

Purposeful, Playful Pre-K

Building on Children's Natural Proclivity to Learn Language, Literacy, Mathematics, and Science



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It's well known that early childhood is a crucial time for cognitive development.¹ Less well known is that very young children are ready—and excited—to develop skill and understanding in language and literacy, mathematics, and science. According to the National Research Council, “these appear to be ‘privileged domains’—that is, domains in which children have a natural proclivity to learn, experiment, and explore.”² Prekindergarten (pre-K) learning experiences in these domains can help build the skills, knowledge, and attitudes that prepare young children for future academic success.* This is

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particularly true for children growing up in poverty—many of whom lag far behind their middle-class peers in key academic areas by the time they enter kindergarten.³ In fact, high-quality prekindergarten programs can help prevent this gap from opening in the first place.

Young children are eager to understand more about the world. They actively strive to build knowledge and to develop language to communicate about what they learn. They develop theories about how the world works, learn to solve problems, and ask questions in a constant quest for information. And, when provided with supportive and stimulating environments, they eagerly engage in language learning, literacy practices, math play, and science exploration.⁴

So, what does a supportive and stimulating pre-K look like? There is now a wealth of research—from fields as diverse as education, cognitive psychology, neuroscience, and sociology—to help us answer that question. According to the research literature, “structural” factors—such as child-to-teacher ratios and

*This is not to say that we believe that these subjects should be the exclusive focus of a quality pre-K curriculum. History and the social sciences, music, arts and crafts, movement, and foreign languages all have a place in a rich, well-rounded curriculum.

teachers' education levels—are important.⁵ In terms of cognitive growth, however, “process” factors—the daily human interactions and activities that have the potential to enhance children’s cognitive, physical, and social-emotional development—appear to be more central. Of particular importance is the quality of instruction, which appears to have a vital, lasting effect on building children’s cognitive and social skills through the elementary school years.⁶

Much is known about effective methods for teaching content to very young children. Not surprisingly, these approaches differ substantially from the teaching methods commonly used with older children. In pre-K, children should be taught foundational knowledge through developmentally appropriate instructional techniques, such as read-alouds, discussions, songs, games, projects, and other active learning opportunities.⁷ In addition, both free play and “structured” play (where teachers purposefully design play experiences to support specific learning goals) are particularly important for this age group.⁸

In this article, we’ll summarize the research on instructional practices for each of the “privileged domains.” For more information on creating a supportive and stimulating pre-K environment—including information on high-quality curricula, tips for English language learners, and key accomplishments for pre-K students—please see the report from which this article is drawn, *Preschool Curriculum: What’s In It for Children and Teachers* (available at www.ashankerinst.org).

The central thesis of this work is that the effectiveness of today’s preschool programs could be significantly improved if they were aligned with what research has demonstrated about how children learn in the academic disciplines of language, literacy, mathematics, and science. So let’s dive in, taking each domain in turn.

I. Oral Language

Oral language is arguably the most crucial area of academic focus during the pre-K years. Oral language is the primary means by which children gain knowledge about the world, and it is the vital foundation for children’s literacy development.

By the time children arrive in pre-K, there are vast differences in their oral language skills. One study found that, on average, by age 3 children who grew up in poverty had been exposed to half as many words as their middle-class peers and their vocabularies were about half as big. This vocabulary gap remained years later when the children were in third grade.⁹ Limited oral language puts children growing up in poverty at a disadvantage when learning to read and comprehend texts. In contrast, children with large vocabularies and a relatively broad range of knowledge are in a better position to comprehend, learn from, and enjoy the books they read, contributing to successful learning experiences.

The relationship between pre-K oral language and children’s literacy development, as well as the social class differences in oral language that are already visible at the beginning of pre-K, make it imperative for pre-K teachers to emphasize instruction in oral language in their classrooms.

Instructional Practices for Oral language

A Language-Rich Classroom

When children are exposed to adults who talk with them regularly about a broad variety of subjects, they become better at speaking and comprehending. Children gain the words they need to represent and communicate their growing knowledge about the world, and they apply what they know to learning even more new words and concepts.

The quantity and quality of these language interactions with adults and other children matter for children’s oral language development. Unfortunately, talk is often lacking in pre-K classrooms. A recent study found that children spent almost 60 percent of their time in pre-K not in conversation at all.¹⁰ These conditions are severely detrimental for children’s language and literacy development—especially for

those children who are unlikely to be exposed to a language-rich learning environment outside of school. Teachers should make every effort to ensure that children are engaging in meaningful conversations and language use throughout the day.

To create a language-rich classroom, pre-K teachers should:¹¹

- Engage children in extended conversations.
- Encourage children to tell and retell stories and describe events.



- Discuss a wide range of topics.
- Model use of new and unusual words.
- Discuss word meanings.
- Ask open-ended questions.
- Give explicit guidance on vocabulary, syntax, and pronunciation.
- Challenge children to justify their thinking.
- Focus on the expression of ideas.

Shared Reading of Challenging Books

Reading aloud to children is one of the best ways to facilitate oral language and vocabulary development. Children need to be exposed to a broad selection of texts, but they also need to experience repeated readings of books so that they have multiple opportunities to learn new language. Thematic units, where several books on the same topic or theme are read aloud over time, can also help deepen and broaden children’s understanding of new words and concepts—allowing them to “get” the ideas and vocabulary in slightly different contexts.

Books expose children to several types of language that are foundational for academic success:

- Decontextualized language—language that must be especially precise because the reader does not have the advantage of being in the same physical location as the author.
- Sophisticated vocabulary and new concepts—interesting new words and ideas. Informational or nonfiction picture books are often underutilized in pre-K classrooms, but they are very useful for introducing interesting new information, ideas, and language to children.
- Book language—language that is specific to written text, including phrases such as “happily every after” or “said the boy” that are not used in everyday speech. Children need a firm grasp of this language in order to comprehend storybooks.

Dialogic Reading

One well-researched technique for encouraging children’s comprehension and expressive language during read-alouds is called Dialogic Reading.¹² Teachers use the acronym CROWD to remember five types of prompts that engage children in conversations about books:

- Completion questions to focus children on the structure of language in the book, for example, “Brown Bear, Brown Bear, What do you see? I see a red bird looking at ____.”¹³
- Recall questions to check children’s understanding of the story’s content.
- Open-ended questions to engage children in extended talk about the book.
- *W* questions—*who, what, when, where, why*—to teach vocabulary.
- Distancing or bridging prompts to help children relate ideas in the book to life experiences beyond the story.

Phonological Awareness Activities

Children develop phonological awareness (the ability to hear

and manipulate sounds in language) as they learn new vocabulary and differentiate between words that sound similar, such as *cat* and *cot*.¹⁴ Types of phonological awareness for pre-K children include:

- Rhyming—the ability to notice that two or more words have endings that sound the same (also called rimes or word families).
- Alliteration—the ability to notice that two or more words begin with the same sound (also called onsets).
- Sentence segmenting—the ability to sense individual words in the stream of spoken language.
- Syllable blending and segmenting—the ability to hear the separate syllables in a word, and to put syllables together orally to make a word or break a word into separate syllables.

Pre-K teachers should provide instruction in phonological awareness by reading aloud books that focus on rhyming and alliteration, singing songs, chanting nursery rhymes, and using musical instruments to clap out words and syllables.

II. Literacy

Young children who are engaged in meaningful, knowledge-building experiences with print gain the foundational skills for becoming skilled readers and writers. But children who grow up in poverty tend to have fewer experiences with print in their homes, as well as fewer print resources in their neighborhoods.¹⁵ One estimate suggests that children from typical middle-class families experience 1,000 hours of book-reading before entering first grade, while children from low-income families may only experience 25 hours.¹⁶

Clearly, children arrive at pre-K with varying literacy experiences, but effective teachers can provide rich language and literacy instruction for all children. Rather than teach a set of isolated skills, teachers should integrate literacy instruction into all subject areas in the pre-K classroom, including math, science, social studies, and the arts.¹⁷ In this way, children gain foundational knowledge, vocabulary, and print skills to prepare them to read and comprehend text. For example, in a classroom where children are learning about insects, teachers can:

- Read informational books and storybooks about insects to develop background knowledge and relevant vocabulary, as well as comprehension and book-use skills.
- Engage children in songs and chants about insects to develop phonological awareness while reinforcing content knowledge.
- Encourage children to draw and “write” about insects that they find outdoors or that they investigate in the science center. As children attempt to write, they practice their letter-sound knowledge and develop an understanding of the connection between oral language and print.

Embedding literacy learning within knowledge-building activities is engaging for pre-K children, and it teaches that reading and writing are meaningful and purposeful activities.

Instructional Practices for Literacy

The Alphabetic Principle

In order to learn to read, children must understand that there is a relationship between the sounds in oral language and the letters of the alphabet. Children who arrive at kindergarten knowing letter names and sound-letter matches are on their way to learning to decode (sound out) and spell words.¹⁸

Pre-K teachers can help children gain an understanding of the alphabetic principle through phonological awareness activities like rhyming, singing, and chanting, and through opportunities to practice recognizing, naming, and producing letters. Teachers can help children to make connections between sounds and letters by reading alphabet books and by systematically introducing children to the letters of the alphabet and their sounds. In addition, pre-K children can learn about letters through a variety of multisensory activities, including play with alphabet manipulatives (e.g., puzzles and magnetic letters) and the opportunity to form letters and write their names using a variety of materials (e.g., with play dough, finger paint, stencils, letter stamps).

Developmental Writing

Developmental writing engages children in actively making the connection between print and oral language. Children who understand that writing is used to communicate ideas and information are interested in attempting to write. At first, children draw pictures to express their ideas on paper, but as they learn the differences between print and illustrations, their writing attempts look more like symbols. As children learn to write their own names, they develop an understanding that writing is made up of letters of the alphabet, and they begin to incorporate letters into their writing attempts. Over time, children learn to use letters to represent specific sounds in words (e.g., writing *home* as *h* or *hm*). This phonetic (invented) spelling encourages children to connect their phonemic awareness (ability to hear sounds in words) and their alphabet knowledge.

Formal handwriting practice and a focus on correct spelling are not useful instructional techniques for pre-K children. Teachers encourage children's developmental writing when they:

- Write and read back children's dictated words, pointing to each word as it is read aloud.
- Model phonetic spelling during shared writing experiences (e.g., morning message or a thank-you note). Teachers say the word slowly, exaggerating key sounds and then match letters to each sound.
- Create a writing center with a variety of papers and writing tools, and include writing materials in play areas throughout the classroom.
- Encourage children to draw a picture and then to write words about their picture. The picture helps children focus on what to write.
- Accept and encourage all writing attempts.
- Ask children to "read" their story when they are finished. Write children's words on the bottom or back of the page and read the story back to the child to reinforce the connection between oral and written language.

Shared Reading

Reading aloud to children, also called shared reading, is an important way for children to learn about literacy. Shared reading shows children that print carries a message, and repeated readings of familiar books help children learn that this message is consistent and unchanging over time. Teachers must schedule times to read to children individually and in small groups, as young children are better at focusing and engaging in discussion in such situations.

Exposure to a variety of books also enables children to develop their vocabulary and background knowledge, which helps them comprehend more and more complex books. Teachers should purposefully expose children to challenging books from different genres that contain engaging subject matter and sophisticated vocabulary. Reading a variety of books on a similar topic helps deepen children's understanding by reinforcing new vocabulary words and key concepts.

Children also learn about print by watching adults model its use. As teachers read aloud, they can help children understand how text works by intentionally demonstrating concepts of print. These demonstrations work best when teachers read from a big book or lap book with simple print that is large enough for children to see. The book is faced toward the children so they can observe the print as the teacher reads and "thinks aloud" to explain how print works.

Children should learn: how to hold a book correctly; where to find the title and author of a book; where to begin reading; how to turn pages correctly; directionality (a line of text is read from left to right, then down to the left of the line below); the different purposes of text and illustrations; the visual difference between a single letter, a word, and a sentence; that there are spaces between words; and one-to-one correspondence (each word read aloud is represented by one printed word).

A Print-Rich Environment

When classroom environments include appropriate literacy materials organized in an accessible manner, children engage in many literacy behaviors and use complex language.¹⁹ Children learn that print appears in different forms (e.g., books, letters, labels) and that print is used for a variety of purposes (e.g., to inform, to tell a story). They become able to identify the familiar labels and signs in their classroom environment. The experience of being surrounded by print leads children to understand that print carries meaning and that it is practically useful. In print-rich classrooms, children demonstrate this understanding by attempting to read and write during their play. These "pretend" efforts should be encouraged, as they demonstrate children's interest in and engagement with print.

A literacy-rich environment includes:²⁰

- A dedicated reading area or library with books stored in an orderly and inviting way.
- Books in a variety of genres and formats (e.g., fiction, nonfiction, alphabet books, big books).
- Books related to curriculum themes or topics that children are studying.
- A dedicated writing area that includes a variety of papers

and writing tools.

- Books and writing materials throughout the classroom (e.g., science books in the science area, paper and crayons in the dramatic play area).
- The alphabet displayed and visible at children's-eye view, with children having access to alphabet toys and manipulatives (e.g., alphabet puzzles, magnetic letters).
- Functional signs that are visible around the classroom (e.g., the class schedule, labels for toy storage, names on cubbies).
- Children's drawing and writing attempts displayed around the room as well as products from group writing experiences (e.g., charts, homemade books).

III. Mathematics

Educators once wondered whether mathematics instruction was appropriate for pre-K children, but an abundance of research shows that children engage in spontaneous mathematics play and demonstrate intuitive understandings about mathematics well before pre-K.²¹ However, in mathematics, as with other core content areas, children who grow up in poverty lag behind their middle-class peers in developing key knowledge and skills.²² Also, children from the United States demonstrate weaker mathematics achievement than children in other parts of the world, and this discrepancy may already be evident as early as kindergarten.²³

Instructional Practices for Mathematics

Problem Solving

Pre-K mathematics is much more than rote memorization of counting words or names of shapes. Children of this age are capable of engaging in thoughtful mathematics reasoning and problem solving. For example, rather than simply telling children that a shape is a triangle, teachers can ask children to examine several different types of triangles to determine how they are the same. Instead of always lining objects up when they are counted, teachers can ask children to “figure out” how to count objects that cannot be moved. Or, in a collection of multicolored counters, teachers might ask children to try counting only the blue ones. Children should be encouraged to talk about their work and to discuss what they have learned. Through active problem solving using concrete objects, children develop a deep understanding of mathematical concepts.

Mathematics Vocabulary

Pre-K children have intuitive understandings about mathematics, but they have difficulty articulating this knowledge because they lack mathematics vocabulary. Pre-K children may use an imprecise word such as “big” to explain that an object is long, tall, or heavy because they do not know these more descriptive words. Children may also have general understandings of mathematics terms without knowledge of their specific use in mathematics. When a young child asks for “the bigger half” of a sandwich, it is clear that the child does not yet know the precise mathematical meaning of the word *half*. Beyond words for count-

ing, pre-K teachers should introduce and frequently review the following types of mathematics vocabulary:

- Names of two-dimensional and three-dimensional shapes (e.g., *circle, pyramid, cube, hexagon*).
- Words to describe shapes (e.g., *sides, lines, angles, round*).
- Language to compare quantity (e.g., *more than, less than, equal to*).
- Terms to compare length and weight (e.g., *longer, longest, heavier, heaviest*).
- Language related to time (e.g., *earlier, later, morning, night, today, tomorrow*).
- Words that identify where things are in space (e.g., *near, far*).
- Positional words to describe the location of objects (e.g., *inside, underneath, next to*).



Mathematics Manipulatives

Mathematics manipulatives are concrete objects that are easily handled—such as beads, puzzles, and blocks—that children can work with in ways that help them understand and explore mathematics concepts. For example, sorting buttons encourages children to focus on mathematical attributes such as the size and shape of each button as well as the number of holes in each button. Pre-K children need opportunities to use these materials in guided mathematics activities and in free play.

Children are more likely to choose to use mathematics manipulatives during free play when these objects are familiar. Teachers should highlight materials, model ways they can be used, and structure problem-solving activities that help children learn to use the manipulatives. Math materials should be stored in an organized and accessible manner within children's reach. Children need long blocks of time to experiment with these materials.

Curriculum Integration

Pre-K teachers should schedule times dedicated specifically to mathematics, but mathematics can also be integrated into many everyday activities (including free play) as well as content area learning in the pre-K classroom. When a child counts out the correct number of snacks for the children at her table, or the teacher announces that free play will be over in “five minutes,” children learn the everyday uses of mathematics.

One way to integrate mathematics and literacy is to use read-alouds to introduce or review mathematical concepts and vocabulary. Children’s mathematics knowledge is deepened when teachers connect concepts from books to hands-on mathematics activities so children can apply and practice what they have learned.

Counting, measuring, and graphing can be integrated into almost any social studies or science activity. If children are learning about parts of the body, the teacher can help them to count “how many” of each part people have. This topic also provides the opportunity to introduce the concept of “symmetry.” A study of pets

provides the opportunity to create a graph displaying the number and types of pets owned by children in the classroom. Making the most of curriculum integration and daily math opportunities requires thoughtful planning, but this type of instruction deepens children’s understanding of the practical applications of mathematics.

IV. Science

Young children are naturally curious about the world, and they regularly ask “why” and “how” questions that logically lead to scientific inquiry. In pre-K, children should grow both in their ability to participate in the cycle of scientific inquiry and in their knowledge of science concepts. These activities also build background knowledge and vocabulary that are essential for future science learning as well as for reading comprehension in the elementary years.²⁴

Instructional Practices for Science

Scientific Inquiry

Scientific inquiry builds on children’s natural desire to discover new knowledge about their surroundings. The goal is to

actively engage children in the process that scientists use to answer questions about the world. Teachers guide children as they determine an interesting science question (e.g., What do plants need to grow?) and suggest possible methods to find an answer or explanation. Children then participate in observing and experimenting to determine an answer to their question. As children participate in inquiry and investigations, they gain in-depth knowledge of science content. While children’s preconceptions about the world can be resistant to change, active participation in hands-on science experiences is more likely to advance their ideas than simply being told new information.²⁵

Careful observation is an important aspect of scientific inquiry, and teachers should provide a variety of opportunities for children to develop this skill. To answer the question “How do trees change in different seasons?” a pre-K class might observe, photograph, and compare a tree in the playground in fall, winter, and spring. This project teaches children the skill of scientific observation as they gain new knowledge about plants and seasons.

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Children should learn that scientists use all of their senses to gather information. They should also be exposed to science tools that can aid in the observation process (e.g., magnifying glasses). Recording observations and communicating about what has been discovered are essential to this process.

Science Vocabulary

Children need words to name and discuss the new ideas that they gain through science activities. Pre-K children are capable of learning the correct terminology for the concepts they explore, and it is important for young children to learn to use the language of science. Children should be encouraged to talk about their science explorations and investigations. Children's vocabulary development is encouraged during in-depth studies of key science concepts because they have repeated exposure to new words in a variety of contexts. Science vocabulary for pre-K children includes:

- Words for scientific inquiry (e.g., *predict, observe, experiment*).
- Words for science activities (e.g., *mix, measure, compare*).
- Names of science tools (e.g., *magnifying glass, balance, dropper*).
- Words for careful observation (e.g., *smell, see, feel*).
- Words to describe properties of objects (e.g., *rough, shiny, round*).

In addition, teachers should introduce relevant vocabulary as children learn about a specific science topic.

Science Area

An engaging science area encourages children to play and explore using science materials. Free play with science materials helps children generate new questions and practice using the ideas they have learned. If the class is studying the life cycle of butterflies, the science area may include books about caterpillars and butterflies, real larvae or a chrysalis for children to examine, paper for children to draw what they observe, a large-scale model or picture cards of the stages of the life cycle, and appropriate science tools (e.g., magnifying glass) to aid in children's investigation.

Curriculum Integration

Some researchers suggest that mathematics and literacy skills are more meaningful to children when they are taught as part of integrated units of study rather than as isolated skills.²⁶ For example, there are fundamental mathematics concepts and skills that are necessary to perform most science investigations. These include counting and determining "how many," comparing, classifying, and measuring.

Science investigations provide an opportunity to bring informational texts into daily use in the pre-K classroom. Research demonstrates that shared reading and discussion of information books has many benefits for pre-K children, but this genre is often underutilized in early childhood classrooms.²⁷ Reading books about content supports background knowledge and vocabulary development, and teaches children that books are a useful place to obtain and communicate information. When reading informative, nonfiction books, teachers should:

- Point out features that are particular to this type of text, such as labeled pictures and diagrams.
- Demonstrate reading to "look up" an answer to a specific question rather than always reading the book from beginning to end.
- Explain new vocabulary and concepts in simple language that children can understand.
- Engage in repeated readings of the same book to reinforce new ideas and vocabulary.

The knowledge that children gain in early childhood is crucially important for their futures, with a quality pre-K experience helping to lay the foundation for the kinds of skills, knowledge, and behaviors that children will be expected to master during school. Indeed, the reading, math, and attention skills that children bring to kindergarten have been found to be a strong predictor of their later academic success.²⁸ □

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