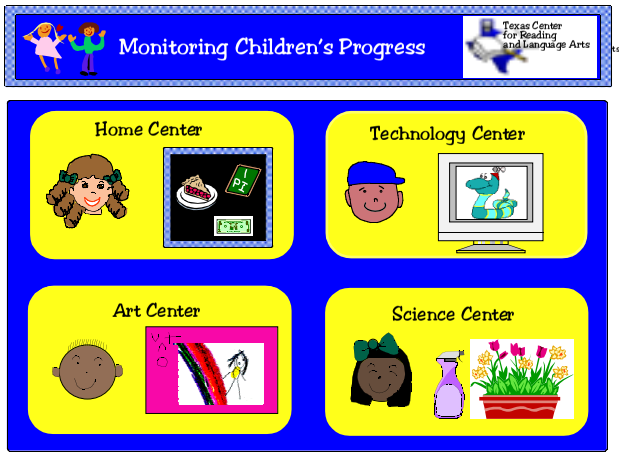
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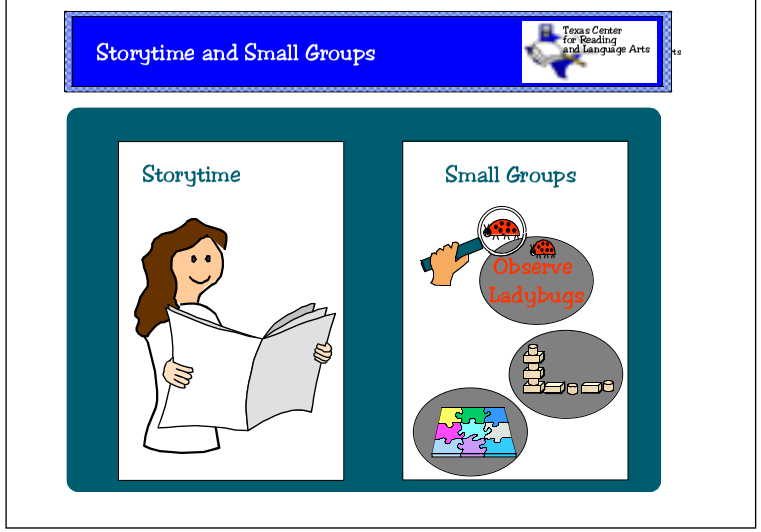
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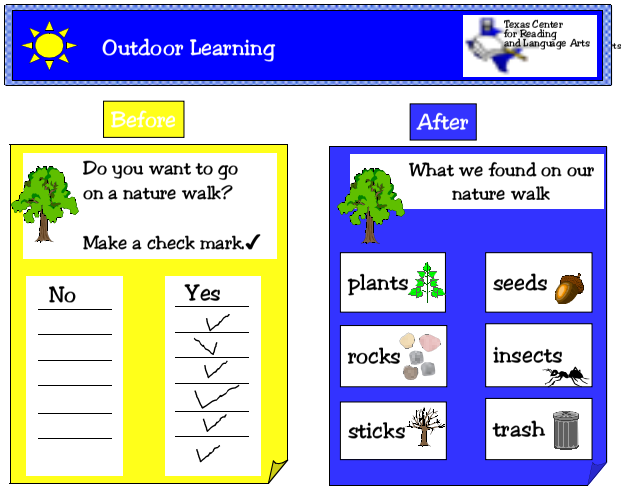
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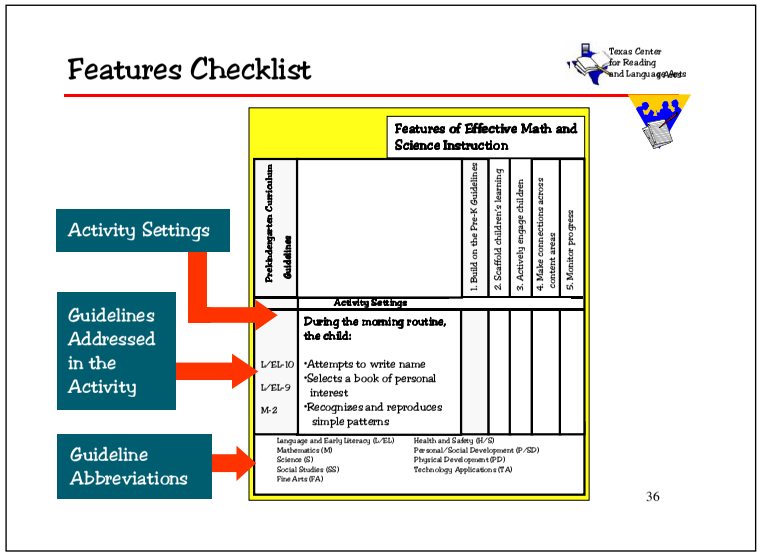
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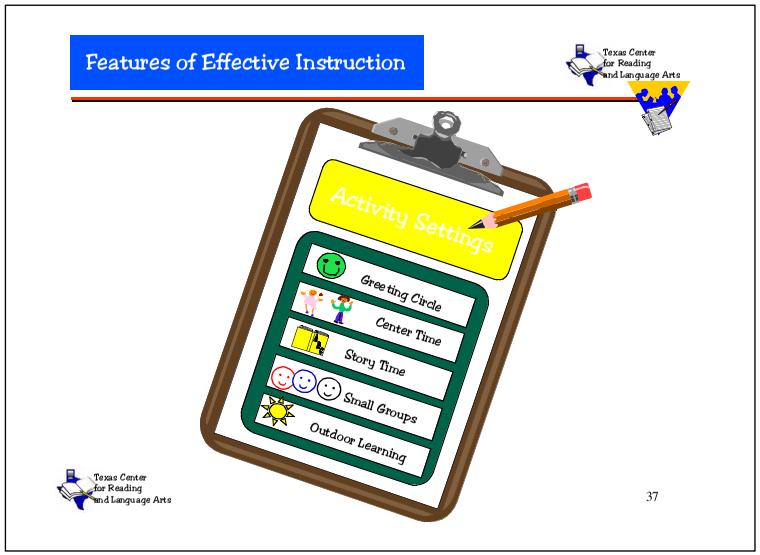
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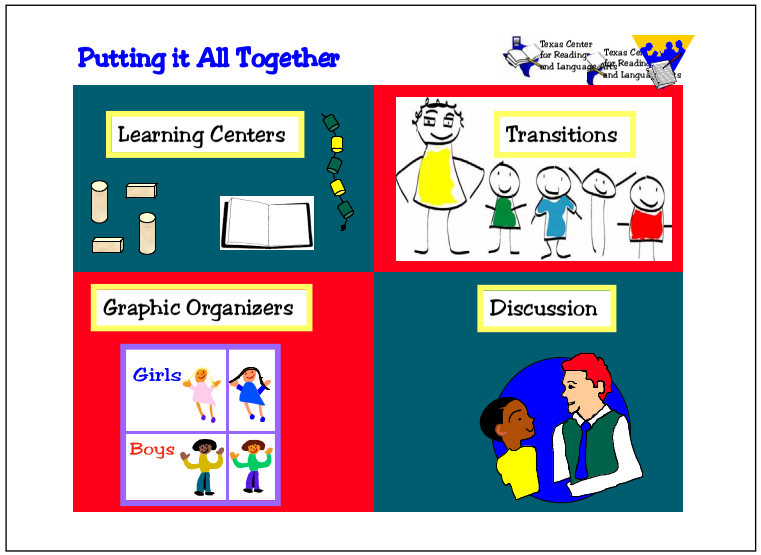
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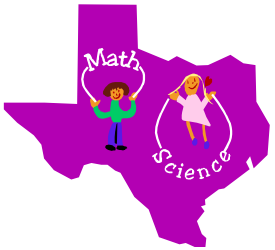
Texas Center for Reading and Language Arts



"Quality programs that provide challenging but achievable curriculum engage children in thinking, reasoning, and communicating with others."

Prekindergarten Curriculum Guidelines, p. 1

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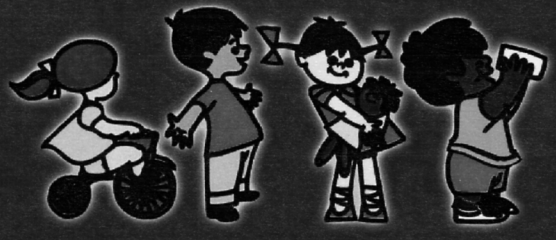

Prekindergarten Curriculum Guidelines

Texas Education Agency

TEXAS EDUCATION AGENCY

1701 North Congress Ave.★ Austin, Texas 78701-1494 ★ 512/463-9734 ★ FAX: 512/463-9838 ★ http://www.tea.state.tx.us

Jim Nelson
Commissioner of Education

December 10, 1999

TO THE ADMINISTRATOR ADDRESSED:

With the adoption of the Texas Essential Knowledge and Skills (TEKS) in 1998, the essential elements of curriculum for the prekindergarten program were repealed. Under the direction of former Commissioner Mike Moses, a working group of educators and community members from across the state convened to draft guidelines for a prekindergarten curriculum that school districts could use on a voluntary basis. Development of the guidelines drew upon expertise from Texas educators, nationally recognized individuals, professional organizations, and university personnel. Draft guidelines were presented to focus groups across the state for input and revision.

Enclosed you will find a copy of the Prekindergarten Curriculum Guidelines. These guidelines articulate what three- and four-year-old students should know and be able to do in the foundation and enrichment areas. These guidelines provide a means to align prekindergarten programs with the TEKS curriculum. Use of these guidelines by school districts is voluntary. The guidelines are intended to help educators make informed decisions about curriculum content for prekindergarten children and define and implement a comprehensive curriculum that will provide many opportunities for our youngest students to achieve knowledge and skills.

Please contact the Division of Curriculum and Professional Development at (512) 463-9581 if you have questions or need additional information.

Sincerely yours,

Jim Nelson
Commissioner of Education

Enclosure

Prekindergarten Curriculum Guidelines

After the initial free distribution to authorized institutions, additional copies of this document may be purchased from Publications Distribution, Texas Education Agency, P. O. Box 13817, Austin, Texas, 78711-3817. To purchase copies, please use the order form found in the back of this publication. With the high demand for educational materials, however, the supply may be exhausted at times.

Questions concerning this document may be directed to the Division of Curriculum and Professional Development at (512) 463-9581 or http://www.tea.state.tx.us.

Texas Education Agency

December 1999

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PREKINDERGARTEN CURRICULUM GUIDELINES

Research confirms the value of early education for young children. Prekindergarten programs that support effective teaching practices have been shown to lead to important growth in children's intellectual and social development, which is critical to their future academic success. Quality programs that provide challenging but achievable curriculum engage children in thinking, reasoning, and communicating with others. With teacher direction and guidance, children respond to the challenge and acquire important skills and concepts.

The purpose of this document is to help educators make informed decisions about curriculum content for prekindergarten children. The guidelines are based on knowledge of theory and research about how children develop and learn; they reflect the growing consensus among early childhood professional organizations that a greater emphasis be placed on young children's conceptual learning, acquisition of basic skills, and participation in meaningful and relevant learning experiences. The guidelines also delineate the content that children are to learn and what they should be able to achieve. Finally, the guidelines provide a means to align the prekindergarten programs with the Texas Essential Knowledge and Skills (TEKS).

The guidelines describe specific goals for prekindergarten children in each content area. The intent of this organizational design is to ensure that all three- and four-year-old children have the opportunity to strive towards these goals. Due to age differences and previous experiences, however, children will have a great diversity of knowledge. Some children, regardless of their age level, will be at the beginning of the learning continuum, while others will be further along. Children with disabilities may need accommodations and modifications of the guidelines in order to benefit from them. For children whose first language is not English, the student's native language serves as a foundation for knowledge acquisition. Students in a prekindergarten English as a Second Language (ESL) program should receive instruction in a manner they can understand and that is commensurate with their proficiency level in English. Children's current strengths and skills should serve as the starting point for new experiences and instruction rather than become a limitation. To use these guidelines to the best advantage and to extend the learning of skills and concepts, teachers must build on children's existing competencies.

These guidelines are important tools to help teachers define and implement a comprehensive curriculum. Such a curriculum helps to build connections between subject matter disciplines by organizing the large amounts of information children must learn into a set of meaningful concepts. Using concepts from the guidelines, teachers can work across disciplines to provide many opportunities for children to achieve knowledge and skills.

This document presents the commissioner's guidelines for prekindergarten curriculum. Because there is no state-required prekindergarten curriculum, use of these guidelines is

voluntary. Texas Education Code § 29.153 contains statutory requirements concerning prekindergarten.

Prekindergarten Guidelines

Language and Early Literacy

During the prekindergarten years, children's experiences with communication and literacy begin to form the basis for their later school success. Given adequate opportunities to interact with responsive adults and peers in language and print-rich environments, young children develop vocabulary, extended language skills, and knowledge of the world around them. They develop listening comprehension and phonological awareness; understanding of the everyday functions of print; motivation to read; appreciation for literary forms; and print awareness and letter knowledge. They learn what books are and how to use them. Understanding the value of literacy as a means of communication, as well as coming to enjoy reading, are accomplishments typical of the future good reader. These language and literacy accomplishments are best achieved through activities that are integrated across different developmental areas: cognitive development, fine and gross motor development, and social and emotional development. It is important to consider native language, augmentative communication, and sensory impairments in accomplishing these guidelines.

Prekindergarten educators should provide opportunities to promote language and literacy learning in children who speak a language other than English. Except where specified, the following guidelines outline language and literacy accomplishments for three- and four-year-old children in their native language. For students whose first language is other than English, the native language serves as the foundation for English language acquisition. Specific guidelines for the language and literacy development of prekindergarten children whose home language is not English in English-only settings appear below in each domain.

Language and Early Literacy Development

(1) Listening Comprehension

Prekindergarten-aged children are able to comprehend what they hear in conversations and in stories read aloud with increasing accuracy, though three-year-old children may respond in single words or brief phrases to some questions, especially "why," "how," and "when" questions. Children demonstrate understanding through their questions, comments, and actions. Prekindergarten children in English as Second Language (ESL) settings listen purposefully to English-speaking teachers and peers to gather information about their new language.

The child:

- listens with increasing attention
- listens for different purposes (e.g., to learn what happened in a story, to receive instructions, to converse with an adult or a peer)
- understands and follows simple oral directions
- enjoys listening to and responding to books
- listens to and engages in several exchanges of conversations with others
- listens to tapes and records, and shows understanding through gestures, actions, and/or language
- listens purposefully to English-speaking teachers and peers to gather information and shows some understanding of the new language being spoken by others (ESL).

(2) Speech Production and Speech Discrimination

Young children must learn to vocalize, pronounce, and discriminate the sounds and words of language. Although most children in prekindergarten can accurately perceive the difference between similar-sounding words, they continue to acquire new sounds and may mispronounce words quite often in their own speech. The ability to produce certain speech sounds such as /s/ and /r/ improves with age. Just as infants and toddlers develop control over the sounds of their first language, young children in ESL settings gradually learn to pronounce the sounds of the English language.

The child:

- perceives differences between similar sounding words (e.g., "coat" and "goat," "three" and "free," [Spanish] "juego" and "fuego")
- produces speech sounds with increasing ease and accuracy
- experiments with new language sounds
- experiments with and demonstrates growing understanding of the sounds and intonation of the English language (ESL).

(3) Vocabulary

Prekindergarten children experience rapid growth in their understanding of words and word meanings. Vocabulary knowledge reflects children's previous experiences and growing knowledge of the world around them and is one of the most important predictors of later reading achievement. As children learn through experiences, they develop concepts, acquire new words, and increasingly refine their understanding of words they already know.

The child:

- shows a steady increase in listening and speaking vocabulary
- uses new vocabulary in everyday communication
- refines and extends understanding of known words
- attempts to communicate more than current vocabulary will allow, borrowing and extending words to create meaning
- links new learning experiences and vocabulary to what is already known about a topic
- increases listening vocabulary and begins to develop a vocabulary of object names and common phrases in English (ESL).

(4) Verbal Expression

Effective communication requires that children use their knowledge of vocabulary, grammar, and sense of audience to convey meaning. Three- and four-year-old children become increasingly adept at using language to express their needs and interests, to play and pretend, and to share ideas. Children's use of invented words and the overgeneralization of language rules (for example, saying "foots" instead of "feet" or [Spanish]"yo no cabo" instead of "yo no quepo") is a normal part of language acquisition. Second language learners in English-only prekindergarten settings may communicate nonverbally (e.g., through gestures) before they begin to produce words and phrases in English. The ESL accomplishments noted below represent a developmental sequence for second-language acquisition in young children.

The child:

- uses language for a variety of purposes (e.g., expressing needs and interests)
- uses sentences of increasing length (three or more words) and grammatical complexity in everyday speech
- uses language to express common routines and familiar scripts
- tells a simple personal narrative, focusing on favorite or most memorable parts
- asks questions and makes comments related to the current topic of discussion
- begins to engage in conversation and follows conversational rules (e.g., staying on topic and taking turns)
- begins to retell the sequence of a story
- engages in various forms of nonverbal communication with those who do not speak his/her home language (ESL)
- uses single words and simple phrases to communicate meaning in social situations (ESL)
- attempts to use new vocabulary and grammar in speech (ESL).

(5) Phonological Awareness

Phonological awareness is an auditory skill that involves an understanding of the sounds of spoken words. It includes recognizing and producing rhymes, dividing words into syllables, and identifying words that have the same beginning, middle, or ending sounds. Phonological awareness represents a crucial step toward understanding that letters or groups of letters can represent phonemes or sounds (i.e., the alphabetic principle). This understanding is highly predictive of success in beginning reading. Some basic proficiency in English may be prerequisite to the development of phonological awareness in English for second-language learners.

The child:

- becomes increasingly sensitive to the sounds of spoken words
- begins to identify rhymes and rhyming sounds in familiar words, participates in rhyming games, and repeats rhyming songs and poems
- begins to attend to the beginning sounds in familiar words by identifying that the pronunciations of several words all begin the same way (e.g., "dog," "dark," and "dusty," [Spanish] "casa," "coche," and "cuna")
- begins to break words into syllables or claps along with each syllable in a phrase
- begins to create and invent words by substituting one sound for another (e.g., bubblegum/gugglebum, [Spanish] calabaza/balacaza).

(6) Print and Book Awareness

Through their daily experiences with reading and writing, prekindergarten children learn basic concepts about print and how it works. They learn that print carries meaning and can be used for different purposes. They begin to differentiate writing from other graphic symbols and recognize some of the common features of print (for example, that writing moves from left to right on a page and is divided into words).

The child:

- understands that reading and writing are ways to obtain information and knowledge, generate and communicate thoughts and ideas, and solve problems
- understands that print carries a message by recognizing labels, signs, and other print forms in the environment
- understands that letters are different from numbers
- understands that illustrations carry meaning but cannot be read
- understands that a book has a title and an author
- begins to understand that print runs from left to right and top to bottom
- begins to understand some basic print conventions (e.g., the concept that letters are grouped to form words and that words are separated by spaces)
- begins to recognize the association between spoken and written words by following the print as it is read aloud

- understands that different text forms are used for different functions (e.g., lists for shopping, recipes for cooking, newspapers for learning about current events, letters and messages for interpersonal communication).

(7) Letter Knowledge and Early Word Recognition

Letter knowledge is an essential component of learning to read and write. Knowing how letters function in writing and how these letters connect to the sounds children hear in words is crucial to children's success in reading. Combined with phonological awareness, letter knowledge is the key to children's understanding of the alphabetic principle. Children will use this sound/letter connection to begin to identify printed words.

The child:

- begins to associate the names of letters with their shapes
- identifies 10 or more printed alphabet letters
- begins to notice beginning letters in familiar words
- begins to make some letter/sound matches
- begins to identify some high-frequency words (age 4).

(8) Motivation to Read

Prekindergarten children benefit from classroom environments that associate reading with pleasure and enjoyment as well as learning and skill development. These early experiences will come to define their assumptions and expectations about becoming literate and influence their motivation to work toward learning to read and write.

The child:

- demonstrates an interest in books and reading through body language and facial expressions
- enjoys listening to and discussing storybooks and information books read aloud
- frequently requests the re-reading of books
- attempts to read and write independently
- shares books and engages in pretend-reading with other children
- enjoys visiting the library.

(9) Developing Knowledge of Literary Forms

Exposure to storybooks and information books helps prekindergarten children become familiar with the language of books and story forms. Children develop concepts of story structure and knowledge about informational text structures, which influences how they understand, interpret, and link what they already know to new information.

The child:

- recognizes favorite books by their cover
- selects books to read based on personal criteria

- understands that books and other print resources (e.g., magazines, computer-based texts) are handled in specific ways
- becomes increasingly familiar with narrative form and its elements by identifying characters and predicting events, plot, and the resolution of a story
- begins to predict what will happen next in a story
- imitates the special language in storybooks and story dialogue, and uses it in retellings and dramatic play [(such as "Once upon a time…")]
- asks questions and makes comments about the information and events from books
- connects information and events in books to real-life experiences
- begins to retell some sequences of events in stories
- shows appreciation of repetitive language patterns.

(10) Written Expression

Prekindergarten-aged children generate hypotheses about how written language works and begin to explore the uses of writing for themselves. They also begin to ask adults to write signs and letters for them. Through these early writing experiences, young children develop initial understandings about the forms, features, and functions of written language. Over time, children's writing attempts more closely approximate conventional writing.

The child:

- attempts to write messages as part of playful activity
- uses known letters and approximations of letters to represent written language (especially meaningful words like his/her name and phrases such as "I love you" or [Spanish] " Te quiero")
- attempts to connect the sounds in a word with its letter forms
- understands that writing is used to communicate ideas and information
- attempts to use a variety of forms of writing (e.g., lists, messages, stories)
- begins to dictate words, phrases, and sentences to an adult recording on paper (e.g., "letter writing," "storywriting").

Prekindergarten Guidelines

Mathematics

Mathematics learning builds on children's curiosity and enthusiasm, and challenges children to explore ideas about patterns and relationships, order and predictability, and logic and meaning. Consequently, quality instruction occurs in environments that are rich in language, encourage children's thinking, and nurture children's explorations and ideas. These ideas include the concepts of number pattern, measurement, shape, space, and classification.

(1) Number and Operations

Understanding the concept of number is fundamental to mathematics. Children come to school with rich and varied informal knowledge of number. A major goal is to build on this informal base toward more thorough understanding and skills. Children move from beginning to develop basic counting techniques in prekindergarten to later understanding number size, relationships, and operations.

The child:

- arranges sets of concrete objects in one-to-one correspondence
- counts by ones to 10 or higher
- counts concrete objects to five or higher
- begins to compare the numbers of concrete objects using language (e.g., "same" or "equal," "one more," "more than," or "less than")
- begins to name "how many" are in a group of up to three (or more) objects without counting (e.g., recognizing two or three crayons in a box)
- recognizes and describes the concept of zero (meaning there are none)
- begins to demonstrate part of and whole with real objects (e.g., an orange)
- begins to identify first and last in a series
- combines, separates, and names "how many" concrete objects.

(2) Patterns

Recognizing patterns and relationships among objects is an important component in children's intellectual development. Children learn to organize their world by recognizing patterns and gradually begin to use patterns as a strategy for problem-solving, forming generalizations, and developing the concepts of number, operation, shape, and space. Pattern recognition is the first step in the development of algebraic thinking.

The child:

- imitates pattern sounds and physical movements (e.g., clap, stomp, clap, stomp,…)
- recognizes and reproduces simple patterns of concrete objects (e.g., a string of beads that are yellow, blue, blue, yellow, blue, blue)
- begins to recognize patterns in their environment (e.g., day follows night, repeated phrases in storybooks, patterns in carpeting or clothing)
- begins to predict what comes next when patterns are extended.

(3) Geometry and Spatial Sense

Geometry helps children systematically represent and describe their world. Children learn to name and recognize the properties of various shapes and figures, to use words that indicate direction, and to use spatial reasoning to analyze and solve problems.

The child:

- begins to recognize, describe, and name shapes (e.g., circles, triangles, rectangles—including squares)
- begins to use words that indicate where things are in space (e.g., "beside," "inside," "behind," "above," "below")
- begins to recognize when a shape's position or orientation has changed
- begins to investigate and predict the results of putting together two or more shapes
- puts together puzzles of increasing complexity.

(4) Measurement

Measurement is one of the most widely used applications of mathematics. Early learning experiences with measurement should focus on direct comparisons of objects. Children make decisions about size by looking, touching, and comparing objects directly while building language to express the size relationships.

The child:

- covers an area with shapes (e.g., tiles)
- fills a shape with solids or liquids (e.g., ice cubes, water)
- begins to make size comparisons between objects (e.g., taller than, smaller than)
- begins to use tools to imitate measuring
- begins to categorize time intervals and uses language associated with time in everyday situations (e.g., "in the morning," "after snack")
- begins to order two or three objects by size (seriation) (e.g., largest to smallest) (age 4).

(5) Classification and Data Collection

Children use sorting to organize their world. As children recognize similarities and differences, they begin to recognize patterns that lead them to form generalizations. As they begin to use language to describe similarities and differences, they begin sharing their ideas and their mathematical thinking. Children can be actively involved in collecting, sorting, organizing, and communicating information.

The child:

- matches objects that are alike
- describes similarities and differences between objects
- sorts objects into groups by an attribute and begins to explain how the grouping was done
- participates in creating and using real and pictorial graphs.

Prekindergarten Guidelines

Science

Young children are natural scientists. They are eager to discover all they can about the world in which they live. In prekindergarten, children participate in simple investigations that help them begin to develop the skills of asking questions, gathering information, communicating findings, and making informed decisions. Using their own senses and common tools, such as a hand lens, students make observations and collect information. Through these processes, prekindergarten children learn about their world.

Children enter the prekindergarten classroom with many conceptions about the natural and constructed world-ideas that they have gained from prior experiences. Meaningful science learning experiences help children investigate those pre-existing ideas while building a foundation for additional knowledge. These meaningful experiences increase children's understanding of the natural world, living things, cycles, change, and patterns—concepts that organize the learning of science.

(1) Science Processes

Children use the processes of science to develop an understanding about their world. They use their senses to gather information, make tentative statements about events and relationships, and begin to test observations, draw conclusions, and form generalizations. Children learn by participating in a simple investigation (for example, adding water to a dried-up sponge), and then thinking about it, and finally discussing what happened. This inquiry approach enables students to build understanding over time.

The child:

- begins to demonstrate safe practices and appropriate use of materials
- asks questions about objects, events, and organisms
- shows an interest in investigating unfamiliar objects, organisms, and phenomena
- uses one or more senses to observe and learn about objects, events, and organisms
- describes observations
- begins to perform simple investigations
- gathers information using simple tools such as a magnifying lens and an eyedropper
- explores by manipulating materials with simple equipment, (e.g., pouring from a cup, and using a spoon to pick up sand or water)
- uses simple measuring devices to learn about objects and organisms
- compares objects and organisms and identifies similarities and differences
- sorts objects and organisms into groups and begins to describe how groups were organized
- begins to offer explanations, using his or her own words

- predicts what will happen next based on previous experience
- solves simple design problems (e.g., making a box into a little house for a storybook character, toy, or pet)
- participates in creating and using simple data charts
- shares observations and findings with others through pictures, discussions, or dramatizations.

(2) Science Concepts

As prekindergarten children learn science skills, they develop concepts about the natural and constructed environment. They identify components of the natural world including rocks, soil, and water. Children observe and describe changes, and they name organisms and describe basic needs of living things. Prekindergarten children observe cycles (for example, wet and dry) and structures (such as fences or buildings) and describe simple patterns that help predict what will happen next. They compare and sort objects and organisms based on observable differences and similarities. The children begin using what they know to solve problems, such as where to hang a wet cloth so it will dry quickly. The prekindergarten children can also develop an awareness that investigations help them learn about the natural world, that certain questions can be answered by investigations, and that those answers can change as new observations are made.

The child:

- observes and describes properties of rocks, soil, and water
- describes properties of objects and characteristics of living things
- begins to observe changes in size, color, position, weather, and sound
- identifies animals and plants as living things
- groups organisms and objects as living or nonliving and begins to identify things people have built
- begins to recognize that living things have similar needs for water, food, and air
- begins to identify what things are made of (e.g., distinguishing a metal spoon from a plastic spoon)
- uses patterns (such as growth and day following night to predict what happens next)
- identifies similarities and differences among objects and organisms
- begins to use scientific words and phrases to describe objects, events, and living things.

Prekindergarten Guidelines

Social Studies

Social studies concentrate on the nature of people and their world, the heritage of the past, and contemporary living and culture. The social studies are both integral to young children's lives and of great interest to them. Driven by a desire to know and achieve mastery over self and their environment, children are eager to gain understanding of the many aspects of their cultural and environmental world. Through social studies, children begin to develop the self-understanding that will serve as a foundation for learning about others and the world around them.

Although all aspects of education have the goal of preparing children to become contributing members of society, social studies are particularly well suited to foster the skills and attitudes necessary for participation in a democracy. Skills such as problem-solving, decision-making, and working independently and with others in a classroom prepare children to become fully functioning citizens.

(1) Individual, Culture, and Community

All children live in some type of group or social organization. Prekindergarten children must learn the skills of communicating, sharing, cooperating, and participating with others. These individual skills are necessary for all groups to function successfully and fairly. The better children are able to understand others, the more they will feel a sense of community and connection with other people and with their world.

The child:

- shares ideas and takes turns listening and speaking
- cooperates with others in a joint activity
- identifies and follows classroom rules
- participates in classroom jobs and contributes to the classroom community
- identifies similarities among people like himself/herself and classmates as well as among himself/herself and people from other cultures
- begins to examine a situation from another person's perspective.

(2) History

Prekindergarten children are aware of time and begin to organize their lives around it. Three- and four-year-old children learn to depend on events and routines that occur in a regular and predictable order. They begin to understand past events and how these events relate to present and future activities, demonstrating evidence of their growing understanding of time, change, and continuity.

The child:

- identifies common events and routines (e.g., snack time, storytime)
- begins to categorize time intervals using words (e.g., "today," "tomorrow," "next time")
- recognizes changes in the environment over time (e.g., growth, seasonal changes)
- connects past events to current events (e.g., linking yesterday's activity with what will happen today)
- begins to understand cause-and-effect relationships (e.g., if one goes outside in the rain, one will get wet).

(3) Geography

Geographic thinking for young children begins with the concepts of location and direction. Children use directions to locate their relative position in space and to locate their home and school in their community. They learn to recognize common features in their immediate environment and begin to represent them symbolically through drawings and constructions.

The child:

- identifies common features in the home and school environment (e.g., the library, the playground)
- creates simple representations of home, school, or community through drawings or block constructions
- begins to use words to indicate relative location (e.g., "front," "back," "near," "far")
- identifies common features of the local landscape (e.g., houses, buildings, streets).

(4) Economics

In prekindergarten, children learn about the world of work in their community. They explore the roles and relationships of consumers and producers, and become aware that people produce services as well as goods. Children learn that their community benefits from many different people working in many different ways.

The child:

- understands the basic human needs of all people for food, clothing, and shelter
- understands the roles, responsibilities, and services provided by community workers
- becomes aware of what it means to be a consumer.

Prekindergarten Guidelines

Fine Arts

Young children express their ideas, thoughts, and feelings using a variety of symbols. Through their art, music, and dramatic play, children actively engage in representing what they know and how they think, using problem-solving strategies to express ideas in different forms. The fine arts enhance children's ability to interpret symbols and are associated with growth in all areas of development, including academic learning.

(1) Art

Children explore a wide variety of materials and make discoveries about color, shape, and texture through art experiences. They learn to express what they know and begin to recognize how others express themselves through art. They also begin to gain control of fine-motor muscles and practice hand-eye coordination.

The child:

- uses a variety of materials (e.g., crayons, paint, clay, markers) to create original work
- uses different colors, surface textures, and shapes to create form and meaning
- begins to use art as a form of self-expression
- shares ideas about personal artwork
- begins to show interest in the artwork of others.

(2) Music

Three- and four-year-old children express themselves through singing and movement, and by playing simple instruments. Like art, music is a form of experiencing, learning, and communicating with others. Children learn to experiment with music concepts, volume, tempo, and sound. They begin to appreciate different types of music.

The child:

- participates in classroom music activities
- begins to sing a variety of simple songs
- begins to play classroom instruments
- begins to respond to music of various tempos through movement
- begins to distinguish among the sounds of several common instruments.

(3) Dramatic Play

Creative drama in prekindergarten involves young children in expressive and spontaneous productions. Children demonstrate their unique interpretation to music, songs, and stories through movement and dramatic experiences. These experiences contribute to children's ability to communicate more effectively and engage in cooperative activity with others.

The child:

- expresses feelings through movement
- begins to create or recreate stories, moods, or experiences through dramatic representations
- begins to engage in dramatic play with others.

Prekindergarten Guidelines

Health and Safety

Young children learn health-promoting habits and routines in prekindergarten. In these early years, they develop basic concepts, attitudes, and skills about nutrition, safety, hygiene, and physical activity that contribute to their well being. Children's experiences with their health and discovery of ways to improve it enhance their desire and ability to make wise decisions for healthy living in the future.

(1) Health

Health education includes personal hygiene and nutrition education. Children learn that regular hygiene routines and good nutrition are important to their health.

The child:

- becomes aware of routine healthy behaviors (e.g., brushing teeth)
- begins to follow health-promoting routines (e.g., washing hands)
- begins to understand the need for exercise and rest
- refines use of eating utensils
- begins to recognize and select healthy foods
- prepares simple healthy snacks.

(2) Safety

Prekindergarten children acquire everyday routines and procedures to remain safe and avoid injury. They learn about fire, traffic, environmental and personal safety, and what to do in emergency situations.

The child:

- recognizes the danger of fire and learns to treat fire with caution
- responds appropriately during a fire drill
- knows how to seek help in an emergency
- knows how to cross a street safely
- recognizes the symbol for poison
- knows never to eat substances that are not food
- recognizes the danger of poisonous substances, including drugs
- knows not to talk to, accept rides from, or take treats from strangers
- knows how to get help from a parent and/or trusted adult when made to feel uncomfortable or unsafe by another person/adult
- knows never to take medicine unless it is administered by an adult

- knows about safe behavior around bodies of water (e.g., pools, lakes).

Prekindergarten Guidelines

Personal and Social Development

Prekindergarten children develop personal and social skills that enable them to function well within the social setting of the classroom. Children develop a sense of who they are and their capabilities, and establish positive relationships with others, which enables them to effectively participate in class and community and accomplish meaningful tasks.

(1) Personal Development

Children develop a sense of self in prekindergarten. They begin to show initiative in learning and begin to take greater responsibility for their own behavior. They learn to channel their energies in ways that promote effective learning experiences.

The child:

- develops a sense of personal space
- expresses interests and self-direction in learning
- begins to show self-control by following classroom rules
- begins to be responsible for individual behavior and actions
- begins to show greater ability to control intense feelings (e.g., anger).

(2) Social Development

Children develop interpersonal and social skills for communicating with others. They learn alternatives for resolving conflicts and communicating their needs and feelings verbally, and they begin to develop and maintain productive relationships with other children.

The child:

- begins to share and cooperate with others in group activities
- respects other people's space and personal belongings
- begins to develop friendships with others
- begins to express thoughts, feelings, and ideas through language as well as through gestures and actions
- responds to the suggestions of others.

Prekindergarten Guidelines

Physical Development

Movement is at the center of young children's lives. Prekindergarten children participate in experiences that foster fundamental motor and movement skills, such as walking and running, which are necessary for participation in games and sports throughout life. They begin to develop gross motor skills that involve throwing, catching, and kicking, and fine motor skills that involve greater precision and accuracy of movement.

(1) Physical Movement

Children explore their physical space and understand how their bodies function in space through active movement experiences. They become more skillful and expressive in their movement from one point in space to another through running, jumping, hopping, and skipping movements.

The child:

- explores moving in space
- shows an awareness of name, location, and relationship of body parts
- moves within a space of defined boundaries, changing body configuration to accommodate the space
- becomes more able to move from one space to another in different ways (e.g., running, jumping, hopping, skipping)
- becomes more able to move in place (e.g., axial movements such as reaching, twisting, turning, and bending)
- begins to move in rhythm
- begins to participate in group games involving movement (e.g., Duck, Duck, Goose).

(2) Gross-Motor Development

Gross-motor development requires thought and deliberate movement. Three- and four-year-old children develop greater control of gross-motor manipulative movements that involve giving force to objects and receiving force from objects. Throwing, catching, bouncing, and kicking are fundamental gross-motor manipulative skills.

The child:

- begins to throw or kick an object in a particular direction
- begins to play catch with a bean bag or a large ball
- bounces a large ball and catches it
- begins to coordinate arms and legs (e.g., swinging, stretching).

(3) Fine-Motor Development

Fine-motor manipulative movements involve object-handling activities that emphasize motor control, precision, and accuracy of movement. Using a computer mouse, cutting with scissors, and drawing are the foundational skills needed for the demands of handwriting and other small-motor skills in later school years.

The child:

- begins to develop pincer control in picking up objects (e.g., weaving, touching small objects)
- begins to practice self-help skills (e.g., zipping, buttoning)
- begins to hold writing tools with fingers instead of with a fist
- begins to manipulate play objects that have fine parts
- begins to use scissors.

Prekindergarten Guidelines

Technology Applications

Young children have much to gain from use of technology. In prekindergarten, they expand their ability to acquire information, solve problems, and communicate with others. Regular access and exposure to computers and related technology can enhance this learning. Children use engaging, age-appropriate, and challenging software, and technology to extend their knowledge and to enrich their learning of curriculum content and concepts. These technologies serve as important learning tools and are integrated throughout the instructional program.

Children learn the basic functions of the computer and related technologies. They develop techniques for handling and controlling various input devices, and become increasingly confident and independent users of age-appropriate software programs.

The child:

- starts, uses, and exits software programs
- uses a variety of input devices, such as mouse, keyboard, voice/sound recorder, or touch screen
- begins to use technical terminology, such as “mouse,” “keyboard,” “printer,” “CD-ROM”
- follows basic oral or pictorial cues for operating programs successfully
- enjoys listening to and interacting with storybooks and information texts (e.g., multimedia encyclopedia) in electronic forms
- uses a variety of software packages with audio, video, and graphics to enhance learning experiences (e.g., improving vocabulary, increasing phonological awareness).

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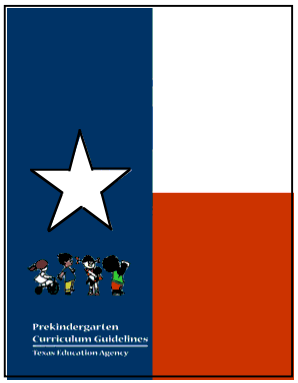


Linking the Prekindergarten Curriculum Guidelines

to the Kindergarten TEKS

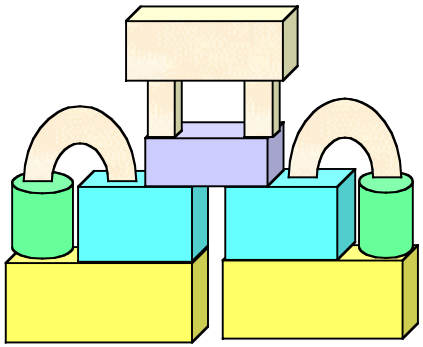
TEXAS Education Agency

Texas Center for Reading and Language Arts

Prekindergarten Curriculum Guidelines Build the Foundation for Kindergarten

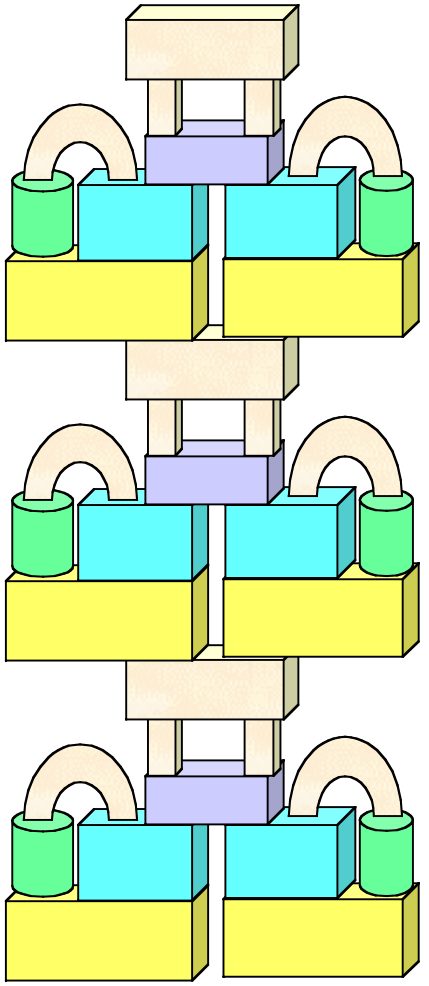
Prekindergarten

- Number Pattern
- Logic
- Measurement
- Classification
- Relationships
- Shape
- Space



Kindergarten

- Number, Operations, and Quantitative Reasoning
- Patterns, Relationships, and Algebraic Thinking
- Geometry and Spatial Reasoning
- Measurement
- Probability and Statistics



Mathematics in the Kindergarten TEKS

Within a well-balanced mathematics curriculum, the primary focal points at Kindergarten are developing whole-number concepts and using patterns and sorting to explore number, data, and shape.

Throughout mathematics in Kindergarten-Grade 2, students build a foundation of basic understandings in

- number, operation, and quantitative reasoning;
- patterns, relationships, and algebraic thinking;
- geometry and spatial reasoning;
- measurement; and
- probability and statistics.

Students use numbers in ordering, labeling, and expressing quantities and relationships to solve problems and translate informal language into mathematical symbols.

Students use patterns to describe objects, express relationships, make predictions, and solve problems as they build an understanding of number, operation, shape, and space.

Students describe shapes, solids, and locations in the physical world and begin to develop measurement concepts as they identify and compare attributes of objects and situations.

Students collect, organize, and display data and use information from graphs to answer questions, make summary statements, and make informal predictions based on their experiences.

Problem solving, language and communication, connections within and outside mathematics, and formal and informal reasoning underlie all content areas in mathematics.

Throughout mathematics in Kindergarten-Grade 2, students use these processes together with technology and other mathematical tools such as manipulative materials to develop conceptual understanding and solve problems as they do mathematics.

Prekindergarten Curriculum Guidelines for Mathematics

Number and Operations

The child:

- arranges sets of concrete objects in one-to-one correspondence
- counts concrete objects to five or higher
- begins to compare the numbers of concrete objects using language (e.g., "same" or "equal," "one more," "more than," or "less than")

Kindergarten TEKS for Mathematics

Number, Operations, and Quantitative Reasoning

(K.1) The student uses numbers to name quantities.

The student is expected to:

(A) use one-to-one correspondence and language such as more than, same number as, or two less than to describe relative sizes of sets of concrete objects;

(B) use sets of concrete objects to represent quantities given in verbal or written form (through 9); and

(C) use numbers to describe how many objects are in a set (through 20).

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Prekindergarten Curriculum Guidelines for Mathematics

Number and Operations

The child:

- counts by ones to 10 or higher

Kindergarten TEKS for Mathematics

Patterns, relationships, and algebraic thinking

(K.6) The student uses patterns to make predictions.

The student is expected to:

(A) use patterns to predict what comes next, including cause-and-effect relationships; and

(B) count by ones to 100.

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Prekindergarten Curriculum Guidelines for Mathematics

Number and Operations

The child:

- begins to demonstrate part of and whole with real objects (e.g., an orange)

Kindergarten TEKS for Mathematics

Number, Operations, and Quantitative Reasoning

(K.3) Number, operation, and quantitative reasoning. The student recognizes that there are quantities less than a whole.

The student is expected to:

(A) share a whole by separating it into equal parts; and

(B) explain why a given part is half of the whole.

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Prekindergarten Curriculum Guidelines for Mathematics

Number and Operations

The child:

- begins to identify first and last in a series

Kindergarten TEKS for Mathematics

Number, Operations, and Quantitative Reasoning

(K.2) Number, operation, and quantitative reasoning. The student describes order of events or objects.

The student is expected to:

(A) use language such as before and after to describe relative position in a sequence of events or objects; and

(B) name the ordinal position in a sequence such as first, second, third, etc.

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Prekindergarten Curriculum Guidelines for Mathematics

Number and Operations

The child:

- combines, separates, and names "how many" concrete objects

Kindergarten TEKS for Mathematics

Number, Operations, and Quantitative Reasoning

(K.4) The student models addition and subtraction.

The student is expected to:

- model and create addition and subtraction problems in real situations with concrete objects.

Prekindergarten Curriculum Guidelines for Mathematics

Patterns

The child:

- imitates pattern sounds and physical movements (e.g., clap, stomp, clap, stomp,…)
- recognizes and reproduces simple patterns of concrete objects (e.g., a string of beads that are yellow, blue, blue, yellow, blue, blue)
- begins to recognize patterns in their environment (e.g., day follows night, repeated phrases in storybooks, patterns in carpeting or clothing)

Kindergarten TEKS for Mathematics

Patterns, Relationships, and Algebraic Thinking

(K.5) The student identifies, extends, and creates patterns.

The student is expected to:

- identify, extend, and create patterns of sounds, physical movement, and concrete objects.

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Prekindergarten Curriculum Guidelines for Mathematics

Patterns

The child:

- begins to predict what comes next when patterns are extended

Kindergarten TEKS for Mathematics

Patterns, Relationships, and Algebraic Thinking

(K.6) The student uses patterns to make predictions.

The student is expected to:

(A) use patterns to predict what comes next, including cause-and-effect relationships; and

(B) count by 20's to 100.

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Prekindergarten Curriculum Guidelines for Mathematics

Geometry and Spatial Sense

The child:

- begins to recognize, describe, and name shapes (e.g., circles, triangles, rectangles—including squares)

Kindergarten TEKS for Mathematics

TEXAS Education Agency

Geometry and Spatial Reasoning

(K.9) The student recognizes characteristics of shapes and solids.

The student is expected to:

(A) describe and compare real-life objects or models of solids;

(B) recognize shapes in real-life objects or models of solids; and

(C) describe, identify, and compare circles, triangles, and rectangles including squares.

Texas Center for Reading and Language Arts

Prekindergarten Curriculum Guidelines for Mathematics

Geometry and Spatial Sense

The child:

- begins to use words that indicate where things are in space (e.g., "beside," "inside," "behind," "above," "below")

Kindergarten TEKS for Mathematics

Geometry and Spatial Reasoning

(K.7) The student describes the relative positions of objects.

The student is expected to:

(A) describe one object in relation to another using informal language such as over, under, above, and below; and

(B) place an object in a specified position.

Prekindergarten Curriculum Guidelines for Mathematics

Measurement

The child:

- begins to make size comparisons between objects (e.g., taller than, smaller than)
- begins to order two or three objects by size (seriation) (e.g., largest to smallest) (age 4)

Kindergarten TEKS for Mathematics

TEXAS Education Agency

Measurement

(K.10) The student uses attributes such as length, weight, or capacity to compare and order objects.

The student is expected to:

(A) compare and order two or three objects according to length (shorter or longer), capacity (holds more or less), or weight (lighter or heavier); and

(B) find concrete objects that are about the same as, less than, or greater than a given object according to length, capacity, or weight.

Texas Center for Reading and Language Arts

Prekindergarten Curriculum Guidelines for Mathematics

Number and Operations

The child:

- begins to categorize time intervals and uses language associated with time in everyday situations (e.g., "in the morning," "after snack")

Kindergarten TEKS for Mathematics

Number, Operations, and Quantitative Reasoning

(K-11) The student uses time and temperature to compare and order events, situations, and/or objects.

The student is expected to:

(A) compare situations or objects according to temperature such as hotter or colder;

(B) compare events according to duration such as more time or less time than;

(C) sequence events; and

(D) read a calendar using days, weeks, and months.

Prekindergarten Curriculum Guidelines for Mathematics

Classification and Data Collection

The child:

- matches objects that are alike
- describes similarities and differences between objects
- sorts objects into groups by an attribute and begins to explain how the grouping was done
- participates in creating and using real and pictorial graphs

Kindergarten TEKS for Mathematics

Probability and Statistics

(K.12) The student constructs and uses graphs of real objects or pictures to answer questions.

The student is expected to:

(A) construct graphs using real objects or pictures in order to answer questions; and

(B) use information from a graph of real objects or pictures in order to answer questions.

Science Processes

Science Concepts

Observe ⟷ **Describe** ⟷ **Investigate**

Patterns

Cycles

Change

Relationships

Living Things
Rocks, Soil, Water

Non-Living Things
Constructions

Science in the Kindergarten TEKS

(1) In Kindergarten, science introduces the use of simple classroom and field investigations to help students develop the skills of asking questions, gathering information, communicating findings, and making informed decisions. Using their own senses and common tools such as a hand lens, students make observations and collect information. Students also use computers and information technology tools to support their investigations.

(2) As students learn science skills, they identify components of the natural world including rocks, soil, and water. Students observe the seasons and growth as examples of change. In addition, Kindergarten science includes the identification of organisms and objects and their parts. Students learn how to group living organisms and nonliving objects and explore the basic needs of living organisms.

(3) Science is a way of learning about the natural world. Students should know how science has built a vast body of changing and increasing knowledge described by physical, mathematical, and conceptual models, and also should know that science may not answer all questions.

(4) A system is a collection of cycles, structures, and processes that interact. Students should understand a whole in terms of its components and how these components relate to each other and to the whole. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems and can be observed and measured as patterns. These patterns help to predict what will happen next and can change over time.

(5) Investigations are used to learn about the natural world. Students should understand that certain types of questions can be answered by investigations, and that methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the natural world and can show how systems work. They have limitations and, based on new discoveries, are constantly being modified to more closely reflect the natural world.

Texas Center for Reading and Language Arts

Prekindergarten Curriculum Guidelines for Science

Science Processes

The child:

- begins to demonstrate safe practices and appropriate use of materials

Kindergarten TEKS for Science

Science Processes

(K.1) The student participates in classroom and field investigations following home and school.

The student is expected to:

(A) demonstrate safe practices during classroom and field investigations; and

(B) learn how to use and conserve resources and materials.

Prekindergarten Curriculum Guidelines for Science

Science Processes

The child:

- asks questions about objects, events, and organisms
- describes observations
- begins to perform simple investigations
- shares observations with others through pictures, discussions, or dramatizations

Kindergarten TEKS for Science

TEXAS Education Agency

Science Processes

(K.2) The student develops abilities necessary to do scientific inquiry in the field and the classroom.

The student is expected to:

(A) ask questions about organisms, objects, and events;

(B) plan and conduct simple descriptive investigations;

(C) gather information using simple equipment and tools to extend the senses;

(D) construct reasonable explanations using information; and

(E) communicate findings about simple investigations.

Prekindergarten Curriculum Guidelines for Science

Science Processes

The child:

- uses one or more senses to observe and learn about objects, events, and organisms
- gathers information using simple tools such as a magnifying lens and an eyedropper
- explores by manipulating materials with simple equipment (e.g., pouring from a cup, and using a spoon to pick up sand or water)

Kindergarten TEKS for Science

Science Processes

(K.4) The student uses age-appropriate tools and models to verify that organisms and objects and parts of organisms and objects can be observed, described, and measured.

The student is expected to:

(A) identify and uses senses as tools of operations; and

(B) make observations using tools including hand lenses, balances, cups, bowls, and computers.

Prekindergarten Curriculum Guidelines for Science

Science Concepts

The child:

- observes and describes properties of rocks, soil, and water
- describes properties of objects and characteristics of living things

Kindergarten TEKS for Science

Science Concepts

(K.10) The student knows that the natural world includes rocks, soil, and water.

The student is expected to:

(A) observe and describe properties of rocks, soil, and water; and

(B) give examples of ways that rocks, soil, and water are useful.

Prekindergarten Curriculum Guidelines for Science

Science Concepts

The child:

- begins to observe changes in size, color, position, weather, and sound

Kindergarten TEKS for Science

Science Concepts

(K.7) The student knows that many types of change occur.

The student is expected to:

(A) observe, describe, and record changes in size, mass, color, position, quantity, time, temperature, sound, and movement;

(B) identify that heat causes change, such as ice melting or the sun warming the air, and compare objects according to temperature;

(C) observe and record weather changes from day to day and over seasons; and

(D) observe and record stages in the life cycle of organisms in their natural environment.

Prekindergarten Curriculum Guidelines for Science

Science Concepts

The child:

- identifies animals and plants as living things
- groups organisms and objects as living or nonliving and begins to identify things people have built

Kindergarten TEKS for Science

Science Concepts

(K.8) The student knows the difference between living organisms and non-living objects.

The student is expected to:

(A) identify a particular organism or object as living or non-living; and

(B) group organisms and objects as living or non-living.

Prekindergarten Curriculum Guidelines for Science

Science Concepts

The child:

- begins to recognize that living things have similar needs for water, food, and air

Kindergarten TEKS for Science

Science Concepts

(K.9) The student knows that living things have basic needs.

The student is expected to:

(A) identify basic needs of living organisms;

(B) give examples of how living organisms depend on each other; and

(C) identify ways that the Earth can provide resources for life.

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Prekindergarten Curriculum Guidelines for Science

Science Concepts

The child:

- uses patterns (such as growth and day following night to predict what happens next)

Kindergarten TEKS for Science

Science Concepts

(K.5) The student knows that organisms, objects, and events have properties and patterns.

The student is expected to:

(A) describe properties of objects and characteristics of organisms;

(B) observe and identify patterns including seasons, growth, and day and night and predict what happens next; and

(C) recognize and copy patterns seen in charts and graphs.

Correlating the Texas Prekindergarten Curriculum Guidelines for Mathematics to National Standards (1 of 3)

Prekindergarten Curriculum Guidelines—Mathematics	National Council of Teachers of Mathematics: Principles and Standards for School Mathematics—PreK-2
The child counts concrete objects to five or higher. The child counts by ones to 10 or higher.	The child counts with understanding.
The child begins to name "how many" are in a group of up to three or more objects without counting.	The child recognizes "how many" in sets of objects.
The child begins to demonstrate part of and whole with real objects (e.g., an orange).	The child develops a sense of whole numbers and represents them in flexible ways, including relating, composing, and decomposing numbers. The child understands and represents commonly used fractions (e.g.,1/4, 1/3, 1/2).
The child imitates pattern sounds and physical movements. The child begins to recognize patterns in their environment. The child begins to predict what comes next when patterns are extended.	The child recognizes, describes, and extends patterns, such as sequences of sounds and shapes or simple numeric patterns, and translates from one representation to another. The child describes qualitative change, such as a student's growing taller.
The child matches objects that are alike.	The child sorts, classifies, and orders objects by size, number, and other properties.

Correlating the Texas Prekindergarten Curriculum Guidelines for Mathematics to National Standards (2 of 3)

Prekindergarten Curriculum Guidelines—Mathematics	National Council of Teachers of Mathematics: Principles and Standards for School Mathematics—PreK-2
The child sorts objects into groups by an attribute and begins to explain how the grouping was done.	The child sorts and classifies objects according to their attributes and organizes data about the objects.
The child participates in creating and using real and pictorial graphs.	The child uses concrete, pictorial, and verbal representations to develop an understanding of invented and conventional symbolic notations. The child represents data using concrete objects, pictures, and graphs, and creates and uses representations to record and communicate mathematical ideas.
The child begins to recognize, describe, and name shapes (e.g., circles, triangles, rectangles—including squares).	The child recognizes, names, builds, draws, compares, and sorts and describes two- and three-dimensional shapes; describes attributes and parts of two- and three-dimensional shapes.
The child begins to investigate and predict the results of putting together two or more shapes.	The child investigates and predicts the results of putting together and taking apart two- and three-dimensional shapes.
The child begins to use words that indicate where things are in space (e.g., "beside," "inside," "behind," "above," "below").	The child describes, names, and interprets relative positions in space and applies ideas about relative position. The child describes, names, and interprets direction and distance in navigating space and applies ideas about direction and distance.

Correlating the Texas Prekindergarten Curriculum Guidelines for Mathematics to National Standards (3 of 3)

Prekindergarten Curriculum Guidelines—Mathematics	National Council of Teachers of Mathematics: Principles and Standards for School Mathematics—PreK-2
The child begins to categorize time intervals and uses language associated with time in everyday situations. The child begins to order two or three objects by size (seriation).	The child compares and orders objects according to the attributes of length, volume, weight, area, and time.
The child begins to make size comparisons between objects (e.g., taller than, smaller than).	The child develops common referents for measures to make comparisons and estimates.
The child begins to use tools to imitate measuring.	The child uses tools to measure. The child measures with multiple copies of units of the same size such as paper clips laid end to end. The child uses repetition of a single unit to measure something larger than the unit, for instance, measuring length of a room with a single meterstick.
The child recognizes and reproduces simple patterns of concrete objects (e.g., a string of beads that are yellow, blue, blue, yellow, blue, blue).	The child analyzes how both repeating and growing patterns are generated.
The child begins to recognize when a shape's position or orientation has changed.	The child recognizes and applies sides, flips, turns.
The child puts together puzzles of increasing complexity.	The child recognizes and represents shapes from different perspective

Adapted from: Texas Education Agency. (1999). *Prekindergarten curriculum guidelines.* Austin, TX: Author; National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: Author.

Prekindergarten Curriculum Guidelines—Science	National Science Education Standards, Chapter 6: Science Content Standards—K-4
The child asks questions about objects, events, and organisms.	An ability necessary for children to do scientific inquiry is asking questions about objects, organisms, and events in the environment.
The child describes observations.	In grades K-4, children can be encouraged to develop their observation and description skills and make explanations based on observations. Young children can be encouraged to talk about and draw what they see and think.
The child begins to perform simple investigations. The child gathers information using simple tools such as a magnifying lens and an eyedropper. The child explores by manipulating materials with simple equipment (e.g., pouring from a cup, and using a spoon to pick up sand or water). The child uses simple measuring devices to learn about objects and organisms.	An ability necessary for children to do scientific inquiry is planning and conducting a simple investigation.

Prekindergarten Curriculum Guidelines—Science	National Science Education Standards, Chapter 6: Science Content Standards—K-4
The child compares objects and organisms and identifies similarities and differences.	Through the observation, manipulation, and classification of common objects, children reflect on the similarities and differences of the objects.
The child sorts objects and organisms into groups and begins to describe how groups were organized.	In classroom activities such as classification, younger elementary students generally use mutually exclusive rather than hierarchical categories. Young children, for example, will use two groups, but older children will use several groups at the same time.
The child begins to offer explanations, using his or her own words.	Students learn through the inquiry process how to communicate about their own and their peers' investigations and explanations.
The child solves simple design problems (e.g., making a box into a little house for a storybook character, toy, or pet).	As a result of science and technology activities, all children develop abilities of technological design. This begins the understanding of the design process, as well as the ability to solve simple design problems. Child investigations and design problems should incorporate more than one material and several contexts in science and technology. For example, making a device to shade eyes from the sun.
The child participates in creating and using simple data charts.	By recording data and making graphs and charts, children can search for patterns and order in their work and that of their peers.

Prekindergarten Curriculum Guidelines—Science	National Science Education Standards, Chapter 6: Science Content Standards—K-4
The child shares observations and findings with others through pictures, discussions, or dramatizations.	Children can act as scientists by making the results of their investigations public and describing their investigations in ways that enable others to repeat the investigations.
The child names organisms and describes basic needs of living things.	Organisms have basic needs. For example, animals need air, water, and food; plants require air, water, nutrients, and light.
The child observes and describes properties of rocks, soil, and water.	By carefully observing and describing the properties of many rocks, children will begin to see that some rocks are made of a single substance, but most are made of several substances.
The child describes properties of objects and characteristics of living things.	In lower elementary grades, many children associate "life" with any objects that are active in any way. This view of life develops into one in which movement becomes the defining characteristic.
The child begins to observe changes in size, color, position, weather, and sound.	When children describe and manipulate objects, they also begin to focus on the position and movement of objects. As they observe changes, such as the movement of an object's shadow during the course of a day, and the positions of the sun and the moon, they will find the patterns in these movements.
The child identifies animals and plants as living things.	In lower elementary grades, many children associate "life" with any objects that are active in any way. This view of life develops into one in which movement becomes the defining characteristic. Eventually children incorporate other concepts, such as eating, breathing, and reproducing to define life.

Correlating the Texas Prekindergarten Curriculum Guidelines for Science to National Standards (4 of 4)

Prekindergarten Curriculum Guidelines—Science	National Science Education Standards, Chapter 6: Science Content Standards—K-4
The child groups organisms and objects as living or nonliving and begins to identify things people have built.	By grade 4, distinctions between the properties of objects and materials can be understood in specific contexts, such as a set of rocks or living materials.
The child begins to recognize that living things have similar needs for water, food, and air.	As a result of activities in grades K-4, all students can develop an understanding that organisms have basic needs. For example, animals need air, water, and food.
The child begins to identify what things are made of (e.g., distinguishing a metal spoon from a plastic spoon).	Young children begin their study of matter by examining and qualitatively describing objects and their behavior. Objects can be described by the properties of the materials from which they are made, and those properties can be used to separate or sort a group of objects or materials. Objects are made of one or more materials, such as paper, wood, and metal.
The child uses patterns (such as growth and day following night) to predict what happens next.	As children become more familiar with their world, they can be guided to observe changes, including cyclic changes, such as night and day and the seasons, predictable trends, such as growth and decay, and less consistent changes, such as the weather or the appearance of meteors.

Adapted from: Texas Education Agency. (1999). *Prekindergarten curriculum guidelines.* Austin, TX: Author; National Committee on Science Education Standards and Assessment. (1996). *National science education standards.* Washington, DC: National Academy Press.

Acid: A material that reacts with bases and tastes sour, such as vinegar.
Active Process: Implies physical and mental activity, as in active learning, where children learn through direct experience with various materials they have chosen to manipulate.
Adhesion: A force that causes molecules to be attracted to the molecules of other materials.
Air: A colorless, odorless, tasteless, gaseous mixture of elements that supports life on Earth. Contains nitrogen, oxygen, other gases, pollutants, and a variety of tiny particles of materials.
Attract: To pull or draw towards, as with magnets.
Balance: Stability of an object or a structure's ability to remain standing; has equal weight on both sides.
Base: A material that reacts with acids and tastes bitter, such as baking soda.
Buoyancy: The upward force that a liquid exerts on an object. The force is equal to the weight of the liquid that is pushed aside when the object enters the liquid.
Chlorophyll: Green pigments found in plants that trap energy from sunlight.
Classifying: Sorting objects into categories or groups, such as by how things feel, smell, sound, taste, or look.
Cohesion: A force that causes molecules to hold together which is a stronger force than adhesion.
Condensation: Tiny drops of water on cold things which form when water vapor in the air cools and turns back into water.
Containment: When an object is enclosed completely within another object, such as children in a school building.
Counting: Using the number word sequence to keep track of how many.
Crystals: Materials that have definite internal structures and external shapes arranged in patterns, such as salt, ice, and minerals.
Diffusion: Spontaneous movement of molecules from a place of higher concentration to one of lower concentration, resulting in a uniform mixture.
Direction: Areas in space based on the location of the observer such as left, right, up, down, top, bottom, in, and out.
Dissolve: The complete mixing of a solid in a liquid which then forms a new substance. When sugar dissolves in water, the new substance is sugar water.
Division: Separation of an object into discrete parts that can be used separately.
Enclosure: A structure that surrounds something or holds something in, such as fish in an aquarium.
Energy: Usable power, as shown in action, exertion, performance, or movement.
Engineering: The design, construction, and operation of structures, equipment, and systems.
Estimating: Making an educated guess about the size or amount of something. To estimate accurately, numbers and size have to have meaning to a child and he or she must understand concepts such as bigger, smaller, more, and less.

Evaporation: The conversion of a liquid to a vapor, which occurs when a liquid is heated to a certain point.
Filter: To separate solids or suspended particles from a liquid by passing it through a layer of sand, fiber, or charcoal.
Fractions: Discrete units that represent parts of a whole.
Freezing point: The temperature at which a liquid becomes a solid.
Friction: Resistance between two materials caused by rubbing the two materials together.
Gases: Matter which has low density, expands and contracts readily, and distributes uniformly through any container.
Gears: Combinations of wheels with teeth around the edge that work together to effect movement.
Geometry: An area of mathematics that involves size, shape, space, position, direction, and movement. It classifies and describes the physical world around us and involves angles, shapes, and solids.
Germinate: To sprout or start to sprout and grow from a seed. Water and sunlight are necessary for germination.
Gluten: A glue-like substance found in flour.
Graphing: Representing numerical data in a visual manner, such as on graph paper.
Gravity: The attraction between two objects associated with their mass and distance; gravity on Earth pulls everything toward its center.
Image: The light seen when it bounces off a surface; in a mirror, the reflection bounces off as an image.
Insoluble: Cannot be dissolved or mixed. Oil and water will not mix well even when shaken or stirred.
Light: A form of energy; part of the electromagnetic spectrum.
Liquid: A state of matter where molecules move freely.
Magnet: An object that attracts or repels certain materials due to an invisible force.
Matching: Finding two objects with the same characteristics.
Measurement: Finding the length, width, height, and weight of an object using units of measurement such as inches, feet, and pounds.
Melting point: The temperature at which a solid becomes a liquid.
Molecule: The tiny particle produced by the linking of two or more atoms. Everything is made up of tiny particles called molecules.
Number value: The value of a given number in relation to other numbers.
Numeracy: The understanding of how to use mathematics.
One-to-one correspondence: The idea that one object goes with another object; a precursor to counting and number value.

Opaque: Cannot be seen through and does not allow rays of light to pass through.
Oral counting: Stating the number words in the correct order; usually 4-5 year olds will memorize the number word sequence to 12 or so, after that they use patterns.
Patterns: Repeating sequences found in such things as music, art, and nature.
Plants: Any organisms, not animal, with cellulose cell walls, that grow, lack locomotion, and lack organs or nervous tissue. Usually have roots, blossoms, and leaves and are often green.
Pressure: The application of continuous force or force applied over a surface.
Proximity: The concept of an object in space and its direction, position, and distance in relationship to other objects.
Reflection: The image or light seen when rays of light bounce off of a surface.
Repel: To push away, as with magnets.
Rocks: Any relatively hard, naturally formed mass of minerals or petrified material.
Scientific inquiry: Refers to the way that scientists study the natural world and propose explanations based on observation and evidence. When used to describe a learning process, refers to children's activities which lead to the understanding of scientific ideas as well as the understanding of how scientists study the natural world.
Scientific knowledge: Refers to the understanding of scientific facts, concepts, principles, laws, and theories. Also includes the ability to see the relationships between these ideas, the reasons for these relationships, and the ability to use this knowledge to make informed decisions.
Scientific literacy: The understanding of science and the processes of science: knowing and understanding the natural world.
Science subject matter: Knowledge specifically associated with the physical, life, and earth sciences.
Separation: Division into discrete parts. For example, when an object is broken into two or more pieces, the pieces are separate.
Sequence: The order in which a series of events takes place.
Shapes: Geometric forms such as circles, squares, triangles, and rectangles.
Solid: A substance that is compact; neither liquid nor gaseous.
Soluble: Capable of being dissolved, such as salt in water.
Solution: Liquid containing a dissolved substance.
Sorting: Finding objects with similarities or differences and putting them into categories according to those characteristics.
Spectrum: The colors found in white light—red, orange, yellow, green, blue, indigo, and violet.
Static electricity: An accumulation of negative charges (electrons) that stays in one place, rather than flowing through things, as electrical currents do.

Surface tension: The stretchy skin of a liquid, which is caused by the attraction of molecules on its surface.
Symmetry: Balance, matching arrangement of pattern, or equal and exact matching, as in two sides of a design that mirror each other exactly.
Texture: The appearance and feel of something. Sandpaper has a rough texture while glass has a smooth texture.
Time: A way of measuring hours, days, months, or years based on the revolution and rotation of the Earth. Time is measured using hours, seconds, and minutes.
Translucent: Light can shine through but cannot be seen through.
Transparent: Light can shine through and can be seen through.
Water vapor: Tiny droplets of water in the air too small to see and formed by evaporation.
Weathering: Actions that occur in nature by which natural materials are gradually broken down through exposure to the elements, such as the grinding action that makes sand.
Weight: The heaviness of something according to a scale of measurement.
White light: A band of seven different colors—red, orange, yellow, green, blue, indigo, and violet. Each color has a different wavelength. All the colors mixed together make white light.
Whole versus parts: A whole object is a distinct, single object that can be broken down into parts that make up the whole objects. For example, a completed puzzle is a whole, but it is made up of individual puzzle pieces, which are the parts.
Wind: Air movement.

Adapted from: Fromboluti, C., & Rinck, N. (2000). *Early childhood: Where learning begins: Mathematics.* Jessup, MD: U.S. Department of Education; High/Scope Press. (1995). *Active learning participant guide.* Ypsilanti, MI: Author; Kohl, M., & Gainer, C. (1996). *MathArts: Exploring math through art for 3 to 6 year olds.* Beltsville, MD: Gryphon House; Kohl, M., & Potter, J. (1993). *ScienceArts: Discovering science through art experiences.* Bellingham, WA: Bright Ring; National Committee on Science Education Standards and Assessment. (1996). *National science education standards.* Washington, DC: National Academy Press.

References

Baroody, A. J. (2000). Does mathematics instruction for three- to five-year-olds really make sense? *Young Children, 55*(4), 61-67.

Basile, C. G. (1999). The outdoors as a context for mathematics in the early years. In J. V. Copley (Ed.), *Mathematics in the early years* (pp. 156-161). Reston, VA: National Council of Teachers of Mathematics.

Bauch, J. P., & Hsu, H. J. (1988). Montessori: Right or wrong about number concepts? *Arithmetic Teacher*, *35*(6), 8-11.

Bennett, A. T., & Kessler, J. H. (1996). *Apples, bubbles, and crystals: Your science ABCs*. New York: McGraw-Hill.

Brown, S. E. (1981). *Bubbles, rainbows & worms: Science experiments for pre-school children*. Mt. Rainier, MD: Gryphon House.

Bruni, J. V., & Seidenstein, R. B. (1990). Geometric concepts and spatial sense. In J. N. Payne (Ed.), *Mathematics for the young child* (pp. 203-228). Reston, VA: National Council of Teachers of Mathematics.

Burns, M. S., Griffin, P., & Snow, C. E. (Eds.). (1999). *Starting out right: A guide to promoting children's reading success*. Washington, DC: National Academy Press.

Church, E. B., & Miller, K. (1990). *Learning through play: Blocks, a practical guide for teaching young children*. New York: Scholastic.

Copley, J. V. (1999). Assessing the mathematical understanding of the young child. In J. V. Copley (Ed.), *Mathematics in the early years* (pp. 182-188). Reston, VA: National Council of Teachers of Mathematics.

Copley, J. V. (Ed.). (2000). *The young child and mathematics*. Washington, DC: National Association for the Education of Young Children.

Dickinson, D. K. (2001). Book reading in preschool classrooms: Is recommended practice common? In D. K. Dickinson & P. O. Tabors (Eds.), *Beginning literacy with language* (pp. 175-204). Baltimore: Paul H. Brookes.

Ellis, E. S., Worthington, L. A., & Larkin, M. J. (1994). *Executive summary of the research synthesis on effective teaching principles and the design of quality tools for educators.* Retrieved July 18, 2001, from University of Oregon, National Center to Improve the Tools of Educators Web site: http//www.idea.uoregon.edu/~ncite/documents/techrep/tech06.html

Fradd, S. H. (1991). Effective practices in meeting the needs of students with non-English-language backgrounds. *Preventing School Failure*, *36*(1), 35-40.

Fradd, S., & Lee, O. (1995). Science for all: A promise or a pipe dream for bilingual students? *Bilingual Research Journal, 19*(2), 261-278.

Fromboluti, C. S., & Rinck, N. (2000). *Early childhood: Where learning begins: Mathematics.* Jessup, MD: U.S. Department of Education.

Greenes, C. (1999). Ready to learn: Developing young children's mathematical powers. In J. V. Copley (Ed.), *Mathematics in the early years* (pp. 39-47). Reston, VA: National Council of Teachers of Mathematics.

Helm, J. H., Beneke, S., & Steinheimer, K. (1998). *Windows on learning: Documenting young children's work.* New York: Teachers College Press.

Helm, J. H., & Katz, L. G. (2001). *Young investigators: The project approach in the early years.* New York: Teachers College Press.

High/Scope Press. (1995). *Active learning participant guide.* Ypsilanti, MI: Author.

Holt, B. (1993). *Science with young children* (Rev. ed.). Washington, DC: National Association for the Education of Young Children.

Hong, H. (1999). Using storybooks to help young children make sense of mathematics. In J. V. Copley (Ed.), *Mathematics in the early years* (pp. 162-168). Reston, VA: National Council of Teachers of Mathematics.

Kilmer, S. J., & Hofman, H. (1995). Transforming science curriculum. In S. Bredekamp & T. Rosegrant (Eds.), *Reaching potentials: Transforming early childhood curriculum and assessment: Vol. 2* (pp. 43-63). Washington, DC: National Association for the Education of Young Children.

Kohl, M., & Gainer, C. (1996). *MathArts: Exploring math through art for 3 to 6 year olds*. Beltsville, MD: Gryphon House.

Kohl, M., & Potter, J. (1993). *ScienceArts: Discovering science through art experiences*. Bellingham, WA: Bright Ring.

Lind, K. K. (1999). Science in early childhood: Developing and acquiring fundamental concepts and skills. In American Association for the Advancement of Science, *Dialogue on early childhood science, mathematics, and technology education* (pp. 73-83). Washington, DC: Author.

Morrow, L. M. (2001). *Literacy development in the early years: Helping children read and write* (4th ed.). Boston: Allyn & Bacon.

Morrow, L. M., Pressley, M., Smith, J. K., & Smith, M. (1997). The effect of a literature-based program integrated into literacy and science instruction with children from diverse backgrounds. *Reading Research Quarterly, 32*(1), 54-75.

National Committee on Science Education Standards and Assessment. (1996). *National Science Education Standards*. Washington, DC: National Academy Press.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.

Notari-Syverson, A., O'Connor, R. E., & Vadasy, P. F. (1998). *Ladders to literacy: A preschool activity book*. Baltimore: Paul H. Brookes.

Oberdorf, C. D., & Taylor-Cox, J. (1999). Shape up! *Teaching Children Mathematics, 5*(6), 340-345.

Owens, C.V. (1999). Conversational science 101A: Talking it up! *Young Children, 54*(5), 4-9.

Padrón, Y. N. (1999). Improving opportunities and access to mathematics learning in the early years. In J. V. Copley (Ed.), *Mathematics in the early years* (pp. 191-197). Reston, VA: National Council of Teachers of Mathematics.

Patton, M. M., & Kokoski, T. M. (1996). How good is your early childhood science, mathematics, and technology program? Strategies for extending your curriculum. *Young Children, 51*(5), 38-44.

Richardson, K., & Salkeld, L. (1995). Transforming mathematics curriculum. In S. Bredekamp & T. Rosegrant (Eds.), *Reading potentials: Transforming early childhood curriculum and assessment: Vol. 2* (pp. 23-42). Washington, DC: National Association for the Education of Young Children.

Schwartz, S. L. (1995). En-chanting, fascinating, useful number. *Teaching Children Mathematics, 1*(8), 486-491.

Schwartz, S. L., & Brown, A. B. (1995). Communicating with young children in mathematics: A unique challenge. *Teaching Children Mathematics, 1*(8), 350-353.

Snow, C. E., Burns, S. M., & Griffin, P. (Eds.). (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academy Press.

Texas Center for Reading and Language Arts. (1999). *Kindergarten teacher reading academy*. Austin, TX: Author.

Texas Center for Reading and Language Arts. (2000a). *First grade teacher reading academy*. Austin, TX: Author.

Texas Center for Reading and Language Arts. (2000b). *Implementing the prekindergarten curriculum guidelines for language and early literacy. Part I: Language development*. Austin, TX: Author.

Texas Education Agency. (1999). *Prekindergarten curriculum guidelines*. Austin, TX: Author.

Van de Walle, J. A. (1990). Concepts of number. In J. N. Payne (Ed.), *Mathematics for the young child* (pp. 63-88). Reston, VA: National Council of Teachers of Mathematics.

Watson, L. R., Layton, T. L., Pierce, P. L., & Abraham, L. M. (1994). Enhancing emerging literacy in a language preschool. *Language, Speech, and Hearing Services in Schools, 25,* 136-145.

Weaver, L. R., & Gaines, C. (1999). What to do when they don't speak English: Teaching mathematics to English-language learners in the early childhood classroom. In J. V. Copley (Ed.), *Mathematics in the early years* (pp. 198-204). Reston, VA: National Council of Teachers of Mathematics.

Westby, C., Dezale, J., Fradd, S. H., & Lee, O. (1999). Teachers' roles in promoting science inquiry with students from diverse language backgrounds. *Educational Researcher, 28*(6), 614-620.

Worth, J. (1990). Developing problem-solving abilities and attitudes. In J. N. Payne (Ed.), *Mathematics for the young child* (pp. 39-62). Reston, VA: National Council of Teachers of Mathematics.

Young, C., & Maulding, W. (1994). Mathematics and Mother Goose. *Teaching Children Mathematics, 1*(1), 36-38.