

DRAFT

**California Preschool Curriculum
Framework**

Volume 3

DRAFT

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History - Social Science

For many educators of young children, the terms history and social sciences conjure up images of children studying past presidents, learning about other countries, and exploring related topics during the primary school years. Yet when we look at young children's emerging sense of identity, their growing interest in the larger social world in which they live, and their developing understanding of time and place, we see that history and social sciences are relevant to them also. Young children are natural historians when they talk about their experiences and enjoy hearing family stories of "long ago." They are intuitive geographers when they recognize the route to the grocery store and create a map of the preschool room. Children are simple ecologists when they worry about a plant that is wilted or a bird's egg on a nature walk. They learn about democracy through their participation in shared decision-making and taking turns on the playground. Their interactions with other children acquaint them with the diversity in culture, languages, and backgrounds that reflects society. Young children are also everyday economists as they begin to understand how money, bartering, and exchange work in the world around them.

Preschoolers' understanding of history and social sciences naturally derives from their expanding knowledge of the world and their place in it. It also provides a foundation for the study of history, culture, geography, economics, civics and citizenship, ecology and the global environment that begins in the primary grades and continues throughout life. These topics are important because they provide a basis for understanding the responsibilities of citizens in a democratic society, the legacy of past generations who built our society, the importance of caring for the natural world, and the rich diversity of other people. In preschool, their introduction to these important issues occurs through everyday activities such as caring for a plant, remembering a recent trip to the zoo, deciding as a group on a name for the class pet, creating a shoe store, imaginative play with adult roles, or sharing family traditions from home. Young children learn about history and social sciences, in other words, from their personal experiences as they are enlisted into a preschool curriculum.

A thoughtfully designed early childhood program includes many activities that contribute to children's understanding of history and social sciences.^{1 2 3 4} Some activities are carefully planned by a teacher to help children learn about weather patterns, bartering for goods and services, responsibilities as a class member, adult occupations, and many other ideas and concepts. Other activities emerge out of the opportunities created by children's spontaneous interests and a teacher's capacities to build these into teachable moments. Both kinds of activities are discussed in this curriculum framework. Taken together, they reflect the assumption that young children develop knowledge of history and the social sciences as they are encouraged to enact their understanding in their everyday interactions with other children and adults.⁵ This knowledge helps young children understand themselves in a wonderfully expanding world.

Guiding Principles

- **Build a cooperative, inclusive preschool community.**
Ensure that the preschool curriculum maximizes children's opportunities to work together in ways that require responsible conduct, fairness, and respect for others. Help children learn how to include diverse peers, including children of different genders, ages, abilities, linguistic backgrounds, and family structures. Inclusive means more than simply “being together”. Inclusion comes through in the ways the child is connected with other children, is an active participant, and “belongs” or has full, unconditional membership in the classroom community.⁶
- **Create activities that will actively engage children's social skills and understandings so they will grow.**
Effective, meaningful activities will include rich conversation with adults and peers, shared projects involving exploration and discovery, and lots of play.
- **Affirm children's home cultures, experiences, and values.**
Provide plenty of opportunities for children to share stories and items from home and welcome their family members to participate as they feel comfortable. Emphasize, in conversation with children, that each family does things differently.
- **Encourage children's social curiosity.**
Build on preschool children's natural interest in their social world, and in the similarities and differences among the people in it. Acknowledge children's awareness of differences, while also expanding their understanding of these differences.
- **Model social behavior and attitudes with explanations.**
Model the ways you would like children to treat each other in the preschool setting, and explain why you are doing what you do. Show respect for the rights and concern for the welfare of both adults and children in the preschool community.
- **Actively teach and practice the essential skills of democratic participation.**
Provide a preschool setting where children can learn and practice the skills they will need to be successful, contributing members of their communities.
- **Encourage children to incorporate their knowledge of adult roles and occupations into their dramatic play.**
Use children's growing interest in their own and others' roles and responsibilities to help them learn about how diverse people contribute to a community.

- **Observe and converse with children during play in order to learn about their current understandings of time and history.**
Focus on children as they communicate about and act out past, present, and future experiences, as well as family stories and broader historical events. Use this information to shape future curriculum plans.
- **Help children deepen their own sense of place.**
Help children begin to understand and reflect on their sense of belonging to places and locations that are meaningful to them.
- **Nurture children's sense of wonder about nature.**
Observe preschool children's engagement with the natural world and encourage their protective feelings toward it.

Environments and Materials

When planning an environment to support children's growth in this area, effective teachers consider the physical, curricular, and social elements. The *physical* environment and daily routine set the stage for children's inquiry, and need to include ample time for children's self-initiated work, a variety of spaces for both solitary and collaborative play, and engaging materials that children are encouraged to use creatively. The *curricular* plan needs to provide opportunities and adult support for both group learning and for informal discovery and skill development. The key to a positive *social* environment is a teacher who actively models curiosity, openness, and engagement and who is eager to explore the world together with children. An environment that supports children's learning in history and the social sciences has the following characteristics:

- **Projects that extend over time, are organized around a topic in history or social science, and emerge from children's interests and inquiries**
There are multiple opportunities for children to actively engage with subject matter (e.g., learning about community helpers) in meaningful and familiar contexts. Adults prepare for individual investigations as well as small- and large-group explorations.
- **Reflective of diversity**
Teachers and children sing songs and read stories from different cultures, highlighting diverse perspectives and experiences. Photographs, artwork, and music are representative of the children and families in the group. The dramatic play area is supplied with multicultural cooking tools, empty food containers, clothing, and other items reflective of the children's home living experiences.
- **A balance between child choice and adult direction**
The daily routine supports both child-initiated play and teacher-initiated learning experiences. Choice time offers children an opportunity to exercise creative freedom

and decision-making. Adults also initiate activities that support community participation and order (e.g., “First we will sing songs as a group, and then we will have snack.”).

➤ **A variety of materials to support children’s inquiry based learning and practice the skills of social science**

Open-ended materials (e.g., sand and water, blocks) encourage children’s creative and divergent thinking. Paper, writing instruments, tallying tools, maps, charts, and other visual aids provoke children to generate questions, collect information, summarize what they have learned, and form conclusions.

➤ **Materials that connect children to times and places**

Program materials include authentic objects (e.g., loom) and cultural artifacts (e.g., hand woven blanket) to encourage children’s questions and active interest. Maps are displayed at children’s eye level.

➤ **Real experiences with nature and other environmental education materials**

Children have frequent access to an outdoor learning environment that is nature oriented; ideally it includes trees, plants, grasses, and other living things. The indoor learning environment is supplied with pictures, puzzles, toy animals, books and other play materials to facilitate inquiry and introduce children to less familiar ecosystems. The care of living creatures, such as classroom pets, is also a part of the program curriculum.

➤ **Tools for appreciating and caring for the earth and its resources**

Systems are in place to introduce the concept of ‘reduce-reuse-recycle.’ Materials are properly cared for, repurposed, (e.g., paper is used on both sides), and shared across programs. Consumables are used as sparingly as possible.

➤ **Display of children’s work and experiences**

Children’s investigations are highlighted using photographs, child-created pictures and maps, dictation, and models. Displays are positioned at children’s eye level.

➤ **Dramatic play props and materials are used to represent firsthand experience with social roles and occupations, as well as consumer actions.**

The room provides an ample supply of clothes for dress-up, items from a variety of work settings, play money, and other real objects (e.g., telephone) and print artifacts (e.g., phonebook). The room intentionally incorporates play props for exploring themes in other learning areas (e.g., transportation in the Block Area).

➤ **High-quality children’s books with content related to self, family, and community.**

The preschool program introduces shared-book reading and discussions about book content to facilitate an understanding of human behavior and relationships. Books are selected and rotated based on emerging themes to expand children’s awareness

of people, places, and time. Books reflect the background and experiences of children in the group, as well as those that extend beyond familiar homes and communities.

➤ **Extension of learning into the local community to help children learn in the “here-and-now” of the world around them**

The program makes use of familiar contexts to permit successful explorations of self, family, and community, as children are able to draw from prior knowledge and experience. Plans are developed for fieldwork, such as visiting a local business or greeting the neighborhood postal worker, to expand learning beyond the classroom walls. If field trips are not practical, every effort is made to bring parts of the community into the setting via pictures, visitors, and props.

➤ **Family involvement in program planning**

The environment and its materials demonstrate a partnership with families and are inclusive of community goals and values.

Summary of the History-Social Sciences Foundations

Sense of Time (History) Foundations

These foundations focus on developing understanding of past and future events, and their association with the present.^{7 8 9 10 11 12} *Understanding past events* describes children's developing ability to remember past events, their connection to other events of the past and to current experience. *Anticipating and planning future events* focuses on the ability to anticipate events in the near future and to make choices that prepare for future needs.^{13 14 15 16 17} *Personal history* is concerned with young children's sense of their own growth and experiences. *Historical changes in people and the world* relates to children's efforts to create a mental timeline in which events of the past are properly sequenced, including family history.^{18 19}

Sense of Place (Geography and Ecology) Foundations

These foundations focus on developing knowledge of the physical settings in which children live and how they compare with other locations.²⁰ *Navigating familiar locations* describes developing skills in understanding the characteristics and activities associated with familiar locations (like home and school), the routes between them, and broader features of the natural environment such as hills and streams, and weather patterns. *Caring for the natural world* concerns preschoolers' expanding awareness of human-environment interaction that is the basis for interest in taking care of plants and animals, knowledge of hazards like pollution and litter, and an interest in natural environments that are different from their own.^{21 22 23} *Understanding the physical world through drawings and maps* describes young children's growth in representing the physical world through their own drawings or by interpreting simple maps.^{24 25 26 27}

Becoming a Preschool Community Member (Civics) Foundations

These foundations are concerned with how young children become responsible and cooperative members of the preschool community.^{28 29 30 31 32} *Skills for democratic participation* focuses on developing abilities to respect others' opinions and preferences, participate in group activities and decision-making, and balance personal goals with the goals of others. *Responsible conduct* focuses on developing self-regulation of behavior in accord with group expectations and rules.^{33 34} *Fairness and respect for other people* describes developing sensitivity to the feelings and needs of others through cooperation and helpfulness, and developing consideration of fairness for all.^{35 36 37 38} *Conflict resolution* focuses on young children's growing skill in managing conflict through bargaining and compromise.³⁹

Self and Society Foundations

These foundations focus on young children's growing ability to see themselves within the context of society. *Culture and society* concerns preschoolers' growing interest in differences in culture, language, racial identity, and family traditions that are different from the child's own.^{40 41 42 43 44 45 46 47 48} *Relationships* focuses on how young children develop skills in creating and maintaining close relationships, including recognizing the mutual responsibilities of relationships.^{49 50 51 52 53 54 55 56} *Social roles and occupations* describes children's growing interest and understanding of adult activities, including work and family roles.⁵⁷

Marketplace (Economics) Foundation

Preschoolers are curious and observant about the world of commerce, including the association between work and income, and purchasing. The single foundation, *Exchange*, describes young children's developing understanding of economic concepts, including the ideas of ownership, money exchanged for goods and services, value and cost, and bartering.^{58 59 60 61 62}

Summary List of Strands and Substrands

The foundations of this section are organized according to the following strands and substrands:

Sense of Time (History)

- Understanding Past Events
- Anticipating and Planning Future Events
- Personal History
- Historical Changes in People and the World

Sense of Place (Geography and Ecology)

- Navigating Familiar Locations

Caring for the Natural World

Understanding the Physical World Through Drawings and Maps

Becoming a Preschool Community Member (Civics)

Skills for Democratic Participation

Responsible Conduct

Fairness and Respect for Other People

Conflict Resolution

Self and Society

Culture and Diversity

Relationships

Social Roles and Occupations

Marketplace (Economics)

Exchange

Strand: Sense of Time (History)

One of our unique human characteristics is the ability to think of ourselves in relation to past events and to anticipate the future. The ability to see oneself in time enables us to derive lessons from past experiences, understand how we are affected by historical events, and plan for the immediate future (such as preparing a meal) or the long-term (such as obtaining an education). The ability to see oneself in time is also the basis for perceiving one's own growth and development, and the expectation of future changes in one's life.

The preschool years are a period of major advances in young children's understanding of past, present, and future events, and how they are interconnected. Yet their ability to understand these interconnections is limited and fragile. Young preschoolers have a strong interest in past events but perceive them as "islands in time" that are not well connected to other past events. As they learn more about events of the past, and with the help of adults, children develop a mental timeline in which these events can be placed and related to each other. This is a process that begins during the preschool years and will continue throughout childhood and adolescence.

A thoughtfully designed early childhood program includes many activities that help young children develop a sense of the past and future. They include conversations about a child's memorable experiences, discussions of a group activity that occurred yesterday, stories about historical events, circle time activities in anticipation of a field trip tomorrow, and picture boards that describe the daily schedule in which special events can be distinguished from what normally happens. In these and other ways, teachers help young children construct their own mental timelines.

Sample Developmental Sequence: Sense of Time

As children mature, they are better able to relate past and future events to their current experience. As they do so, they are developing an expanded and more detailed mental timetable that they can use for remembering the past and anticipating the future.

Beginning level: Children can talk about events in the immediate past and ask questions about activities in the near future, but they need an adult's help to understand events in detail that are not part of immediate experience.

Next level; Children remember past events easily, enjoy hearing stories about "long ago," and anticipate events in the near future, but are often confused about when these events occur in relation to each other (for example, Grandpa was a boy "long ago," but is this the same "long ago" when the dinosaurs lived?). Children also enjoy talking about their experiences of the recent past.

Next level: Children demonstrate greater skill in relating past events to one another (Grandpa was a boy "long ago," and that was before your parents were born), knowing how past events affect the present (Maria is happy today because her Daddy arrived home yesterday from a long trip), and planning in simple ways for future activities.

Mature or proficient level: Children are now capable of distinguishing events that happened "long ago" from those of the more recent past, and distinguishing events in the near future from those much later in the future. Their mental timeline is more detailed and accurate. In addition, children enjoy telling more complex autobiographical stories about their own experiences, reflecting the importance of their personal past to who they are today.

In this section, specific strategies are discussed that support development in each of the following substrands:

- 1.0 Understanding Past Events
- 2.0 Anticipating and Planning Future Events
- 3.0 Personal History
- 4.0 Historical Changes in People and the World

Substrand 1.0 Understanding Past Events

Young children enjoy talking about their own experiences and hearing stories about past events. They are also slowly developing an ability to understand when past events occurred in relation to one another (such as realizing that their birthday was celebrated

after they started going to preschool) and how past events are connected to current experience. By conversing with young children about events of the past, asking questions and making connections between past and current experience, teachers can help children begin to construct a mental timeline of past experiences. They can also use visual aids, stories, and other tools to communicate about events of the recent past and "long ago.

Vignette:

At the beginning of outdoor playtime, Mateo hurries over to a large tree limb he notices lying at the edge of the playground. "Look what happened!" he exclaims. "Yeah," agrees Luis, who had joined him, "the wind did it. It crashed down our big tree, too, right into the street. Some guys are coming to see it up." Luis pauses. "My grandma said that tree was really old". Ms. Sofia, who has followed them to the area, joins the conversation. "Your grandma told me about that when she came with you this morning. It's a big surprise when a tree that was there just yesterday suddenly isn't there anymore today, especially when it had been growing there for a long, long time. Things like that can happen fast. What do you think will be different when you get home this afternoon?"

Teachable Moment:

The teacher observes their intense interest in the fallen playground limb and listens attentively to Luis' narrative description of the fallen tree at home. When she joins the boys' conversation, she uses time words and phrases, including yesterday, today, this afternoon, suddenly, fast, and a long, long time. She can tell by listening that the event made an emotional impression on Luis, and affirms that it was a big surprise. With her question, she encourages him to think about how the change will feel. See Sample Developmental Sequence: Sense of Time, p. 8.

Vignette:

As Circle Time begins, the teacher says, "Right before we went home yesterday, we sang our "Slippery Fish" song. This morning I noticed that Jonah and Hailey were singing the song in the reading area and were using these shark and whale finger puppets to act it out. I could tell they were really enjoying singing that story, so I found more puppets for them to use." She holds up a small fish, a bigger fish, and an octopus finger puppet as the children name them. She asks them if they would all like to sing the song again, and then asks them to recall the sequence of the sea animals in the song. As they call out or sign the animal names, she arranges them on the floor in the middle of the circle. As she points they name each one and then the group sings the song together with its accompanying gestures. Afterwards, she tells them that the basket of finger puppets will be in the reading area tomorrow for them to use.

Teachable Moment:

This teacher is attuned to children's activities during playtime and modifies her circle time plan to build on an interest she has observed. She chooses to revisit a song they have enjoyed the day before, and retrieves props from a cupboard—the finger puppets—to help focus the group's attention on the song's sequence of sea animals.

She uses playful repetition during the group activity to reinforce the concept of sequence, and uses the words, “first, next, and last,” as she arranges and then points to the animal puppets. She encourages the children to use gestures or signs and follows up by telling the children where they can find the puppets to use themselves on the following day.

Interactions and Strategies:

Use predictable routines to facilitate children’s sense of time. Incorporate visual and auditory aids to promote understanding and use them in conversation with children. “Yes, before we went outside we played inside (pointing at a picture on the daily routine chart), went to circle time, and then had snack. We are very busy at school.”

Incorporate time words into conversation. Intentional use of words like *before*, *after*, and *yesterday* supports the development of a child’s sense of temporal sequence. Calendar activities, such as Calendar Time during class meetings, provide labels for concepts such as *first*, *last*, *next*, and *later*. “Last Friday was Orrin’s birthday, this Thursday is Maya’s birthday, and next Friday is Wenqi’s birthday. We have a lot of birthdays this month!” See Sample Developmental Sequence: Sense of Time, p. 8.

Create opportunities to converse with children about meaningful experiences and build connections between current and past events. Encourage small-group conversation during mealtime: “What was the first thing you did at work time?” Invite community reflection during large-group time: “What did we do before we came inside?” Initiate one-on-one conversation during child-initiated play: “You started this project yesterday during outside time. What did you use to build the bottom of your fort? ...What will you add today?”

Listen attentively to children’s narrative descriptions. Regularly invite children to talk about past and current personal experiences. Extend and expand on a child’s initial statement with descriptive language. “Yes, last week we did go on a special field trip to the post office. We had to walk very safely. We will have to be safe again today when we go on our neighborhood bird walk.” Make use of reflective comments and open-ended questions. “I liked seeing the scrub jays and hearing their calls. What things did you like best about our bird walk?”

Communicate with awareness about children’s narrative style, noting preferences for linear time sequences, emotional cues, and other practices that influence the formation of mental “scripts.” Adults may recall experiences differently than children; we may attend to different details of the event and bring a deeper understanding of sequence and time. Listen attentively to children’s descriptions of past events. Take note of what pieces of the occasion were most important to the child. Ask open-ended questions to extend the conversation, “What happened after you went to the park?” Add your own observations to elaborate and expand on children’s initial recollections, “I am

usually ready for a rest after a long day of playing, too." Pay attention to the pace of the child's communication. Avoid rushing the conversation; pause and wait for details. See Research Highlight, p. 43.

Document and display children's work at their eye level to encourage recall and reflection. Invite children to talk about their learning experiences one-on-one ("Tell me about this drawing of the robot you made. How many days ago did you make it?") as well as with peers during large-group experiences ("During our class meeting Kaylah is going to show us what she made with recyclables on Monday."). Take pictures of projects that extend over time and converse about the exploration process. Write down the children's words as they describe their work. "When we started our paper mache project last week we first had a wire shape. Then it took several days to add the wet strips of paper. Now that it is dry we can start painting our paper mache animal."

Sing songs, recite poetry, and read books that involve sequencing. Popular stories, shared in book format or by oral storytelling, like *The Very Hungry Caterpillar*, *We're Going on a Bear Hunt*, or *The Three Billy Goats Gruff* offer children a predictable sequence of events to recall and discuss. "What happened first?" "Then what happened?" "How did the story end?" Songs that include a progression in activity, such as the Peanut Butter and Jelly song, offer a similar experience.

Substrand 2.0 Anticipating and Planning Future Events

"What happens next?" is in the mind (and words) of young children as they try to anticipate events, such as what will happen tomorrow. They can anticipate events because they understand the predictable routines of their lives, such as the daily schedule of the preschool, or what usually happens after they wake up in the morning. During the preschool years, children become more skilled at planning for these routine events and even anticipating unusual events, such as a family visit that will happen soon. Teachers can contribute to the development of these future-oriented skills by helping young children understand the regular routines of daily life, conversing with them about unusual events to come (such as a visit to the fire station), and helping them plan (such as talking about dressing more warmly when the weather turns colder).

Vignette:

Beata and Simon are painting at the easels when Ms. Neva begins reminding children in each interest area that it is time to begin finishing their work before clean-up time. As she approaches the easels Simon tells her, "Mira! I painted three pictures before clean-up time."

Teachable Moment:

In this situation, Simon knows that his preschool program has a predictable daily routine, and that clean-up time always follows play time. His teacher gives the children a reminder ahead of time so they can predict the transition to clean-up time.

Vignette:

“My birthday is just two more days,” Jordan tells Ms. Trisha excitedly. She responds with enthusiasm and suggests that they look at the class birthday calendar together. He finds his photo and name on a calendar square and she shows him the square for today and notes how close together the two are. He begins looking for his friends’ photos on the calendar and asking how soon their birthdays are. Ms. Trisha converses with him about how many days make it seem like a short or a long time, and about how it feels to be waiting.

Teachable Moment:

This situation illustrates the challenges of anticipating and waiting for future events, and how teachers can begin to introduce time concepts. It shows how difficult it is for young children to understand how their *experience* of time relates to the calendars, timers, clocks, and other tools adults used to represent it.

Interactions and Strategies:

Maintain a consistent daily routine so children can anticipate, predict, and follow through with program expectations. A picture schedule may be utilized to help children get ready for program transitions. “It’s almost circle time, Everett. Let’s pull off our picture and get our chair for circle time.”

Converse with children about upcoming events. Invite children to share their plans for the weekend (“I know Grandma is picking you up today for your weekend together. What will you do at her house?”). Prepare children for any change in program routine (“Today we have a special visitor. Yana’s father will come to talk to us about his job at the grocery store during small-group time. Instead of sitting at your tables, we will meet at our circle time rug.”).

Comment on behaviors that anticipate future events. Describe steps for participating in a daily routine (“Before we go to snack, we wash our hands.”) or explain a child’s response to an expected experience (“I think Hailey is feeling excited about her dad coming for a visit. She’s missed him while he’s been away.”). Explain your actions that look ahead to a future event. “I am putting our outdoor water toys away. It is almost winter and it will be too cold to use them until the weather warms up again in the spring.” See Research Highlight, p. 13.

Promote planning as children engage in child-initiated projects. Begin a play period with a brief planning time. Ask children to share their idea for play. Using comments and open-ended questions, encourage children to provide details about their play plans. Help children anticipate problems and support their ideas for solutions. “So, you plan to play with the droppers and test tubes in the Science Area. Yesterday you

ran out of baking soda for your experiment. What can you do today to make sure you have enough baking soda to go with your vinegar?"

Involve children in program planning. To prepare for change in curriculum, invite children to share their current knowledge of a subject and then ask for ideas for supplying the learning environment. "What do you know about airports?" "What will we need to build an airport in our room?" Plan meaningful celebrations by asking children to suggest elements from their home celebrations that could be translated for the group setting. See Research Highlight on p. 13.

Introduce time keeping tools to help children monitor the passage of time. "I'm looking at our timer. We have to wait three more minutes until it will be your turn on the tire swing." A paper chain can be used to help children count the number of days before an exciting event. "We have two more rings on our chain. That means two more days until our Día de los Muertos celebration. I know Tia Liz has been baking bread at home." Mark special days on the program calendar. Keep the calendar accessible and use child-friendly pictures and symbols (e.g., a photograph of a child on a calendar square to denote their birthday).

Talk with children using time words. "Tomorrow morning we will have more time to play with our hamster. She needs to rest now. I know a whole day can seem like a long time to wait."

Research Highlight

Planning for a future activity requires anticipating what one might need, and preschoolers are developing skill in this kind of "mental time travel." In one study, 3-, 4-, and 5-year-olds were shown photographs of several natural settings and were encouraged to imagine that they were in those environments (such as imagining walking across a sunny desert, or walking across a rocky stream).^{12, 14} Children were then asked to choose what they would need for that activity from among three items. After hearing the story about the desert, for example, children were asked to choose either a bar of soap, a mirror, or a pair of sunglasses. Most of the children at each age chose the correct item (e.g., the sunglasses for the desert), but their skill improved with age, and older children were much more capable of explaining their choice with reference to a future need (e.g., "The sun will be shining").

Substrand 3.0 Personal History

A sense of time also includes understanding one's personal history. For young preschoolers, the awareness that they are changing appears in their pride in displaying their developing accomplishments, knowledge, and skills. Older preschoolers may

explicitly contrast what they can do now with the fact that they could not do this when they were younger. In addition, children are beginning to create an autobiographical memory of their personal experiences that they enjoy sharing with others. Teachers contribute to this developing sense of personal history by recognizing children's accomplishments, sharing their pleasure in their expanding competencies, and discussing with children the experiences that are significant and memorable to them. See Research Highlight, p. 43.

Vignette:

Today is Annie's fifth birthday and her mother has sent an envelope of photos of Annie at different ages for her to share at Circle Time. She is excited to show them to Ms. Jen, who takes time to sit down at a table with her to look at them. Ms. Jen comments on each one Annie takes out, asking questions and encouraging her to reminisce about what the photo shows her doing. She then suggests that they line up all six photos on the table in sequence, starting with the one that shows Annie as a newborn baby and ending with a recent family celebration.

Teachable Moment:

Ms. Jen acknowledges Annie's excitement about her birthday photos and takes time to converse with her about them. Her questions and comments help Annie to recall more details. She uses them to prompt and then informally assess Annie's sequencing abilities.

Vignette:

Two children look around the room to find their teacher. "Mr. H., look what we made!" Mr. H. walks over to where they have finished constructing a long tunnel using cardboard tubes and masking tape and are now rolling marbles through it. "You finished your experiment, and now you're testing it," he observes enthusiastically. "Is it working the way you had wanted it to?" As the children decide to prop it up on blocks to carry the marbles down faster, Mr. H. stays with them, conversing about the long time they worked on it, the challenge of getting the masking tape to hold together the tubes, and the fact that they now are both very good at using masking tape themselves and at helping younger children learn how to use it.

Teachable Moment:

In this interaction, Mr. H. expresses enthusiasm about the children's accomplishment, reviewing with them the steps of their project and acknowledging how challenging the task was. He reminds them of how much their skills have grown and lets them know that he has noticed them helping younger children learn the same skills.

Interactions and Strategies:

Share memories. Engage children in conversation about their own current work and recent accomplishments. "You did it! You filled in all the pieces of the puzzle!"

Communicate observations of children's abilities of over time. "You wrote the letter 'A'! You've been working hard on writing this year!"

Ask questions to increase children's recollections of events. Use open-ended questions to invite language-rich conversation and prompt children's recall of specific details. "Tell me more about your family reunion. It sounds like you had a lot of aunts and uncles there. Did you eat something special at the party?"

Encourage children to express their feelings and reactions to experiences. Ask children to share their personal reactions as they pursue new challenges, face frustration, and experience success. "It took a long time to climb that ladder. How did it feel?" Use descriptive statements to paraphrase their response. "So you were feeling scared at first, but then you felt better after you climbed back down." Such conversation supports the development of self-awareness.

Document children's work over time and create individual portfolios for each child. Include photographs, anecdotal notes, samples of writing and artwork, and other pieces of work. Organize materials in chronological order to illustrate change and passage of time. Share with children and families. "I remember when you first started preschool you rode the small yellow bikes. Now (pointing at a picture) you are big enough to pedal the large bikes."

Acknowledge birthdays. With sensitivity to family preferences, plan a simple activity such as highlighting the date on the calendar and/or singing a preferred song of the child. Use language focused on developing children's understanding of change. "You were three, and today you are four-years-old!"

Provide activities that invite personal reflection. Use old photographs, clothes, and personal data (e.g., length at birth) to help children think about personal change. "You were 21 inches long when you were born. Let's use a tape measure to see how big you are now...Wow! You are 40 inches tall! You've grown so much!" Ask questions to invite appropriate comparisons. "What was something you couldn't do when you were a baby, but is easy now?"

Make use of children's stories that explore growth and individual change. Stories like *Leo the Late Bloomer*, *Peter's Chair*, or *The Growing Story* can be used to further children's understanding of personal change over time. Engage children in conversation about their experiences of growth. "Peter outgrew his chair. He was too big. Is there something you had when you were little that you are too big for now?"

Substrand 4.0 Historical Changes in People and the World

Young children enjoy learning about events of "long ago" and displaying their knowledge of dinosaurs or other historical phenomena. They also enjoy hearing stories

of their parents and family history. Their understanding of time is reflected in their ability to distinguish events of the recent past from those of "long ago," but they are confused over when different historical and family events occurred in relation to each other. Teachers can aid children's developing historical understanding by sharing their enthusiasm for the events of "long ago" that provoke their interest, and discussing with them the family stories that tell of the past experiences of their family members.

Vignette:

The teacher notices that several children are standing up against the tall sunflowers along the fence that the class had started from seeds last spring. She joins them, asking if they remember planting the seeds. After listening to their comments, she adds, "Yes, that does seem like a long time ago. It was before we said goodbye for the summer. Now we are back at school in the fall, and look how much our sunflowers have grown and changed. They are taller than most of us and their seeds are almost ready to roast and eat or to save for planting time next spring."

Teachable Moment:

This teacher uses the children's interest in the sunflowers to begin a conversation about seeds growing into plants, reminding them of both the beginning and end of the cycle, as well as its relationship to the seasons of the year.

Vignette:

Adelia's aunt has come to the group's circle time to tell stories about her town's holiday fiesta. She has brought a colorful dancing skirt and shawl for the children to see. Adelia adds, "We only do that kind of dancing at special parties. You need the right kind of music." Her aunt explains that, when she growing up, many people played musical instruments and danced often. The teacher converses with the group about how sometimes the way people do things changes over time. She makes a "mental note" to find more books at the library about holiday traditions.

Teachable Moment:

For this group time, the teacher invites a child's family member to share her own holiday memories and items. She introduces to the children the idea that the ways people do things can change over time, and she makes her own plan to follow up using library resources.

Vignette:

Nico looks through the familiar homemade, photo-illustrated book titled, Teacher Jen's Broken Ankle, that is displayed on the reading area book rack. "My papa fell and broke his arm when he was a little boy," he tells Ms. Jen. She asks him how it happened, and he tells her the story his papa has told him. Ms. Jen wonders with Nico whether his papa had to wear a cast on his arm while it was healing. Nico says he thinks so, because he remembers that Papa was supposed to keep his arm dry for a long time. He then asks Ms. Jen to show him again the ankle cast she wore while her leg was healing.

She keeps the two halves of her bright pink cast in the “Hospital” prop box that teachers use in the dramatic play area when children’s play signals interest in medical themes.

Teachable Moment:

This teacher has incorporated homemade books documenting real-life experiences into her classroom. When a book reminds the child of a family story, she listens and encourages him to think about more of his story’s details. She extends the interaction using an authentic prop that Nico remembers.

Interactions and Strategies:

Utilize familiar resources, such as parents, grandparents, close friends and community members, to share their own childhood experiences. Encourage them to share photographs of when they were the children’s age. Prepare questions to facilitate the conversation: What games did they like to play? What was something that was hard to do then, but is easy now?

Read children’s stories about different places and times to expand children’s perspective. Converse about concrete comparison experiences: How do the homes in the book differ from the homes we live in? Do you have clothes like the children in our story? What are they eating in the story? Do we still eat it?

Expose children to the arts. Sing traditional songs from a variety of cultures, both familiar and unfamiliar to the children. Listen to music and introduce art from different eras. Invite conversation of children’s initial impressions and observations.

Observe changes in animals, plants, and the outdoors. Record children’s remarks over time and compare notes (“Yes, Harley the Hamster was small in September. I’ll write down she is now five blocks long.”). Take photographs and create a chart to illustrate change (“This is our seasons’ poster. Let’s add the pictures we took of our neighborhood in spring... See how the trees have new green leaves? In winter our trees looked so empty.”). Converse about change (“What did you notice about our bean sprouts... Yes, they’ve grown quite tall with sun, water, and time.”). Provide children with documentation tools to keep details of their observations over time.

Celebrate holidays in a meaningful and authentic way. Avoid “tourist curriculum” by maintaining a consistent daily routine and incorporating celebratory events into regularly scheduled activities. Incorporate families and other community members into the experience, “Today at large group, Andrew’s mother is going to teach us how to move like lions and dragons.” Children should be an integral part of the planning process. Brainstorm ideas together and then put children’s ideas into action. Keep activities simple and understated. Introduce key concepts related to holiday celebrations in concrete terms (e.g., “During Chinese New Year, some people decorate their homes, cook special food, and exchange gifts.”).

Record significant events on a classroom calendar to create a program history. Refer back to the calendar and previous events as opportunities arise. “Last month we went on a field trip to the grocery store. This month we have planned a trip to the library.”

Provide children with hands-on experiences with concrete artifacts and historical objects (e.g., toys, utensils, tools). Allow children to explore and experiment. Facilitate conversation about how the object was used and compare with current instruments (“We have three kinds of egg beaters; a hand egg beater, an egg beater with a crank, and an electric egg beater. Which one do you think will work the fastest? Which one is the hardest work for your body?”). Document the conversation and display with the objects.

Bringing It All Together: Sense of Time

The preschool year is almost over, and Ms. Nguyen has finished compiling the portfolios for the children in her group. She will review and discuss them with family members at year-end parent conferences, and then families will be able to take them home. First, though, she has brought them to share with children during a small group time.

“These are special books,” Ms. Nguyen tells the small group of children around the table. “There is one for each of you, and it is all about you. Let’s see if we can figure out together which is whose.” She holds up the first one, with a photo and large printed name on its cover. “That’s me!” exclaims Lamar, and Ms. Nguyen hands him the book. “We’ll need to turn the pages gently so none of them will rip,” she reminds the group. The other children identify their books and then they all spend a few minutes paging through them, looking at their photos, artwork, dictated stories, writing and drawing samples, and other items put aside in their folders during the preschool year.

“Look! That’s me carrying back that bag of apples we bought at the store,” Tyree shares. As the children look and comment, Ms. Nguyen reminisces with them about the shared experiences their portfolios document, like their walk to the grocery store and the signs children made afterward while setting up their own store in the dramatic play area. She has saved these signs and other contributions made by children, and has noted the date on the back of each one. She encourages them to converse with each other, as well as with her, about the memories their portfolio pages evoke.

The practice of making portfolios to document children’s activities and growth over the course of the year contributes to their understanding of the passage of time. It also affirms for families how capable their children are becoming as they grow. Ms. Nguyen’s group viewed a sample portfolio early in the year, and she explained that they could choose to save some of their work to add to their own special book. Throughout the year the teacher has labeled and filed samples of each child’s work, including art,

writing, dictated stories, and her own recorded anecdotes about projects and milestones she has observed. At times, she has asked a child if they would like her to save a specific item for their book. In addition, she and parent volunteers have documented with photos some of the significant group experiences and projects of the year, and the program has printed copies for families. A portfolio takes planning, but it is a significant gift of personal history for both children and their families.

Engaging Families

The following ideas may be suggested to families as ways of helping their children begin to understand the concept of time and the passage of time in their own lives.

Establish some dependable family rituals and routines to share. Children enjoy being able to anticipate predictable elements of each day, week, and season. Daily rituals can include a bedtime story or song or a special morning goodbye routine. Friday night pizza or a Saturday morning family walk can be weekly markers. Holiday rituals and traditions that include children can be anticipated and then remembered over time.

Discuss family plans and events with children before they occur. Find some choices that children can make at home, such as choosing before bedtime which clothes to wear to school the next day or which color drinking cup to use for milk. Inform children of upcoming changes in advance. Knowing about a parent's planned absence, a weekend family gathering, or a move to a new apartment can help children cope with the change.

Find a special place for items that document children's growth. This can be a scrapbook or album, a box, or a drawer. Include photos taken at different ages, artwork or dictated stories from preschool, a first stuffed animal, birthday cards or other keepsakes. These are tangible reminders of a child's own personal history.

Tell children stories about their family's history. Hearing stories about the past experiences of people close to them brings to life the idea that people grow and change over time and that everyone has a personal story. Hearing the childhood memories of adult family members is especially memorable to children.

Questions for Reflection

1. What kinds of comments and questions can you use when children share stories about their personal experiences with you?
2. How can you partner with children's family members to make the preschool environment reflective of their diverse family stories?
3. In what ways can you ensure that your preschool setting's daily routine is accessible and understandable to all of its children?

4. What can you do to make concrete documentation of each child's growth manageable for teachers and meaningful to children and families?

Strand: Sense of Place (Geography and Ecology)

Each person has a sense of the places to which they belong: home, workplace, school, and other locations that are familiar and meaningful. Young children experience this sense of place strongly because familiar locations are associated with important people who constitute the child's environment of relationships. Locations are important because of the people with whom they are associated: home with family members, preschool with teachers and peers. Preschoolers also experience a sense of place because of the sensory experiences associated with each location: the familiar smells, sounds, and sometimes temperatures and tastes combine with familiar scenes to create for young children a sense of belonging.

Developing a sense of place also derives from how young children interact with aspects of that physical location. Preschool children relate with their environments as they work with materials, rearrange tables, chairs, and other furniture, create maps to familiar locations, travel regularly from one setting to another, and work in other ways with their environments. Young children also interact with their environments as they learn to care for them. Young children's natural interest in living things engages their interest in caring for plants and animals, concern for the effects of pollution and litter on the natural environment, and later, taking an active role in putting away trash and recycling.

These interests present many opportunities to the early childhood educator. Young children can be engaged in activities that encourage their understanding of the environments in which they live, whether they involve creating drawings and maps of familiar locations, talking about how to care for the natural world, discussing the different environments in which people live worldwide, or taking a trip to a marshland or a farm. In this section, specific strategies are discussed that support development in each of the following substrands:

- 1.0 Navigating Familiar Locations
- 2.0 Caring for the Natural World
- 3.0 Understanding the Physical World Through Drawings and Maps

Sample Developmental Sequence: Sense of Place

With increasing age, children better understand the settings where they live and learn, the routes between these places, and the natural ecology in which they are located. As they do so, children also become interested in places that are unfamiliar and different.

Beginning level: Children use their knowledge of familiar places, like home and school, to confidently find the people and things they need. They can become confused or distressed if these settings change abruptly, such as if a room is redecorated at home.

Next level: Children are aware of a broader variety of physical settings, such as the places where familiar people live and work. Children also recognize the routes between well-known locations, and may use simple drawings to describe them.

Next level: Children's broadening understanding of the environment includes an appreciation of landscapes like hills and streams, weather patterns, and other features of the environment. Children also become more skilled at understanding the relative distances between familiar locations.

Mature or proficient level: Children's understanding of their own environment leads to expanding interest in unfamiliar locations and the people and activities associated with them. This can lead to an interest in maps and globes to understand "far away" places.

Substrand 1.0 Navigating Familiar Locations

The earliest "sense of place" that develops for young children is their personal experience of familiar locations, such as their home, preschool, and the routes connecting them to each other. Younger children identify familiar locations by the people and activities associated with each one and the routes between them, while older preschoolers have a wider view of the world in which differences in topography (e.g., hills and streams), weather, and common activities are better understood. Teachers can contribute to this developing understanding in their efforts to help young children understand their familiar locations in relation to the other places that people live and work, and by helping children better comprehend the physical world in which they live through activities such as nature walks.

Vignette:

Michael sits down with his peers and Mr. Sean at the snack table. "There was a huge dump truck going down my street today," he tells everyone. Mr. Sean asks him what was in the truck. "Rocks and big sidewalk pieces," replies Michael. "I know that," adds Rio. "It's by my house. Papa says they're digging up the street for water pipes." Several other children nod and agree that they know where that is and they have gone by it, too.

Mr. Sean tells the children that the construction site they are talking about is just around the corner and down one block from their preschool. “Would you like to take a walk together to watch them work?” he asks. “It sounds like a big and exciting construction project is happening in our neighborhood.”

Teachable Moment:

These children have noticed something exciting that is happening to the landscape of their preschool neighborhood. Mr. Sean notes their interest and joins the conversation, pinpointing the geographical location of the construction site. He makes plans to follow up on their interest by arranging a walking trip to watch the work being done.

Interactions and Strategies:

Supply open-ended materials in the indoor and outdoor early learning environment to promote exploration of spatial relationships. Blocks, plastic or wooden animals and people, and transportation vehicles offer children opportunities to construct pretend homes and habitats as well as larger cities and worlds. Provide additional loose parts to designate bodies of water (e.g., an empty container filled with water or pieces of blue felt) and land formations (e.g., small cardboard boxes).

Describe your own actions as you travel between locations. “I am going to walk to the office to make a copy of our project. I will have to walk through the Toddler Yard to get there.” Or, “I go across a bridge each day when I drive to work.”

Play games about how to get from here to there. Challenge children to see how many different ways (e.g., walking, skipping, crawling, etc.) they can move from one location to another (“Today let’s see how we can get from the door to the swing set? ...Instead of walking, let’s try hopping across the yard.”). Incorporate children with mobility challenges utilizing their adaptive equipment (e.g. wheelchair, walker, “skateboard”). For more information about resources for teachers of children with disabilities or other special needs, see Preschool Curriculum Framework, Volume 1, Appendix D.

Engage children in conversation about how they travel to and from school each day. Plan a discussion during a large-group gathering. Create a list of the many forms of transportation. Utilize pictures of different types of transportation to encourage all children’s participation. Extend the conversation to include what children observe while on their way to school. Compare with the route home. Is it the same or different? Talk about travel time.

Take walks through familiar locations and neighboring areas. Make a list of the things the children see, rephrasing the children’s language to elaborate on their ideas (e.g., “I can hear the creek, too! We must be getting very close to the water now.”). Invite children to record their observations during the walk using drawings and photographs.

Repeat the same walks to build children’s familiarity with and knowledge about significant landmarks. See Sample Developmental Sequence: Sense of Place, p. 21.

Converse about the here and now as well as encouraging later reflection. Discuss the surfaces children encounter. “How does the surface feel when we walk on the grass or touch it with our hands?” “How is it different from the gravel?” Help children recall important landmarks from recent outings. “Which building did we notice first on our walk?”

Locate and explore local landmarks. Research and introduce bodies of water and landforms in your region. Visit sites when possible or share photographs of them. Compare and contrast each attraction’s characteristics: “What do you notice about these two pictures? ...Yes, one is the Golden Gate Bridge, and the other is the bridge near our school. How are they the same? How are they different?” Extend the learning into the home by encouraging family outings to local destinations.

Promote children’s understanding of weather and its impact on their day-to-day experiences. Use small and large-group activities to reflect on clothing choices during specific seasons. Help children attend to the impact of weather on living things and outdoor spaces. How does weather change our environment? Comment on weather and its influence on the daily routine. “I hear thunder and lightning. We will stay inside today until the weather clears.” Or “It’s a windy day, perfect for flying the kites we made last week!”

Comment on weather patterns and invite children to share their observations. Record patterns over time on poster board and post documentation at the children’s eye level. Take dictation as children comment on weather. Elaborate on their descriptions. “Adelia says ‘It’s hot and sticky.’ It is hot, and with a lot of gray rain clouds over our heads it feels humid. The extra moisture in the air makes us feel ‘sticky.’” Also take photographs of the appearance of familiar landmarks (e.g., trees) over time to show a continuum of change in weather through the seasons and its influence on the natural world.

Read aloud books and engage children in storytelling related to navigating familiar locations and daily routines. *Corduroy Lost and Found*, *Rosie’s Walk*, and *Jesse Bear What Will You Wear?* are treasured children’s books that depict characters encountering and responding to the physical features of their world.

Substrand 2.0 Caring for the Natural World

Young children have a strong interest in the natural world because of their direct experience of growing things -- a flower or plant, a kitten or puppy -- that they can care for. A plant or pet may be a young child’s first experience of providing nurturance to another who is dependent on their care (just as the child depends on the care of

others). Teachers contribute to this awareness by guiding their understanding of the connection between their feeding and watering and the growth they observe in a plant or class pet. They also encourage young children's understanding of caring for the natural world through their guidance about the hazards of pollution and litter. Teachers can also help preschoolers learn about natural ecologies that are very different from their own, whether of arctic, jungle, or other regions of the world.

Vignette:

As the preschool group prepares to go outside, Ms. Toni comments, "Yesterday I noticed something different about the trees along our playground fence. This is the season we call autumn, and in autumn, the trees begin changing. Let's observe them while we are playing outside today, and we'll talk about them when we come back in."

Teachable Moment:

This simply stated observation by Ms. Toni draws children's attention to something they see every day but may not have intentionally observed. Mentioning it just as the children are going outside will focus their attention on the trees for long enough so that most children will notice the changing colors of the leaves. Having introduced the concept ahead of time will enrich the follow-up indoor discussion and story time about trees that she has planned.

Vignette:

"I like this place," shares Maya as she looks around the small reading area. "What do you like about it?" asks Ms. Nicole. "I like the green. Is like un bosque." Yes, agrees Ms. Nicole. The green plants do make it seem like a forest."

Teachable Moment:

Plants in the preschool environment have a positive effect on children's mood and behavior. They can make an otherwise institutional space feel welcoming and homelike. Green, growing plants are an especially important element to include indoors when a playground does not provide much green space outdoors.

Interactions and Strategies:

Use children's current knowledge to plan effective curriculum. Attend to children's spontaneous inquiry and provide them with the materials and tools needed to expand their understanding of a particular topic or phenomena. "Hmm...you are wondering if our pet walking stick has eyes. Let's get a magnifying glass from our science kit and find out."

Set aside time for outdoor explorations each day. The natural world supports all areas of learning, but the outdoor classroom is especially encouraging of children's dramatic play, gross-motor activity, and scientific inquiry. Children need plenty of time to investigate, repeat actions, and attempt new tasks. Plan the daily schedule to include at

least 30-40 minutes of outdoor play every day. Encourage weather-appropriate clothing so that children may explore the outdoor spaces year-round.

Provide children with sensory experiences, especially those with sand and water. Create a generously sized sandbox in the outdoor environment with access to water for children's experiments. Indoors, offer children a sensory table for similar, small-scale investigation. Supply children with tools for exploration (e.g., magnifying lenses, small shovels, buckets, clear containers, drawing tools).

Integrate living things into the indoor learning environment. Choose classroom pets carefully with thought to the amount of care and attention they will require. Provide a clean, comfortable habitat. Post the name of the animal and information about its care at the children's eye level. Encourage the children to participate in its care as appropriate. Incorporate child-safe, non-toxic plants throughout the program. Choose plants with different shapes, colors, and textures.

Observe life in its natural setting. In addition to making observations in the outdoor learning environment, plan frequent nature walks through surrounding neighborhoods. Offer children tools to focus their observations (e.g., paper towel tubes, binoculars, paper, pencils, cameras, etc.). Talk with children about how to be good observers (e.g., sitting quietly and giving an animal space to feel safe in their natural habitat).

Model respect and care for the natural world. Be careful to not pick wildflowers, pull branches from trees, or harm insects and other creatures. "I see a caterpillar walking across the sidewalk. Let's all move around so we do not hurt it."

Use descriptive language to converse about the earth and its features. Encourage children to reflect on the colors, shapes, textures, smells, and size of elements in their natural world. Extend the discussion by sharing your own observations. "This plant has rough leaves, but this plant's leaves have a smooth surface."

Compare and contrast living and non-living things. Invite children to observe different objects and living things in the indoor and outdoor environment. Ask them if each is living or not living. Encourage deeper analysis by asking, "How can you tell?" For more ideas on this topic, refer to the Science chapter.

Teach young children easy ways to conserve the earth's resources. Create a recycling center in the classroom. "It looks like we have some scraps from our paper cutting activity. I will put them in our recycling bin so they can be made into new pieces of paper." Repair toys and books where possible instead of purchasing new ones. "I think we can glue this traffic sign back together. Let's try it. If it works, we won't have to buy a new one." Reuse materials in different ways. Read *Not a Box* and encourage the children to think of creative ways to use recyclables. See Research Highlight, p. 26.

Grow a garden in the outdoor classroom. Use small plant boxes or build a large planting bed. Plant seeds as well as seedlings. Document the garden's growth over time with photographs. Encourage children's observations and record them in a garden journal. Discuss why some things grow and why others may not.

Eat fresh produce at snack and obtain food directly from a local gardener, farmers market or food vendor when possible. Take time to converse with the children about where the produce came from and how it was grown.

Use books to extend children's investigations of the earth and its attributes. Some explorations of the natural world may not be possible or accessible in the early learning environment. Books allow children an alternative way to explore small and large-scale phenomena (e.g., volcanoes). Display concept books with related ongoing investigations in the classroom.

Research Highlight

Caring for the natural world gradually develops as young children begin to understand how human activity affects animals, plants, and the natural environment. One research team created a measure of environmental understanding to assess how much preschool children knew about everyday practices that affect the environment ²². In this measure, preschool children were told about two different types of children, and were asked which they most resembled. In one item, for example, they heard "Some children like to leave the water running when they brush their teeth" and "Other children always turn the water off while brushing their teeth," and they were asked to indicate which kind of child they were like. The measure was given to children ranging in age from 40 to 73 months. The research team found that scores for environmental awareness increased with age, and scores were also associated with parents' reports of how often children participated in environmentally relevant activities in the home, such as recycling.

Substrand 3.0 Understanding the Physical World Through Drawings and Maps

One way of understanding the physical world is by describing it through a drawing or a map of a familiar location. Older preschoolers may spontaneously create a map of the directions to an imagined treasure or a real discovery. It is more difficult for young children to use a map drawn by another to identify a location, although preschoolers make significant advances in doing so with adult guidance. Teachers contribute to these achievements by encouraging young children to represent their physical environments through drawings and maps, and prompting their use to find locations or explore.

Vignette:

“This is the castle for the princess and her friends,” explains Grace to Tanya as she describes her unit block structure. “Here’s the bedroom over here and the tower over there.”

Ms. Julia, sitting in the block area to observe children’s play, responds, “It looks like a very long way from the bedroom to the tower. Do the princess and her friends ever get lost in the castle?” “Well . . . sometimes they do,” replies Grace. “I wonder if we could draw something to help them find their way,” suggests Ms. Julia. “Like a map!” exclaims Tanya to Grace.

Ms. Julia offers to bring the clipboards, equipped with paper and pencils, from the art area. She takes one and begins describing her drawing plan. “First I’m going to draw a square for the bedroom in this corner . . .” The girls begin by imitating her technique and soon are exchanging ideas with each other as they draw their versions of the castle. When they are finished, Ms. Julia asks questions about the parts of their castle maps and offers to label them. When the maps are finished, labeled, and signed, Ms. Julia asks the girls’ permission to display them on the block area wall.

Teachable Moment:

This experience with map-making occurred in a constructive play setting, which often provides similar opportunities. The children needed some support and guidance from an adult, but then were able to create their own maps. Labeling and displaying the child-drawn maps identifies them as important work and may inspire other children to pair map-making with their constructive play.

Interactions and Strategies:

Engage children in a conversation about maps. What are they? What do they do? Expand on children’s ideas about the purpose and use of maps. Share that maps are smaller pictures of streets and roads, the places we live in, and the world.

Supply the learning environment with a variety of blocks and other open-ended materials to support the symbolic representation of the world the children see and experience each day. Provide traffic signs, train tracks, road pieces, and other materials that may be used to create roadways, landmarks, and buildings.

Incorporate maps in dramatic play experiences. Supply prop boxes and learning areas with maps that match emerging play themes. For example, if the children express an interest in camping, include trail maps, maps of different campsites, and other local attractions.

Provide children with map-making tools in both the indoor and outdoor preschool settings. Include paper, drawing tools, glue sticks, tape, scissors and other art supplies.

Capitalize on children’s initiative in exploring maps. Comment on their observations and work. “Oh, you’re drawing a picture of the tire swing on the playground, and that is the sandbox next to it. It looks like you are making a map.” Expand on their initial view by drawing attention to additional features of the space. “I know we have a tree in between the tire swing and the sandbox. Will you add that to your map?” See Sample Developmental Sequence: Sense of Place, p. 21.

Utilize maps while planning and attending group outings, in preparation of safety exercises (e.g., fire drills), and as children join your program or move to a new home. Introduce maps prior to the event. While on an outing, check the map to highlight past, current, and upcoming locations. “First we crossed this street. Now we are at the fountain. Keep alert now for the sign that says (shows picture to children of sign) ‘Train Station.’”

Play board games that use trails and pathways. In these and children’s games, the game pieces follow a specific path that includes ‘landmarks’ throughout each player’s journey.

Make a map of the early learning environment. Begin the project first with blocks and other three-dimensional materials. Help children attend to different barriers and furnishings. “Let’s make a map of our classroom in the Block Area. What blocks could we use to represent our couch? What’s next to the couch? A shelf...hmm, could we use this block to be the shelf?” Next create a map on paper. “Let’s draw a picture of our blocks. This will be our paper map of the classroom.”

Invite children to use their imagination and create maps to go along with familiar stories. Choose stories where the main characters are going on an adventure. “How would Max get to the where the wild things live?” Help children recall the land and water features the characters would encounter on their journey.

View locations from different physical perspectives. Make opportunities for children to explore familiar settings from different vantage points. Encourage reflection using open-ended questions. “What does our yard look like when we are in the sandbox?” “How is it different when we look down from our climbing structure?” Take pictures of other local attractions from different heights. “I took this picture of our city when I went on a hike in the hills. What do you see in the picture?”

Prepare a treasure hunt. Provide child-friendly maps and clues to facilitate their search. Have children work in pairs or small-groups to support collaborative learning and facilitate perspective taking. “What do you think, Jorge? Where do you think the blue bear might be hiding? ...Your idea is that the bear is where the blue mark is on our map. Let’s test your idea. Let’s go to the tree with the blue mark.”

Document work over time. Display children’s map making projects in the early learning environment at their eye level. Maintain records of children’s work to illustrate a change in spatial awareness and attention to detail. “When you first started drawing maps you used lines and ‘x’ marks. Now you have pictures of different landmarks like the bridge and the lake. It is clear how we had to go over the bridge to get to the lake.”

Bringing It All Together: Sense of Place

At circle time, Mr. Kyle reminds the children that last week many of them were burying treasures in the sandbox for their friends to find. “Since that seemed like such a good idea, I thought it might be fun to have a bigger treasure hunt.” “Yeah,” agree the children. “X marks the spot,” adds one.

“Before you came to school this morning,” Mr. Kyle continues, “I hid our teddy bears (plastic counting bears) all around the playground. To help you find them, I drew a map.” Mr. Kyle unrolls a large piece of mural paper in the center of the circle. He gives the children a little time to look at it, listening to their comments to assess whether they are able to identify his representations of playground landmarks.

“What do you think?” Does this look like our playground? “Can you spot some familiar things on the map?” The children begin pointing to the various line drawings and naming playground features: slide, balance beam, tree, sandbox. Mr. Kyle then points to some of the colored “X” marks he has made on the map. “Each of these Xs marks a spot where bears are hiding. When we go outside, I will put the map on the picnic table so you can look for the X marks and remember where to hunt for bears.

Checking for understanding, Mr. Kyle asks, “Andy, where do you see an X for bears?” “By the slide,” responds Andy. “I see one at the bottom of the big tree,” adds Jana. After several more children have added their observations to the conversation, Mr. Kyle says, “I can see that you really know how to use this map. Let’s meet at the door to get ready to go on a bear hunt.”

Using a printed map is a skill beyond the capacities of most preschool children. A simple hand-drawn map of a very familiar location, such as the indoor or outdoor preschool setting, can be a good way to develop this skill with older preschool children. Keeping it simple and talking about its features together as a “rehearsal” for its use will increase children’s success. To accommodate children with varying skill levels and children with visual or motor challenges, consider having children explore the area in small groups instead of individually. For more information about resources for teachers of children with disabilities or other special needs, see Preschool Curriculum Framework, Volume 1, Appendix D.

Engaging Families

The following ideas may be suggested to families as ways to increase their children's familiarity and engagement with the world around them.

Look for maps in places your family goes. Draw your child's attention to maps posted at the bus stop, in a big store or shopping mall, a museum, or elevator or emergency exit in public buildings. Point to the "You are here" dot and trace with your finger where you are going.

Take different routes when you go to familiar places. Make a game of taking a different route to a park, preschool, a friend's house, or a store. Try narrating your trip, saying things like, "Now we are turning the corner, and then we will go over the bridge and across the street."

Talk about the weather with your child. Use different weather words to describe the temperature, wind, cloud patterns, and precipitation. Children can become more aware of the information their senses are taking in if they have descriptive language for it. Saying, "The wind is cold and gusty today," makes the experience more graphic.

As a family, think about ways you can reduce waste. Give your preschool child a role in recycling items you use at home, including paper, food containers, and boxes. Encourage your child to think about other ways your family can protect the environment.

Share with your child elements of the natural world you especially enjoy. Hearing you say that spring is your favorite season or that you love listening to birds sing can help your child reflect on personal favorites in the outdoors. Your child will often come to value the things that you value.

Questions for Reflection

1. What are the features you think preschool children would include in a description of your program's indoor and outdoor physical environment?
2. Which program practices can you change to indicate to your children that it is important to take good care of the natural world?
3. What simple activities can you incorporate into your curriculum to increase children's familiarity with their preschool neighborhood?
4. Which children's books do you already read aloud that could be used as starting points for conversations and activities about aspects of the natural world like weather, seasons, and living things?

Strand: Becoming a Preschool Community Member (Civics)

An early childhood program is a wonderful setting for learning how to get along with others. It is also an important setting for learning about oneself as a responsible member of the group. In an early childhood education setting, young children are enlisted into responsible citizenship for the first time outside of the family, encouraged to think of themselves as sharing responsibility for keeping the room orderly, cooperating with teachers and peers, knowing what to do during group routines (e.g., circle time), cleaning up after group activities, participating in group decisions, supporting and complying with the rules of the classroom, and acting as citizens of the preschool.

This early experience in elementary civics is challenging for young children because it requires that children balance their own desires and goals with those of others. For this reason, many of the skills of preschool community membership take time to develop as young children gradually acquire the social understanding, self-regulatory capabilities, and motivation to compromise, bargain, negotiate, take turns, and act in other ways that respect the needs and interests of their partners.

Many formal and informal activities of an early childhood education setting contribute to developing the skills of preschool community membership. These include group decision-making that may occur during circle time (including voicing opinions, voting on a shared decision, and accepting the judgment of the majority), resolving peer conflict and finding a fair solution, understanding the viewpoints of another with whom one disagrees, sharing stories about acting responsibly or helpfully, and the guidance that older children can provide younger children about being a preschool classroom citizen. In this section, specific strategies are discussed that support development in each of the following substrands:

- 1.0 Skills for Democratic Participation
- 2.0 Responsible Conduct
- 3.0 Fairness and Respect for Other People
- 4.0 Conflict Resolution

Substrand 1.0 Skills for Democratic Participation

An early childhood program is the first social setting outside of the home in which young children can learn, understand, and practice the skills of democratic participation. These skills are learned by doing. The opportunity to be a responsible member of the group, to share in group decision-making, to express one's opinion and listen respectfully to others' views, and to accept the majority decision but also respect the feelings of the minority -- these are skills that most preschoolers are ready to learn because of advances in their social and emotional understanding. Even so, young children may be challenged to cooperate with a group decision that they do not share, and teachers can

be helpful as they model democratic practices in the preschool setting, encourage children's positive participation in group activities, and acknowledge the disappointment that can arise from not always getting one's way.

Vignette:

The children gather with Ms. Yana in a circle on the rug for their morning meeting. After they join in singing their greeting song, Ms. Yana shares some news. “Ms. Katrina, who works in our school office, has given us this fish for our preschool room. She has given us the fishbowl and fish food, too.” Many children are excited and want to ask questions and tell stories about fish. Ms. Yana reminds them of the class rule they agreed on that only one person at a time should talk during the class meeting. Several children indicate that they have ideas to share. Ms. Yana calls each by name in turn, and several children in the group remind others of their rule to listen quietly during others’ turns. During their meeting, they discuss ways to keep the fish safe and healthy, and Ms. Yana lists on chart paper the ideas they suggest. Their list includes: Feed him every day; Don’t drop things into his fishbowl; Make sure his water is clean; and several other ideas.

Lev adds, “Hey, our fish needs a name.” Ms. Yana puts up a new piece of chart paper and asks each child around the circle for their naming idea, which she writes on the list. “Now that we have everyone’s ideas, we can vote on a name. It looks like we have five to choose from. Listen as I read and point to our whole list of names, think carefully about which one you would like to give our fish, and then raise your hand when you hear or see your favorite fish name.”

They complete the process of voting, and Ms. Yana records the numbers on the chart. Several of the older children identify “7” as the highest number on the list. “Yes, seven people voted for the name ‘Stripey,’ so that will be our fish’s name. I will make a nametag for the fishbowl during work time.”

Teachable Moment:

This anecdote describes a class meeting with older preschool children who have had experience with class meetings throughout the year. The class has established rules together and some children want to make sure that everyone follows them—typical behavior at this age. They have participated in simple voting before, but still need the teacher’s specific instructions and reminders about how the process works. With practice, most children can participate successfully in a brief, well-structured group meeting that focuses on a topic of interest to them. A voting exercise also provides a manageable experience of active participation for English learners. For more information about strategies to support children who are English learners, see Preschool Curriculum Framework, Volume 1, Chapter 5.

Interactions and Strategies:

Share control of the preschool environment with children. An environment that prepares children to become members of a democratic society fosters mutual respect and focuses on how children feel, act, and interact with others. Rather than primarily asserting their authority and giving orders, teachers sensitively attend to children's ideas and offer developmentally appropriate guidance to enable children's successful, shared engagement in the early learning environment (e.g., "It seems that you all want to play with the new blocks. How can we make sure that everyone gets a turn?").

Promote a sense of connection and community by using terms such as "we" and "our" when speaking with children and adults: "We all clean up at the end of play time." Or "Our garden needs water to grow. Who will help water it?" Or "Our friends need help solving their problem. What can we do to help?" This intentional language choice communicates shared responsibility for both the people and things in the preschool setting. Encourage shared goals by planning for shared work and events. As children participate in group activities, both small and large, they see themselves as active members of a community with an important role in its success (e.g., "Let's bounce the balls on the parachute together. We need everyone's help to keep the balls in the middle of the parachute.").

Incorporate class meetings into the daily routine of older preschool children. Community meetings offer children an opportunity to practice communicating in groups by sharing their own ideas as well as carefully attending to the ideas of their peers. Set aside time each day for children to gather as a group for problem-solving, project planning, and collaborative learning. Class meetings should be brief, lasting no more than 10 minutes. Teachers set the tone for participation in group meetings by creating a predictable structure for the event. They may consistently begin with a greeting song before introducing new materials for the week (e.g., "This week we have watercolor paints in the Art Area. Does anyone know how to use watercolors?"), opening up a discussion about a program problem (e.g., "A lot of our friends have been worried about not getting a turn with the new bikes. What ideas do you have for solving our problem?"), or inviting the children to share an important learning experience (e.g., "Taylor found out something about magnets. Let's listen to what she has to tell us.").

Support freedom of thought and speech in individual investigations, as well as in planned group experiences. Free speech is an important foundation of democracy. Children can practice expressing their own ideas, thoughts, and feelings as they create unique art, build with blocks, develop their own ideas about scientific phenomena, and dictate their stories. Teachers should listen attentively to children's ideas and mediate conflicting viewpoints and perspectives: "You think the balloon will get bigger, and Taiga thinks it will stay the same size. You have different ideas." Such intentional efforts

facilitate a communication-friendly environment that promotes critical thinking and the sharing of differing ideas and perspectives.

Generate community rules and expectations to protect the rights of each individual and to create a community of trust and security. Begin with a group discussion about how rules keep order and ensure fairness for all. Extend the conversation to include rules of the community (e.g., Circle Time Rules). With an understanding of rules and expectations, invite the children to create rules for the indoor and outdoor settings.

Engage children in community brainstorming and problem-solving. As children share their thoughts for program planning and problem-solving, they develop their ability to communicate ideas and influence group decisions. Engage children in brief discussions both individually (e.g., “Sasha, what role will you play in the doctor’s office?”) and in small- and large-groups, documenting their ideas and using charts to organize suggestions for action (e.g., “Lili, I’m asking all of our friends what we would like to have in our pretend restaurant. Do you have ideas for me to write down?”).

Make group decisions when appropriate. Voting, a cherished right and privilege of democracy, introduces children to accepting the majority’s judgment while still respecting the minority view. Teachers should first set up voting activities that permit each child to have his or her own way. (e.g., “Which topping will you have on your biscuit? Butter or jam?”) Graph votes to document individual and group decisions (e.g., “Four friends will have butter, and ten friends will have jam.”). With experience, children can vote using the majority rule. Make decisions about what to name a classroom pet, what type of restaurant to add to the dramatic play area, or what game to play at large-group time (e.g., “Some of our friends wanted to play ‘Red Light, Green Light,’ but more of our friends wanted to play ‘Simon Says,’ so today we will play ‘Simon Says.’”).

Acknowledge emotions related to group brainstorming and decision-making. Young children struggle with impulse control as it relates to group wants and needs and may express strong reactions to what they perceive to be disappointing decisions. Teachers who describe what they see, putting language to the child’s response and the experienced outcome, help children make sense of democracy in action: “You really wanted to name the fish ‘Blue’ but more friends wanted to name the fish ‘Stripy.’ It’s frustrating when the group makes a decision we don’t like.”

Model citizenship skills. Adults who form positive relationships with children, characterized by mutual respect and care, encourage children to replicate such sensitive and attentive interactions with their peers. For example, a teacher, working with a child to fold a paper airplane, suggests asking the other children for help when they become stuck in the process: “I can’t remember what comes next. Maybe we could ask our friends if they have ideas about making paper airplanes.” Teachers also reinforce citizenship skills as they model prosocial behavior in their relationships with other adults (e.g., “I’m going to offer these extra crickets to Mr. Sanchez. I know his classroom likes insects, too.”).

Use guidance to redirect children to more appropriate actions and behavior. Set predictable and consistent limits based on agreed upon community rules. Encourage children to reflect on their actions and recall expectations for behavior: "You look angry. Yesterday we all agreed to be gentle with our friends. We said, 'no hitting' (pointing to rule chart). What can we do? Offer more specific support as needed. "You can tell Rosa, 'I'm not done. I want the binoculars back.'"

Reinforce behavior. Teachers who draw attention to the positive actions of children build a foundation for respecting and protecting the rights of others: "Bruna, you're helping Vicente and Marcos build their castle. And you are each taking turns adding pieces to the top. You are all making sure each friend gets a turn."

Create an inclusive environment that values and encourages the participation of children from all cultural and linguistic backgrounds as well as children with special needs. Children need adult guidance in order to develop respect for individual and group differences. Teachers who model respect encourage children's positive, inclusive behavior. Adults can further promote the active participation of all members of the preschool community by intentionally including multi-cultural, anti-bias literature, displays, materials, and goods. Adults can also adapt materials and activities when necessary to foster inclusion of children with special needs. For example, use a variety of voting methods (e.g., buttons, stickers) to ensure all children's active participation. By representing and including all children, teachers promote children's positive self-concept and affirm the value of our diversity. For more information about strategies to support children who are English learners, see Preschool Curriculum Framework, Volume 1, Chapter 5. For more information about resources for teachers of children with disabilities or other special needs, see Preschool Curriculum Framework, Volume 1, Appendix D.

Substrand 2.0 Responsible Conduct

Young children enjoy being helpful. Their self-esteem is enhanced by assisting others and by being regarded by adults as responsible group members. As preschoolers develop greater self-regulatory skills, and as their memory for classroom expectations and rules grows, they become more capable of responsible conduct in the early childhood education setting. Teachers contribute to the growth of responsible conduct when they ensure that group expectations for behavior are developmentally appropriate, the schedule and environment are organized to enhance children's self-regulation, and when they help children understand and enact appropriate behavioral expectations.

Vignette:

On Monday morning, Will, Peter, and Emma choose the art area as their first plan for the day. As they begin to gather the materials they need for their projects, they are upset by the condition of the art area materials they had planned to use. "Ms. Mary, the

art area is messy! The glue sticks don't work and the ribbons, buttons and paper are gone. Yucky sticky scissors, too!" they report to her with dismay. She joins them to survey the area.

Ms. Mary commiserates with the children. "I'm so sorry it looks this way. While I was home sick last week, our teacher helpers had so much to do, and didn't know how we store the things in our classroom. We always keep our art shelves neat and clean. What shall we do now to fix the art area?"

The children, who are used to their active role in helping maintain the classroom environment, begin to talk about the things that need to be done. As they do so, Ms. Mary brings over trays and suggests that they place the dry glue sticks, sticky scissors, and empty collage material bins on them. She then asks them to look around again and tell her all the things that need to be done as she writes a list. As she supplies soapy sponges, they volunteer to help clean up messy shelves and art tools while she resupplies materials from the cupboards. After a few minutes of group work, Ms. Mary looks around and says, "Thank you all for your hard work. This already looks better. Work goes so much faster when we do it together."

Teachable Moment:

In this anecdote, the teacher affirms the children's frustration about the art area's disarray. While providing an explanation, but not blaming others, she quickly guides them into problem solving and cooperative work to help correct the situation. This reinforces their sense of group responsibility and ownership of the preschool environment. Her follow-up comments reaffirm the value of group collaboration in addressing a problem.

Interactions and Strategies:

Set the tone for responsible conduct by creating a high-quality learning environment and thoughtfully scheduled daily routine. Make the space aesthetically pleasing and designate learning areas to guide children's constructive, self-initiated play. Choose developmentally appropriate, conceptually organized materials for exploration to ensure successful learning experiences for all children. Plan a predictable daily routine that promotes self-regulation; limit transitions, offer a balance of active and quiet activities, individual and group experiences.

Create community rules with children's input. Converse with children about the purpose of rules and their impact on our day-to-day lives ("What rules do you have at home?" "What would happen if we didn't follow rules?"). Invite children to share ideas for caring for their program and one another. Summarize and post these rules at the children's eye level.

Model the behaviors you expect. Children imitate the behavior of others, especially that of the trustworthy adults important to them. For this reason, adults must make sure to follow all community rules and expectations; having adults not adhering to group standards confuses children. Be consistent. Communicate the purpose of your actions. “I am helping Owen put away these train tracks so our other friends have more room to play.”

Help children remember and meet community generated rules and expectations by providing both visual and auditory cues and prompts. Display posters with pictures illustrating steps for positive action throughout the environment (“Gentle hands, Emilia. See (pointing to the rule poster), our rule is ‘No hitting.’”). Use picture cards in different contexts with children to help them recall and apply appropriate social norms (“Look. Wait.” Child looks and points at a picture of child waiting for a turn. “Yes, it’s time to wait. It will be your turn to wash hands next.”). Coach children and provide prompts to prepare them for success (“I can tell you are excited for our walk to the park. Remember, we hold hands together on our walk. Ask Liam, ‘Can I hold your hand?’”). For more information about resources for teachers of children with disabilities or other special needs, see Preschool Curriculum Framework, Volume 1, Appendix D. For more information about strategies to support children who are English learners, see Preschool Curriculum Framework, Volume 1, Chapter 5.

Plan opportunities to further explore and converse about community rules during small- or large-group meetings. Connect rules to everyday experiences. “What if you wanted to ride the bike, but a friend was already using it? What is our classroom rule?” Rules can be context specific (e.g., home and school). Help children differentiate social norms and behavioral expectations across settings (e.g., “At school the rule is we all clean-up our toys when we are finished playing.”).

Redirect children’s actions towards more appropriate behavior using positive descriptions of what you expect children to do. Rather than limiting children’s forward movement with “No,” “Stop,” or “Don’t,” state expectations for action in clear, short statements. “Walk inside.” “Keep the cornmeal in the tub.” “Feet stay on the ground.” Give reminders as children work to internalize rules of conduct. Enforce developmentally appropriate consequences connected to the behavior as needed. “It looks like it is too hard to keep our blocks low right now. Let’s find a new activity. We can try again later.”

Facilitate problem solving. Help children plan for the future by asking open-ended questions and offering supportive comments. “What could you do next time a friend takes your truck? ...Yes, you could tell them ‘stop.’ What if they don’t listen to you? ...Pushing could hurt, and our rule is ‘be gentle.’ You could get a teacher to help, though. Come find me next time a friend won’t listen to your words.”

Reinforce responsible conduct using descriptive language. Acknowledge children’s actions by reporting what you see (“You sat quietly at large-group time without any help.”)

And you raised a quiet hand to share your idea!”). Emphasize the positive impact of a child’s actions on others (“When you gave Kamau a turn with the dinosaur puzzle it made him happy! That is being friendly.”).

Utilize books to build on the children’s ability to empathize and extend care to others. Stories can promote positive values such as cooperation, generosity, kindness, compassion, and interdependence. Read stories and engage children in conversation about the content. Help them extend ideals described in text and illustrations into their own lives and social experiences.

Assign tasks for community care, such as watering plants, feeding program pets, or helping to prepare snack, to help children practice responsibility. Rotate jobs and make developmentally appropriate adaptations to include all children’s active participation. For more information about resources for teachers of children with disabilities or other special needs, see Preschool Curriculum Framework, Volume 1, Appendix D.

Substrand 3.0 Fairness and Respect for Other People

"That's not fair!" expresses a preschooler's concern for fairness, and the child's growing sensitivity to others' feelings also contributes to this concern. Efforts to act fairly can be manifested in turn-taking, sharing, cooperation, and understanding how classroom rules help to maintain fairness. During the preschool years, children gradually become more capable of balancing their own interests with those of other children and of respecting another's desires and goals. Teachers contribute to these achievements as they explain rules (and the justifications for them) that emphasize fair conduct, the need to cooperate with the interests of others, and using words to help children understand another's emotions, viewpoints, and goals. It is also important to assist children when they think that fair equals the same. There are times that a child may need an adult’s help to do something (e.g., hold the jar steady) and another child is asked to do it without an adult’s help.

Vignette:

Three children spin around on the playground tire swing, two of them laughing and talking as they go. “Faster, faster,” Mariana and Isabel tell Mr. Kevin, who is pushing the swing. “No, slow down,” counters Juana. “My head is feeling too dizzy.” Mr. Kevin stops the swing from spinning and says, “It sounds like we have a disagreement about how fast to swing.” “We want fast! We want fast!” chant the two girls.

Mr. Kevin leans in to speak calmly to all three girls. “I know it’s fun for you to twirl fast, but it makes Juana feel sick. What shall we do to make sure she can have a good time on the tire swing, too?” They all think for a minute. “I know,” responds Isabel.” “We can have a turn for kids who want to ride fast and then a turn for kids who want to ride slow.” Mr. Kevin turns to Juana. “How does that sound to you?” Juana nods her agreement.

Mr. Kevin repeats the plan and then tells the girls, “You figured out a fair way for everyone to have fun on the swing.”

Teachable Moment:

In this situation, the teacher was attentive to the experience of all three children, and stopped the game when one expressed discomfort. His words helped the two friends consider the wellbeing of the third, as well as affirming her right to have her needs respected.

Interactions and Strategies:

Maintain a culturally inclusive environment. Encourage friendships among all children in the classroom community. Be mindful of the social expectations of children’s home cultures. Build strong relationships with families and ask authentic questions to gain insight into family norms and values.

Model respect and care in everyday interactions. Attend to children’s cues. “It looks like you are feeling frustrated. I’m concerned. What’s wrong?” Listen attentively to children’s ideas and feelings. Paraphrase and restate the feelings they express to ensure your own understanding of each child’s individual perspective and experience. “Oh, you wanted to play with Jiyou, but she’s playing with Valerie right now.”

Use language that promotes concern and care for the community. Using descriptions such as “our class,” “our room,” and “our program” encourages a sense of responsibility for the care and wellbeing of one another.

Converse about the “whys” of fairness and respect. Some program resources are limited. Help children consider the importance of sharing in these circumstances. Provoke a large-group discussion about “why we share.” Promote children’s self-reflection to further their understanding of the feelings involved in such situations. “What does it feel like when a friend tells us we can’t play with a toy?” “Why might the friend not want to share their toy?” “What could they do to help solve the problem?”

Teach social skills, such as patience and generosity, using social stories and role-play experiences. In pairs, small, or large groups, introduce perspective-taking activities to further children’s ability to treat others with sensitivity and care. Plan small group or partner activities during which children can practice these skills.

Coach children during their interactions with peers. Build perspective by describing another person’s feelings and needs and offer suggestions for appropriate response. “She looks upset that you grabbed the paper airplane without asking. Hand it back and then let’s ask Beatrice to share it. You could say, ‘Beatrice, can I hold the airplane you made?’”

Intervene and address bullying immediately. Create an environment where all children feel safe and secure. Take immediate action when someone is being mistreated. Seek information from both the bully and those they are targeting. Provide guidance to both children. Offer effective coping strategies (e.g., "Get a teacher.") and additional prosocial instruction for relating to one another (e.g., "I don't like that. Please stop.").

Use storybooks to enhance children's understanding of ways to express feelings and build peer relationships. Select books, such as *If Everybody Did* and *My Mouth is a Volcano*, to match emerging challenges with fairness and respect in the preschool community. Encourage children to reflect on the text and illustrations ("What do you think Jamaica is feeling now? What does the illustration show us?"). Invite them to share personal experiences that match story content ("Have you ever felt mad at a friend? What did you do? How did you solve the problem? Was it fair?").

Substrand 4.0 Conflict Resolution

Conflict with peers and teachers is inevitable in an early childhood education setting, and it offers opportunities for learning about conflict resolution. Young children are becoming more capable of understanding others' views and goals, coordinating them with the child's own desires, and devising strategies for their mutual accommodation. Although distress, aggression, and adult mediation are common outcomes of peer conflict, so also are bargaining, negotiation, compromise, and other approaches that reflect growth in social and emotional understanding and in self-regulation. Teachers contribute to these achievements as they put children's feelings into words, encourage children to think of solutions to their own problems, and model skills of compromise and negotiation.

Vignette:

Four children are playing in the block area, building a complex array of roads and garages for the small metal cars that teachers have just introduced into the area. "Hey, that one is mine!" shouts Peter, who has quickly gathered all but one of the shiny red cars close to his legs. Abdul tightens his grip on the red car he holds and looks at Peter. Nolan also notices that Peter has most of the red cars. He tells him, "Peter, that's not fair. We get some, too." Peter still refuses to let go of any of "his" cars, and tells the others that he got them first. Owen, who is still working on the road, looks cautiously at the others as he builds, listening to their conversation.

Nolan looks at the rest of the cars in a pile on the floor and tells Peter he needs to share the good ones. When Peter refuses, Nolan finds Ms. Deborah, who accompanies him back to the block area, where she gathers the children around her on the rug and uses questions to prompt them to describe what has happened and their feelings about it. "You were all working on the road together, but now I hear that everyone is upset and

worried about who is going to use which cars on it, especially the new red ones,” she summarizes. “I’m glad you came and asked me to help you figure it out.”

Then Ms. Deborah asks, “What are your ideas for solving this problem?” She makes sure that each of them has a chance to contribute to the conversation, rather than allowing it to be dominated by the two most verbally assertive children. When they cannot agree on which idea to try first, she suggests a plan that combines the ideas from several children. As they get back to work, each with a couple of cars, she selects a car that no one else has chosen and runs it toward the road while asking the builders about the next step in their road design.

Teachable Moment:

This is a fairly complex conflict resolution situation, involving several players, as is common in preschool dramatic play and block play areas. The teacher has the children describe the situation, which she did not observe, including the children’s emotional cues she does observe, and pauses the action while involving everyone in a problem solving conversation. She is especially deliberate about representing the interests of the less verbal children. She is aware that the issues may resurface, particularly if children did not fully process the emotions they were experiencing, so after the incident is resolved for the moment, she remains in the block area to support this group’s play and interaction for as long as she can.

Interactions and Strategies:

Prevent conflicts by limiting program transitions and minimizing waiting time. Avoid overly competitive games that can work against community caring and collaborative learning. Plan group projects during which children can work together to achieve a shared goal.

Model cooperation and care for others. Be mindful of the interactions you have with the other adults and children in the preschool setting. How do the children perceive your efforts to resolve disagreements among staff members? How do you respond to differences of opinion with parents? How do you handle disagreements between children? Children will naturally imitate adults. Be consistent in implementing a sensitive, positive approach with others.

Provide children with a calm presence in conflict situations. Begin by stopping any harmful actions, placing your body in between the children in conflict. Gently hold onto any object in dispute to help children focus on the problem at hand. Take an unhurried approach to resolving conflicts. Give the children a chance to identify their feelings, then generate ideas for solutions. As they are supported to approach the conflict in a consistent way, they will begin to work through the steps on their own with minimal support from the teacher.

Use descriptive language to help children make sense of conflict. Verbalize your observations of the children’s physical actions in response to conflict, “Your fists are really tight, Lucas. Ellie, you’re holding on tight to the blue shovel.” Encourage the children to identify and label their emotions. Offer tentative interpretations of the children’s emotional state as additional support, “You both look angry.”

Prompt children with open-ended questions and statements. Ask each child to share their version of the incident. “What happened, Taiga?” Offer appropriate ways for the children to express their wants and needs. “Oh, you don’t like it when Cara moves over your road. You can tell her to go around.” Attend to the needs of children who have difficulty expressing themselves verbally. Offer them effective tools for communicating with others.

Involve children in the problem-solving process. Facilitate rather than direct the solution generating process. Ask children to share ideas for resolving the problem. Include all children involved in the conflict. Patiently wait for them to agree upon a solution. “So you are saying you don’t like that idea. What ideas do you have for solving the problem? ...What do you think Kelsey? Do you like Megan’s idea of taking turns?” Once a decision has been made, offer follow-up support as needed. “Okay, I will come back in five minutes when it is Kelsey’s turn to wear the dress.”

Create problem-solving kits. Prepare sets of visual cue cards (e.g., picture of children finding more, taking turns, waiting, etc.). Keep problem-solving kits easily accessible and stationed throughout the early learning environment. Introduce their use to children during a large-group meeting. Remind children of this resource as conflicts arise. “Let’s grab a solution kit to help us think of ways to solve our problem.” Refer to Center on the Social and Emotional Foundations for Early Learning (CSEFEL) teacher resources (<http://www.vanderbilt.edu/csefel/>) for details about solution kits.

Read books related to social conflict. Help children connect previous experience with storybook content. Invite them to think of ways the characters could solve their problem.

Use persona puppets and social stories to promote skill development and perspective taking. Choose an area in which the children are currently challenged in their social interactions. Prepare a puppet show or social story based on the problem. Introduce the characters and the conflict between the characters. Encourage the children to support the characters in their resolution of the conflict. Create a list of prosocial options. Demonstrate the positive resolution of the conflict using the puppets.

Bringing It All Together: Becoming A Preschool Community Member

The children gather for circle time, and, after the group’s gathering song, Ms. Anya begins dramatically, “Today I am going to tell you a story about something that just happened in our room.

At the beginning of playtime today, two of our friends told me their plan was to work in our dramatic play area medical clinic. They were going to use the stethoscopes, bandages, and all the other medical tools to take care of the babies. I told them I would plan to visit later to see if their patients were feeling better.

A few minutes later, Julia and Javier hurried over to tell me that all the babies were missing. They had looked all over the clinic, and had found no babies! Where do you think they looked?"

The children in the group call out their ideas about all the places the children could have looked. Ms. Anya continues, "You are right. They looked in all those places. No babies. So what did they do next?" Many children around the circle who are now recalling the incident call out, "They asked us to help!" "That's right," affirms Ms. Anya. "They knew what good problem solvers you are and how good you are at teamwork, so they asked you. Pretty soon you had given them lots of helpful suggestions of places to look. And did they find the babies?" "Yes!" the children call out. "And where were the baby dolls, Julia and Javier?" "They were out on the porch!" the children respond, laughing.

Ms. Anya concludes the story by repeating, "Yes, you are right. The dolls were out on the porch drying after yesterday's bath. Thank you all for helping us solve the mystery of the missing baby dolls."

This anecdote illustrates one technique a teacher has chosen to help build a sense of community among her preschool class members. Children love to hear stories about themselves, especially stories they can all help to tell. With practice, an attentive teacher can learn to recount and elaborate on everyday preschool experiences in ways that help a group of children remember them positively and draw from them important lessons about their own prosocial behavior. A good story can do far more than merely entertain. See Research Highlight, p. 43.

Research Highlight

Young children's memories for past experiences are important, but their recall is sometimes scattered and incomplete. Adults often discover that young children do not remember the details of an event that the adult would expect (such as which team won the ballgame, or the ducks encountered on a nature walk), but instead they recall the funny sound of someone's voice, a piece of paper picked up along the way, or the snack after returning home. When an adult takes the time, however, to reminisce about the event with the child, researchers have found that young children remember more and their memories are better organized as a result. Adults are particularly helpful when they talk about the child's past experiences in an *elaborative* manner.^{63 64} Elaborative speech expands on the details of what happened, asks the child *wh-* questions (such as *what*

happened next? *why* did she say that? *who* was that person?), and provides clarifying feedback, such as confirming the child's accurate recall but questioning mistakes in memory. Young children are just beginning to develop the skills of remembering, and reminiscing about past experiences with an adult who is elaborative provides children with enhanced memory for these experiences and help in recalling them.

Engaging Families

The following ideas may be suggested to families as ways to help their children learn and practice the skills that are foundational for positive community participation.

Find household projects to work on with your child. Everyday chores like folding laundry and putting away groceries can provide opportunities to work together and to give children an experience of contributing to the household.

Notice and recognize times when your child is being cooperative and responsible. Comment positively about what you notice and appreciate. Having the approval of their special people is important to preschool children. It motivates them to behave responsibly in the future.

Talk with your child about respect and fairness. When children disagree with siblings or others during play, remind them that their way of solving the problem should be fair to everyone involved. Point out to them rules and laws you follow that help protect people's rights, especially the rights of people who are not as strong or powerful as others. This can explain why some things are not "the same" and are still fair.

Establish some simple rules to be followed at home and help children understand that there is a reason for each rule. "We need to be quiet when other people in the house are sleeping" conveys the message that you behave in ways that respect others' needs for sleep and, thus, contribute to their welfare.

Questions for Reflection

1. What techniques and activities do you use to build a sense of community among the children and adults in your preschool setting?
2. What process do you use to create rules for responsible behavior in your preschool setting? What differences do you observe in rule-following behavior when children participate in setting class rules?
3. What do you do to encourage and support children in seeking assistance from peers and in collaborating to achieve their play-project goals?

4. How does your program work to help children who are English learners build a sense of being part of the preschool community and overcome possible feelings of being outsiders?
5. How can you introduce the concepts of fairness and respect for everyone into various daily activities within your preschool curriculum?
6. In what ways do you set a good example for children to follow as they learn skills for being members of a community?

Strand: Self and Society

An early childhood education setting acquaints young children with people who have different backgrounds, family practices, languages, cultural experiences, special needs and abilities. In their relationships with teachers and peers, preschoolers perceive how others are similar to them and how they are different, and gradually learn to regard these differences with interest and respect rather than wariness or doubt. This is especially so if early childhood educators incorporate inclusive practices into the preschool environment. The relationships that young children are developing with others in the preschool provide opportunities for understanding these differences in depth and in the context of the people whom the child knows well. One of the most valuable features of a thoughtfully designed early childhood program is helping young children to perceive the diversity of human characteristics as part of the richness of living and working with other people.

Young children are beginning to perceive themselves within the broader context of society in another way also. Their interest in adult social roles, occupations, and responsibilities motivates pretend play, excitement about visits to the fire station or grocery, and questions about work and its association with family roles and family income. Teachers can help young children explore these interests as children try to understand what adults do, and the adult roles they expect to assume in the future.

In this section, specific strategies are discussed that support development in each of the following substrands:

- 1.0 Culture and Diversity
- 2.0 Relationships
- 3.0 Social Roles and Occupations

Substrand 1.0 Culture and Diversity

As they are learning about themselves, preschoolers begin to appreciate the cultural, ethnic, racial, and linguistic identity that they share with family members. They also become interested in people with different backgrounds and practices to compare with their own. Although preschoolers initially favor their own cultural, ethnic, or racial group,

the early childhood education program offers them opportunities to appreciate and value the cultural diversity of everybody in the group. Teachers can also help young children appreciate the broader range of cultures, languages, and practices worldwide through stories, cultural artifacts, and conversation.

Vignette:

Ava and Wenqi relax in the reading area, leaning up against the big pillows and looking at the new array of library books Ms. Zhang has arranged on the shelves. Attracted by the cover illustration of a child drawing with a stick in the sand, Ava begins paging through a book. Wenqi gestures to the characters as Ava turns a page. “Those look like the words in our books at home.” “They’re not words; they’re just squiggles,” replies Ava. “They ARE words,” Wenqi insists, “My mama reads them. Ms. Zhang can read them, too.”

Later, Wenqi shows Ms. Zhang the book and asks her to read it at story time. Ms. Zhang introduces it to the gathered group by telling them, “This morning Wenqi noticed that I added some new library books to the reading area. Some of them have English words and some of them, like this one, have Chinese words. This book is about a boy who goes to the beach with his mother. I will read the Chinese words and the English words. They look and sound very different, but they tell us the same story.”

Teachable Moment:

The bilingual teacher in this vignette has supplied the preschool reading area with books written in both of the home languages of the children in her class. She uses this story time opportunity to introduce the idea that the same story can be told in different languages. Later, she can do the same with other books and can incorporate print in both languages into classroom displays. For more information about strategies to support children who are English learners, see Preschool Curriculum Framework, Volume 1, Chapter 5.

Vignette:

Mr. Scott enters the block area, where Daniel and Charlie are building towers with the large wooden blocks. He has heard a loud crash and wants to make sure no one has been hurt. Charlie immediately tells him, “That was Daniel’s tower. He built it taller than you said we were supposed to and it crashed down. It almost fell on me.” Mr. Scott replies, “I’m glad no one got hurt.”

Then he turns to Daniel, who stands quietly, eyes lowered. Mr. Scott says, “Daniel, do you remember a few minutes ago when I asked you to build your block tower only as high as your shoulders? This was the reason. When block towers are this tall, they can really hurt someone if they fall. Would you like some help picking up these blocks?”

Daniel continues to look down at the floor and says quietly, “No, Sir.”

“No, Sir?” repeats Charlie, in a puzzled tone of voice. “Why did you say that? Mr. Scott isn’t a sir. That sounds stupid. He said he’d help you.”

“Charlie,” says Mr. Scott, “the way Daniel spoke to me was not stupid. It told me that he had listened carefully to what I said. In some families, children do call their fathers and other men “sir.” In your family, it sounds like they don’t.

Teachable Moment:

In this situation, the two children who are building together come from two different family cultures. In Daniel’s family, a child in this kind of situation is expected to listen quietly to the adult’s response and show respect, both by lowering his gaze while listening and by addressing the male adult as “Sir.” In the preschool setting he is behaving consistently within his home culture’s expectations.

Charlie is clearly having trouble understanding Daniel’s response, which is very different from the casual give-and-take between adults and children that is the norm in his family. Mr. Scott explains to Charlie that families are different in the ways their members speak to each other. He describes the difference to Charlie simply, without using evaluative language. His words and manner convey to the boys acceptance of both interaction styles.

Interactions and Strategies:

Practice a reflective approach to build awareness of self and others. Examine your own attitudes and values. How do these impact your caregiving style? As you work with others, stay mindful of potential bias and consistently practice perspective taking. Attend to personal cues of stress and frustration and self-regulation as needed. Utilize community and professional resources to build competence in reflective practice.

Maintain a healthy curiosity about the experiences of others. Ask authentic questions to build understanding. Consider the value in different caregiving practices and their purpose in supporting the development of the next generation of young children.

Partner with families in goal setting and program design. Make it a priority to learn individual family values. Listen attentively to their goals for their child’s care and education. Respect preferences in communication. Seek knowledge and understanding as you confront differences in caregiving practices. Offer guidance sensitive to diversity. Request family support as you implement or modify home practices for use in the preschool setting. Negotiate conflicts with sensitivity.

Prepare an active learning environment that incorporates the full spectrum of the human experience (e.g., diversity of cultures, ethnicities, gender, age, abilities, socioeconomic class and family structure). Supply materials reflective of the diverse

backgrounds of the children in your care. Include materials that encourage self-reflection and awareness of others such as mirrors, dolls, toy people, multi-cultural crayons/pens/paints, etc. For additional ideas, reference *Anti-Bias Education for Young Children and Observers*. Incorporate throughout the daily routine authentic experiences with language, utensils, foods, and music. Display images and documentation throughout the space inclusive of all children in the community of young learners.

Create an environment, both indoors and outdoors, inclusive of all children’s abilities. Routinely evaluate the accessibility of the learning space. Make appropriate adaptations as required to ensure the successful participation of all children. For more information about resources for teachers of children with disabilities or other special needs, see Preschool Curriculum Framework, Volume 1, Appendix D.

Address children’s initial comments and inquiries about diversity with honest, direct communication. “I heard you talking about firefighters. Tell me more about what you know about firefighters.” Gently challenge children’s limited views or perspectives. “My friend is a girl and she is a firefighter.”

Focus on similarities. Children readily notice differences and generally need more support in attending to commonalities. Pose questions to encourage children’s attention to similarities. For example, invite conversation in response to the question, “What do families do?” Discuss the different tasks and routines of families, converse about who does these things in each home.

Sing songs and share stories in different languages. Invite family members to teach songs from their home culture during large-group activities. Create a community songbook including these songs. Engage in oral storytelling, teaching children key phrases in home languages and encouraging active participation from the community of families in your early childhood program. For more information about strategies to support children who are English learners, see Preschool Curriculum Framework, Volume 1, Chapter 5.

Plan meaningful celebrations with support of the children and families. Use information gathered from conversations with families to plan important events (e.g., “What traditions would you like see included in our program?”). Ensure authentic celebrations by asking the community, children and families for input about how they would like to plan and carry out the event. Integrate family-inspired activities within existing daily routines.

Read and converse about books that accurately represent the lives and experiences of children, such as *The Colors of Us*, *Whoever You Are*, and *Tar Beach*. Promote discussion and encourage children to identify with the experiences of diverse story characters.

Substrand 2.0 Relationships

Children learn about themselves and others through the relationships they develop with teachers and peers in preschool. Early childhood witnesses significant advances in social skills with the growth of social and emotional understanding, and children grow in recognizing the mutual responsibilities and accommodations of relationships. Friendships become closer, more cooperative (which aids in conflict resolution), and often more exclusive as children increasingly value their friends. Teachers contribute to the development of these social skills through the close relationships they develop with the children in their care, their encouragement of shared activities with friends (and other peers), and their contribution to children's mutual understanding.

Vignette:

Jaime and Max are riding a tandem (two-seat) tricycle around the playground tricycle path, both grinning as they go around the curves. "Just a minute," Max tells Jamie. I want to go over and get my jacket." "Okay," responds Jaime. "I'll save your seat."

As Max leaves, Sofia approaches Jaime and gestures to the empty second seat. "I want to ride with you," she tells him. "No, you can't. This is Max' place. I'm saving it for him," explains Jaime. "You can ride on that one," he suggests, gesturing to an unused tricycle.

"That's not fair," protests Sofia. "I want to ride with you." "But I'm riding with Max," repeats Jaime. "We're friends." At that moment Max returns, wearing his jacket. "Okay, ready to go again," he tells his friend as he climbs back on. They zoom down the path as Sofia looks sadly after them.

Ms. Carla, monitoring the riding path area, approaches, squats down, and puts her arm around Sofia's shoulders. "It looks like you wanted to ride, too," she observes. Sofia tells her, "I want to ride with a friend."

Ms. Carla looks around the playground to see what other children are doing, hoping to find another child she thinks Sofia might enjoy joining in play. She notices Ana, also alone, hopping around the large circle of stepping stones. Knowing that the two girls have enjoyed conversation with each other indoors while building block structures for the animal figures, she comments, "I see your friend Ana enjoying the stepping stones. Shall we go over together and join her?" Sofia agrees, and Ms. Carla helps her to greet Ana in a friendly way and ask if she can hop on the stepping stones with her. She leaves after the two girls have begun making up a story together about crocodiles in the water all around the stepping stones, and deciding on rules for how to avoid getting caught by them.

Teachable Moment:

Ms. Carla knows the children in her preschool group. She respects special friendships of the kind that Jaime and Max have, while also being aware of children like Sofia, who need extra help finding compatible play partners and initiating interaction with them.

In this situation, she comforts and sympathizes with Sofia, understanding that Sofia's real desire is to play with someone, rather than simply to ride the tricycle. She bases her suggestion about joining Ana on her past observations of the children's interests and play styles and her judgment that they would probably enjoy playing together.⁶⁵ She also knows that Sofia needs support to initiate interaction, so she facilitates her entry into Ana's game and observes until the two girls seem to be playing companionably. She makes a note to herself to find other occasions during play and projects to nurture their relationship.

Interactions and Strategies:

Develop quality, nurturing relationships with the children in your program. Make time to regularly connect with individual children throughout the daily routine. Observe children at play, noting personal style, preferences in play and exploration, developmental level and special needs. Use this information to support children in child-initiated play and teacher-initiated instruction. For more information about resources for teachers of children with disabilities or other special needs, see Preschool Curriculum Framework, Volume 1, Appendix D.

Model effective relationship skills as you interact with other adults and children. Communicate with care and respect. Make explicit your intent. "I am going to ask Ms. Wong if she and her class would like a turn with our new camera. I bet they would like to take some pictures of their projects, and I like to be helpful to my friend!"

Prepare an early learning environment and daily routine that fosters peer interaction. Supply the space with materials that encourage interaction. Plan the daily routine to include opportunities for children to work in pairs as well as small-groups. As mentioned in the Social-Emotional Development Curriculum Framework, choose well-balanced partnerships and groups with attention to individual interests, energy, developmental stage, and emerging friendships.

Teach children positive interaction strategies during large-group meetings. Use visual aids, including posters and cue cards, to enhance children's understanding of prosocial behaviors. Break down social skills into simple steps and have children role play. "When you want to join others already playing a game the first step is to move closer (points to picture of a child moving closer). Next, watch how they are playing the game (points to picture of eyes). Finally, ask to play (points to picture of a child interacting with the group). Say or sign, 'Can I play?'" Provide children with a chance to

practice with toy people or puppets. Refer to CSEFEL teacher resources (<http://www.vanderbilt.edu/csefel/>) for specific ideas and strategies.

- **Provide all children with coaching and appropriate prompts** as they maneuver through peer relationships. Observe the environment for children in need. Take advantage of teachable moments to remind children of skills previously introduced in large-group experiences. Offer words to support children's constructive behavior. "I can see you are waiting for a turn. Remember you can ask to ride the swing. Say or sign, 'I want a turn, please.'" For more information about strategies to support children who are English learners, see Preschool Curriculum Framework, Volume 1, Chapter 5.

Reinforce prosocial behavior and its impact on others. Draw attention to children's actions using descriptive language. "You gave Nolan a turn with the typewriter. He looks excited to get a chance to explore!"

Offer sensitive guidance as children experience challenges related to peer interactions and friendship. Communicate matter-of-factly about children's emotions and perspectives. Offer ideas for coping. "It looks like you are feeling sad that Van is playing with Riley. Sometimes friends play together and sometimes they play with other friends. That can be frustrating. Maybe I could help you find someone who wants to play puzzles with you."

Facilitate positive social problem-solving. Use open-ended questions and commentary to summarize the problem. "It sounds like Gwen wants to play with Jolie and Morgan, but Morgan, you just want to play with Gwen." Use active listening to encourage perspective taking. "Morgan, you are saying only two people can play princesses." Ask for solutions. "What can we do? We have a problem." Offer suggestions as appropriate. "I wonder if there is another game you could all play together that has three princesses."

Read books dealing with the themes of friendship and relating to others, such as *Jamaica and Brianna*. Help children prepare and confront challenges in relationships by offering indirect opportunities to explore friendship. Select books carefully to ensure they are representative of authentic experiences for the children in your care.

Substrand 3.0 Social Roles and Occupations

Young children are fascinated by the world of adults. This is apparent in their careful observation of adult activities, reenactment of these activities in their play, questions about adult roles and occupations, and excitement about activities (like visits to the fire station) that permit direct experience with adult occupations. An early childhood education program encourages this interest through activities such as creating a market

or repair shop, the availability of artifacts of adult occupations in the dress-up area (such as a police officer's hat), and opportunities to visit places where adults work.

Vignette:

Marcela knows exactly what she wants to do this morning when Mr. Paul greets her at the door. "I'm going to the block area," she indicates. She continues purposefully toward the shelves and takes down all the long wooden blocks, piling them on the floor. She begins to build a pattern of horizontal and vertical blocks that looks like a series of window frames, and becomes frustrated when they fall over.

"We need some nails with the blocks," she tells Mr. Paul. "You can't make boards just stay together by themselves." As they converse about this idea, she tells him that her papa is working every day now, building the inside of a store. "Does he use nails when he builds?" asks Mr. Paul. "He has nails in his tool belt, she answers. "When we went there, he let me put it on. It was really heavy."

When Marcela's mother arrives to pick up Marcela from preschool, Mr. Paul relates the story and finds out that the project is in a local building that is being converted into two smaller stores. Marcela's papa and other carpenters have been hired to frame the interior walls and put up drywall.

Since the project site is in the school neighborhood, Mr. Paul arranges a walking field trip to visit it the following week. In preparation, the class makes a list of questions about the project. Mr. Paul checks out library books about carpentry and building projects to display on the block area shelves. He posts a set of blueprints, and adds clipboards and pencils to a nearby shelf. He also brings out the carpentry prop box, which contains hard hats and plastic tools. He ensures that the books and images portray a variety of people, including women, with active roles as architects, designers, and members of the building trades. During and after the field trip he will observe what especially interests his class and decide what other elements might enrich this curriculum.

Teachable Moment:

In this situation the teacher is attentive to a child's play and converses with her to find out what is prompting her comments. He tries to match his curriculum to the interests of children in his class, and takes this opportunity to address a new topic. This inquiry is specifically about a parent's job, but can be expanded in many directions to explore work roles in the neighborhood, occupations of family members, and the skills and tools people use to do different kinds of work.

Interactions and Strategies:

Design the early learning environment to encourage all children's active engagement in each area, regardless of gender, home language, or abilities. Invite participation in the Block Area, Science Area, Art Area, Dramatic Play Area, and in all

other designated learning areas of the program by carefully selecting materials for exploration based on observations of the group's individual children at play. For more information about resources for teachers of children with disabilities or other special needs, see Preschool Curriculum Framework, Volume 1, Appendix D. For more information about strategies to support children who are English learners, see Preschool Curriculum Framework, Volume 1, Chapter 5.

Provide children with play props for exploring occupations and work settings. Dress-up clothes, office supplies (e.g., computer keyboard, envelopes, stamps), and other tools (e.g., aprons, fire hoses, garden gloves) used in the work force encourage children to imitate the actions of family members and other adults in their lives. Incorporate real objects when possible.

Get to know the workers in your setting. If your preschool program is housed within a larger school or community organization, visit the various workers onsite to observe them in action. Have the children prepare a list of questions to ask them about their jobs. Draw a visual organizational chart showing each person's job name and where they work.

Convey respect for the roles of adults who work at home. In discussion, book selection, and visual documentation, include and represent the adults whose work is primarily within the family home. Tasks such as cooking, laundry, shopping, home maintenance, and baby care are essential to household functioning, and the family members who do them should be represented in the preschool setting.

Highlight the roles that elders play in family life and in society. Invite children's grandparents and older family members to visit the preschool setting, either as program volunteers or to share skills, hobbies, or stories with the group. Emphasize that children's grandparents are often also in the paid workforce and in family caregiving roles. Read books that portray older adults positively, introduce photos and news stories involving older public figures, and emphasize the roles elders have played in children's own family histories.

Incorporate books, magazines, and other forms of print that include images and stories of different workers. Be sure to include people of different gender, abilities, and racial backgrounds. Display in conjunction with current program investigations.

Include the pursuit of further education among work options. Many young children have parents who are engaged in education or training programs—some as a fulltime occupation. Discuss the importance of this and demonstrate respect for adults who balance parenting and study. Invite student parents to share their fields of study with the group. If possible, take a field trip to a setting where adults go to school.

Invite family members to share their work experiences, especially those that challenge traditional gender roles. Help children prepare questions in advance about

roles and responsibilities. “What do we want to know about being a cook?” Provide photographs, pictures, and real objects to help children visualize work experiences.

Talk about future career goals. Ask children to share, in a large group, what jobs they hope to do when they grow up. Write a list of their ideas. Counter misconceptions directly. “Boys and girls can be teachers.”

Visit community stores, businesses, and service providers to observe workers in action. Prepare them to ask questions during the visit. Record children’s observations. Help them reflect on the purpose of the work and its impact on our daily lives.

Bringing It All Together: Self and Society

“You always get to do the money,” complains Emma. “Beck announces, “No, Tommy, I’m the customer. I was here first.” Ella and Maya argue about the pieces of a plastic hamburger: “You can’t have it again. It’s the only one . . . “ These and similar interactions between children have been typical in the area ever since Ms. Berta added the ‘Restaurant’ prop box to it.

Now Ms. Berta is struggling to figure out how to foster more cooperation among children playing in this dramatic play area. The restaurant theme is very popular, but children’s play is currently dominated by arguments over who gets to use which items from the restaurant prop box. Each child seems to be trying, independently, to hoard the most items from the box.

Ms. Berta shares her dilemma with Ms. Galyna, the school’s mentor teacher, who says she can come in for a quick visit during the next day’s play time. She follows her visit with some suggestions that help Ms. Berta rethink the area’s design for the following week.

On Monday, the children entering the area are greeted by a large RESTAURANT sign. A waist-high shelf unit defines the front of the area. On top of it sit two toy cash registers, supplied with ample paper bills, plastic coins, receipt pads and pencils. A clear plastic jar labeled ‘TIPS’ sits in between. On a hook hang clip-on badges that say: Cook, Cashier, Server, and Customer. There are several of each. The shelves under the front counter hold stacks of paper drink cups and trays. The cooking pans and utensils are clearly displayed on the area’s stove and sink shelves, as are multiples of food items and dishes in the refrigerator and cupboard. The eating table is set for customers.

Ms. Berta begins play time as a restaurant customer, placing her order, asking questions of the employees, and helping the other players think about what a cook, server, or cashier in a restaurant would do. She refers them to each other with their

ideas and questions, and soon they are having restaurant conversations with her and with each other “in character.”

Over the next two weeks, the group makes changes and additions to the restaurant. At a class meeting, the group votes to make it a pizza restaurant, and the teacher adds donated pizza rounds that children cover with drawn-on toppings. With Ms. Berta’s help, interested children work in pairs to write and post MENU signs. Several small groups of children remain intensely interested in the theme, and their play in the restaurant area becomes more elaborate and content-rich. With active teacher support and modeling, friends are able to constructively solve conflicts that occur.

The design of the early education environment can be crucial to encouraging positive interactions and relationships. In this example the teacher, with mentoring, prepares a learning environment that leads to rich peer interactions focused on a play theme. She structures opportunities for children to work in pairs and small groups, and to try out a variety of roles. The play theme appeals equally to boys and girls, and so supports more social interactions between them than often occur in the dramatic play area. It is also effective at including children who are English learners in a play scenario that can offer a variety of roles and can include some key vocabulary in their home language.

The teacher spends at least a few minutes each day playing a role in the restaurant, and sometimes invites a more socially or linguistically isolated child to join her to provide experience with peer group entry skills. She intentionally interacts in ways that help children expand their collaborative play scripts as they try on a novel set of adult roles. Pretend play interactions such as these can be an important scaffold for English learners to build language and social skills when they might otherwise feel more isolated.

Engaging Families

The following ideas may be suggested to families as ways to help their children expand their understanding of family culture, relationships, work and roles in the home and in the broader world:

Tell stories and sing songs to your child about your home culture. Children benefit from learning about the things that are important to their families. They develop a sense of pride in their heritage, including customs, history, and talents of family members.

Draw your child’s attention to the ways you interact and cooperate with others in your community who may be different from you. You are your children’s most influential model. Your attitudes toward people of different cultural and racial backgrounds, abilities, and personal characteristics will shape their attitudes.

Help your child develop strong, warm relationships with adults and children among your family and friends. Children need opportunities to practice their positive social skills with people they love and trust. Coach them in how to talk and play with others in polite and friendly ways.

Talk with your child about the daily work you and other family members do. The tasks you do at home, at a job, in the community, or in school are important for your children to be aware of as “work.” They are beginning to learn about the different ways people contribute to their families and communities. You can help shape their ideas about future possibilities open to them.

Questions for Reflection

1. What are some of your own biases and “blind spots” about people whose racial or cultural backgrounds are very different from yours?
2. What could you add to your early education environment that would help children learn appreciate the diverse characteristics of people different from themselves?
3. What specifically could you do to support children from diverse linguistic and cultural backgrounds to engage with peers who may not share a home language or culture?
4. In what ways do you see your style of interacting with children reflected in the ways they interact with each other in the preschool setting?
5. What could you add to your curriculum and interactions to help children become more aware of the roles and occupations open to them as adults?

Strand: Marketplace

Young children's interest in adult roles and occupations extends to the economy. Preschoolers know that adults have jobs, and they observe that money is used to purchase items and services, but the connections between work, money, and purchasing are unclear to them. This does not stop them, however, from enacting these processes in their pretend play and showing great interest in the economic transactions they observe (such as a trip to the bank with a parent). Moreover, young children are also active as consumers, seeking to persuade their parents to purchase toys or activities that they desire, sometimes hearing adult concerns about cost or affordability in response. All of these activities convince them that the economy, while little understood by them, is important.

A carefully-designed early childhood education setting provides many opportunities for young children to explore these ideas through play, conversation, and the creation of economic items to buy, sell, or exchange. In this section, specific strategies are discussed that support development in each of the following substrands:

In this section, specific strategies are discussed that support development in the following substrands:

Substrand 1.0 Exchange

Young children have a remarkable intuitive grasp of basic aspects of economic exchange. They understand the concept of ownership. They recognize that obtaining something requires giving something in exchange (often money). With increasing age, they also appreciate that goods and services vary in their cost, and that the more people want something, the more you can sell. Teachers contribute to this growing understanding by providing young children with opportunities to explore economic exchange through pretend stores and services, talking about money and its uses, and enlisting children's understanding of the economic activities of the adults in their lives.

Vignette:

For this week Ms. Laura and Mr. Luan have transformed a corner of the dramatic play area into a shoe store. They had been observing children's interest in the many dress-up shoes in the area, and hearing their accompanying conversations about shoe sizes, styles, prices, and parent spending on shoes. Setting up a store seemed like a good way to help children explore these economic concepts in more depth.

A set of shelves displays open shoeboxes. Chairs for customers and rulers for measuring feet fill the area. At the entrance is a table with a cash register, play money, pencils and receipt pads. Notepaper and masking tape are available for making signs and price tags.

The first children to enter the store take on roles of seller and buyer. "Hey, I can't find the shoes I like," says Alicia. "Where are the sparkly red ones?" Zara replies, "Maybe they already got bought. My mommy really gets mad when that happens to her." As the morning progresses, many children visit the store and a teacher tries to be present and engaged in some of the conversations that develop. Children's behavior and comments clearly reflect their own family experiences. They bring "children" whose feet are growing "too fast," tell the cashier they only have enough money this time for school shoes—not party shoes, and want to trade one pair of shoes for another. Mr. Luan helps interested children write and post sale signs and stick price tags onto shoeboxes. He encourages some boys, who have not yet entered the store, to come in and discover that there are lots of shoes for them, too.

Teachable Moment:

Providing a variety of marketplace opportunities in a preschool setting's dramatic play areas is a valuable way to encourage children to explore their ideas about economic exchange. It is important for teachers to not only provide the play props but to facilitate the play when they can. This can be done by entering into the play as a "customer," complete with customer comments and questions, and by engaging in related

conversations with children as they play various roles. Teacher-child conversation about children's home and community experiences with the larger marketplace, including their considerable exposure to media messages, can also be very helpful.

Interactions and Strategies:

Introduce economic concepts (e.g., production, exchange, consumption, etc.) through children's books. Some books that highlight such content include *Alexander, Who used to be Rich Last Sunday*, *A Chair for my Mother*, *The Great Pet Sale*, and *Sheep in a Jeep*. Help children focus on themes including the following: What did the characters want? What did they really need?

Provide open-ended materials to support children's spontaneous investigations of business and the economy. Supply the learning environment with play money, paper pads for receipts, stamps, and cash registers. Introduce ways such materials may add to children's play. "I hear you are building a shoe store. I wonder if you might need a cash register to hold the money your customers give you for the shoes? We have one in our House Area prop box."

Offer dramatic play experiences that allow children to explore economic concepts. For example, prepare a pretend restaurant in the classroom. Use your observations of children's play to plan meaningful play opportunities. Incorporate realistic play props (e.g., dress-up clothes, office supplies, cash registers). Supply poster boards for making business signs. Display photographs of a variety of people at work and consuming goods. Avoid any images that perpetuate stereotypes.

Explore alongside children, expanding on their initiative. "You want more (pretend) money. Simon and I are playing house and our sink is broken. I can give you money for fixing our sink. I will pay you \$20.00." Introduce the vocabulary of the marketplace into play experiences.

Draw attention to trends of consumption in the classroom. "We used a lot of glue this week. We will need to order more soon. I wonder if we can think of ways to save some glue until our new glue is delivered." Extend learning into the home. Invite families to create a collage of items their family purchases regularly. What do they consume now? What do they want to consume in the future?

Converse about wants and needs. Speak with children about individual wants. "It sounds like you really wanted that school bus toy. We only had two, so you found a fire truck." Talk about choices in consumption. "Did you like your choice of finding a fire truck?" Additionally, in large-groups brainstorm materials needed for the emerging investigations. Introduce economic alternatives. "We do not have enough money to buy new baby beds for our baby hospital. What can we use instead? ...Yes, we could make beds with shoe boxes from the Art Area."

Allow children to make economic decisions. As a group, make a purchase for the community. Pose a choice between two options. Encourage the children to discuss the reasons for their choice. Help them distinguish between something the program wants and something the program needs.

Explore all forms of exchange. Reflect on times when children traded one object for another. Document the children's recollections. Use play money as you participate in children's dramatic play. "Thank you for packing my groceries. Here is money for the things I bought." Plan an outing during which children can observe exchange of real money. "Today we will walk to the market to buy strawberries for snack."

Visit local businesses in small or large groups. Prompt children to ask store owners or managers where the goods in their businesses come from and how the goods are transported from one place to another. Document the outing, including information shared by store owners. Display photographs and dictation alongside ongoing explorations of economics in the classroom to inspire and support children's play. "Remember when we visited the smoothie store near school. Worker Tiffany showed us how to make a smoothie and collect money from the customer."

Create an opportunity for children to produce their own product. Plan, prepare, and implement a Market Day for families. Ask for children's ideas about what to sell at their market. Offer limited choices to ensure a reasonable plan. "Should we sell muffins or breads in our market?" Encourage each child's active participation as they make signs, advertise their product, and bake goods. Donate the money to a local charity and share how the money will help someone else purchase needed goods.

Bringing It All Together: Marketplace

Ms. Jen settles into the reading chair to begin large group story time. She holds a tall empty jar, a small cloth bag, and a book.

"Today I brought something with me to help me tell a story," she begins. Then she holds up the small drawstring bag and shakes it. "Money!" call out the children. "Yes, it is money. My little bag is full of coins: nickels, dimes and quarters," she says, pulling out one of each. "This book is all about a family who collects coins and saves them in a jar that looks a lot like this one. It's called, A Chair For My Mother, and Vera B. Williams is the author. She wrote the words. She is also the illustrator, which means she painted the pictures."

As Ms. Jen reads the book, she stops frequently to converse with children about what is happening in the story. "The mother in this story works as a server in a restaurant. That's how she earns money to buy the things her family needs." After reading the page that describes the "tips" Mother brings home and puts into the jar, Ms. Jen asks the

group if anyone they know gets tips at work. After explaining the idea, she pours the coins from her small bag into the tall jar she has brought as a story prop.

When she reads the pages about the family's moving day, when all their relatives and neighbors brought things they needed to replace the ones lost in the fire, Ms. Jen talks about how people don't always buy all the things they have. Sometimes people receive gifts and things that others share with them.

As each economic concept is introduced in the book, Ms. Jen pauses to draw attention to it, while maintaining the flow of the story. At the end, she holds up the jar of coins and asks the group how long they think it took for Josephine's family to collect enough coins to buy the chair. She responds to their comments, listening as they share their own related ideas. She concludes by telling them that the book will be in the reading area tomorrow for them to enjoy again.

Reading stories that incorporate economic ideas and events is an effective way to put them in a real-life context for children. This particular book addresses everything from earning wages to losing material possessions in a fire, experiencing the generosity of friends and neighbors, planning and saving for a large purchase, and sharing good and bad economic times as a family. The teacher structures an interactive reading experience to introduce ideas that she can revisit with children later in play and projects.

Engaging Families

The following ideas may be suggested to families as ways to help their children understand family wants and needs and the roles that work and money play in family life.

Talk to your child about where your family income comes from. Preschool children see adults using money, but often have no idea how they get it and why they cannot always get more if they want or need more.

Help your child understand the connection between cost and decisions to buy items and services. Make a game of looking for the price signs at the grocery store. Read the numbers on two kinds of fruit and ask your child which kind costs more. Talk about how you decide which one to buy.

Have family conversations about “wants” and “needs.” Preschool children often feel their strong desire to buy a toy or food treat as a need. Hearing about how their families decide what is most important to buy (e.g., food for dinner) and whether to buy other things family members want (sparkly red party shoes) will influence their later ability to make responsible financial decisions.

Show your child some alternative ways you acquire things your family needs or wants, as well as ways you help meet the needs of others. You or someone in your family, neighborhood, or religious community may give haircuts, do free repairs, share garden vegetables, provide childcare, or make clothing for others. It is important for children to know that not all good things cost money.

Begin to share with your preschool children your values about money. If some of your financial decisions are based on values they can understand, such as the importance of sharing a portion of income with extended family members who need it or giving money or goods to charitable groups, converse with them about those values.

Questions for Reflection

1. What kinds of child conversation about money-related topics do you most often hear in your preschool setting? In what ways do these reflect the economic circumstances of the children's families?
2. How can you use resources in your preschool neighborhood, including stores, restaurants, service providers, and work sites, to introduce children to different aspects of their community's economic life?
3. What can you incorporate into your preschool curriculum that will convey messages about economic justice and values appropriate to your program's context?
4. What vocabulary words can you use with children to help them better understand the economic world of their community?

Concluding Thoughts

The knowledge and skills in history and social science that preschoolers acquire in an early education setting provide a foundation for their understanding of themselves and the world in which they live. As adults, each of us benefits from the perspective of history (of our society, our families, and our personal past). We are connected deeply to the physical settings and natural ecologies in which we live. We learn about ourselves and others by comparison with people who differ in culture, language, ethnicity, and tradition. Our lives are shaped by the economy and its influence on our roles as workers, consumers, and investors. As citizens, we participate with others in the political process and in building our communities. As preschoolers learn about these topics through instruction, enactment, and play, they are being introduced to issues that will remain important to them for years to come.

Map of the Foundations

History-Social Science

Domain

Substrand

Sense of Time (History)

Strand

2.0 Anticipating and Planning Future Events

At around 48 months of age

At around 60 months of age

2.1 Anticipate events in familiar situations in the near future with adult assistance.

2.1 Distinguish when future events happen, plan for them, and make choices that anticipate future needs, with adult guidance.

Age

Foundation

Examples

Examples

- When the teacher points to the art photo in the picture schedule, the child begins to prepare (putting on an apron, moving paper to the easel).
- When asked what he is going to do tomorrow, indicates that he will have breakfast and then come to school.
- Tells an adult, "When we go outside, I need a plastic bag on my cast so it won't get muddy."
- Tells other children that she and her papa go outside to look at the stars when it gets dark, right after they eat dinner.
- Knows that snack time at preschool always follows circle time with the help of a picture schedule.
- Excitedly tells the teacher, "We're going to the airport to pick up my uncle from Taiwan next week!" but has no idea how soon next week will be.
- At planning time, a child who is nonverbal uses a communication board with pictures to indicate where he will play first.
- When asked for an idea about what the group will need to bring on a lunchtime picnic, suggests a blanket.

Examples

- As the group is getting ready to go on a trip to the fire station, asks the teacher whether they should bring the firefighter's hat from the dress-up area.
- Tells a friend that she has to give away toys to make room for her grandparents from India to stay.
- Today's schedule is changed because of a special event. Several children express concern that snack time will be skipped.
- Communicates to a friend that he is getting an electronic wheelchair soon, so he needs to practice steering.
- Tells teacher, "I get to visit my cousins on Saturday. Mommy says that's after two more sleeps!"
- Encourages friend to put on his shoes and jacket fast so they will have more time to dig in the sandbox together.
- When the nurse enters, child tells a friend that it is time for her tube feeding and that she will come back to play in ten minutes.
- Knowing that park time is at 10:00 every day, brings jacket from cubby and asks "Is it 10:00 yet?"

Teacher Resources

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Science

Children have a sense of wonder and natural curiosity about objects and events in their environment. Just like scientists, they seek information, and are actively engaged in exploring and investigating the world around them, trying out new things to see what happens, and confirming or adjusting their expectations. Children's exploratory play with water, sand, blocks, and other objects and materials in the preschool environment provide them with opportunities to discover the physical characteristics of different materials, and to explore concepts such as balance, forces, motion, and how solid objects are different from liquids. Observations and investigations of plants and animals, whether indoor or outdoor, allow children to discover what different living things look like, how they behave, what are their habitats and needs, and how they grow and change over time. Experiences of night and day, rain, wind and other changes in weather and the environment raise interesting questions about the nature of earth phenomena, and provide children with opportunities to discover characteristics of the natural world.

Preschool science is built on children's curiosity and enthusiasm to explore and learn about their environment. It is not about children memorizing scientific facts, or watching the teacher perform science demonstrations. Preschool science guides children's natural curiosity into opportunities to observe, explore and inquire about basic phenomena and materials in their world. From infancy, children develop concepts and gain knowledge about living things and physical objects.^{1 2 3 4 5} Preschool science provides children with focused experiences to extend their concepts, and to develop the basic skills and language of scientific inquiry. The purpose is to nurture children's habits of inquiry, critical thinking, creativity, and innovative problem solving, and to foster scientific attitudes such as curiosity, open mindedness, and motivation to learn.

Science is a natural part of the preschool environment, and can be conducted in any preschool setting. All preschools (regardless of their level of resources and access to nature), can utilize their existing facilities and materials to create an environment with meaningful learning experiences of science. Pushing cars down an incline, building with blocks, manipulating tubes at the water table, or mixing clay with water are everyday play activities that engage children in experimenting with objects and materials. Collecting leaves, searching for insects in the yard, sorting and classifying fruits and vegetables, and sprouting seeds in pots engage children with living things. Experiences of child-initiated play are important as they provide children opportunities to integrate the information and experiences provided by the teachers into their construction of knowledge. With teachers' intentional planning, guidance and support, children's play and interactions with objects can become rich experiences of scientific inquiry, and can facilitate children's knowledge and understandings of objects and events in the world. Preschool teachers have a significant role in expanding children's understanding of concepts in science, and developing children's attitudes, skills and language of scientific inquiry. They focus children's curiosity on particular concepts of science, ones that are

developmentally appropriate, interesting and engaging for children and teachers. They engage children in inquiry experiences, encouraging them to observe closely objects and events, to ask questions, to predict and experiment with objects and materials. They guide children to reason and think more deeply about the phenomena they observe, to notice patterns and draw connections, to document their work, and to share their observations and ideas with others. For example, children's activity of planting, or sprouting seeds can become a rich inquiry process, in which children predict what plants will look like as they grow, engage in detailed observations of plants over time, track and measure, record their plant's growth through drawings, words and photos, and participate in group discussions, in which they share their observations and thoughts. Such experience deepens children's understanding of how plants change, and what they need to grow and develop. Children may draw the connection to their own growth, and the growth of other animals, and begin to develop a broader understanding of living things. Such experiences of scientific inquiry not only support children's development of scientific knowledge, but provide a natural vehicle for developing children's social skills, and their development in mathematics, language, literacy and other subject areas.

Preschool teachers do not need to have extensive knowledge about science in order to be able to teach it well,⁶ but they should be willing to research and gain general knowledge of the concepts and principles they explore with children. The kind and amount of information or knowledge they need to know, whether the focus is on concepts from physical science, life science or earth science, is readily available through basic research. Acquiring some background knowledge about the topic helps teachers in planning inquiry experiences, and in supporting and challenging children through their explorations. Teachers should not worry about being able to answer all the questions children will raise. Rather than providing children with answers, teachers should use children's questions as a springboard for further investigations. They may answer, "I don't know. Let's find out together."⁷ It is more essential that teachers become inquirers together with children, model for children a questioning mind, think out loud, and express interest and enthusiasm. Teachers' thoughtful guidance and support through inquiry experiences builds a foundation for children's understanding of basic science concepts, fosters a positive approach to learning, and develops learning skills and attitudes necessary for later success in science and in other subjects.

Guiding Principles

The following principles will guide teachers in establishing a preschool science program that fosters children's curiosity and develops their skills and habits to explore and learn about their world. These principles are consistent with a constructivist approach to learning, where children actively engage in constructing their knowledge. The principles are drawn from current, research-based models and approaches to early childhood science,⁸ and are consistent with the National Association for the Education of Young Children (NAEYC) guidelines on developmentally appropriate practice.^{9 10 11}

➤ **Physical and social environments support children’s curiosity, and encourage inquiry and experimentation.**

The preschool environment should support children’s natural inclination to engage in scientific inquiry. Teachers should create a physical and social environment that sparks children’s curiosity and creativity, fosters their question-asking, and fuels their experimentation and problem-solving. The physical environment should provide children access to a wide range of objects and materials to explore and investigate, and tools to support their investigations. The social environment must be one that fosters in children scientific attitudes important for learning. These include curiosity, open-mindedness, critical reflection, respect for evidence, independence of thought, perseverance and cooperation. Social interactions with adults and peers nurture children’s dispositions to observe and seek information, encourage children to communicate their observations, ideas and thoughts, and build on their enthusiasm and motivation to learn. In a preschool environment with a culture of inquiry, the teacher:

- Acts as a researcher, joining children in exploring their world.
- Asks open-ended questions
- Introduces children to new vocabulary, including scientific vocabulary such as observe, explore, predict and measure.
- Encourages children to think, reason and draw conclusions
- Encourages children to share their observations and communicate their thoughts

➤ **Content of inquiry is developmentally-appropriate, based on children’s prior knowledge and experiences, and is interesting and engaging for children and teachers.**

Experiences of scientific inquiry are meaningful when they take into account children’s developmental level, existing knowledge, prior experiences and cultural backgrounds. Certain content areas are more suitable for early education because they are developmentally appropriate and build on children’s existing knowledge. The focus of study should build on scientific concepts preschool children have already begun developing and on competencies they are ready to accomplish. The Preschool Learning Foundations in Science present inquiry skills and core concepts in the areas of physical sciences, life sciences, and earth sciences that are developmentally-appropriate for preschool children, and are based on children’s existing knowledge and predisposition to learn about certain concepts in science.

Children come to school with varying prior experiences. Their intuitive understandings of scientific concepts may vary based on their cultural beliefs, language and the daily experiences in which they are immersed. These differing backgrounds that children bring with them as they enter preschool serve as a foundation upon which they build new knowledge and understandings. To make learning more effective, it is critical for teachers to determine and understand

children's existing knowledge and beliefs, and build upon this base when introducing new concepts.

Experiences of scientific inquiry should be interesting and engaging for children and teachers. Teachers should observe children and listen to their ideas to learn about their interests and questions. In this way children's questions and ideas may become teachers' starting points in selecting and designing experiences for scientific inquiry. Whether science activities are derived from the children's own questions or are initiated by teachers (based on their knowledge of the children in the group), activities should be drawn from the world around the child, be relevant and connected to children's daily experiences, and be responsive to children's questions and interests. When children's interests and ideas are recognized, children feel that their thoughts are valuable. They are more motivated to participate in scientific experiences, and take ownership of scientific discoveries. The teacher's own level of enthusiasm, engagement and interest in the topic of study is of equal importance. If the teacher is interested in the content of study, she is more likely to be engaged and motivated to participate with children as a researcher, and to generate ideas and activities. Moreover, the teacher's sense of enthusiasm will transfer to the children in her group, and will help develop and maintain children's curiosity, joy of discovery, and positive attitudes about learning.

➤ **Children explore scientific concepts directly through active, hands-on, minds-on playful experiences.**

The preschool environment must provide children with numerous opportunities to explore objects and phenomena drawn directly from their world. However, opportunities to simply touch or manipulate real objects are not enough to foster conceptual growth. What children are thinking about while physically engaged with objects is as important as what they are actually doing. Children should be encouraged to conduct focused observations, ask questions, make predictions, engage in simple experiments, and share their experiences and ideas with others. Such hands-on, minds-on activities reinforce children's natural interests and curiosity while strengthening their reasoning skills.

➤ **Children explore scientific concepts in depth through multiple, related learning experiences over time.**

In order for children to build a deeper understanding of a concept, they need to have many opportunities to work with a concept and to explore it from different perspectives over an extended period of time.^{12 13} Children should be offered science activities that are conceptually connected by a big science idea. Unrelated science activities, presented in isolation, provide children with a quick, shallow learning experience. On the other hand, a range of conceptually related experiences that continues for weeks, or even months, allows children a deep exploration of the scientific concept, and result in learning that is more effective and powerful.

➤ **Children construct knowledge through social interactions with peers and adults.**

Social interactions are vital for conceptual growth, and the development of social and communication skills. Children and adults co-construct knowledge as they explore and investigate together. Through a collaborative inquiry process, children and teachers seek to make meaning of the situation they explore. At the same time, adults ask questions to challenge and expand children’s thinking, and guide and scaffold them through the learning process. They model for them a questioning mind, and the use of scientific vocabulary in a meaningful context (e.g., “I observe,” “What is your prediction?”). When children interact with others, they learn to work cooperatively, take turns, share, listen to others’ ideas, respect different views, think flexibly, sometimes hold to their own ideas and assist each other when needed. Interactions with peers and adults facilitate children’s construction of scientific knowledge while developing children’s social, language and communication skills.

➤ **Children use language and other forms of communication to express their thoughts, describe observations, and document their work.**

Communication is an integral component of children’s learning and formation of scientific concepts. Children use language when describing their observations, reflecting on their work through collaborative discussions, and sharing their ideas and thoughts with others. They also learn to use the vocabulary associated with science, and gradually begin to use terms such as predict, observe, measure, or experiment. Children can communicate in their home language, in sign language, or English. Children also use different forms of communication to record and document information, including drawing, gesturing, and dictations of words or sentences, signing, and symbol boards. The use of language enriches children’s scientific experiences, and facilitates their understanding of scientific concepts.

➤ **Teachers support children who are English Learners in understanding and communicating scientific knowledge and skills.**

Scientific experiences provide natural opportunities to expose children to new words in English and in their home language, whenever possible, and to use these words in a meaningful context. During initial stages, children who are English learners may not yet have the confidence or the vocabulary to describe their observations and express their thoughts in English. They may represent their thinking through drawings. Teachers should support children’s understanding of the content, and encourage children to express themselves whether in English or in their home-language. Teachers may need to scaffold communication with English Learners by using gestures and visual cues, to describe, clarify or demonstrate by acting out the meaning of a word or phrase presented in English, and to expand and extend the child’s language. For more information about strategies to support children who are English learners, see the Preschool Curriculum Framework, Volume 1, Chapter 5: English-Language Development.

- **Science is embedded in children’s daily activities and play, and provides a natural vehicle for integrating mathematics, literacy, and other subject areas.**
Science can be integrated throughout the school day and included in a wide range of activities throughout the preschool environment, rather than take place in one particular time slot, or one particular area of the classroom. The teacher can encourage children to pursue science ideas while playing with blocks, at the water table, or in the sand box. Furthermore, the nature of science explorations facilitates curricular integration, and provides meaningful situations to use and develop math, literacy, writing and other skills. While engaged in scientific explorations, children are provided opportunities to compare, classify, count or measure objects, all fundamental mathematical skills. Children also have opportunities to use and develop important language and literacy skills. The teacher encourages them to look at books with relevant science concepts and incorporate the vocabulary into daily activities, record observations or thoughts in journals, and communicate ideas and share explanations with others. Such experiences develop children’s vocabulary, comprehension and conversational skills, important aspects of language development for all children.
- **Individual differences are recognized and supported.**
Children are different from one another and enter preschool with various levels of social, linguistic, motor, and cognitive abilities as well as sensory preferences. They may vary in the way they develop and display scientific skills and knowledge, but they all share a natural curiosity and desire to explore their environment and make sense of their world. Science is for all children regardless of their age, sex, cultural or ethnic background, ability, aspirations, or interest.¹⁴ The amount and kind of support children need varies from child to child. As stated in the NAEYC guidelines on developmentally appropriate practice, “Teachers should incorporate a wide variety of experiences, materials and equipment, and teaching strategies in constructing a curriculum to accommodate a broad range of children’s individual differences, prior experiences, maturation rates, style of learning, needs and interests”.¹⁵ It is vital that teachers provide many entry points into a topic to meet children’s different learning styles and needs. Multiple hands-on, playful activities with concrete objects benefit all children, including children who are English learners and many children with special needs for whom learning through authentic experiences with concrete objects is very important. If children are receiving special education services, teachers should ask for ideas from families and specialists, as some activities for children with special needs may need to be adapted.
- **School, home and community are connected.**
Teachers and parents can foster connections between school and home experiences, and facilitate continuity. By communicating to parents the preschool’s approach to science education, parents and other family members can become more involved in children’s learning and share with them the excitement and joy of

discovery. Parents are the child's first teachers. They can use everyday situations to extend and enrich children's learning and understanding of scientific concepts, and take an active role in children's science experiences. By partnering with parents, teachers can also learn about children's interests, cultural beliefs, and home experiences related to science. In addition to families, numerous community resources can be tapped to enrich science activities. Local facilities and businesses can host field trips, and professionals (e.g., veterinarians, engineers, nurses; scientists) can be asked to make presentations and provide valuable information to children and teachers alike.

Environments and Materials

When science is viewed as the process of studying objects and events in the environment, the indoor and outdoor environments provide the context for children's physical and social explorations and construction of scientific concepts. Teachers need to be thoughtful about what objects and materials to include in the environment, and how to make these materials accessible and meaningful for *all* children. Objects and materials stimulate children's interest, and provide the means for scientific investigations. They are particularly important when teaching children who are English learners, as they give concrete meaning to the words children hear in the context of doing science. The environment should provide all children, including those with special needs, accessibility to a wide range of objects and materials, particularly ones that focus children on important aspects of the scientific phenomena they currently study. Teachers should also be thinking about the arrangement of the room, and allow space for small-group and large-group explorations and discussions. The following section includes strategies for helping teachers set up an environment that is rich, stimulating, and conducive to children's construction of knowledge.

➤ **Provide a variety of natural materials to observe and investigate.**

The selection of objects and materials is vital for engaging children in meaningful hands-on explorations. Children can explore the properties and characteristics of natural objects, and how they change under different conditions. Water, sand and clay are natural materials which are traditionally found in early childhood settings, and can foster scientific investigations. Water can be explored as a solid or liquid, it can be moved from one place to another, make other things move, and can be mixed and affect other materials. Sand can be explored for its texture, composition, and ability to pour like a liquid and take on different properties when it gets wet. Clay is a material which can change shape by applying forces, and is affected by water and by temperature.¹⁶ The thoughtful questions and set-ups of these materials can lead children to explore these traditional materials in different ways, using scientific methods and vocabulary.

Children who observe and study trees or plants may collect and explore twigs, leaves, bark, pine cones, and different kinds of seeds. When studying earth materials, children may explore rocks, polished stones, small beach pebbles, or shells. Such natural objects come in a variety of colors, shapes, sizes, textures and patterns, and are fascinating and intriguing for children. They encourage sensory explorations, close observations, questions that may lead to further investigations, and provide opportunities to label, sort, classify, order, compare and contrast, and pose questions for further study.

➤ **Include objects and materials that can be used in multiple ways, and allow for creativity and open-ended investigations.**

The environment should include a variety of reclaimed materials to spark children's curiosity, and enhance children's playful explorations. Children use different kinds of blocks, boxes, cardboard and other construction materials when investigating structures. Tubes, connectors, measuring cups, funnels and basters can be used during exploration of water flow.¹⁷ Collections of different objects (e.g., corks, plastic lids, glass nuggets, plastic bottles, metal screws) can lead to children's explorations of properties and characteristics of diverse materials, like in the exploration of sinking and floating, and can be used in ordering, sorting and classifying activities.¹⁸ Open ended materials are materials that can be used in many different ways, and are different from objects that were designed with a particular use and only one way of operation. For example, in a prefabricated marble run, all children need to do is drop the marble in and watch it roll. This is very different from when children create their own roadway for marbles by using blocks and different kinds of gutter materials.¹⁹ Open ended materials, like blocks, can be used in different ways for different projects, and encourage experimentation.²⁰

➤ **Include living things in the preschool environment.**

Experiences with plants and animals, including human beings, develop children's ideas about living things. Animals and plants in the preschool environment allow children to systematically observe their characteristics. Children begin to think about the appearances, behaviors, and habitats of living things in their environment. Taking care of pets and plants, and watching them grow and change, also makes children more aware of the basic needs and life cycles of living things. Plants in the preschool environment can range from seedlings in small cups or pots that children are experimenting with, to a terrarium, an open container with soil, and a collection of plants in the room, and gardens or large pots in the outdoors. The preschool environment may also include pets (e.g., birds, guinea pigs, hamsters, or rabbits), and opportunities to observe changes in animals as they grow and go through transformations related to the life cycle (e.g., caterpillars or tadpoles). Check for allergies before deciding which pet to include in the classroom, because some children may be allergic to certain animals.

➤ **Include scientific tools for observation, measurement and documentation throughout the preschool environment.**

Magnifiers, hand lenses, measuring cups, and a balance scale are scientific tools that help us observe and measure objects. Magnifiers (such as hand held lenses and microscopes) help children observe details in living things or other objects (e.g. feathers, insect eggs, salt crystals, water droplet). Measuring tools such as a balance scale, rulers, measuring tape, measuring cups and spoons, and a thermometer introduce children to ways in which we can measure weight, length, volume and other measurable attributes. Preschool children are not expected to know how to use these tools on their own. Tools should be introduced in small groups. With guidance from teachers children become familiar with the tools, and learn about the function of different measuring devices (See the Preschool Curriculum Framework, Volume 1, Chapter 6: Mathematics for more information about opportunities to promote measurement concepts in the environment). Children should also have tools for recording data and for documenting their work, such as clipboards, paper, journals, pencils, cameras, and other materials to record and draw their findings. Scientific tools should be available on a daily basis, and accessible to all children in different interest areas, for example, measuring tools can be part of the play house, and clip boards and measuring tapes can be part of the block area. The mere presence of scientific tools does not invite children to use them in a purposeful way. These tools should be included in planned activities where children are encouraged and supported in their investigations using these tools. Children with disabilities and other special needs may need assistance from adults and special adaptations in using the tools. For example, putting a bigger grip on the hand lenses can help children with low muscle tone. Children with differing motor abilities may need assistance from an adult or peer to use some tools.

Scientific tools and materials should be included throughout the preschool environment, and not only in a particular area. In addition, teachers may choose to have a **science table** devoted to scientific tools, objects and materials related to the current focus of study. It is important that teachers be mindful and intentional about tools, materials and books to include on the science table. These should allow children to focus on important aspects of the selected phenomenon they study, and be meaningful and accessible for all children. The teacher needs to create activities around the science table to engage children and help them feel comfortable with its tools and materials. The materials and tools may need introduction for children to begin using them appropriately. It may be helpful to start with a few tools and add or rotate tools as investigations expand.

➤ **Use technology in service of children's scientific experiences.**

Technology is part of children's world. The use of technology can augment and enrich children's scientific explorations. Computers, particularly access to the internet, provide expand resources, and enable teachers and children to obtain a great amount of information instantly. Teachers may use the internet to obtain

background information on any topic of inquiry, and to show children photographs or videos on a range of topics. In addition to computers, other technologies such as video and digital cameras and tape recorders can be used to support children's documentation practices. These can be powerful tools in recording observations and tracking changes in objects and materials.

➤ **Present documentation of science-related experiences in the preschool environment.**

When engaged in scientific explorations, children are encouraged to record and document information in drawings, charts, photos, or by constructing three-dimensional models. For example, to record the growth of lima beans, children, with the assistance of the teacher, may create a chart with photos of the lima beans before and after sprouting and growing. Making children's and teachers' documentation visible in the room, allows children to re-visit an experience, provides a focus of conversation for children and teachers, and makes the process of inquiry visible for children and for the parents. It also gives a positive message to children about the importance of their investigations, and the value the teacher places on their work.

➤ **Include children's books with science-related content.**

Children's books provide powerful ways to extend children's firsthand scientific experiences. Non-fiction, informational books about things and events in the world, such as insects, animals, seeds, the seasons, fruits and vegetables, or the human body, provide resources for children's investigations through pictures and descriptions, and enrich children's knowledge about their world. Numerous literature books such as "The Tiny Seed" or "The Happy Day" have science connections, and can be starting points for discussing concepts such as growth or seasonal and weather changes.²¹ Teachers can use books to introduce scientific concepts, to encourage the use of scientific language (e.g., "What do you predict will happen next?"), and to develop skills of scientific thinking. Reading for information supports language development and comprehension skills as well as the learning of science.

➤ **Use the potential of the outdoors for natural explorations and investigations.**

The outdoor environment is where children can experience their natural surroundings first hand, and learn about concepts related to living things, physical objects, and earth materials, and phenomena. It provides ideal sites for explorations of natural objects such as insects, plants, rocks, clouds, shadows, water, light, weather, and the motion of objects. Teachers should create multiple opportunities for children to experience and do science outdoors.²² Children can observe and investigate plants, insects and other small animals in their natural habitats, experiences that will broaden their understanding and respect of living things. The outdoor environment should also include space and resources for children's large-scale construction projects and exploration of physical science, in which they investigate forces, balance, and properties of different materials. They should also

have an open space to experiment and interact with moving objects (i.e., balls, wheeled items, slopes). Such outdoor explorations promote collaboration and teamwork, and positive attitudes towards nature.^{23 24}

➤ **Organize the space in ways that promote children’s explorations.**

Several considerations in organizing the indoor physical space can facilitate the smooth flow of playful explorations throughout the environment, and promote social interactions among children.²⁵

- **Space.** Allow space for observations, and for objects, materials, tools and resources related to science. Some investigations last for extended periods of time, and may require storage and display space, and open space indoors and outdoors.
- **Flexibility.** The amount of space and kind of setups needed for different activities changes based on the nature of the investigation children engage in. Allow for flexibility in the use of physical space and furniture to accommodate the changing needs of each activity.
- **Accessibility.** In order to promote self-direction and free explorations, children should have constant access to tools and materials in the environment. Scientific tools (e.g., magnifiers, tweezers, clip boards), books, and the objects and materials children explore, should be placed on low shelving or tables, and be accessible to all children.
- **Social interactions.** The arrangement of the physical space can facilitate children’s interactions with each other. For example, the setup of an activity suggests to children whether they should work alone or with other children. The environment should allow for children’s solitary play and individual explorations, and also for social interactions and collaborative investigations, in small or large groups. Social interactions are necessary for conceptual growth and the development of communication skills.

➤ **Always be aware of children’s safety.**

Keep children’s safety in mind every time you plan an activity, whether indoor or outdoor, and when selecting the materials to be included. Be sensitive to children’s allergies. Children may be allergic to certain plants or animals, and some materials may produce allergic reactions. Ask parents and check children’s records about any children’s allergies. Talk with children and demonstrate how to carry out good safety practices when using tools and when manipulating different materials. Safety goggles that fit young children may be used in activities that have any potential for liquids or solids accidentally getting into the eyes. Good safety practices should also be part of children’s outdoor explorations of plants and insects. Make sure the area is free of poisonous plants or undesirable animals. Check for your local licensing regulations for any safety related issues.

Summary List of Strands and Substrands in the Science Domain

Scientific Inquiry

- 1.0 Observation and Investigation
- 2.0 Documentation and Communication

Physical Sciences

- 1.0 Properties and Characteristics of Non-living Objects and Materials
- 2.0 Changes in Non-living Objects and Materials

Life Sciences

- 1.0 Properties and Characteristics of Living Things
- 2.0 Changes in Living Things

Earth Sciences

- 1.0 Properties and Characteristics of Earth Materials and Objects
- 2.0 Changes in the Earth

Strand: Scientific Inquiry

Children’s natural curiosity and need to make sense of their world drives them to question and explore objects and events in the environment. Like scientists, they have a natural desire to inquire, but in order for them to become more focused and systematic in their observations and investigations, they need the teacher’s guidance in developing skills of scientific inquiry. Skills of scientific inquiry provide children the tools for investigating and learning about science topics. Such experiences build habits of questioning, critical thinking, innovative problem-solving, communication, collaboration and decision making. And when these activities are child-centered, experiences of scientific inquiry ignite the excitement and pleasure of exploration and discovery, and build a strong foundation for children’s interest in learning science.

Young children’s experience of science is an interplay between *content knowledge*, what children learn about, and *inquiry skills*, the skills and processes they apply to explore and develop knowledge and understanding of scientific ideas. Content knowledge and process skills are linked. Children build knowledge and understanding of concepts through active participation in processes of scientific inquiry.

The preschool learning foundations in science include the following inquiry skills under the strand of Scientific Inquiry:

Observation and Investigation
<ul style="list-style-type: none">• Raise simple questions• Observe and describe• Extend observations with scientific tools• Compare and contrast

<ul style="list-style-type: none">• Predict and check• Make inferences and draw conclusions
Documentation and Communication
<ul style="list-style-type: none">• Record information• Share findings, ideas and explanations

Observation and investigation involve ways to observe, and to compare and investigate objects and events. Additionally, the ability to sort and classify, identify patterns, compare and measure, and have spatial awareness are fundamental skills for both math and science domains, and are included in the *Preschool Learning Foundations, Volume 1, Mathematics*.

Documentation and communication skills are employed to document and record information, and to communicate findings and explanations with others while engaged in experiences of observation and investigation.

Scientific inquiry skills are integral to children’s ongoing play and explorations, and are not taught in isolation. Children need to develop their abilities to make observations, ask questions, and gather information, as part of meaningful exploration and investigation experiences. The following sections provide strategies as to how teachers can establish an environment with a culture of inquiry, and facilitate children’s use of scientific skills and language through everyday explorations and planned experiences of scientific inquiry.

Substrand 1.0 Observation and Investigation

The first strand, *Observation and Investigation*, focuses on skills and language applied in processes of observing and investigating objects and events in the environment. Children learn to observe objects closely, using their senses and tools, and to describe their observations. Noticing details and recognizing similarities and differences between objects and events underlies children’s ability to sort, classify, and compare and contrast, also important skills in mathematics that facilitate the learning about properties and characteristics of objects and materials.

As children engage with objects, they enjoy trying out things and seeing what happens. Pushing cars, building with blocks, manipulating tubes at the water table, or collecting leaves are all examples of children’s experimentations with objects and materials. Such experiences provide the context for developing the attitudes, skills and language of scientific inquiry, and allow children to construct meaning and knowledge about objects and events. Teachers can use such experiences to encourage children to observe closely, describe their observations, notice similarities and differences, and compare and contrast. Children can also make predictions about changes in materials and objects based on their intuitive knowledge or past experience, and then test their

predictions through observations or simple experiments. Such experiences also illustrate to children the value of observable evidence. They learn to use evidence to verify their predictions, make inferences or draw conclusions.

Vignette: Making the Car Go Down Faster

Ms. Lucinda notices that Yau and Tommy are very excited about the ramp they built in the block area. They put the car at the top of the ramp, and watched it going down slowly by itself. They did it over and over. At some point, Tommy raised the board, and it made the ramp steeper. They put the car at the top, and let it go again. Both of them got excited when they noticed that the car was going down faster, "Wow, that was fast." Ms. Lucinda then said, "It was faster. I wonder what you did to make the car go down faster". Tommy said, "I was holding up the road. You see, like this." Ms Lucinda asked, "How can you change the ramp so the car goes down fast, even when you are not holding it up?" Yau tried to put more blocks under the higher side of the ramp (making the ramp steeper). Tommy then put the car at the top and let it go, and they watched the car going fast," really fast."

Teachable Moment:

Observing Yau and Tommy playing in the block area, the teacher notices they discover through play how to make objects go faster downhill. She intervenes and asks, "I wonder what you did to make the car go down faster". Yau and Tommy were quickly engaged, and Ms. Lucinda observed them solving the problem on their own. Physical science of movement is exciting for young learners because they can see immediately the cause and effect. They can test and retest their solutions, get results and draw conclusions.

Creating an environment with a culture of inquiry

While a physical environment with a wide range of objects and materials is necessary for fueling and encouraging children's experimentation, the social environment must be one that supports children's self confidence to explore and investigate, and encourages children to pursue their own questions and develop their ideas. In a preschool environment with a culture of inquiry the teacher is a researcher, joining children in exploring the world, and modeling for children a questioning mind. The teacher observes children closely, avoids overtly correcting children's misconceptions, fosters children's curiosity and questioning, and asks open-ended questions (questions that do not have a single right answer or that end with a yes or no answer) to engage children in conversations, challenge their thinking, and enhance their enthusiasm and motivation to learn.

Interactions and Strategies:

The following interactions and strategies promote children’s observation and inquiry.

Be an active observer. Spending time with children and observing them closely, whether inside the room or outside in the yard, is key in supporting children’s scientific skills and knowledge. Teachers should observe children, listen to their ideas, and learn about their interests, needs and understandings. Through observations they find out what themes are of interest to the children in the group, where they are going with different materials and activities, and what questions they ask. Such information can guide teachers in selecting a focus of inquiry that is relevant and responsive to children’s questions and interests, and build on children’s existing knowledge and understanding. Based on this information, teachers can decide what experiences to offer children next, how to deepen their understanding, and how to support the needs of individual children in the group.

Talk with children and engage them in conversations. While observing children as they work, opportunities arise to ask questions, challenge their thinking, and engage them in conversations about their work: “What can you do to make the bridge higher?” “Why do you think roly polies roll up?” “Tell me about your rock. Where did you find it? Are there more rocks like this around?” Interactions of this kind guide children’s thinking, and provide them with opportunities to use language to describe, explain, and reflect. This is also the opportunity to introduce children to scientific vocabulary such observe, predict, measure and experiment. More specific strategies about how to engage children in conversations about their work are in the next substrand, “Documentation and Communication.”

Know when to intervene and when to stand back. While observing children, the teacher needs to make a judgment about when and how to intervene. When children are intensely engaged, while experimenting with objects or trying to figure out a solution to a problem, they will probably benefit most by not being distracted by questions. The teacher should be attentive to what children are doing, and intervene only when they feel it is the appropriate time to further stimulate the child. Be careful about overwhelming children with too many questions.

Foster children’s curiosity and questioning and model for children a questioning mind. As children interact with objects and observe their environment, they express curiosity and raise different questions: “Do snails have eyes?” “Why doesn’t the ball come out?” “Where the rain is coming from?” The teacher should welcome and value children’s questioning, and, rather than provide answers, and encourage them to pursue their ideas and questions. Children who are English learners should be encouraged to ask questions in their home language whenever possible, as these questions are likely to be more complex. In some cases, teachers may not know the answers to children’s questions, and should invite children to explore together, “I don’t know. Let’s find out together.” They often need to do some investigations of their own so they can know

where they can take the children upon future investigations. They should take time to guide children in finding out the answers to their questions. It indicates to children that their thoughts are valuable and important. Some children's questions can be explored directly with appropriate experiences and additional support and materials to extend their learning. Other questions can be answered by using resources, such as books, the Web or an expert.²⁶ Modeling inquiry practices for children is a powerful way to establish a culture of inquiry in the preschool environment. Teachers' enthusiasm about exploring and investigating is relayed to children in the group. They should model eagerness to learn, persistence, and determination.

Not all children use words to express curiosity. Children may express their questioning and interest non-verbally, through their facial expressions, body language, and their behaviors. For example, they may be absorbed in an exploration for a long time, try out different ideas, or repeat the same experience over and over. Teachers can scaffold the child's interest by thinking out loud: "It looks like you enjoy mixing the sand with water. I wonder what happened to the water, or I wonder what would happen if you put some of the wet sand in the sun" "It looks like the snail is using its antenna."

Provide children with time. Scientific inquiry requires time. Children need time to explore materials and tools, to learn skills of inquiry, to investigate a concept in depth, to discuss and document. The daily schedule should allow for long enough time to explore and interact with materials, and for group times to discuss and reflect. Long-term planning should allow for deep and extended explorations of a concept over time. The explorations of big scientific ideas (e.g., change in materials, growth, form and function of tools) may require several weeks or more. Children need time to experience, repeat and revisit a variety of activities to deepen their understanding of a concept. There may need to be some area set aside to preserve on-going investigations.

Vignette: Observing a Pumpkin

During the fall, Ms. Linda brought a big pumpkin to class, and placed it on a table. When children came in they noticed the pumpkin. Some of them just looked at it. Others touched it with their fingers. Alonzo and Lai tried to pick it up, and commented, "This pumpkin is heavy." During small group activity, Ms Linda invited the children in the group "to observe" the pumpkin, "When we observe it," she explained, "we use our senses to find out about it. We use our eyes to notice carefully what it looks like. We may find out what it smells like, and touch it to find out what it feels like. We may even decide to taste it. What do you notice about the pumpkin?" She invited children to observe the pumpkin and make their own observations, "What colors is it? Describe the shape of the pumpkin." Some children immediately started making observations, while others needed more time. Ari said "It's orange." Joseph said, "It is orange and has lines on it," and pointed to the creases running from the stem to the bottom. Andrea said "It is big and round." Veronica seemed very interested. She touched the pumpkin, but did not share her observations. Slowly, more children became comfortable making

observations. Tim said "It has a stick on it." On a group chart, Ms. Linda recorded each child's name and his or her observation. She told them these were great observations, and prompted children to use different senses to describe more attributes of the pumpkin. To model for the children, she touched the pumpkin and said, "It feels bumpy." Kim touched it said, "I can feel the lines on it." Then, Veronica felt comfortable sharing her observation and said "It's hard." Alonzo tried to pick it up again with both hands and said, "It's so heavy." Ms. Linda asked the other children, if they also wanted to try to pick it up and feel how heavy it was. She asked the children, "How heavy is the pumpkin, as heavy as what?" "Like this," Alonzo pointed to the biggest block in the blocks area. Ms. Linda brought the block over, and let Alonzo hold it in his hand. She asked, "Which one do you think is heavier, the pumpkin or the block?" Alonzo said, "Maybe the block." Ms. Linda asked, "How do you think we can tell?" Alonzo said, "You need to measure" Ms. Linda said, "Oh, so I need a scale to find out." Ms. Linda helped Alonzo put the pumpkin on one side of the balance scale, and the block on the other side, and invited children to observe and tell her which is heavier. After all the children had a turn sharing their observations, Ms. Linda read the group their observations, "Let's see what we observed about the pumpkin," and then invited children to record their observations by drawing a representation of the pumpkin they observed.

Teachable Moment:

During the fall, children see pumpkins everywhere, but in this type of activity they get to observe a pumpkin closely. Ms. Linda first introduces the broad meaning of the word "to observe." She encourages the children to observe carefully using their senses and to share their observations with others, by asking questions and modeling for them how to observe and describe observations. Modeling is particularly important for children like Veronica who may not be ready to respond to open ended questions, or who may be developing English language skills. She also recognizes an emergent opportunity to explore the concepts of weight, and to illustrate for children the use of a scale as a tool for comparing and measuring weight. This type of experience not only introduces children to observation as a science practice, but also provides opportunities for noticing details, using measuring tools, building new vocabulary, and developing math concepts. Observations of the pumpkins can be expanded into different explorations, for example, recording observations in journals, predicting what is inside the pumpkin and checking what is inside, comparing and contrasting the inside and outside of the pumpkin, tracking the natural deterioration of a carved pumpkin, and sorting a variety of pumpkins and other kinds of squash by attributes such as size, shape, weight and color. This can lead to connected meaningful activities in other subject areas such as math, literacy and art.

Interactions and Strategies:

Facilitate children's observation skills. Observing is the most fundamental scientific process for receiving information, constructing meaning and gaining knowledge about

the world. Children use their senses of sight, smell, sound, touch, and taste to observe objects and phenomena in their environment. Everyday playful explorations and focused investigations provide children with many opportunities to make careful observations.

- **Invite children to observe objects and phenomena related to their current focus of inquiry.** Observations can focus on living things, non-living objects and different materials (e.g., insects, plants, body parts, fruits, vegetables, tools, rocks), and different phenomena in the environment (e.g., “How the worm moves.” “What happens when they let the ball go?”). Observations are meaningful when built into children’s inquiry experiences, and allow children to construct knowledge related to their focus of inquiry. For example, while investigating properties of water, children observe drops of water, and notice that drops of water are absorbed by fabric. Such observations may suggest related questions and phenomena to be investigated (e.g., “Would the drops of water be absorbed by other surfaces? Other materials?”).
- **Encourage children to observe carefully.** Introduce children to the process of observation by using a simple, familiar object from their daily environment. Let them hold and touch the object. Remind children to use all their senses, instead of “just looking” at the object, and to note specific details. Teachers may need to spend time talking about the senses and experiment with using each sense.²⁷ For example, they may smell something they can’t see or feel, they may feel something they can’t see, or hear something they can’t see or touch. Isolating individual senses will help children to understand how they receive and process information from their senses.
- **Encourage children to describe their observations.** Talk with children and ask questions to guide their observations: “What do you notice about this apple?” “What is your observation about your plant?” “How is it different from the last time we observed it?” “What does this rock look like?” “What does it feel like?” “Does it make any sound when you shake it?” Encourage children to describe the different attributes of objects, including size, shape, color, texture, and other observable properties (e.g., “Is it soft or hard?” “Is the rock smooth or bumpy?”). Children readily acquire the skills of making observations and describing objects or events. Encourage all children to participate at their comfort level, and do not correct them, or judge them for being right or wrong. Remember the teacher is encouraging the process of observation. Children who are English learners may be actively engaged by listening to others’ observations, but not yet feeling confident or willing to share their observations in English. These children can be encouraged to describe their environments by the teacher noticing their observations and modeling for children, “This rock is very hard,” “It feels bumpy”. Describing observations that include all senses is a prime opportunity to teach new English vocabulary to describe attributes of objects such as size, height,

weight, length, shape, texture, and the language of science (e.g., observe, explore, measure, record).

- **Record children’s observations.** For example, the teacher records on a chart, children’s observations of the inside and outside of a watermelon. She writes down the child’s name, and next to it, his observations. On one side of the chart, she records children’s observations of the outside of a watermelon (e.g., “It is green” “It is smooth” “It is round like a ball” “It is heavy”) and on the other side she records children’s observations of the inside (e.g., “It has seeds.” “It is red.” “It feels soft.” “It has juice.” “It smells sweet.”).
- **Invite children to draw a representation of their observation.** Children may document what they observe by drawing a representation of the observed object or event. This requires them to observe closely, and to notice details: “What shape is the petal?” “How many petals does it have?” “Which color would you use?” It also allows them to track changes over time. For example, when children record the growth of beans, by drawing, or taking photos, they can refer to their records and describe changes at different times. The teacher may also write down the comments children make when describing their drawings. These representations may be displayed, made into a book about the investigation, or used in a child’s portfolio to document development in drawing and verbal skills.

Vignette: Observing Pill Bugs with Magnifiers

While exploring what animals live in their schoolyard, children became fascinated with pill bugs (usually called roly polies by children). While in the yard, they would look for pill bugs and enjoy watching them curl into balls. One day, Ms. Lopez noticed that a group of children collected pill bugs into a bucket. She invited the children to put the “roly polies” on a tray and observe them closely at the outdoor investigation table. Ms. Lopez said, “Let’s use our tools and look really closely at the pill bugs. What do you notice about their body?” The outdoor investigation table includes tools for exploration such as trays and clear containers, magnifying glasses, rulers, and children’s notebooks where they record their observations. Most of the children in this group were familiar with the tools on this table, as they have used them before when exploring rocks, leaves, snails, and other objects collected in their yard. Ms. Lopez assisted Jennifer holding the magnifier above the pill bug, “Wow, It looks so big,” Jennifer says. Jose observes the pill bug with a magnifier and gets excited, “I can see its head.” Ryan asks “When is it going to open up again? I want to see how many legs it has.”

Teachable Moment:

Having an outdoor investigation table with tools for observation, measuring and recording facilitates children’s observations and outdoor explorations. The use of magnifiers allows children to observe the pill bugs more closely than they can with just their eyes. Ms. Lopez makes scientific tools available for children so that she can be

ready for teachable moments. Over time, children start to use magnifiers and other tools spontaneously and more independently. The observations of pill bugs can be expanded in different ways. Teachers can invite children to record their observations by taking photos or drawing a representation of the pill bugs and dictating to the teacher what they have observed. It can also lead to deeper explorations and discussions about the body structure of pill bugs, how they move, what they like to eat, where they live, and most interesting for the children in this group, finding out when and why they curl up, and possibly to comparisons with other animals.

Interactions and Strategies:

Promote the use of scientific tools to extend children’s observations and investigations of objects. Children’s investigations of objects and phenomena can be augmented with the use of observation and measurement tools. Magnifiers, such as hand lenses, can help children observe details and objects that are too small to see without the use of tools. Measuring tools, such as rulers, scales and a measuring tape, extend the investigations by enabling observers to find out how long something is, how much it weighs, and how much space it takes up. Measuring tools also allow us to compare one object to another (e.g., “Which is longer?” “Which is heavier?”) (See the *Preschool Curriculum Framework, Volume 1 in Mathematics* for more information about measurement concepts). The mere presence of scientific tools in the discovery area or throughout the environment does not invite children to use them in a purposeful way. The teacher has an important role in promoting the meaningful use of scientific tools in children’s investigations.

- **Introduce children to scientific tools and their function.** Teachers should take time to introduce children to the tools and to their functions. Not all tools should be introduced at once. Instead, the teacher should gradually increase the number of tools in the environment. This will increase children’s tendency to use tools in the intended way. For example, to introduce magnifiers, the teacher can set up a situation in which children observe an object, and need to see details more closely than they can with just their eyes (e.g., in observing ants, seeds, the pattern on a leaf, or grains of soil), and tell children, “You still need your eyes to see, but the eyes and the magnifiers together allow us to see some things bigger. The magnifiers help to “*observe*”.²⁸ Like with any new object, children need time to explore and interact with them and use them on their own.
- **Support children in using the tools.** After being introduced to tools, and experiencing their use with the help of teachers, children may begin to spontaneously pick up the magnifiers or a ruler and ask to use them in context. For example, while observing a worm, the child might say, “I need the magnifying glass to look very close,” or “I want to see how big it is.” Preschool children are not expected to know how to use a ruler on their own, and may need help in holding the magnifiers properly. They will need the teacher’s direction and

support in using these tools. Children with motor impairments or other disabilities may need more assistance from an adult or peer in using the tools. For example, the teacher may need to hold the hand lenses steady for the children, to help them observe closely, or offer them the use of a stationary magnifier.

Facilitate children’s abilities to sort, classify, and identify patterns. Children’s observations and ability to identify similarities and differences lead naturally to classifying. Children start sorting objects into groups with similar attributes (e.g., “These are big seeds and these are small ones.” “These rocks are smooth and these are bumpy.”), and put together objects that belong to the same category. Categorizing and classifying encourage children to focus on physical and other characteristics of objects, and provide a foundation for future understanding of the scientific classification of organisms. They also start recognizing patterns in objects and events, including ones in nature (e.g., colors on caterpillars, veins on leaves, rings on the slice of a tree trunk, the day and night pattern, or everyday routines), and are able to predict what comes next based on the repeated pattern. Classification and patterning are mathematical skills essential to learning and organizing information about the world. Like other mathematical skills such as counting, estimating, ordering and measuring, they are important in the processes of scientific inquiry. The Preschool Curriculum Framework, Volume 1, Chapter 6: Mathematics provides strategies to facilitate these mathematical skills.

Vignette: Exploring Beans

Following a group discussion about seeds, Mr. Adato set out a tray with a variety of beans of different sizes and colors, including kidney, pinto, and Lima beans. He told the children that there were different kinds of beans, and mentioned some of their names. The children were engaged in free exploration of the beans. They piled them up and then spread them in the tray, or filled up containers of different sizes with beans, and then poured the beans back on the tray. Mr. Adato asked the children to put together all the beans that belonged together. He provided them with small containers on the table, and demonstrated, “I am going to put all the white beans here.” Children began sorting the beans, mainly by color. He noticed that Lee, a new child to the group, was sorting the white beans by size, and he asked, “I wonder why you put those beans together and those beans together?” Lee pointed to piles she created and said, “Big here and small here.” During group time, Mr. Adato invited children to observe the Lima beans and the red kidney beans. He wrote down children’s observations, and led a discussion about what was the same and what was different about the two kinds of beans: “What do you notice about their size?” “What about their color?”

Planning Learning Opportunities:

Mr. Adato presented children with hands-on experiences of exploring beans of different kinds. Learning the names of different bean kinds was less important for him than having children explore a variety of beans, and compare and contrast beans based on

different features. He encouraged children to explore them, sort beans in different ways, and talk about similarities and differences. Lee, a child who is learning English, is engaged in sorting the beans, and explains her sorting to Mr. Adato. She is empowered when Mr. Adato asks about the way she sorted the beans. This experience encourages children to notice different attributes of objects, and introduces Lee and other children in the group to new vocabulary in a meaningful context. Following up on the differences and similarities Mr. Adato is planning on soaking, then cooking the beans and in that way providing more possibilities for comparisons (e.g., between the size and texture of raw, soaked and cooked beans, the tastes of different beans).

Interactions and Strategies:

Encourage children to compare and contrast objects and events. As children develop skills in observation, they notice discrete elements of objects, and naturally begin to identify similarities and differences. The ability to compare builds upon the process of observing. In addition to learning about an object (such as an apple), by observing its characteristics, children learn more about the object by comparing it with other similar objects. For example, when comparing apples of different colors children can learn to infer that color has a relationship to taste. It also introduces children to the concept of variation and diversity. Children can also compare an object to other related objects, or discuss similarities and differences in an object as it goes through changes. The ability to compare and contrast is a critical thinking skill, and strengthens children's classification skills. It also sets the foundation for children's understanding of experimentation, in which children observe similarities and differences between two objects or events that differ in only one way.²⁹ For example, observing similarities and differences between two plants growing in similar conditions, except that one plant is in the dark, and another plant is in a place with light.

- **Ask questions and model comparative language to facilitate the comparing process:** "How are these alike?" "How are these different?" "What is kind of the same?" Such open-ended questions may spark a conversation, and encourage children to describe similarities and differences. Also, model comparative language for children who may not be ready to answer open ended questions, "These apples are different. One is green and one is red. One is bigger than the other. What else do you notice about these apples?"
- **Invite children to compare and contrast objects and phenomena related to their current focus of inquiry.** The process of comparing and contrasting is a powerful tool for constructing meaning and knowledge about scientific concepts. Comparing and contrasting different kinds of leaves, for example, not only expands children's knowledge of leaves in the environment, but more importantly, introduces children to the concept of *variation and diversity*. Similarly, comparing and contrasting an object before and after change due to growth or other transformations (e.g., seeds before and after sprouting, powder

before and after being mixed with water; or transformations such as in egg, larva, pupa, and moth) highlights changes in objects, and the concept of cause-and-effect.

Vignette: Predicting Changes in Ice

Ms. Brown presented children with a big cube of ice. She asked the children to hold it and tell her what they notice about it, “What does it feel like? What does it look like?” Children shared their observations, “It is cold.” “It is slippery.” “It is very smooth.” “It is wet.” “It is white.” “It is square.” Ms. Brown asked children, “What do you know about ice?” Some children shared their ideas, “We keep it in the freezer,” “It’s very, very cold.” “If you put it in water it disappears.” She invited children to draw their observations of the ice cube in their notebooks. The next day, Ms. Brown told the children that together they are going to explore what will happen to ice when it is left outside of the freezer. She has asked children: “What do you think will happen to this ice cube if we left it in this bowl? What is your prediction?” “Will it stay the same?” “What will be different?” Children made predictions and she wrote them down on a chart, “After lunch, we’ll check our ice cube and find out what happened.”

Planning Learning Opportunities:

Ms. Brown presented children with opportunities to explore properties and characteristics of water, including changes in water due to changes in temperature such as freezing and melting. In this particular example, Ms. Brown guides children in exploring the phenomena of melting through a series of scientific practices. The children *observe* the ice and *record* their observations (i.e., “What does it feel like?” “What do you know about ice?”). Next, they *predict* changes to the ice. Ms. Brown asks questions to elicit predictions, and records their predictions. Finally, they *observe* the ice at a later time to *check* their predictions. This experience can be expanded into more investigations of melting, for example, by varying the size of the ice cube or the location of the bowl (indoor or outdoor). Children may also investigate how water can turn back into ice.

Interactions and Strategies:

Encourage children to make predictions. While observations involve using the senses to gain information about objects and phenomena, predictions are about making a reasonable guess or estimation of what is going to happen, on the basis of previous evidence, and pre-existing knowledge. For example, children can predict whether an object will sink or float in water, where a car will stop after rolling down a ramp, or what is going to happen after planting the sunflower seeds. They may not be accurate, but they can make a reasonable guess based on previous experiences and knowledge of objects. The more experiences children have with phenomena or objects, the more likely they are to make reasonable predictions.

- **Introduce children to the idea of predicting.** Children need to be introduced to the process of making a prediction. Gelman and others (2010) used the following reasoning with children: “Prediction is kind of like a guess: When we predict, we do not know the answer or what is definitely going to happen, but we usually have some information that helps to make a prediction, to make a guess.”³⁰
- **Encourage children to first *predict* and then *check*:** When children first predict and then check their predictions with actions, they learn to compare what actually happens with what they thought would happen rather than merely accepting facts without thinking about them.³¹ “Now let’s release the car down the ramp and check how far it got.” “What happened when you dropped the block in the water?” By testing and verifying their predictions, children gain new information that informs their future predictions. Some discrepancies between what children have predicted and what actually happens may lead to further inquiry, and this is the beauty and fun of science.
- **Elicit children’s predictions by asking questions.** Teachers can ask children questions to encourage them to make predictions: “What do you think will happen if we mix the water with flour? What is your prediction?” “Will the flour still look the same?” “What would it feel like?”
- **Record children’s predictions.** Recording children’s predictions facilitates the comparison of what they predicted with what actually happened. Writing down children’s predictions conveys to children that their predictions are valuable, and that documentation is integral to the process of scientific inquiry. A small or large group activity in which each child expresses her prediction, and the teacher records it on a chart, illustrates for children that not all predictions are the same, and every child can have her own prediction.
- **Remind children that predictions do not have to be right.** Children need to be encouraged to make a prediction, and to not be afraid of “being wrong.” All predictions are valuable and should be respected as children’s thinking about the question. With more experiences predicting and checking, they feel more comfortable with the process, and may spontaneously suggest ways to test their predictions. In a preschool environment with a culture of inquiry, children feel comfortable to make predictions and express their ideas. The teacher communicates to them that predictions are like estimations, and do not have to be right, and that with more data or information their predictions may change. Remember that the goal is to support children’s scientific thinking. They will come up with hypotheses and ideas that teachers know are incorrect. But the important thing is to support their thinking, not provide them with the correct answer.

Facilitate children’s ability to make inferences and draw conclusions. Both predicting and inferring are processes of reasoning that rely on observable information.

In predicting, children guess what will happen next, and then check their prediction. In inferring and drawing conclusions, children observe a given situation, and make an assumption about what has caused it to happen based on previous experience, even though they can't observe the cause directly. For example, when noticing that the grass is wet, a child infers that it was raining before they went outside. Children constantly try to make meaning of their observations. From a very young age, they learn to use their observations to make inferences. For example, a child notices that the plant is wilting, and infers that it needs water. The teacher can help children draw connections to previous experiences, "You remember when." or "I remember that the last time we..."

- **Use everyday observations to model inferring.** Everyday interactions and observations provide many opportunities for making inferences. For example, while outside, the sky turns dark, and the teacher says, "It looks like it going to be raining soon." During mealtime, the teacher can lead the children to make a similar inference, for example, drawing the children's attention to the steam rising from the soup, asking what they notice and what it might mean, so leading them to infer that the steam they can see indicates the soup is hot.
- **Encourage children to explain the reasoning behind their inferences.** When children make inferences and draw conclusions, encourage them to explain their reasoning: "What makes you think the plant needs some water?" "What tells us that it is probably cold outside?"

Substrand 2.0 Documentation and Communication

Integral to children's processes of scientific inquiry is their communication about what they are doing and thinking. As illustrated by the vignettes in the previous section, experiences of observation and investigations provide children with many opportunities to use language to describe, explain, and reflect on their work. They describe their observations using their own words, explain the reasoning for their sorting and classifications, discuss similarities and differences, make predictions, and describe and record findings. Children also communicate and reflect on their experiences through the documentation of their work. They may use drawings, words, photos, charts, and other forms of communication to record and document information. Such experiences build children's language and communication skills. Through conversations with adults and peers, children expand their vocabulary, and learn to share their thoughts and to listen to others. Talking and reflecting on their experiences also help children think more deeply about their work, and facilitate their understanding of science content knowledge.

Vignette: Making Water Flow Down

Maya fills up a cup with water, and pours the water into the opening of a long clear tube, watching the water going down the tube and coming out at the other end. She repeats it

over and over. Seth is holding his hands at the other end of the tube, touching the water that is coming out. Maya tries to pour all the water inside the tube, but a lot of water spills down its sides. Maya asks, "How can I get more water inside?" Ms. Ruben replies, "What do you think you can use to keep the water in the tube?" Maya sees others using a funnel, and attaches a funnel to the top end of the clear tube. Now she can pour more water into the funnel, and Seth gets excited as more water is slowly coming out at the other end. Then, Seth puts a bucket right underneath the bottom of the tube. Maya and Seth pour water into the funnel and watch the water flowing down the clear tube and filling up the bucket. "More, more water!" He tells Maya. "Let's fill it all the way up to here." He points to the top of the bucket. "Ms. Ruben, look! We are filling the bucket with the tube." Ms. Ruben says, "Tell me how you do it." Maya explains, "We put water in this hole, and then the water goes in here and down to the bucket." Ms. Ruben says, "You used the tube with a funnel to make the water fill up the bucket. What an interesting way to make the water flow down. What do you predict will happen if the tube is held this way (she holds it horizontally)? (Pause) Will the water still flow through the tube?"

Teachable Moment:

Ms. Ruben observes the children as they play and explore with water and materials at the water table. She is waiting for the right moment to intervene, and asks questions to facilitate problem-solving (i.e., "What do you think you can use to keep the water in the tube?"), and to engage children in talking and reflecting on their experience of making the water flow down the tube. She asks questions to encourage them to describe and explain what they were doing, and to predict what might happen if the position of the tube is changed. She wants the children to think about how water moves, and what they can do to affect its movement. The teacher is also planning ahead for the next time the children will be at the water table, and adds tubes of different sizes and measuring cups to facilitate children's work.

Interactions and Strategies:

The following strategies provide suggestions as to how teachers can help children develop their documentation and communication skills.

Ask open ended questions. One effective way to encourage children to think and talk about their ideas is to present them with open ended questions. As opposed to questions with "yes" or "no" answers (e.g., "Is it black?"), or questions with one defined answer (e.g., "What color is it?"), open ended questions can have a multitude of answers (e.g. "What will happen if..." "How did that happen?" "What kinds of things do you think look like that?") The goal is to challenge children's thinking, and encourage children to put forward their ideas and thoughts, not necessarily give the answer the teacher is looking for. Questioning also supports language acquisition by embedding new words into open-ended questions. Children who may not be ready to respond, or who may be developing English language skills, would benefit from teachers' modeling of possible responses and the teacher's expansion of children's initial observations.

- **Questions to encourage children to share their observations:** “What did you notice when you observed the snail?” “What happened to the ice cube when we left it outside?”
- **Questions to facilitate children’s problem-solving and investigations:** “What do you think we could do to make the ball roll down in this direction?” “Can you think of another way to make the clay softer?” “How could we find out what worms like to eat?”
- **Questions to elicit children’s predictions and explanations:** “Why do you think this plant grew and this one did not?” “Why do you think the pill bug turned its body into a ball shape?” “What do you think would happen if you mix salt with water?”

Engage children in collaborative discussions. A powerful way to encourage children to discuss their ideas, share their experiences, and listen to others’ perspectives is through small and large group discussions. While children interact with adults and peers, they learn to express their ideas and thoughts in a way that others can understand them. The meaning of concepts is co-constructed through effective adult-child interactions and scaffolding. Teachers may ask reflective questions (e.g., “What do you think will happen next?”), encourage children to describe their observations, and challenge them to give reasons and explanations for their ideas. Discussions are richer when children refer to concrete examples, including children’s representations, documentations, and the actual objects and materials they discuss while sharing their experiences. This is particularly relevant for children who are English learners who benefit from visual cues as they try to give meanings to words. Concrete experiences and visual cues are useful for many children with disabilities as well. In leading the discussion, the teacher asks questions to engage children in collaborative discussion involving observation, prediction, and explanation: “Leah, what did you do to make your tower stable?” “Kim, how did you get the water to flow through the tube?” “Which ball do you think will roll farthest when we let go of it at the top of the slide?” In group discussions, children learn to take turns, and understand that other children in the group may have a different idea than theirs.

Vignette: A Group Book about Growing Plants

Emilia’s favorite book in the reading area is one that was created by Ms. Moreno and the whole group to document the growth of their plant. She is pointing to the photos in the book (taken by Ms. Moreno to document the process) and to children’s drawings and quotes while telling the story out loud, “First we had to buy seeds (points to a photo of the seeds packet on the first page), then we put the soil, and then we put the seeds inside the dirt...” Emilia continues with more details while looking at the pictures in the book, about how they put the pot in the sun, watered it, and measured its growth, “Here

it was one inch, and here it was bigger, and here it was very tall and it has many leaves.”

Teachable Moment:

A book with photos and children’s drawings makes the process of growth visible. It allows children to re-visit the experience, and to notice changes in the plant over time. Creating a class book not only facilitates science learning, but also becomes a focus of discussion and storytelling, and supports the development of language and literacy. It is also useful for children new to the program and for English learners as they revisit an experience and recall the terms used and express their memories in either or both their home language and English.

Interactions and Strategies:

Encourage children to record observations and document investigations and findings. Recording and documenting facilitates children’s understanding of the content they investigate, and provides a tool for communication. The entries in journals are conceptual representations that are important for the child’s understanding of scientific concepts and of print. In recording and transcribing the child’s own words, teachers validate the child’s ideas while showing the importance of writing. It develops children’s understanding of symbolic representations, as they begin to use drawings and print to record information.

- **Promote the use of different forms of communication to record and document information.** Children may create a representation by drawing, making a three dimensional model, or taking a photo. They may also participate in recording information on a group chart, or by keeping logs of data. The use of different forms of documentation provides children with multiple ways to process information and express their ideas. Recording and communicating information through drawings, models, and actions allow children to express themselves using non-verbal means of communication. This is particularly relevant for children who are English learners and who are still developing their confidence and ability to express themselves in English. They may benefit from recording their ideas and understanding non-verbally, and then describe it in their home language to teachers who share the child’s home language, or to parents at home. Children with speech or language delays also benefit from expressing themselves using non-verbal means of communication. Children with motor delays or other disabilities may appreciate dictating their drawing ideas or “directing” the teacher to photograph something for their journal.
- **Guide the recording process.** Encourage children to note details and create an accurate representation, “What colors will you use for the caterpillar? (Pause) Let’s look and see what colors the caterpillar is and find those color crayons.” “How many blocks are in your tall tower?” Creating a representation of an object

or event is a skill that develops over time. Scaffold children's recordings with sensitive guidance and in a nonjudgmental way. Remember, it is the process that is important, not the final product.³²

- **Encourage children to describe their representations, and write down their words.** Children's descriptions of their drawings, models, or photos will reveal their conceptions and understanding of the object or event they recorded. For example, the teacher said to the child, "Tell me about your drawing (or model or photo)," and the child explained, "This is the snail, and this is the leaf, and this line is how the snail got from here all the way to the leaf." The teacher wrote down what the child said next to his representation. Children might use any means of communication, including home language, sign language and communication devices, to describe their representations. Having an adult to encourage, prompt and scaffold the use of expressive language in English and in the child's home language whenever possible, would support the child's overall development of scientific knowledge and language skills.
- **Invite children to record collaboratively, using charts, graphs, or models.** Some forms of documentation such as journal entries and drawings are more appropriate for individual work, while others can become a group collaboration of data collection and recording activity, guided by the teacher. For example, children recorded on a chart whether they predict lemon has seeds inside, by writing down their name (or other symbol), either under the "Yes" column or the "No" column. During group time, the teacher invited the children to count the number of names under each column, and together they created a bar graph that represented how many children think lemon has seeds inside and how many children do not think so. In the following small group activity, children investigated what's inside a lemon.

Bringing It All Together: Scientific Inquiry

Applying Inquiry Skills: Exploring a Variety of Squashes

Ms. Linda had noticed how engaged children were observing the pumpkin in the room, and looked for ways to extend their explorations. She remembered that whenever she gave her children opportunities to compare things, they learned more about each thing. She brought in several more pumpkins and other squashes varying in size, shape, color and texture (e.g., acorn squash, butternut squash, gold nugget, sweet dumpling, zucchini, and yellow squash). During group time, she showed them the variety of squashes and pumpkins, including the pumpkin they already had in the room, and asked them questions to engage their interest, "I brought more pumpkins and many other squashes for us to explore. Have you seen any of these squashes before?" "Where did you see them?" Some children talked about their visit to the pumpkin patch. Others talked about how they made zucchini muffins with their teacher (last month). Ms.

Linda wanted to draw the children’s attention to the characteristics of the different squashes, “Look at all of these squashes. What do you notice about them? What colors do you see? How are they alike? How are they different?” These types of questions generated a rich discussion of comparing and contrasting. Children shared their observations, “These are really big, and this one looks like a baby pumpkin.” “This one is long and this one is more like a pumpkin.” “The pumpkins are orange and big, but these (pointing to other squashes) are orange, and green and yellow.” Ms. Linda sometimes rephrased their observations, “So you observed that all the pumpkins are orange, but the other squashes have many different colors.” Or, “So you noticed that some are big and some are small.” She told the children that the squashes will be available for more observations and explorations during their choice time.

The squashes in the room immediately generated children’s spontaneous explorations. Children observed the squashes and commented about their color, size, shape and texture, “What a small pumpkin. It is still a baby,” “This one is smooth and this one is not” Some children started sorting them by color, or by size. “Let’s put the big ones here and all the small ones here.” Ms. Linda observed the children exploring the squashes, and posed questions or made comments along the way, “So here you put all the orange squashes, and here you put all the green ones. What other ways can we sort the squashes?” The children who put all the orange squashes together started ordering them by size. They explained “This pumpkin is the biggest, this one is medium, and this one is the baby.” Ms. Linda pointed to the larger two pumpkins and said, “I wonder which one is really bigger, this pumpkin or this pumpkin. How can we find out?” The children pointed to the ruler and measuring tape in the room. Ms. Linda helped them measure the circumference of both pumpkins using a measuring tape, to find out which one is larger. One of the children also held the pumpkin in his hand and said “This one is also more heavy.” Ms. Linda asked other children to hold each pumpkin and tell which one feels heavier. Then, they brought over the scale and measured the weight of each pumpkin to determine which is heavier.

On a different day, Ms. Linda wanted them to focus on the inside. She invited them to predict what is on the inside of a pumpkin. Children came up with different predictions, for example, “seeds, “orange stuff”, “juice.” Ms. Linda recorded their predictions, and asked, “How do you think we can find out?” One of the children said, “Let’s cut it and see what’s inside.” Children observed the inside of a pumpkin. They were mostly fascinated with the great number of seeds inside, “Wow, many seeds.” Ms. Linda asked, “How many seeds do you estimate it has inside? What is your estimation? How many do you guess?” Children came up with a wide range, from twenty to one million. Ms. Linda told them that the seeds would be available for their explorations. “You may try to count the seeds to find out how many seeds are inside the pumpkin.” “The children recorded their observations of the inside of the pumpkins through drawings and dictations. During group time, Ms. Linda invited the children to share their observations of the inside of the pumpkin with the group. She engaged them in a discussion about how the inside of a pumpkin is similar or different from the outside. They also continued

estimating the number of seeds inside the pumpkin. Ms. Linda then pointed to one of the other squashes around the room and asked, "I wonder what we will find inside this squash if we cut it open? What do you predict?" One of the children said, "We are going to find many seeds." Ms. Linda asked, "Why do you think so?" and the child replied, "Because it looks like a small pumpkin, so maybe it is also has the same inside." Ms. Linda told the group, "During choice time, we are going to explore what is inside some of our squashes.

The teacher provided children with multiple experiences of observing and investigating characteristics of squashes. Children had varied opportunities to explore the outside and inside of squashes, while developing their inquiry skills of observing closely, describing, predicting and checking, recording, and discussing their observations. Exploring squashes also provided the context for building children's language skills and expanding their vocabulary as they describe, compare and predict the different attributes of squashes (e.g., words to describe color, size, or texture). Furthermore, it also involved the application of different mathematical skills including sorting, ordering, measuring, estimating and counting. By providing children different squashes varying in color, size, shape and texture, the teacher introduced children to the concept of variation and diversity in living things. The zucchini, for example, looks very different from the pumpkin, yet both are called "squash." It provides an opportunity to challenge children's thinking about ways that they are the same and ways that they are different. Sorting squashes into groups based on similarities and differences provided the foundation of future understanding of scientific classification.

Engaging Families

- **Communicate to parents their important role in supporting children's curiosity and the development of scientific knowledge.** Children have opportunities to engage with science all around them through the course of their daily life. They ask "why" questions and seek explanations about objects and events in their environment. They develop intuitive ideas about the world through informal interactions with family members, through cultural practices, daily activities, books and media sources. Teachers can help parents understand the importance of nurturing children's expressions of curiosity and discuss ways to engage children in conversations and activities that enhance science learning. Parents may not realize, but just by interacting with children in everyday routine activities, as in preparing dinner, gardening, visiting the nearby park, dinner table conversations, and bedtime reading, children learn about topics relevant to science. For instance, as they are preparing dinner, taking a minute to wonder out loud to their child "I wonder if there are going to be seeds in this zucchini" will invite his or her prediction and then surprise at what is found when it is cut open.

Research Highlight

There is a growing recognition that out of school activities including family social activities, dinner table conversations, access to books, and visits to nearby parks, museums, zoos or libraries have a cumulative effect on children's science learning.³³ Parents, adult caregivers and siblings can play critical role in enhancing children's learning. Studies of dinner table conversations, visits to the zoo, and other everyday activities have uncovered rich conversations on a variety of scientific topics.³⁴ Families of all backgrounds engage with children in everyday conversations about a range of topics related to science. Through these kinds of interactions, children engage in questioning, explaining, and making predictions.³⁵ Evidence indicates that parents' involvement and explanations to children during a museum visit or while watching TV (e.g., a session of Sesame Street) enhance children's learning experience and makes it more beneficial and productive for children.^{36 37}

- **Share with parents your approach to science and how you support children's development of inquiry skills.** Inform parents and other caregivers about children's current focus of inquiry and the skills you help children develop while engaged in processes of inquiry. The teacher may use different ways to communicate with parents, including parents' bulletin, newsletter, and parents' nights. Communicating the objectives of children's current focus of explorations is vital to engaging parents and other family members as partners in supporting children's development of scientific skills and knowledge. Many adults may not be aware that they are engaging in scientific inquiry as they are making observations, predictions and inferences on a daily basis. Help family members understand these concepts along with the value of asking questions. Most scientific inquiries start with a question. Share with families the question the children are working on, explain your objectives and why is it important.
- **Learn about cultural beliefs and practices.** Talk with family members and learn about their cultures and children's experiences. In some cultures, children are encouraged to question and speak up, while in other cultures they tend to be silent observers, and are expected to listen rather than question. Teachers should know the families, and respect cultural differences in the way children display questioning and exploring behaviors. This knowledge will help engaging families appropriately and respectfully.

Questions for Reflection

1. What elements of your program's physical environment could you change or enhance to facilitate children's experiences of scientific inquiry?

2. How would you incorporate practices of scientific inquiry (e.g., observing, predicting, comparing and measuring) to engage children in learning about topics typically in your curriculum (e.g., autumn, fruits and vegetables, rocks)?
3. How would you facilitate children's thinking skills through everyday observations and interactions?
4. What are different ways you can encourage collaboration among children to facilitate scientific investigations?
5. What sorts of strategies can you use when engaging in scientific explorations to develop children's language and communication skills?
6. What is a current topic of interest of your group? How can you help them explore it directly through hands-on observations and investigations? What questions would you like them to think about?

Strand: Physical Sciences

Young children's inquiry in physical science involves the active exploration of non-living objects and materials and of physical events in their everyday environment. When children build with blocks, play with different balls, push, or slide objects of different kinds, play with water, sand, clay, and other objects in the preschool environment, they explore materials in different ways, and begin to form ideas about their physical properties. They manipulate objects, act on them and observe what happens. They may try things over and over to see if the same thing happens again. Through such exploratory interactions with objects and solid and non-solid materials, children can learn about cause-effect relationships, the physical properties of objects and materials (e.g., size, shape, rigidity, texture), and about changes and transformations of objects and materials. For example, when building with various kinds of blocks, children may learn about their size, shape, and about characteristics of their materials (e.g., wood, foam, or plastic). They may discover that the big cardboard blocks should be used at the bottom of a tower and the small unit blocks on top, in order to create a strong and stable tower. When playing at the water table, they experience how water flows down, and takes the shape of its container.

With teachers' guidance, children's everyday play can become rich, hands-on inquiry experiences of main concepts in physical science. Teachers provide children with materials to broaden their investigation, encourage children to try out their ideas, even those that are wrong, and ask questions to challenge their thinking and focus their attention on key science concepts they investigate: "What can you do to make the bridge higher?" "What can we do to make the paper softer?" "Why is the ball not rolling down in this direction?" Interactions of this kind provide children with opportunities to extend their experimentations with objects, to notice patterns of cause and effect, to reason and think more deeply about the phenomena they observe and to use language to describe, explain, and reflect on their work.

The following section provides practical strategies to engage children in rich, playful explorations of the physical world.

Substrand 1.0 Properties and Characteristics of Non-living Objects and Materials

Children’s natural interest to examine objects and act on them leads them to discover with their senses the physical properties of objects such as size, shape, weight, texture, sound, flexibility and rigidity. The teacher has a significant role in providing children with opportunities to notice and explore the inherent properties of solid materials they encounter daily such as wood, metal, rubber, foam, or clay, and of water and other liquids. Teachers encourage children to observe objects closely, and in some cases, to use simple observation and measurement tools such as magnifiers and measuring devices to extend their observations of objects and materials. The teacher invites children to sort, classify, and reflect on the similarities and differences of objects and materials, to describe the characteristics of objects and materials in greater detail, and to think about their function.

The preschool foundations in science separate aspects related to properties and characteristics of objects and materials (Substrand 1.0) from aspects related to changes in objects and materials (Substrand 2.0). But in reality these aspects of physical science are interrelated. While acting on objects and experimenting with different materials, children notice changes in their shape, size, form or substance. Physical properties of objects and materials have a direct effect on how objects move, what they sound like when tapped, and how materials change and behave when squished, wet, heated, or mixed together. Children learn about the physical properties of objects and materials while manipulating objects and investigating how they move and change. The following strategies, as well as the ones in the next section (Substrand 2.0 Changes in Non-living Objects and Materials), will broaden and deepen children’s awareness and understanding of properties and characteristics of objects and materials.

Vignette: Building a Tall Tower

Ramon is busy building in the block area. He places two flat rectangle blocks one on top of the other. On top of the block, he puts two cylinders, and spreads them apart. He then looks for another rectangle block. He notices that the rectangle block he picked is not big enough to cover both cylinders. Instead, he grabs a bigger, flat rectangle block, and places it gently on top of the two cylinders, trying to balance the structure, moving the rectangle block more to the right. Then, on top of it, he stacks smaller rectangle blocks vertically, one on top of the other, until the structure begins to lose balance. He takes away the last rectangle block that he added on top, and tries to balance it again. He gently adds to the top small foam blocks one on top of the other, and a small triangle block at the very top. As he sits back and observes his tower, the teacher tells him, “Ramon, you built a really tall building. Tell me about your building. How did you build it?”

What kind of blocks did you use?” Ramon points to the rectangle blocks, saying the shape name in English. The teacher expands Ramon’s description of the different parts of the tower, “Yes, you chose rectangles made of wood and rectangles made of foam.” Then she adds, “I also noticed that you were trying to make it strong. You put heavy, wood blocks at the bottom, and the small foam blocks at the top.” She points to a large foam block on the floor and asks, “What do you think would happen if we put this block at the bottom?”

Teachable Moment:

The teacher is observing Ramon’s actions very closely, and acknowledges his play with a smile, but does not interfere while he is engaged in building the tower. She notices that he is trying to choose blocks that are likely to balance, and is keeping the tower from falling down. Ramon demonstrates an understanding of balance and stability, and of characteristics of different materials.³⁸ When it is clear that Ramon is done building the tower, she engages him in a conversation about his tower. She invites him to notice, share and reflect on his experience by asking guiding questions. Ramon is learning English. He does not yet have the confidence to talk in a big group, and his vocabulary is very limited. This type of one-on-one interaction with the teacher provides him with an opportunity to express himself, and to build his vocabulary, particularly words to describe shapes, different materials, and the position of objects (e.g., bottom, top, above, below). It also sends the message that the teacher values and is interested in what he is doing.

Interactions and Strategies:

The following interactions and strategies promote children’s understanding of the properties and characteristics of non-living objects and materials.

Provide children with opportunities to explore a variety of objects and materials in their daily environment. Children learn about the properties and characteristics of objects through direct hands-on manipulation of real things. They need lots of experiences with a variety of objects made of different materials, and with different substances and liquids. Typical objects and materials in the preschool environment such as moving objects, water, clay, blocks and musical instruments can be used to explore and study properties of objects and materials.

The teacher can facilitate play and experimentation with such materials to allow all children, including those with special needs, to investigate in depth concepts of physical science, and to discover properties of objects and materials in new and different ways. Children with motor impairments may need assistance from an adult or peer to manipulate objects. Consultations with specialists may be helpful to find materials that allow for discovery and that can easily be used by children with physical disabilities or other special needs.

Children can explore the properties and characteristics of materials in different areas of the preschool environment. A collection of different fabrics and household objects made of different materials (e.g., wood, metal, plastic) in the dramatic-play area, and different kinds of papers (e.g., construction, tissue, wax paper) in the art area, enrich children's experiences with different materials. During lunch time or a cooking activity, young children can be encouraged to describe how various liquids such as water, milk, juice or oil, and various kinds of food differ in taste, smell, texture and so on. By having wood, plastic, cardboard, foam and plastic blocks at the block corner, children experience similarities and differences in how different materials behave, and how it affects the strength and stability of their constructions. Similarly, by playing with a variety of balls (e.g., tennis, soccer, billiard), children experience how some balls bounce higher, or go farther, and with teacher's guidance, they may begin to make predictions and draw conclusions related to the properties of the balls.³⁹

Engage children in projects that allow them to explore, experiment, and invent with objects and materials for an extended period of time. Children need extended opportunities to explore and investigate concepts of physical science. They need time to experience, repeat and revisit a variety of activities with the materials to deepen their understanding of a concept. The more experiences children have with the same objects and materials, the more likely they are to become aware and reason about their properties, and be creative in their experimentation with objects. A project of exploring water or building structures can last for weeks and even months.⁴⁰ Long term projects allow children a deep exploration of the phenomena they investigate, and result in effective and powerful learning. This may necessitate designating some space to keep projects between explorations.

In some cases, the teacher needs to add some specific tools and materials to facilitate children's explorations of certain materials. For example, to help children explore how water flows, the teacher may need to add to the water table: containers, tubes, basters, funnels and droppers. Similarly, to investigate the properties of sand, children may need containers of different sizes, funnels, plastic bottles, magnifiers, and access to water.

Prepare yourself, and be purposeful about the scientific concepts children will investigate while engaged with objects and materials. Ask yourself "What scientific concept(s) will children explore while engaged in this activity or project?" Have a clear set of goals for children's exploration projects. When teachers have a basic understanding of the scientific phenomena embedded in children's activities, they are more likely to be thoughtful and selective about the materials they provide children, and to guide children towards exploring and thinking about concepts of physical science. To have clear goals for children's scientific explorations, the teacher needs to prepare herself and acquire background knowledge about the topic. For example, in preparation for a project that involves explorations of different materials, teachers may need to read and think about the different materials in the children's environment (e.g., wood, metal, plastic, water, juice, paper, glass, fabrics), and how they react in different ways. The

teacher may want to gain basic knowledge about the three different forms that materials can take (solids, liquids, and gases), and about how materials change. Some changes in materials such as freezing and melting of water, are reversible (physical changes), and others are irreversible, as in cooking (chemical change). The teacher should not become an expert on these topics, or introduce theoretical information to young children, but have a basic understanding of the scientific phenomena children investigate in order to support and challenge children through their explorations. Please refer to the Teacher Resources section for more informational sources.

Research Highlight: Children’s Misconceptions in Science

Children bring to science many ideas about how things work. These intuitive understandings or naïve theories that children have constructed often conflict with what is known to be scientifically correct. Children hold misconceptions about different topics of science including forces, changes of matter, light, sound and phenomena of earth (Landry and Forman, 1999). For example, children believe that water disappears when it evaporates or that rain occurs when clouds are shaken. Children’s misconceptions are intuitively reasonable from the child’s perspective, and are used by children to explain the reasoning behind physical events. Thus, the teacher cannot ignore children’s misconceptions, or simply ask the child to abandon them in favor of scientific explanations. It is important to know how these conceptions differ from the scientific explanation, and why children construct these ideas. The teacher’s role is to guide children as they confront challenging evidence, and engage them in experiences that gradually modify their misconceptions. Teachers’ awareness and understanding of children’s misconceptions is an important entry point for effective instruction of science. The resources section includes references with lists of children’s common misconceptions.

Experiment with materials and objects before offering them to children. It is important that the teachers themselves experiment with the materials children will use, and with objects children will investigate prior to offering them to children. By experimenting with objects directly, teachers can learn first-hand about their characteristics, and how they behave. For example, prior to introducing children to a variety of materials to explore sound, teachers need to experiment with actions and materials to produce different sounds, and engage in some of the science experiences and concepts children are likely to encounter in their explorations. Similarly, before teachers introduce children to a variety of building materials and tools, they need to work with the tools, and learn about the form and function of each tool. It will prepare teachers in guiding children’s investigations, and will help them anticipate children’s questions, challenges and interesting ideas for investigation.⁴¹

Invite children to observe and describe the characteristics and physical properties of the objects and materials they investigate. Create opportunities for children to observe objects carefully. Encourage them to touch or hold the object, when possible, and to note specific details about the inside and outside of the object. Children may use tools such as a magnifier, a ruler, or a scale to observe and study it more closely.

- **Encourage children to describe their observations.** Talk with children and ask questions to guide their observations. “What do you notice about this maraca?” “What does it sound like when you shake it?” “What does this wagon look like?” “How is it different?” “What does this blanket feel like?” Objects can be hard, soft, rough, smooth, heavy, light, springy, firm, shiny, dull, and so on. It is important for teachers to use these terms themselves throughout the course of their interactions with objects, to provide children with the vocabulary to make detailed observations. Encourage all children to participate, and do not judge them for accuracy. When children describe their observation in a group, you may document their observations on a chart and then read aloud what everyone observed about the object. It gives children an opportunity to note and listen again to the different attributes of the object, and it reinforces the meaning of the words they hear. As children describe the properties of objects they observe, they learn the vocabulary associated with the specific concept they investigate (e.g., rolling, slide, fast, slow), develop their communication skills, and learn to participate in collaborative discussions. Children vary in their levels of observation, language and observational skills. Some children may not have the vocabulary to describe what they see, but may use their bodies and actions instead. They may also represent their observations through drawings.
- **Invite children to draw a representation of their observation.** Children may document what they observe by drawing a representation of the observed object or event. This requires them to observe closely, and to notice details: “How big will you make the ball?” “How many wheels does this wagon have?” “Which color would you use to draw it?” For a child who is not physically able to draw, due to a disability, provide an option such as holding the object on her wheelchair tray while the other children draw or taking photographs from various angles for her to use as her observation.

Vignette: What’s in the Brown Bag?

It is Emma’s turn today to bring an object from home, hidden in a brown bag, and during group time share three clues about it. The rest of the children try to identify what’s inside the bag without looking inside. Emma shares with the group, “It is red, it is rectangle, and has holes on one side.” The children make guesses, “Is it a piece from a game? “Is it a car?” “Is it a box?” Emma shook her head “no”. The teacher makes a suggestion, “Let’s ask Emma some questions about her object. Emma, can you please feel the object with your hand and tell us whether it is hard or soft?” Emma touches the bag and

answers, “It is hard.” Jamie asks “Is it heavy?” and Emma says, “No, it is not heavy.” Jamie asks if he can hold the bag and Emma lets him hold it and feel its weight. Julia asks, “Is it something you can eat?” Emma says, “You cannot eat it. You can only play it with your mouth, and it makes music.” The teacher clarifies, “So it is a musical instrument?” Emma says, “Yes.” Ron asks, “Is it a flute? What other instruments do we play with our mouth?” The teacher asks Emma, “Can you turn around and play it with your mouth? We’ll listen to the sounds it makes and try to guess what instrument it is.”

Teachable Moment:

This routine activity encourages children to notice specific characteristics and properties of objects and use words to describe them. Because the teacher has given adults some guidance in helping their children choose the hidden object and develop good clues, Emma not only brought an appropriate kind of object but also provided useful clues. The teacher facilitated the conversation, helping children ask questions about different characteristics of the objects (e.g., “Is it hard, heavy, or edible?”). This type of activity not only encourages children to think about the characteristics of objects and materials, but also provides a natural opportunity to expand children’s vocabulary, and to develop their communication skills.

Interactions and Strategies:

Provide children with opportunities to build and experiment with simple machines. Simple machines refer to six mechanical devices that make it easier to move or lift something. These include levers, wheel on axle, pulley, incline plane, wedge and screw. Simple machines are elementary building blocks of many complicated machines that we use daily. For example, wheel on axle is used in cars, bicycles, ferry wheels, door knobs, clocks, steering wheels, even in a toilet paper holder. Encourage children to find examples of wheels on axles and other simple machines in the preschool and their home environment. Children can build their own simple machines using blocks and other materials. For example, they can build an inclined plane (a ramp), using a board or a long block, and use it for running cars or other rolling objects. Teachers can also help children set up a lever simple machine in the block area, and have children experiment with lifting loads of different weights. Children can place objects of different weights (very heavy, little heavy or light) on one side of the lever, and discover when it takes more effort to push down the other side to lift the load. Experiences of building and experimenting with inclined planes, levers, or wheeled objects provide children with concrete experience of principles related to forces and the motion of objects.

Provide children with opportunities to investigate tools and machines.

Children encounter different tools in their daily environment. Different garden tools, kitchen tools or building tools are different in shape, size, materials they are made of, and the function they serve. Encourage children to observe tools and machines closely,

describe what they look like, inside and outside, and the different parts of their structure. The teacher may set out some old machines such as a radio, a telephone, a camera, or a keyboard, and let children explore their insides and outsides, and take them apart. Children should also have opportunities to operate and use tools and machines. They will learn best about their function by using them, and operating them themselves, whenever possible. Children with motor impairments, visual impairments, or other disabilities may need assistance from adults or peers while operating the tools.

Encourage children to think about the form and function of tools and machines.

Young children can reason about the relation between what objects look like, and what they do. Some objects are made very sharp because they cut things, others have wheels to help us transport things from one place to another. Talk with children about the physical characteristics of different tools, what they are used for, and what materials they are made of. This could lead to an investigation about whether different tools could still serve the same function if built with different materials.

Plan opportunities for children to sort and classify objects and materials, and reflect on similarities and differences. An effective way to extend children's awareness and understanding of different materials is by engaging them in classifying activities. Classification of objects into groups requires children to pay close attention to properties of objects, and to identify similarities and differences among objects and materials. Children may classify objects and materials with similar physical properties, ones they can see, feel, or hear. For example, sorting balls into balls that are soft and balls that are rigid, balls that are smooth and balls that are rough, sorting different containers based on whether they are opaque or transparent. They can also explore different materials such as feathers, woodchips, pennies, Styrofoam pieces, and sort them by different criteria. For example, "Which materials are rigid and which ones are soft?"

Children can also classify or categorize objects that belong together because they have a similar function (e.g., kitchen tools, types of clocks). They may observe objects that belong to the same category (e.g., bicycle, car, motorcycle, wagon), and discuss in what ways they are similar or different: "What is similar about these objects?" "What is different?" "What materials are they made of?" Classification of common objects and reflecting on their similarities and differences increase children's understanding of the characteristics of objects, and provide a foundation for later introduction of more abstract ideas of physics.

Vignette: Exploring Solid Materials

Over a period of several weeks, Ms. Yen introduced children to solid materials, feathers, woodchips, pennies, Styrofoam pieces, marbles, and eggshells. Once a material was introduced, she encouraged children to observe it closely using their senses, and to describe what it looks like, how it feels, or how it smells. Then she would leave it for

children's free exploration in the discovery center. The center also included tools such as magnifiers, trays, cups, and a balance scale to expand their observations of the materials. Children enjoyed exploring these materials, especially finding out how they are similar or different from each other. For example, one question they investigated was, "Which materials are rigid and which ones are soft?" Children tried pressing, poking, twisting, tearing and breaking the different materials, and came to their conclusions: "The pennies are hard" "The feathers are very soft. You can bend them, and they do not break" "The eggshell breaks when you press on it, and these (points to Styrofoam pieces) are soft, and you can break them like this (the child demonstrates how they break easily)." "The woodchips are very hard too." Ms. Yen suggested that they record their findings on a chart. She created a group chart divided in two; one side said "rigid" and the other side said "soft." The children recorded their findings on the chart, by gluing a sample of each material either under "rigid" or "soft." Another question they investigated was, "Which material is heavier?" Ms. Yen noticed that while children explored the materials in the discovery center, they put materials on the balance scale and observed what happened. She reminded children, "We use the balance scale to determine which of two things is heavier." She filled up one cup with Styrofoam pieces and another cup with pennies, and asked children to hold the two cups and predict which one is heavier. After children had an opportunity to feel with their hands and predict which material feels heavier, she encouraged them to put the cups on the balance scale, one on each side of the scale, and find out which side goes down. She reminded children that the cup with the heavier material makes the scale go down. Children repeated the process with different materials (e.g., pennies and woodchips, feathers and marbles). They would hold the two filled cups and predict which is heavier, then place the cups on the balance scale and check their prediction.

Planning Learning Opportunities:

To broaden children's experiences with materials, Ms. Yen decided to invite children to explore various materials. She was looking for materials that are safe for children to experience directly with their hands, and are different in texture, weight, rigidity, color and shape. Exploring how different materials are similar or different with respect to different properties (e.g., rigidity, weight) was an interesting and engaging experience for children. Children learned about properties of materials through a process of active inquiry. The teacher encouraged children to observe objects closely, identify similarities and differences among materials, sort and classify, make predictions, check evidence, and record their findings.

Research Highlight

Understanding cause-effect relations is fundamental to children's understanding of the world. Based on their understanding of cause and effect, children are able to make appropriate predictions, provide causal explanations, and draw inferences. Evidence suggests that three- to five- year old children can think about cause and effect in a wide range of contexts, including how physical objects cause each other to move,⁴² the causes of growth⁴³ and how emotions, desires and beliefs cause human actions.⁴⁵ ⁴⁶ By the age of four, children demonstrate knowledge about the causal relationships between object properties and object motion.⁴⁷ ⁴⁸ They assume that a physical event has a cause and search for it. They believe that causes must precede their effects, and can reason about the kind of mechanism that can or cannot produce a certain effect. In situations in which one object caused the motion of another, children were able to infer that physical objects have to contact other objects to set them in motion, and that physical effects require the transmission of force.⁴⁹

Young children are sensitive to evidence of cause-effect relations in the course of free play. When playing with a toy, they figure out which parts activate the toy, for example, make the toy light up and play music, based on patterns of evidence.⁵⁰ When evidence is not consistent (e.g., a lever that sometimes does and sometimes does not cause an effect), young children are motivated to explore the causal structure. They would continue exploring the toy, preferring to play with it over other novel toys, until they figured out how the toy works.⁵¹

Substrand 2.0 Changes in Non-Living Objects and Materials

Changes in Objects and Materials

While interacting with objects and materials, building, cutting, combining, squishing, or mixing, young children make them change. Some changes involve the rearrangement of existing parts and structures to produce a new structure, such as in building with blocks, pipe cleaners, or play dough. Other kinds of changes involve combining, mixing and heating materials, creating mixtures or solutions, and may result in changes of the structure of materials in some way. Young children can reason about changes and transformations of objects and materials. From a very young age, children understand the cause and effect relationship in everyday physics, and that certain actions produce certain outcomes. They also have an intuitive understanding about some properties of materials. Through various exploratory interactions with objects and materials, children experience different kinds of changes. Physical changes in materials, as in building structures with blocks, or melting ice, are usually reversible changes (i.e., materials can be transformed back to their original state). In chemical changes, as in cooking, or other activities of mixing and combining different materials, changes are irreversible. Children

cannot bring objects or materials back to their original state. As children combine, mix and attach different objects and materials together, they begin to develop an understanding of how things change and react with one another.

Movement of Objects

Everyday play activities such as rolling, dropping or throwing balls, riding bicycles, swinging, pulling a wagon, or pushing cars, are experiences in which children produce movement by their own actions, and increase their understanding of the movement of objects. Through interactions with objects, children learn about cause and effect relationships in the movement of objects. They understand that inanimate objects cannot move themselves, and need to be moved in order to change their position and location. They experience the force of gravity, and notice that some objects move by falling or sliding on an inclined surface. By moving things in different ways, children also discover that the movement of an object depends on various factors such as the force that produced the movement (e.g., through pulling, pushing, throwing, or rolling), the physical properties of the object such as size, mass, shape, the materials of which the object is made of, and the friction created by the surface on which the object is moving. A stimulating preschool environment provides children with opportunities to experiment with objects and make them move, to describe the direction, speed, and way they move, and to investigate and reason about the different factors that affect the movement of objects.

Inquiry in physical science must involve hands-on direct explorations with objects and materials, whether about changes in objects and materials, or the movement of objects and changes in their position, Kami and Devries proposed four criteria for good physical-knowledge activities: (a) the child must be able to produce the phenomena by his or her action. (b) The child must be able to vary his or her action. (c) The reaction of the object must be observable. (d) The reaction of the object must be immediate.⁵² These four criteria were used as guidelines in developing the following strategies to broaden and deepen children's experimentations with objects and materials, and their understanding of cause and effect.

Vignette: Mixing Solid Materials with Water

During their last cooking activity Ms. Moreno had noticed that the children were fascinated when they mixed the flour with water. They were sharing their observations: "It feels sticky." "Can I pour more water?" "You can't see the water anymore." "The flour was dry and now it looks different." "My fingers stick together." The children's reactions gave Ms. Moreno an idea for extending the group's ongoing explorations with dry materials, and engage them in exploring mixtures. Over several days, children observed a selection of different materials such as flour, sugar, salt, and corn starch, and shared their observations about how they are similar or different, for example, "The flour and the sugar are white, but they do not feel the same." "The corn starch looks like flour." After the children had opportunities to discover texture variations among the different

materials, Ms. Moreno provided the children with various opportunities to mix these materials with water. Children were invited to predict: “What do you think will happen if we add salt to water...” and to immediately check their predictions. They discovered that when sugar or salt are mixed with water, you cannot see them anymore. Ms. Moreno asked the children, “What happened when you stirred the salt in water?” Children came up with different answers, “It disappears.” “It is inside the water but you cannot see it anymore.” Ms. Moreno invited the children to taste plain water and the water stirred with salt, and tell the difference. Many said that they taste the salt, and it is still in the water. She took this opportunity to introduce children to the word “dissolve” and explained that the salt dissolved in water. The children tried out different materials, and discovered that some materials dissolve in water and others such as flour or sand do not dissolve in water. The next day, the children tried out mixing other materials such as glue, lemonade powder, tea leaves, and play dough to find out what happens to each of these materials when mixed with water.

Planning Learning Opportunities:

The teacher had a clear goal for the children, to explore how different solid materials react when mixed with water. Ms. Moreno facilitated the children’s inquiry process by providing a variety of materials, some that dissolve in water and some that don’t, and by encouraging children to predict and check what happens to different materials. She introduced children to new words such as *mixture* and *dissolve* to describe the scientific phenomena they explore. Other phenomena related to water and other materials that children can investigate include water absorption and saturation, how different materials (e.g., sponge, cotton balls, paper, wax paper) differ in their capacity to absorb water.

Interactions and Strategies:

Avoid presenting children with activities of “magical” science. Often, commercial science activities for young children involve combining materials to produce an unusual, radical reaction that is exciting and fascinating for young children. For example, combining baking soda and vinegar to create an exploding “volcano”, or other chemical reactions involving foam, bubbles, and magical potions. Such “mad science” activities may be fascinating for children, but they do not help children to understand the connection between what they do and the reaction in materials, and how variations in actions can produce different responses. The magical transformation is the whole point of the activity. Furthermore, in activities of magical science, children usually are only observers, and are not given the opportunity to explore the properties of the materials being used, or to understand what typically happens when different materials are mixed together.

Select activities or projects in which children are able to vary their actions on objects, and immediately observe corresponding reactions to their actions. To maximize children’s ability to observe the effects of their actions on objects, they must

be able to manipulate objects directly and produce the reaction by their own actions. They cannot be passive and observe an adult performing the activity. In order for them to see the connection between their actions and the resulting effect on the object, the reaction must be observable, and immediate. A delayed reaction makes it difficult for the child to construct the correspondence between their actions and the reactions of the objects. Furthermore, the activity must provide children with ways that their actions can be varied. For example, when mixing clay with water, adding different amounts of water, and observing the resulting effect on clay. In rolling a ball down a ramp, varying the height of the ramp, or the type of ball, and observing how far the ball will go. This kind of variation makes experimentation possible. Otherwise, children only reproduce the same action over and over and cannot explore the effect of their own actions on the outcome.^{53 54}

Vignette: Rolling a Ball Down the Slide

While playing outdoors, Ms. Rosalinda notices that Darren is rolling the ball down the slide over and over. He is letting go of the ball at the very top of the slide and watching it roll all the way down. Jasmine is sitting on the ground about 3 feet from the bottom of the slide, facing the slide, and watching the ball rolling down. "Roll it all the way to me," she tells Darren. Darren goes up the slide, and this time, instead of just letting go of the ball, he pushes the ball slightly when rolling it down the slide. They observe the ball rolling down all the way to Jasmine. Jasmine and Darren get really excited, "Let's do it again!" Now Jasmine takes the ball up the slide, pushes it down even harder at the top of the slide, and watches it roll down all the way to the tree. Ms. Rosalinda asks Jasmine, "You made the ball roll all the way to here. How did you do that?" Jasmine says, "You have to push it hard, and then it goes all the way to here." Ms. Rosalinda brought a small ball and asked, "What do you think will happen if we used this ball instead, and just let go of it at the top of the slide? How far do you think it will go?"

Teachable Moment:

When children are pushing, rolling, kicking throwing and bouncing balls, they have opportunities to explore phenomena in physical science. At first, Darren is watching the ball roll down due to the force of gravity, but it stops before it reaches Jasmine. Darren and Jasmine discover that to make the ball roll down further, they need to push it, to apply force to the ball. Ms. Rosalinda asks them questions to raise their awareness of how they made the ball roll further. She also encourages them to try using a different type of ball, and find out whether they would get the same result. This could evolve into a series of experiences in which children roll balls of different sizes and different materials down the slide. Children can predict and test which balls roll fast or slow and how far different balls would go. For additional support in extending this activity, see *Ramps & Pathways: A Constructivist Approach to Physics with Young Children*, by Rheta DeVries & Christina Sales.

Interactions and Strategies:

Help children notice how variations in their actions result in corresponding variations in the object's reaction.

- **Ask questions to raise children's awareness of how they produced an effect.** Offer opportunities for children to reflect and become conscious of how they produced the effect: "How did you make the water go in this direction?" "How did you make the ball roll down faster?" "Can you show Ron how to do that?" "Can you do that again?"
- **Invite children to set up an experiment, collect and analyze data.** Older children in the group can also participate in focused experiments and collect and analyze data. For example, they may investigate the characteristics of the ramps they build and explore how the height of the ramp and its steepness affect how far the ball would roll. They may vary the height of the ramp, and measure the distance from the ramp to the point where the ball stopped, using a yard stick or unit blocks, with the assistance of an adult. The teacher can also help children use a chart to record their data, and to think about the evidence. Collecting data and analyzing evidence help children reach conclusions such as "the steeper ramp makes the ball go really far."⁵⁵
- **Focus children's attention on the effect of one variable at a time.** In order to help children reason about the relation between their action and the outcome, teachers may need to help children vary only one aspect (variable), and leave the other constant. For example, while exploring the relationship between the steepness of a ramp and how far the ball would go, children need to vary the height of the ramp, and other variables such as the surface of the ramp or the kind of ball rolling down should not vary. Another example is when children experiment with different materials (e.g., beads, pebbles, sand) to find out which materials make a maraca with a softer sound, and which ones make a maraca with a louder sound. The teacher may need to make sure that other variables such as the material to produce the body of the maraca, or the amount of beads or pebbles they put inside is about the same. This helps children attribute differences in the sounds only to the content of the maraca, and not to other variables.⁵⁶

Lead children to make predictions about what they expect to happen. In physical science, children can have many opportunities to try things over and over, and see what happens. Because the reactions are immediate and observable, children can first predict what they expect to happen, try out their ideas and immediately return to the evidence and check their prediction, for example, whether an object will sink or float in water, where a car will stop after rolling down a ramp, or what is going to happen after they mix the powder with water. Encourage children to make predictions by asking questions: "What do you think will happen if we mix the flour with water?" What do you

predict will happen to this block when we drop it in the water?" "What will happen if you let the ball drop in this direction?" They may not be accurate, but they can make a reasonable guess based on their previous experiences and knowledge of objects.

Vignette: Will the Plastic Cup Sink or Float?

The children took turns tossing an object into the water, to find out which objects sink and which objects float. Ms. Schultz held a plastic cup, and asked, "What do you predict will happen to this cup when you put it in the water? Will it sink or float?" David said, "It will float like the other cup," referring to the Styrofoam cup they tested earlier. Dana said, "It will sink because it is more hard than the white cup." Gaby said, maybe if we put it in like this (facing up), it will not sink." Ms. Schultz asked, "Why do you think so?" Gaby said, "Because the water will not go inside." She put the cup in the water, facing up, and the children were observing the cup floating. "You see! It is floating." David said, "Now, let's put it in like this (facing down)." Ms. Shultz said, "That's a great idea. Let's put the cup in the water facing down and see what happens. What is your prediction? Will the cup sink or float?" The children predicted that the plastic cup will float again. Ms. Shultz asked, "Why do you think it will float?" David answered, "Because it was floating before." She put the cup in the water, facing down, and everyone, including Ms. Schultz, was surprised when they saw the cup sinking in the water. Children were fascinated with what they discovered. They kept putting the cup in the water, one time facing up and one time facing down, watching it turning from a "floater" to a "sinker."

Planning Learning Opportunities:

Ms. Schultz decided to use one of children's favorite activities- playing at the water table to focus their thinking on sinking and floating of different objects. Preschool children are not ready to understand the concept of density. In fact, they tend to think that heavy objects sink and light objects float. By providing children with a variety of objects (i.e., light and heavy), made of different materials, the teacher can challenge and refine their theories about why some objects sink and why some objects float. In this example, the same object turned from floater to sinker, depending on whether the space within the cup was filled with air or water. Ms. Schultz encouraged children to make predictions, explain their reasoning, test their ideas, and record their results. In fact, together with the children in her group, she discovered a result she did not expect.

Interactions and Strategies:

Encourage children to record and document investigations with objects and materials. Children's documentation and representation of their work is part of children's inquiry in physical science. Children may draw a representation or make a model of their constructions with objects, such as their tower or ramp built with blocks. They may also draw a representation of what materials look like before and after mixed or combined together, what they predict would happen, and what actually happened.

The teacher may also use a camera or video to capture elements of movement and actions involved in physical science events, for example, how the ball is rolling down a structure, or the different steps involved in preparing play dough. Experiments with objects and materials also provide opportunities to record data on charts and graphs. For example, recording on a chart which materials sink in water and which ones float, or how far each ball was rolling. Recording and communicating information through drawings, models, and actions allow children to express themselves using different means of communication is particularly relevant for children who are still developing their confidence and ability to express themselves in words, and may benefit from recording their ideas and understanding non-verbally.

Invite children to reflect, describe and share their discoveries with others. Ask questions to encourage children to reflect and share their discoveries and ideas: “Why do you think the ball rolls faster on this ramp? “What did you do to make your tower stronger? “How did you get the water in the tube?” “Which ball do you think will slide farthest when we let go of it at the top of the slide?” Encourage children to describe what they have seen and done, and encourage them to give reasons and explanations for their ideas. Such teacher-child collaborative discussions encourage children to put their thoughts into words and challenge children’s thinking, facilitate their understanding of scientific phenomena, and refine their ideas.

As children reflect, describe and explain, they also learn to use a variety of new words. For example, in experimenting with moving objects, children learn to describe their actions (e.g., pulling, pushing, throwing), and the direction, speed, and different ways that things move (e.g., rolling, sliding, flying). This is especially relevant for English learners who learn a variety of new words in meaningful, authentic learning experiences.

Bringing It All Together: Physical Sciences

Rolling Objects

Nicholas and Andrea demonstrated how the ramp ride they constructed works, “We put the ball all the way up, and now look how it rolls all the way down.” They let the ball go down at the very top of their ramp, and watched it roll down into one cylinder and straight down into another long open tube until it stopped.

It was after Ms. Rosalinda had noticed how excited children became about rolling different balls down the slide in the playground, that she decided to build on their interest in motion of objects, and to offer children indoor and outdoor opportunities to explore ways to make objects move. She engaged children in thinking about which objects will be good at rolling downhill. She set up a short ramp using a piece of wood and a large wooden block. During large-group time, she presented children with a collection of objects she prepared in advance (some that can roll and some that

cannot), and asked, “Which objects do you think will be good at rolling downhill?” Ari predicted that the car and the truck will roll down because they have wheels. Jared predicted that the can and the water bottle will roll too because they are round. More and more children made predictions and shared their explanations and Ms. Rosalinda wrote them down on a chart. At the end of group time, she read to the children the predictions of all the children in the group, and invited them to check their predictions. The box with the objects was available next to the ramp during free play time, and children tried rolling different objects down the ramp. Ms. Rosalinda observed them closely while exploring the objects. She would ask, “Why do you think the block is not rolling down the same way as the ball?” or “Why do you think the rock is rolling down in a funny way?” The children put the rolling objects in a box that said “Rollers,” and the other objects in a box that said “Not Rollers.” Children got excited, and tried rolling other objects in the room, such as an orange, a paintbrush, and a spoon. During group time, Ms. Rosalinda invited children to share their experiences at the ramp. She asked them why they think some objects roll and others don’t.

The next day, Ms. Rosalinda asked the children to bring an object from home that they think can roll. The children shared their objects during group time. Later, they tested the objects they brought from home. Ms. Rosalinda invited children to record their results on a group chart she prepared, and mark whether their object is rolling or not rolling. Ms. Rosalinda wanted to draw children’s attention to similarities and differences between the different rolling objects, and to the form of ‘rolling’ objects. She invited children to help her sort the objects in the “Rollers” box, “Let’s put objects that belong together in the same pile.” She picked up a ball, and asked children for all objects that have the same shape. Children quickly started sorting out all the balls. Jonathan said, “We also have the marbles.” Ms. Rosalinda asked, “Where do you think they fit?” Ari said, “They look like small balls.” Other children sorted out all the cars, as Ms. Rosalinda had suggested, “Let’s put all the objects that have wheels together.” There were still more objects in the box like a bottle, a can, and a candle. Ms. Rosalinda asked the children, “What is the same about these objects?” It evolved into a discussion about the shape of rolling objects, and how it helps objects to roll. The children then counted the number of objects in each category, and together with Ms. Rosalinda, they created a graph that showed the number of objects in each category (objects in the shape of spheres, objects in the shape of cylinders, and objects with wheels).

After having many different opportunities to explore characteristics of rolling objects, Ms. Rosalinda wanted children to focus on how they can control and change the movement of rolling objects. She provided children with different materials such as cardboard rolls, cardboard tubes split in half, blocks, boxes, and wood surfaces, and invited children to construct “a long roadway for the ball.”

Building on children’s interest, the teacher provided them with multiple related experiences to explore and think about the form and function of rolling objects. She first engaged children in exploring and describing the characteristics of rolling objects. The

children observed the objects, made predictions, checked their predictions by rolling the objects down the ramp, and recorded the results in different ways. Children also had an opportunity to reflect and share their discoveries with rolling and non-rolling objects during group-time. Bringing an object from home increased children's interest even more, and their choices of objects helped the teacher assess their understanding of rolling things. To facilitate children's ideas about the characteristics of rolling objects, she invited them to sort and classify rolling objects into different categories. The teacher next focused children's attention on the movement of objects downhill, and the different ways to control the speed and direction of the rolling object. She provided children with different materials, and invited them to plan, design and construct a track for a ball to roll down. This project not only facilitated children's understanding of properties and characteristics of objects, and the physical science of the motion of objects downhill, but also fostered children's math skills, language skills, and their creativity and ability to work cooperatively.

Engaging Families

- **Learn about children's prior experiences, preferences and particular interests with objects and materials.** Some children may have had many opportunities to play and experiment with different materials (e.g., blocks, sand). Other children may come from cultures where they are discouraged from messing up with materials. Teachers may need to explain parents the importance of active hands-on explorations of objects and materials in physical science. Some children may have specific interests, and are intrigued by particular objects or materials such as cars, blocks, water or sand, while others may avoid interacting with particular objects or materials. Talk with parents to learn about their approach and children's prior experiences and interests. Such information is vital in connecting with families and in supporting children's explorations in physical science.
- **Share with parents children's experiences of inquiry in physical science** Inform parents about children's explorations and experimentations with objects and materials. The family culture may be different from the one in the school or community. Parents may not recognize the value of children's direct interactions with objects and materials. Share with parents your goals, what children are focusing on and why it is important. During parent night, for example, the teacher may provide parents with opportunities to engage in physical science through hands-on manipulations of objects and materials similar to those children do. Share ongoing information and documentations of children's work through newsletters and the parents' bulletin in the room. Sending home children's work or items related to children's experiences of inquiry is a powerful way to connect with families and engage parents in conversations with their children about children's projects in preschool.

- **Involve parents as volunteers and rich resources.** Once parents are informed and aware of children’s science activities in preschool, they can become more involved and supportive. They can refer children to examples in their everyday life that illustrate the phenomena they learn about in class. As illustrated in the above examples, parents can help children collect objects in the home environment related to children’s current focus in school (e.g., rolling objects; a musical instrument or a tool) to share with other children in their group. Parents can also come to the preschool to share their expertise in a particular area of study. They can make presentations to children, set up exhibits, or engage children in different activities. For example, as part of children’s experience of building structures with different materials, the teacher can invite a family member that is a builder, architect, engineer or carpenter to come talk with the children. The visiting parent can tell children what they do, and share designs, tools, books and stories related their work. Children benefit from seeing their parents in the preschool setting, and it benefits the teacher, who cannot be an expert in all areas.
- **Support families in facilitating children’s curiosity and learning about objects and materials.** Suggest parents any enrichment and follow-up activities they can do with children at home, questions they may investigate with children and key vocabulary associated with these experiences. There are many opportunities to involve children in science inquiries at home, including observations and discussions during daily routines about phenomena related to physical science (e.g., freezing, melting, rolling; operating a machine; cooking), and home-based activities in which children explore different materials. Baking a cake, taking apart an old machine, and discovering what materials the buildings in the community are made of provide opportunities for engaging children in physical science. Parents can encourage children to observe carefully, predict what might happen, and think about how and where they could obtain more information.⁵⁷

Questions for Reflection

1. How can different interest areas in the preschool environment (e.g., the block area, the water table, the sensory table, and the playground) be used to enhance children’s explorations of objects and materials?
2. Think about your physical environment. It is probably full of things. What would you add or take away to enhance children’s explorations of properties and characteristics of particular objects or materials?
3. Think about one of your group’s previous projects or activities with objects and materials:

- What was the purpose? What did you want them to notice and discover while interacting with these materials?
 - How engaged were the children with the activity? What makes you think so?
 - Did the children produce an effect or a change in objects or materials? Was the effect immediately observable? Were children able to vary their actions and observe corresponding reactions?
 - How did you facilitate children's explorations and experimentations with objects?
 - How did you encourage them to reflect, describe, and share their discoveries?
 - What would you do differently if you had an opportunity to do it again?
4. How can you facilitate the development of children's math and language skills while interacting with objects and materials? How can you use these opportunities as a vehicle to support English learners?
 5. What adaptations can you make, to materials or ways of interactions with children, to support children with special needs?

Strand: Life Sciences

Life science for young children is about nurturing children's curiosity and fascination with the natural world, and building their understanding and appreciation of living things. Preschool children have various opportunities to engage with living things in their preschool environment. When playing in the yard, they may come across small animals or bugs, or notice changes in the trees. They may help take care of the class pet or plants in the room. They participate in different planned activities related to living things, such as going on a neighborhood walk to collect different leaves, search for bugs or other small animals in the yard, sort and classify fruits and vegetables, explore various seeds, plant bulbs, sprout seeds, or grow a garden. Such experiences in the preschool environment can provide the context for rich experiences of scientific inquiry about properties and characteristics of living things. The goal of life science in preschool is to provide children with opportunities to closely observe living things, including human beings, and to encourage them to question, explore and investigate their characteristics such as what they look like, how they behave, what their habitats are, what their needs are, and how they change over time. Through ongoing opportunities to observe and discuss what they have seen, children develop their ideas about living things, how they are the same, and how they differ from one another. They start to sort and classify and look for patterns. They begin to recognize commonalities such as the physical structure and basic needs of different living things, but also the diversity and variation among different organisms.

Unlike physical sciences, where the focus is on children's experimentation with objects and materials, the study of life sciences has a strong basis in observation. It is about

observing and exploring the life of different organisms through direct sensory experiences. It also involves the use of tools such as hand lenses, digging and collecting equipment, and measuring tools, to extend the ability to see details and take exact measurements. The teachers have an important role in facilitating children's explorations. They guide children through experiences of exploring and observing animals and plants around them, whether outdoors, as they exist in nature, or indoors in an environment that is as natural as possible. They deepen children's understanding of living things, including features of their own body parts and processes, by encouraging children to observe closely, raise questions, investigate more about a topic, describe and represent their observations, and by creating opportunities for discussion and reflection.⁵⁸ At the same time, they model wonder and excitement of the natural world, and an attitude of respect for living things and their habitats.

Substrand 1.0 Properties and Characteristics of Living Things

The following section provides practical strategies for engaging children in thinking and exploring important characteristics of living things, including their physical appearance, body structure, behaviors and habitats, growth, and basic needs. For example, the teacher can engage children in explorations of the *physical characteristics* of living things, and encourage them to observe their shape, color, body structure and different parts. They can also encourage children to think about what's inside the body of living things, and how it is different from the insides of non-living objects. Teachers may also invite children to investigate how different animals move, what they eat, and where they live (i.e., their habitat). By encouraging children to observe various plants indoors and outdoors, including trees, bushes, flowers and seeds, and different organisms of the same species, the teacher also highlights for children *variation and diversity* in living things. The following strategies, as well as the ones in the next section (Substrand 2.0 Changes in Living Things), will broaden and deepen children's awareness and understanding of properties and characteristics of living things.

Vignette: A Squirrel in the Yard

While playing outdoors, Gregory pointed up to the oak tree, and shouted, "Look, a squirrel up in the tree." Joanna whispered, "Shhh... You will scare the squirrel away." They stood there silently, watching the squirrel. Soon more children have joined them. Ms Leon, watched them observing the squirrel and asked, "What do you think the squirrel is doing?" (Pause) "What do you think he is looking for?" She listened carefully to the children's ideas and questions while observing the squirrel: "It is climbing up" "He is looking at us" "I think he is looking for something to eat." "It has big eyes." "It has a long tail." Joanna has asked Ms. Leon, "Is that where he lives?" Ms. Leon turned the question right back to her and asked, "What do you think?" Ms. Leon expected this question to come up because recently they were talking about the habitats of different animals, and that some animals live in trees. Later, during group time, Ms Leon invited

children to share with the group their observations of the squirrel. She brought up her question again, “What do you think the squirrel was looking for in the tree?” Some children said that squirrels were looking for food. Ms Leon asked, “What kind of food do you think squirrels may find in the tree?” Joanna suggested, “Maybe they eat leaves.” Gregory said “I saw a squirrel in my yard. They like to eat fruit.” Miguel said, “Maybe the squirrel was looking for seeds.” Ms. Leon answered, “Oh, so you think that squirrels may eat leaves, fruit, and seeds. We can try to observe more squirrels when we are out in the yard, and learn more about what they eat.” Then she read the group the book A Home for Pearl Squirrel by Amy Crane Johnson. A story that illustrates for children the idea that squirrels, like other animals, have their own habitat that suits them best. Ms. Leon invited children to continue observing the oak tree over the next several days, “Next time we will get our small binoculars and journals and observe the squirrels, to try to find out what squirrels are doing in the tree, and what they like to eat.”

Teachable Moment:

This schoolyard provides an ideal site for explorations of animals and plants in the everyday environment. Children display a natural wonder and an interest in observing and learning about squirrels, and Ms. Leon supports children’s excitement. She guides children towards focused observations by asking questions (e.g., “What does it look like?” “What do you think the squirrel is doing?”), and getting them to think about how squirrels’ habitats (like trees) help them meet their needs. Squirrels live where there is food, and the tree is a source for food (i.e., acorns, other seeds). Their habitat helps them meet their needs. She invites children to continue to observe the squirrels and find out more about what squirrels eat. Later, she may also bring books from the library about squirrels so that children can find out more what squirrels like to eat, and where they find their food. She may also bring in some examples of what squirrels eat for the children to examine and investigate. Ms. Leon uses a process of inquiry and reflection to focus children’s experiences and thinking about animals’ habitats, and how they help them meet their needs. It includes observations, discussions, and the use of relevant literature and informational books, strategies that deepen children’s thinking and enrich their experiences.

Interactions and Strategies:

Focus children’s explorations on key concepts of living things. The teacher should be purposeful about the concept(s) children investigate while exploring living things, and offer them many opportunities to explore a concept from different perspectives over an extended period of time. A range of conceptually related experiences that last for weeks, or even months, allow children a deep exploration of the scientific concept, and result in learning that is more effective and powerful. For example, in exploring the physical structure of living things, children can engage in a series of investigations of the physical characteristics and body structure of animals, plants and humans, and think about the function different body parts serve, and how their form helps different living

things function and survive. Similarly, in investigating the concept of growth, children may investigate growth in animals, plants, and themselves, and begin to recognize common needs of all living things. Through such conceptually related experiences, children will gain a broader and deeper understanding of living things. With various kinds of teacher support they are more likely to draw connections between one activity and another, and to search for patterns and relationships as they think about and reflect on their work.

Take children on outdoor explorations of plants and animals. The outdoor environment provides ideal sites for explorations of living things. Teachers should create opportunities for children to engage in outdoor explorations, either in the schoolyard or other places in the neighborhood, and observe animals and plants in their natural environment.

- **Point children’s attention to important aspects of living things.** As children engage in observations of various trees, bushes and other plants, and search for bugs, insects and other small animals in their environment, they can learn to appreciate the variation and diversity in living things. They can also discover that certain animals live in certain places, for example, some squirrels live in trees, and worms live in dirt. These discoveries help children recognize that different animals have different habitats, and that their habitats help animals meet their needs. When exploring outdoors, teachers can also direct children’s attention to changes in local plants and animals over a long period of time and during seasonal changes, such as leaves that change color or fall, or the growth of buds, flowers or fruits. Such experiences build children’s connection to nature, increase their awareness of plants and animals in their environment, and broaden their understanding of living things. Chalufour and Worth recommend the following strategies in guiding children’s outdoor explorations:
 - **Model curiosity and interest in nature.** Children become interested in exploring nature through interactions with adults who model deep curiosity and interest in studying living things. Share your excitement with children, look closely at plants and animals, wonder aloud, and comment on interesting features: “Look at this leaf. What does it look like? What tree do you think it came from?” “I wonder if we can find some bugs under this log?” “What do you think we will find under the rock?”
 - **Remind children to be respectful of nature.** While teachers model deep curiosity and interest in living things, they should also convey an attitude of respect toward living things and their habitats. Help children understand that they study animals and plants by looking at them carefully, and that animals and plants are living things and need to be treated with respect. The more aware children are of the unique needs of plants and animals, the more likely they are to interact with them in ways that keep them healthy and safe.

- **Engage children in conversation about what they notice.** Encourage children to talk about what they notice and find: “What did you find in the dirt?” “What does it look like?” “How does it feel?” “How is it moving?” “Who else found living things under the log?” Use expansive language while communicating with children, “Some of you found leaves in the dirt. Some of you found roots and rocks. Some even found insects.”
- **Document children’s outdoor explorations.** Encourage children to draw a picture of what they observed, and document their explorations. Take photographs or draw sketches of the plants and animals that captured children’s interest, and write down children’s questions and snippets of conversations or words they use to describe what they observe. During group-time, children can share their drawings of a plant or animal they observed outdoors. The teacher can also make children’s and teachers’ documentation visible in the room, to allow children to re-visit an experience, and to use it as a focus of conversation for children.⁵⁹

Provide children with tools for explorations of living things. Children’s close observations of living things require the use of observation tools. Magnifiers, such as hand lenses, can help children observe details in plants or animals that are too small to see without tools. Penlights help children see plants or animals that live under rocks or in other dark places. Small sticks (e.g., tongue depressors), tweezers, containers, and other digging and collecting equipment can be used to safely collect living things. Children also can use a clipboard, paper, pencil, and art materials to record and represent what they discover. Learning how to use tools properly and safely takes time and practice. The teacher should take time to introduce the tools, and support children in using them. (For more information, see section on Scientific Inquiry). Children with motor disabilities and other special needs may need assistance in using tools, or require special adaptations. For example, a child in a wheel chair can use a wedge to look for small animals or other natural materials while engaged in outdoor explorations.

Include plants and animals indoors. Including plants and animals in the indoor environment provides opportunities for children to look more closely at characteristics and needs of living things, and demonstrates to children how to treat plants and animals with care and respect. It may include indoor plants, and pets, such as birds, fish, chameleons, guinea pigs, lizards or rabbits. It may also take the form of a terrarium an open container with soil, and a collection of small plants and small animals, in which living things live indoors in as natural an environment as possible. The terrarium, or vivarium, could serve as “home” for visiting animals that the children have collected outdoors such as worms, snails, pill bugs and caterpillars. Having a terrarium is an especially meaningful experience for children when they are involved in creating it, helping to collect terrarium materials (e.g., dirt, small plants, stones and sticks), and to decide what animals and plants to include in it: “How do we make this a good place for snails?” “Why do we need to put in dirt?” “What plants should we include?” When

actively involved in putting together the terrarium, children become engaged in observing and caring for living things in the terrarium, and are more aware of ways to provide for the needs of animals and plants needs. In urban centers, or other places with limited access to natural outdoor areas, bringing the plant and animals inside will be very important.

Use books to enrich and extend children’s study of living things. Children’s books can extend children’s first hand scientific explorations, and enrich their experiences. Include in the environment a selection of books that focus on living things, including fiction books, informational and reference books, and books with clear and vivid images of the kinds of plants and animals children observe. Some of your books should present living things in a scientifically accurate way, and not as they appear in fantasy. They should be engaging, informative, and relevant to the group’s current interest. For example, books can illustrate the body structure or growth process and life cycle of living things through accurate images, and serve as resources for children and teachers. Make books accessible to children either in the book corner, or around the area where they observe plants and animals closely, and use them during small or large group time to support the discussion. Children may look at the images of animals and plants in the books and compare them to the living things they are observing. Fiction books about plants and animals (e.g., *Tiny Seed*) can also enrich children’s learning experiences about living things. The teacher can invite children to reflect about the content of the story, and encourage them to act and demonstrate with their bodies how the plant or animal has grown or changed.

Vignette: Inside an Avocado

The teacher cut open the avocado, and Danny got really excited. “I knew there was going to be a big seed inside.” Ms. Wilson replied, “You did predict that there was going to be a big seed inside.” She invited children to observe the inside of the avocado. Rena said, “It has this thing inside.” Sara pointed to the empty half and said, “This is where it was.” The teacher replied, “It is the avocado seed.” She took out the seed, and handed it to Rena, “Oh, It is slippery.” Ms. Wilson put it on a tray and said, “It does feel very slimy.” She invited children to observe the seed. What does it look like? What does it feel like?” After she gave children time to observe the avocado seed, she pointed to the other fruits in the basket and said, “I wonder if these fruits are also going to have seeds inside. What do you think?” Rena said, “Maybe the orange will not have very big seeds.” Danny said, “The avocado has a big seed inside, not the orange.” Ms. Wilson asked, “What do you think is inside the orange?” The teacher invited the children to predict what’s inside an orange, a butternut squash, and a plum, and wrote down their predictions. She then invited the children to cut open the fruits, and check what was inside.

Planning Learning Opportunities:

Ms. Wilson invites children to observe seeds in cut open fruits. Her goal is for children to focus on one way seeds are produced within fruits. She invites children to notice, discuss and compare seeds of different fruits (scientifically, tomatoes, cucumbers, peppers and zucchini are classified as fruits). Some seeds are small and some are big. Some fruits have many seeds inside, and others (like the avocado) have only one. Seeds vary in size, shape, color, and number. By comparing seeds of different fruits, children will become aware of the variety of seeds within and across different kinds of foods. Children can also discover that carrots, potatoes and other vegetables do not contain seeds.

Research Highlight

Traditionally, young children were described as externalists, focusing on external features of objects, and incapable of reasoning about internal non-observable (non-obvious) aspects of things such as internal mechanisms of the human body and other animals.^{60 61} Research in the last two decades has challenged this view, suggesting that by the age of four, children distinguish between animals, plants, and machines, and display clear expectations for the kinds of things that are inside each of these categories of objects.^{62 63} When asked about the content of various objects, they offer different answers for animate and inanimate things, typically reporting that animates have skin on the outside, and blood, bones, and internal organs such as hearts or muscles in the inside, whereas inanimate objects have cotton, paper, buttons and other “hard stuff” inside. By four years of age, children also appreciate the special importance of insides for an object’s identity and how it functions. For example, they would agree that a dog is still a dog if you get rid of its fur, but not if you take out its inside such as the blood and bones, and all is left is the outside. They also expect all dogs to share the same insides.⁶⁴ Although children develop knowledge of internal parts between ages three and four, they do not see these internal parts as the causal explanation for familiar biological events such as movement or growth. Rather, young children endorse that animals have an internal mechanism, some type of vital energy relevant for animals and not machines. As more concrete understanding of internal parts develops, a truly biological understanding of biological cause of behaviors arises, for example, an understanding that something inherent in bones, brain, and muscles cause animals to behave in particular ways.⁶⁵

Interactions and Strategies:

Engage children in close observations of plants and animals. Invite children to observe closely small animals and various plants from their environment. They may

explore in depth animals such as worms, snails, pill bugs, caterpillars, or insects, both in the outdoors and indoors, by bringing animals inside the room for a short period of time. They may also observe trees, bushes, flowers and other plants outdoors, as well as indoors, by observing potted plants, sprouting seeds, or the terrarium in the room. Focus children's explorations on a particular aspect of animals and plants, such as their physical structure, how they move, what they eat, where they live (what is their habitat), how they protect themselves, and engage them in close observations of this aspect. For example, to engage children in deep explorations of the physical characteristics of living things, encourage children to look closely at the structure and body parts of the particular animal they observe: "What shape is the pill bug?" "What does it look like when it curls up?" "Look at the snail's antennae. What is the snail doing with them?" Probe children's thinking by asking: "What do you think the snail use their antennae for?" "Why do you think it has a hard shell? What is it for?" Children can observe their animals closely over time, and compare them to other animals, including themselves. It will help them recognize similarities and differences across different animals, and between humans and non-humans.

Similarly, to explore the physical structure of plants, encourage children to look closely at their distinct parts. Invite children to closely observe stems, trunks, branches, leaves, and roots: "What shape are the stems?" "What do they feel like?" "How are the leaves the same? How are they different?" "What do you notice about the roots?" Probe children's thinking by asking questions related to the function and purpose of different parts: "What do the stems do for plants?" "Why do you think plants have roots?" Such thought provoking questions focus children's explorations on animals' unique body structure, or the distinct parts of the plant they observe, and may engage them in thinking about ways their forms help them function and survive.

Vignette: Why Do Pill Bugs Curl Up?

Children were fascinated with their observations of the pill bugs at the outdoor exploration table. Mr. J invited children to use their hand lenses and observe them closely, and documented their observations: "Look it is rolling up again." "It is moving now." "I thought it was soft, but when I touched it, it felt hard." "It has lines on its body." More than anything, the children were fascinated with how it curls into a ball. Mr. J wanted to focus the children on pill bugs' behavior, and help them notice patterns of behavior and changes. He directed children's attention to one of the pill bugs that was not curled up and asked, "What shape is its body?" "How is it different from the one that is curled up?" "What shape is the pill bug when it curls up?" After the children around the table shared their observations, Mr. J encouraged them to draw representations of their observations, of what the pill bug looks like, before and after it curls into a ball. Later, Mr. J gathered the children together to share and discuss their observations of how pill bugs curl into a ball. Diana pointed to her drawing and explained, "First it looked like this, just straight," referring to a horizontal line, "and then it was round," and pointed to the circle she drew next to it. Maya showed with her body how pill bugs curl up. Mr. J

encouraged other children to try to curl up like pill bugs, “Can you use your body to show me how the pill bugs curl up?” He helped Kashira curl her hand up since she was wearing a leg brace and couldn’t curl her body up. He then invited children to share their ideas about why pill bugs curl up, “I wonder why pill bugs curl into a ball?” Sharon said, “Maybe because they are shy?” Mr. J asked, “Why do you think they curl up when they are shy? What makes you think that?” Kayla said, “I think it is because they get scared.” Mr. J asked, “Why do you think pill bugs curl up into a ball when they are scared?” Tim jumped up, “Because they turn into a ball every time we touch them. They are afraid we are going to hurt them.” Mr. J replied, “How does curling up into a ball help them protect themselves?” Tim answered, “Because they can hide inside,” and Kayla said, “Because they look like a ball. They do not look like a bug anymore.”

Planning Learning Opportunities:

Mr. J wanted to focus children’s exploration on pill bugs’ behavior, particularly one that has captured children’s interest, how pill bugs curl into a ball. He first directed them to observe the phenomena closely, and to notice the way the pill bug’s body changes. He also invited children to represent their observation through different forms of communication, including drawings and movement, illustrating with their bodies how pill bugs curl into a ball. Mr. J wanted children to think deeper about this phenomena- *When* do pill bugs curl up? *Why*? He invited them to reflect on this experience, and share their observational drawing with the group. He then probed them, asking, “I wonder why pill bugs curl up into a ball?” The children shared their ideas about why pill bugs curl up the way they do. Some of the children’s theories are not correct (e.g., “Because it is shy.”). The teacher does not try to correct them directly. Through questions, and gentle probing, children come to new understandings, more reasonable and sometimes more accurate, than their previous understandings. As a follow up, the teacher may show children how to do a little research on the Internet. Children can look at enlarged photos of pill bugs, and learn more about them, for example, that they are not insects, that they prefer living in soil and under decaying leaves, and how these creatures are related to the armadillo. The teacher himself may be surprised.

Interactions and Strategies:

To facilitate children’s close observations of plants and animals.

Encourage children to observe closely. Encourage children to observe closely, describe, and draw their observations. Ask children questions to elicit the use of descriptive language to describe sizes, shapes, colors, parts, and position (e.g., above, under, next to), for example, “What do you notice about this caterpillar? What is it doing? What does this leaf look like?” Encourage children to compare and contrast: “What are some ways these leaves look the same? What are some ways these leaves look different? Are all the leaves the same size?”

Invite children to use different methods to record or represent their observations.

Children can record and represent their observations using different methods. They may draw a picture (an observational drawing) of what they observed, or create a model using collage materials. The teacher can also write down the children's words as they explain what they were drawing, or describe their observations. Children may also have a specific science notebook or journal which they use on a regular basis to record their observations with drawings and verbal dictations. A child with motor disabilities may have pictures taken and put into her journal rather than drawing. Children can also represent their observations through movement and drama. For example, they can represent the way an animal moves or stages of the life cycle, using their own body.

Create opportunities for discussion and reflection. Encourage children to share and discuss what they have learned about the plant or animal they observed, whether in a small group or with the large group. Children may share their drawings and observations, and talk about their experiences. Use these opportunities to ask thought provoking questions, and encourage children to share their developing ideas and theories.

Substrand 2.0 Changes in Living Things

A unique aspect of living things is their ability to grow and change. Living things change over time through stages of the life cycle, as they grow, develop, reproduce and die. In order for living things to grow and develop, they must meet their basic needs. They need water, food, light, oxygen and space to grow. The notion of growth and change is fundamental to children's understanding of living things. From a very young age, children recognize that people, animals and plants change over time due to growth, and that these changes are specific to living things.⁶⁶ By the age of five, children realize that animals grow over time, and can go through a metamorphosis,⁶⁷ and understand some aspects of the life cycle of plants.⁶⁸ From a very young age, children also associate growth of plants and animals with feeding or watering. They understand that animals and plants have needs and require care. They may suggest that plants require rain and sunshine, but overall have less understanding of what plants need in order to grow compared to animals.

Preschool experiences of caring for plants and animals, exploring growing plants, and observing and studying animals as they grow and develop over time, deepen the children's understanding of how living things grow and change, and what they need to grow and develop. By studying and comparing the needs of different animals and plants, children begin to realize that there are similarities and differences in how living things meet their needs, and that some needs such as food, water and air are basic to all living things.

Provide children with opportunities to care for plants and animals.

Plants and animals in the preschool environment raise children’s awareness of growth and change in living things, and what they need to survive. By observing adults caring for plants and animals, and by actively participating in watering plants, feeding the class pet, or working in the garden, children become more aware of the needs of plants and animals, and how they change over time. For example, a child may notice that the food tray of the class pet is empty and offer to feed it, “Teacher can I give it some food?”, or that the soil in the pot is very dry, and try to water it. They may also discover that if the needs of animals and plants are not met, they will die, “It’s dying. The leaves are yellow.” Caring for plants and animals in the preschool environment may raise children’s awareness of what plants and animals need to survive, but to deepen the children’s understandings of growth and change in living things, they should engage in exploring and investigating changes in animals and plants, observe them closely over time, track and monitor their changes, and discuss and formulate ideas about how plants grow and animals change as they move through the life cycle.

Vignette: Predicting the Growth of Lima Beans

After children were given time to explore the lima beans, Mr. Adato asked them, “What do you think will happen to the lima beans if we plant them in our garden?” Sara predicted, “They will grow and we will have more beans.” Eric predicted that the lima beans will get bigger.” Shawn predicted “If we water the beans, we will have a bean tree.” Danielle predicted, “We will have a plant with leaves and beans.” Mr. Adato wrote down the children’s predictions, and then read them to the group and said, “So you all predict the lima beans will grow, some of you predict we will have a bean tree, and some of you think we will have bigger beans. What might we need to help them grow? What do you think our seeds will need to grow?” Mr. Adato invited the children to share their ideas, the children responded, “water,” “soil.” Mr. Adato said, “These are great ideas. Plants need water to grow, and many plants need soil to grow. What else do you think the lima beans need to grow?” The children said, “a garden,” “a pot,” “dirt” “rain.” Mr. Adato recorded their ideas and asked, “Do you think they may need light?” One of the children said, “They need to be outside, because they need sunshine.” Another child said, “No, they can grow inside.” Mr. Adato suggested that they also grow some beans inside the room, in a pot, and find out what happens. “Let’s walk outside and find a good place in our garden for growing lima beans.”

Planning Learning Opportunities:

The teacher gathered the children together to introduce the idea of planting seeds, and prepared them for their next learning experience with seeds- planting lima beans in the garden. He elicited children’s predictions about what the seeds will look like as they grow, and focused the conversation on plants’ needs, “What will our beans need to grow?” This raised their anticipation and involvement level in the upcoming planting project, and also gave Mr. Adato an opportunity to find out and assess what they know, and what were some of the children’s misconceptions. Mr. Adato accepted the

children's ideas, even if some seemed incorrect, and invited children to grow lima beans both, outside in the garden and inside the room, and see what happens.

Interactions and Strategies:

Provide children with opportunities to observe and monitor plants' growth and development. Sprouting seeds and watching them grow, planting bulbs in the garden, or planting indoors in pots made of recycled materials are activities that are typically used in early childhood programs when teaching units on growing plants or gardening. Outdoor and indoor planting activities can become experiences of inquiry about plants, in which children ask questions, observe and explore plants closely, and track their changes and growth over time. Through experiences of caring for plants and observing them change from seed to plant, flower, and/or fruit and back to seed, children will learn about plants' needs and about their life cycle.

- **Provide children with varying planting experiences.** Invite children to start new plants in several different ways, including seeds, bulbs, tubers and cuttings. By experiencing different ways to start new plants, children recognize that various plants may look very different but have similar needs.⁶⁹ Furthermore, children can compare and contrast what the growing process looks like in the seedling, bulb, and cutting they planted.
- **Invite children to experiment and test what plants need to live.** Children may have different ideas about what plants need to grow. You can set up experiments and control conditions to test their ideas. Children can contrast plants that are grown in light and those grown in dark closet. They can grow seeds in different mediums such as sand, clay, potting soil, or garden soil, and notice differences in plants' growth. They may also give different amount of water- very little, a medium amount and a lot (differences are more dramatic if there is no drainage from the pot.) One class even thought that plants, like children might need water or milk or orange juice to thrive and tried out their ideas with surprising results.
- **Invite children to predict what plants will look like as they grow.** Engage children in a conversation about how their plants will grow, "What do you think it will look like when it grows?"
- **Encourage children to notice changes in their plants' growth.** "How is your plant different?" "How has it changed?" "Do you notice any buds?" "Does it have more leaves?" Encourage children to notice the way plants have grown and changed, and keep a record of children's observations. Children can communicate their observations and ideas verbally, or by drawing, pointing, and acting with their bodies.

- **Invite children to measure the growth of plants.** Engage children in thinking about ways they might measure a plant's growth and keep track of the plant's changing height "How can we measure how much it grew?" They may measure its height and keep a log of the plant's growth, using nonstandard measures like unit blocks, paper strips, or a piece of string. Older children can also keep track of the plant's height using standard measuring tools such as a ruler or a cloth measuring tape, with the assistance of an adult.
- **Invite children to record the growth of plants.** Children can record the growth of plants using different methods. They may draw a representation of the plant in their journal. A series of drawings with their notes would allow them to compare changes from week to week. They may also take photographs of the plant, with the assistance of an adult, to keep track of changes in the plant's development over time. They can also keep a log, or record on a chart, the plant's height as measured on different days by gluing down strings cut to the measurement, or by writing down numbers, with adults' assistance.
- **Engage children in reflective conversations in small or large groups.** Invite children to share their observations, and present their drawings or refer to their other records of their plant's growth. Encourage children to talk about how the plant has changed and to reflect on what plants need to live: "How has it changed?" "What did you do to help it grow?" "What might we need to make this new seed grow?"

Provide children with opportunities to observe changes and transformations in animals as they pass through stages of the life cycle. Providing children with the opportunity to observe the life cycle in organisms, and see the transformations and changes that occur, enriches and enhances their learning experience, and expands children's ideas of the different ways living things change over time. Some animals do not go through metamorphosis. Land snail and guinea pig babies look like small versions of their parents when they are young. Other animals change and go through metamorphosis as they move through the life cycle. Painted lady butterflies change from larva to butterfly in a few weeks, frog eggs develop into tadpoles which become frogs, and mealworms change into beetles. If possible, let children observe the life cycle of different animals. It generates in children a sense of wonder and excitement about the transformations they witness, and dramatize the growth process.

- **Invite children to predict changes, and observe animals closely as they pass through different stages of a life cycle.** Provide them with hand lenses and encourage them to observe closely and notice any changes. Model close observations, wonder aloud if they notice any changes, and encourage them to talk about what they see: "How did the baby caterpillar grow?" "What do you think will happen to them as they grow?" "What do you think this white "stuff" is?"

- **Invite children to record and document their observations of changing animals.** As children observe changes in the animal, encourage them to record their observations by drawing. Date their work, and write down their observations in their journal, “It is getting bigger and bigger.” The teacher can use children’s drawings and photos taken with a camera, to create a class book that describes the life cycle of these animals. Some of the older children may decide to measure animals’ changes in size. For example, they may pick a larva and measure it every couple of days, with the assistance of an adult in the room, and see how much the larva has grown. They may also predict and chart the number of days until the animal goes through transformation.
- **Encourage children to use different forms of representations.** Children can use different ways to represent their work. Recording in journals provides opportunities for children to express their ideas in words, whether in English or in the child’s home language. Children can also use non-verbal forms of communication to document changes, such as drawings, photos, model making, and collages, and to use their body to dramatize the way the animals change and grow. Using different forms of communication is particularly important for children who are English learners, who do not yet have the confidence to communicate in English, or for children with special needs who have speech delays or other disability impacting their communication, and would benefit from non-verbal ways to communicate their thoughts and share their observations.
- **Encourage children to compare life cycles of different animals.** Engage children in a discussion about how other animals grow and change over the course of their life. If possible, let children observe, or read about, different life cycles, one that goes through metamorphosis and one that doesn’t, and encourage children to compare the two. “What do baby snails look like when they grow? What do caterpillars look like when they grow?” Young children also compare the life cycle of animals to their own process of growth and development.

Invite children to investigate their own growth. Children have ideas about the process of growth in humans based on their own experience of growth from a baby to a toddler to a young child, or their experiences with younger siblings. Invite children to compare the stages of growth and change in the animal they observed to their own lives and experiences, “What about you? Do you grow like this?” This could be a good transition to invite children to investigate what happens to them when they grow. Some activities that have been used with young children by Gelman et al (2010) include, comparing baby pictures to recent pictures, having children visit the infant room and compare their hand sizes and heights to babies’, and recording changes in shoe sizes or height from when they started school to when they leave.⁷⁰

Bringing It All Together: Life Sciences

Raising Silkworms

Ms. M invited the children in her group to observe stages in the life cycle of silkworms, hatching from eggs, growing as larvae, and spinning cocoons. She gathered the children together, read them a book about the life cycle of silkworms, and showed them pictures describing the metamorphosis. She invited children to look at the pictures and talk about the book: “What happened to the eggs?” “What happened to the larvae?” “How did they grow?” The next day, Ms. M showed the kids the box with silkworm eggs. She invited the children to observe them closely using hand lenses, “What do these eggs look like?” She helped some of the children hold the magnifiers and observe the silkworm eggs closely. She encouraged children to record their observations of the eggs by drawing them, and wrote down their words, “They are tiny.” “Many black eggs.” Some children asked, “When are we going to have silkworms like we saw in the book?” Ms. M. asked the children, “What do you predict will happen to the eggs in a few days?” She wrote down their predictions.

Ms. M. wanted the children to think about what the silkworms would need to grow. She invited the children to look through a book about silkworms, and to help her find out what kind of food they eat. The children said, “The silkworms eat leaves.” Ms. M. expanded on it, “It says here that they eat mulberry leaves.” One of the children had brought in leaves to feed the silkworms. A few days later the silkworms hatched. Ms. M invited children to observe the silkworms and the children immediately noticed the change: “They are moving.” “They stay on the leaf.”

The children were fascinated with the growth of the silkworms in their room. They had been watching the larvae get bigger and bigger, and were excited every time they noticed new changes. They would stop by the container to look at them, and would share their observations with each other, “Look, this one is really big.” “Maybe they need more leaves, I think they are hungry.” They took turns feeding the worms mulberry leaves, and enjoyed watching them growing rapidly and molting. Ms. M encouraged the children to observe them closely and notice any changes, “Look how their head is white and green, but the rest of the body is still brown” “What do you think this white stuff is around them? She invited children to observe them closely and record their growth and changes through drawings and words. Their drawings were dated, and later, Ms. M put them into a book.

At the end of each day, Ms. M invited the children to share their observations during circle time with the whole group. She asked them questions to focus the conversation, and invited some of the children to share their drawings, “What did you notice when you observed the silkworms today?” “How are they different?” “What do you think helps them grow?” “What do you predict will happen next?”

Observing the silkworms grow and change introduced children to the development of an animal through a metamorphosis, and allowed them to observe the changes and transformations over time. The children learned from direct observations about the life cycle of silkworms, what they need in order to grow, and how they grow and develop. In addition, books about silkworms served as an important resource for introducing children to the process, and for learning some important information about how to care for silkworms. The use of inquiry skills was embedded in the process. Ms. M invited children to observe the silkworms closely using observation tools, to make predictions, to record their observations in their books, and to reflect and share their observations and ideas with others during group time. Most importantly, it generated in children an excitement and fascination with a process of growth and change in nature.

Engaging Families

- **Ask families about children’s previous experiences, cultural beliefs, and theories about living things.** Some children may have had contact with many living things, while others may have had little contact. Some may view certain living organisms as dangerous, scary, elusive, or holy. Children’s day-to-day interactions with the natural world and their sensitivity to the culture and belief systems of their communities influence their reasoning about concepts of living things. For example, there may be differences in the understanding of concepts such as, which things are alive, whether plants are alive, and the ability to view humans as animals are related to children’s previous experiences (i.e., rural or urban), naming practices in their languages, and the cultural belief systems within their communities.⁷¹ It is essential for teachers to talk with and listen to children’s families to learn more about children’s previous experiences, beliefs, and interests with regard to living things.
- **Share with parents children’s experiences of inquiry in life science.** Explain parents that life science for young children is about nurturing children’s curiosity and fascination with the natural world, and building their understanding and appreciation of living things. Share with parents how you provide children with opportunities to closely observe plants and animals, and the strategies you use to encourage children to question, explore and investigate the characteristics of living things. Invite parents into the preschool or host a family night where parents can learn about the science curriculum, observe documentations of children’s work, and experience firsthand explorations of living things. Also, share with parents the ongoing information and documentations of children’s work through newsletters and the parents’ bulletin in the room.
- **Involve parents as volunteers and rich resources in the study life sciences.** Encourage family members to assist as volunteers with explorations of living

things outdoors or indoors. They can provide children with guidance and help them focus and observe more deeply. Parents with certain expertise or interest (e.g., an avid gardener or a bird watcher) can be invited to the preschool to share their knowledge in a particular area of study. They can make presentations to children, tell children what they do, set up exhibits, or engage children in different activities. They can also share tools, books and stories related their work. Parents' visits enhance children's learning and the home-school connection.

- **Support families in facilitating children's curiosity and learning about living things.** Preschool children have many opportunities to engage with living things outside the preschool environment. When playing in their backyard or the park, they may come across small animals or bugs, or notice changes in the trees. They may have a pet they take care of, and plants their family grows inside the home or outside in yard. Remind parents of the many opportunities to engage children in life science explorations outside the preschool environment. Such experiences provide the context for observing and learning about characteristics of living things. Provide parents with tips to guide children's explorations of living things, for example, what they may note about animals or plants when observing them together, key vocabulary associated with these experiences, sample questions they may ask to spark some conversations, and ways they can support children in expressing their thoughts. Share with parents simple activities they can do with their children such as planting seeds, building a terrarium, or looking for living things in their neighborhood. The teacher might also provide a list of suggested places they can visit such as the zoo, botanical gardens, aquariums, museums, and farms in their area, and a list of children's books that are related to the life science concepts they are learning.

Questions for Reflection

1. Think about activities or projects related to life science that you were doing or are planning to do with the children in your group-
 - What is the purpose of these activities?
 - What concepts of life science do they focus on?
 - How do you develop children's inquiry skills in the context of these activities or projects?
 - How do you introduce the inquiry topic?
 - How did you, or will you engage children in thinking about the key ideas or concepts of science underlying these projects or activities?
 - How do you find out about children's questions, ideas and understandings related to these explorations?
 - How to you know when and how to draw an inquiry to a close?
2. How do you use the outdoors for engaging children in explorations of plants and animals? What could you add or change in the way you use the outdoors to

enhance your life science curriculum? How will you bring living things inside as well?

3. How can you find out what ideas, interests, cultural beliefs or fears the children in your group bring to their study of living things?
4. What tools, books or other resources, would you include in your environment to enhance children's observations and explorations of living things? How would you adapt some of these tools or materials to support the special needs of children in your group?

Strand: Earth Sciences

Young children's inquiry in earth science involves the active exploration of the physical properties of earth materials in the immediate environment, and of observable changes of the earth, including ones of natural objects in the sky (e.g., sun, moon), in the weather, and in the environment due to weather and seasonal changes. When children play with dirt, jump in puddles, collect rocks, observe the rain, or feel the sun heat they have direct contact with aspects of the earth. Daily interactions and direct contact with objects and events of the earth provide children with the context to observe and explore properties of earth materials, and to identify patterns of change in the world around them. For example, patterns of day and night, and changes in temperature. With teachers' guidance, children's everyday interactions and direct contact with objects and events of the earth can become rich, inquiry experiences of earth sciences. Teachers can provide children with opportunities to explore the physical properties of earth materials, and to observe, record, and track the changes in the weather, and how it affects the living world. Exploratory interactions with earth materials and ongoing observations of earth phenomena enhance children's connection to nature, and raise their awareness of the importance of caring for and respecting the natural world. The following section provides practical strategies to engage children in rich, focused explorations of earth materials and phenomena.

Substrand 1.0 Properties and Characteristics of Earth Materials and Objects

Earth materials are part of children's daily environment. Children have direct contact with soil, rocks, sand, air, and water through daily experiences. While playing outdoors, children may spontaneously collect rocks, or dig in soil. They enjoy pouring and mixing water with dirt and sand. Through close observations and explorations of earth materials, children can learn about their properties, how they are similar or different, and where they can be found. For example, through a close observation of sand they may discover that it is made up of tiny pieces of rocks, and that dry sand can be poured like a liquid. A closer look at rocks will reveal children that rocks vary in size, shape, color, texture, and hardness. They may also begin to notice that soil, like sand, absorbs water, and that there are different kinds of soils with different properties. They may notice that

some areas around where they live have many rocks and some areas have no rocks. They learn about the geographical characteristics of their home environment, and become aware of whether they live in the mountains, near the beach, in a valley or a desert.

The preschool environment can provide children with a variety of experiences to observe, explore, compare and ponder about earth materials in their environment. Some projects or activities may focus directly on investigating properties of earth materials. For example, in studying rocks, children may collect different rocks, observe them closely, classify and categorize them in different ways, and may decide to investigate how they change, for example, what happens to different rocks when put in water, or scratched on their surface. Other opportunities to explore properties of earth materials may be embedded in the context of learning about topics from life and physical sciences. For example, a planting project can provide the context for investigating different kinds of soils. The following strategies will broaden and deepen children's awareness and understanding of properties and characteristics of earth materials.

Vignette: Timothy's Rock

Timothy was very excited this morning about the rock he brought from home. "Tell us about your rock," said Mrs. Hunt. Timothy told the group, "I found it when I went to the beach with my mom and dad, and I kept it in my pocket." Mrs. Hunt asked if he could pass around his white rounded pebble, so that everyone had a chance to look at it, and asked the group, "Have you seen a rock like this before?" One child said she saw one in her garden. Another child said he saw many rocks like this when he went to the beach. "What have you noticed about Timothy's rock? What does it look like? How does it feel?" The children were sharing their observations of the rock. They have mentioned that it is white and smooth, and it has one hole on the side. Mrs. Hunt wondered aloud, "What rocks do you think we can find in our yard? I wonder if the rocks we have in our yard look similar to Timothy's rock." Later, while playing in the yard, Mrs. Hunt noticed that some of the children in the group were searching for rocks, "We are looking for more rocks," they explained. Mrs. Hunt had joined the children in searching for rocks in the playground. She noticed how the children got excited with every rock they found, and invited the children to put the rocks on a tray. By the time they had to go back inside the room, they had a collection of rocks to observe and investigate in the next days.

Teachable Moment:

Mrs. Hunt builds on children's emerging interest and excitement with rocks, and plans to use it as a springboard for studying the rocks in their environment. By wondering aloud about the kind of rocks they may find in their yard, Mrs. Hunt raises their curiosity, and also plants the idea that different locations may have different kinds of rocks. Smooth rounded pebbles are usually found at the beach, or near rivers or streams. Mrs. Hunt

plans to do some research about rocks in their area, so she can guide and enrich children's investigations of rocks. She is not interested in teaching them the names for different rocks, as much as she wants them to recognize the characteristics of rocks in their area, and what they may discover about them by observing them closely. For example, rocks can be white, gray, yellowish brown, or red (depending on whether they are white marble, slate, scoria or others). Some rocks are smooth, and others are chalky looking, or have bubble holes. Ms. Hunt plans to invite children to sort and classify the rocks they found, discuss similarities and differences and investigate their characteristics.

Interactions and Strategies:

Provide children with opportunities to explore and investigate earth materials.

Children are surrounded by earth materials such as soil, sand, water and rocks. Provide children with opportunities to collect earth materials, to observe them closely, to ponder about them, and to investigate them further.

- **Invite children to observe earth sources in nature.** Children should be given opportunities to observe soil, rocks, water, and sand as they appear in nature, whenever possible. Take children on a search for natural materials in the preschool's playground, on a nature walk in the neighborhood, or a field trip in the area. Direct their attention to where earth materials can be found, what they look like in their natural setting, and what materials are parts of their own environment. A field trip in their area may provide them with opportunities to observe big rocks, high mountains, dunes of sand, dirt and rocks at a construction site, or water in a stream, river, lake or ocean, depending on where they live. You may invite children for a rock hunt (children often have their favorite rock in their pocket), (Note: You must make sure there are no dangerous materials on the ground before you invite children to collect natural materials and prepare them for some of the things they might find that should not be collected but just observed). Having magnifying glasses, binoculars and recording materials will allow children to observe things more carefully, and document what they see. Further explorations of rocks, sand, soil and other natural materials they collected outdoor can be the focus of closer observations and investigations in the preschool setting.
- **Invite children to observe, compare and classify earth materials.** Encourage children to observe earth materials closely, using their senses, and with the help of magnifiers and other tools, to discover their physical properties. For example, in observing rocks, minerals, or crystals, encourage children to explore their color, shape, size, and texture "What does it look like? What color is this rock? "How can we find out how big it is? "Is it heavy or light? "How can we find out how much it weighs?" "Is it easy or hard to scratch?" "Does it feel smooth? Does it feel rough?" "Is it shiny? Is it dull?" Similarly, children can observe soil closely,

using magnifiers, and explore its color, what's in it, how it feels, or what it smells like- "What does it feel like when you touch it with your fingers?" "Does it feel soft?" "Are there any small rocks in it? What did you find when digging in the soil?" "How does it feel? (e.g., wet, dry) "Why do you think the soil is wet?" An examination of different kinds of rocks, sand and soil allows for comparison and categorization of earth materials. Encourage children to come up with their own criteria for sorting, and Invite them to describe their sorting and classifying, "Tell me how you sorted these rocks," "Why did you put these rocks together?" Activities of this kind not only highlight for children variation in earth materials, but also introduce children to descriptive words and expand their vocabulary in a context that is meaningful for them. This is particularly relevant for English learners who benefit from concrete examples when trying to make meaning of words in English. Consideration should be made for children with special needs so they are able to participate and make observations.

Vignette: A Mountain at the Sandbox

Ms. Tina observes the children playing at the sandbox. Ted fills up the bucket with water and pours it on the sand. Olivia and Ted watch as the water absorbs in the sand. They are putting sand together in a pile. Olivia says, "It's like a mountain. Let's make it bigger." They add more sand and compact it together, and their mountain is beginning to take shape and gets bigger and bigger. Olivia says, "I am going to get water." She gets a small bucket and gently pours it on top of the mountain. She notices how the water creates a crack in the sand, and then flows down. Ted says, "Like a river." He gets more water in the bucket, and pours it again at the same place. The crack gets bigger. Ms. Tina gets closer and asks, "What happens when the water is flowing down your mountain?" Ted describes, "The water makes a hole in the mountain. Olivia says, "It takes the sand down." Ms. Tina said, "A little bit of water at the beginning helped to hold the mountain together, but pouring a large amount of water causes the sand to slip and slide away. It can also happen in nature, when water or wind break down the land."

Teachable Moment:

The sand box is a great place to create different land forms such as mountains, valleys, craters, rivers and lakes. Through playful hands on experiences with sand and water, Ted and Olivia learn about their properties, for example, how water is absorbed in sand, and a stream of water causes the sand to drop and slide away. Ms. Tina raises their awareness of the phenomena they observe by asking them to describe what happened to the mountain. She then draws the connection to the phenomena of erosion in nature, one that is prevalent in California's coastal line.

Interactions and Strategies:

Invite children to explore and experiment with earth materials. Exploring and experimenting with earth materials lead children to discover more of their properties. For example, when playing with rocks, children may discover that they can use certain rocks to draw on a sidewalk, that some rocks break more easily, or change color or texture when put in water. Children also discover what happens when water is poured into soil or sand, and how it affects the water and the sand. Wet and dry sand and soil do not behave the same way. Wet sand behaves like mud while dry sand in some ways behaves like liquid. You can pour dry sand through a funnel and fill up a bottle with sand, but you can't do it with wet sand. Clay is another earth material derived from minerals. When adding water to solid clay, children may discover how it transforms into a soft, slippery material which can be cut, rolled, or flattened. They can also vary the amount of water they add to clay and notice how it affects its texture. Children may discover what happens to clay when it dries out, and whether they can make it soft again.

Use opportunities to explore earth materials in the context of studying living things, or when exploring other solid and non-solid materials. Much of the explorations of earth materials can be a natural extension of children's explorations in physical and life sciences. Living things use earth resources to grow and survive. The study of plants, for example, provides an opportunity to explore properties of soil, and to discuss with children the way soil helps plants grow. As children take part in putting together all the materials needed for creating a terrarium for their indoor plants, they may notice that the teacher puts gravel in the bottom and soil on top. The teacher may use this as an opportunity to explore these earth materials with children, "How are gravel and soil different? Why do you think we need gravel at the bottom and soil on top?" "How are these materials help plants grow?" As children investigate the habitats of different animals, they notice that some prefer to live in soil, some live under rocks, and some live in water. This creates the opportunity to explore different earth materials, and how they provide for the needs of different animals. The exploration of sand, soil, clay, water and rocks can also be part of children's exploration of other solid and non-solid materials (e.g., wood, play dough, rubber, metal), as described in section on physical sciences.

Vignette: What is Hiding in the Soil?

The children in Mrs. Cooper's group were excited about collecting soil from the garden. Before going outside, Mrs. Cooper showed them a trowel, and asked, "What do you think this is for?" Nikko said, "It's for digging in the mud." Hanna said, "My mom uses it for taking out the plants." Mrs. Cooper explained, "It is used for digging and its call a trowel. We are going to use this tool to dig up and collect some soil. I wonder what we are going to find in the soil, when digging in it. What do you predict we may find in the soil?" The children came up with different predictions: "rocks" "leaves" "a ladybug" "old

flowers” “ants” “seeds,” and Mrs. Cooper wrote down their predictions. Later, Mrs. Cooper brought outside several trowels and hand lenses. She helped the children use the trowels to dig in the dirt, and collect some soil from the garden, which they put in a dishpan. Mai said, “My soil has roots inside. Look! I found roots.” Mrs. Cooper looked at the roots and said, “It seems like they go pretty deep. I wonder what plant they grow.” After they collected enough soil for their plants in the dishpan, Mrs. Cooper invited them to observe the soil they collected more closely. She brought a sieve, and showed the children how they could use it to sift the soil. She also provided them with tweezers to pick decomposing plant and animal materials. The children looked curiously, and were excited to discover roots, small rocks, slugs, and even worms, using their magnifiers. During group time, Mrs. Cooper invited the children to describe what they discovered in the soil, and she made a list of all the things they found. She read the list and explained, “Soil is made up of all of these things. Small rocks, minerals, plant and animal materials make soil.”

Planning Learning Opportunities:

Mrs. Cooper recognizes an opportunity for exploration of soil, as part of her group’s planting project. An activity of digging and collecting soil for their pots became a learning experience about soil. She prepares herself by reading about soil and learning about the main components of soil (i.e., minerals, organic matter and living organisms). She introduces children to the trowel, a new tool they were going to use, and later she assists them in using it. Children’s predictions about what they will find in the soil inform Mrs. Cooper of their ideas and thoughts, and increase children’s curiosity and interest as they hear each other’s predictions. Digging in the soil provides them with an immediate way to check their predictions, and it opens the door for more explorations of the things they found in the soil.

Substrand 2.0 Changes in the Earth

Young children have daily experiences and interactions with changes in the earth. They experience changes of night and day, and may notice how the sun and the moon appear to move across the sky (They believe that the sun and the moon are actually moving, as they do not yet understand that the earth rotates around once in 24 hours). They experience changes related to weather, and know they need to dress differently when it is hot or cold outside. They also notice when the rain falls or the wind blows, and the changes it causes in the environment around them, such as the leaves falling down, or puddles on the playground. The preschool environment can invite children to observe, and to record and track changes in earth that occur around them, such as pattern of movement and change in the sun and the moon, changes in the weather and seasons, and the impact of weather and seasons on them, and on the environment around them. This requires systematic observations and recording, to identify patterns in the data and changes over time. The following strategies will

increase and deepen children’s awareness and ability to observe, describe and track changes in the earth.

Interactions and Strategies:

Engage children in observing and describing the sun and the moon and other natural objects in the sky. Young children are aware that the sun, the moon and the stars are in the sky, but most likely are not aware of patterns of movement and apparent changes in the sun and the moon. Invite children to observe the sky and describe what they see. This can lead to discussions about clouds and their shapes, where the sun appears to be at different times of the day, that the moon usually can be seen at night, but sometimes during the day, and how it appears to change shape over time. Children may also describe what they see in the sky when they look at the sky at night, and compare it to the day sky. The teachers can ask questions to focus children’s observations and facilitate the discussion about object in the sky, “What does the moon look like?” “When you looked at the sky at night, what did you see?” You can also invite children to make predictions, “What do you predict we will see in the sky when we go outside?” Invite children to record their observations of objects in the sky by drawing, or by creating other representations and by using different materials.

Invite children to track patterns of movement and change of the sun and moon. Systematic observations of the sun and the moon over time will allow children to discover patterns of movement and change. They may notice that the sun shines on different areas at different times of the day. For example, they may notice that when they go outside in the morning, the sun shines in the swing area, and during lunch it shines by the tree. By observing and recording the shape of the moon, children will discover how the moon appears to change shape over time from a full circle to different-size parts of a circle. Ongoing observations and recording of data, in drawings or words, will allow children to look at data that was collected over time, and identify patterns of change.

Vignette: Observing the Rain

It was a rainy day and Mr. Kim decided to take the children out to explore the rain. Before they went outside, Mr. Kim discussed it with the group and asked for their ideas of what the rain may feel, sound, taste and smell like, and where they think the rain comes from. After coming back inside, the children were all excited. They were still observing the rain through the window. Mr. Kim invited the children to share their observations of the rain and the clouds. “What did you notice about the rain?” Simon said, “I saw the rain falling on the ground.” Reina said, “I felt the raindrops on my face. It was ticklish.” Mr. Kim asked the children, “Can you show me with your body how the rain was falling down?” “It falls down like this,” said Nicholas, and started jumping fast, rocking his feet on the floor. Mr. Kim said, “Oh, so rain is falling down from above

(showing with his hands the direction in which the rain is falling). “Where do you think the rain is coming from?” John said, “It’s falling down from the sky.” Tommy said, “It is coming from the clouds.” Mr. Kim invited children to observe the clouds again. “What do you notice about rain clouds?” Children looked outside and shared their observations, “They are up in the sky” “They are not white,” “They are grey.” “They have lots of rain inside.” Mr. Kim said, “These are rain clouds. Scientists call them Cumulonimbus clouds.”

Planning Learning Opportunities:

Mr. Kim provides children with an opportunity to observe the rain and clouds, and think about the connection between them. He is guiding them to think about where the rain comes from, and to notice what rain clouds (Cumulonimbus clouds) are like. The teacher did some basic research about different types of clouds, and is introducing their names in a meaningful context. Even though the children may be too young to understand how water droplets are formed in the clouds, they can begin to understand where rain comes from. The teacher encourages children to use all their senses to observe the rain and clouds. Such experiences help children to develop their ability to describe their observations, in words and through body movements, and to allow children who are non-verbal to participate and communicate their observations of the rain. Mr. Kim may also invite children to record their observations of the rain through drawings and dictations in their weather journals.

Interactions and Strategies:

Provide children with opportunities to observe, record and discuss the weather.

- **Develop an awareness of the daily weather.** Weather is driven by changes in temperature, air movement and precipitation activity. Common weather phenomena in California include wind, rain, clouds and fog. Discussions about the weather can raise children’s awareness to changes in temperatures, and provide children with opportunities to use vocabulary to describe the types of weather they experience (e.g., sunny, windy, rainy, foggy). The teacher may read with children the temperature on the thermometer. It will introduce children to the tool and measurements of temperature. During large or small group time take opportunities to talk about the weather. Invite children to observe and describe the weather, “What do you see?” “How is the weather different from yesterday?” “What happens when the wind blows?” Children may start making predictions, based on their observations. For example, by observing the sky, they may tell whether they think it is going to rain “Do you predict it is going to rain today? What makes you think so?” Encourage children to label their observations, using words such as windy, cloudy, foggy, rainy, sunny, and to represent their observations in drawings or actions.

Invite children to record and discuss changes in the weather. Recording the weather may take different forms, including drawing a picture of the weather and describing it in words, recording the weather in their journal, or recording their observation on a weather chart, for example, using a picture with a drawing of clouds to indicate that it is a cloudy day. Children can also learn about the different types of clouds (e.g., Cumulus, Cumulonimbus, Cirrus), and may observe the sky and record the clouds they are observing in their journals. Older children may also read an outside thermometer, with assistance from adults, and record observations in their journals or in a chart. Systematic recording of the weather in a chart allows children to look back at the data, and learn about changes in the weather over time. Children discover that weather can change from day to day and during the day, and can identify and describe weather patterns. For example, “It was raining three days this week,” or “How many sunny days did we have in the past month?”

Vignette: Is It Windy Today?

During group time, Ms. Reese invited the children to record the weather. Tania said, “It is windy. When I came, I felt the wind in my face, and it moved my hair.” Ms. Reese told the group, “Tania says that it is windy or breezy, because she felt the wind blowing her hair when she came in this morning. Let’s look outside. How can we tell if it is still windy or not?” The children looked through the window. Josh said, “It is windy because we can see the trees moving.” Dora said, “It is windy because our wind wheel is moving.” Ms. Reese told the group, “These are all signs that it is windy outside.” She opened the door and the children could feel the wind coming in. Ms. Reese asked, “Is it a strong breeze or a light breeze?” The children agreed it was a strong breeze. Ms. Reese told the group that there are special ways to tell if it is windy and to measure the strength of the wind. She showed the group a windsock that she ordered in advance, and explained to the children what it is. She told the children that she is going to hang it up high in the yard. “Together we will look at it and will be able to tell different things about the wind, for example, how fast it blows, and in what direction it is going.” Then, she asked Tania, “Will you please help us record on our weather chart that it is a windy day?” After Tania marked the chart, Ms. Reese asked the group, “Can you look at the chart and tell me, how many windy days we had in the past week?” The children looked at the chart and started counting, “One, two- two. We had two windy days.”

Planning Learning Opportunities:

A routine daily activity of recording the weather can become a rich experience in which children observe the weather outside, and use the evidence to determine whether it is windy or not. When children were observing the yard through the window, they could not feel the wind, but were able to pick up on other clues to determine it was windy outside. Once Ms. Reese opened the door, they could also feel the wind, and it confirmed their observations. Ms. Reese presented children with a windsock, and included it in their yard, so that children would become aware of the tools that inform us about different features of the wind such as its direction and relative speed. Ms. Reese

also invited children to record the weather in a weather chart. Recording the weather increases children’s awareness of the daily weather, and their ability to observe how it affects their immediate environment.

Interactions and Strategies:

Provide children with opportunities to observe and discuss the effects of weather and seasonal changes on the environment.

- **Discuss the effects of weather and seasonal changes on children’s own life.** Invite children to describe how it feels outside, and what they need to do to keep themselves safe and healthy. What type of clothing would they need to wear? What items they might need to use to stay dry, or to protect themselves from the sun? Children notice that it is necessary to wear jackets in the winter, because it is cold outside, and that they may need their boots and umbrella when it is raining. Invite children to share experiences related to weather and seasonal changes from home and from family trips to other areas. Use books and songs to enrich the conversation.
- **Invite children to observe and discuss the effects of weather and seasonal changes on the environment around them.** Weather can cause immediate changes in the environment. After the rain, children may notice puddles, or a stream of water in the yard. They may notice trails of water through the sand or soil. The wind may blow away leaves, toys and other objects in the playground. On a hot day, children may notice that the slide is too hot to slide on, or that the sand in the sandbox is hotter than usual. Provide opportunities for observations and discussions of the changes they notice in their environment. “

With seasonal changes, there are noticeable changes in weather and temperature, and some observable changes in plants and animal activity. For example, in the autumn, the leaves of some trees and plants change their color, and fall down. Animals with fur grow thicker coats to keep them warm during the coming winter, and many birds travel to warmer places. In the spring temperatures become warmer. Trees sprout buds and grow new leaves and flowers, and more birds and bugs are seen around. Draw children’s attention to seasonal changes in their environment. Invite children to observe, record and discuss changes in plants and animal activity. For example, children may observe a tree or bush in the yard regularly throughout the year, and track its changes over time, “Does it lose its leaves? “Is it growing new leaves?” “Does it grow flowers or fruits? “Which animals can be seen around, or use it as part of their habitat?” Children may record their observations of the tree at different times of the year.

- **Read children non-fiction books and scientifically accurate fictional stories related to seasonal and weather changes.** Include in the preschool environment a selection of books that focus on seasonal and weather changes, including fiction books, and information books, and use them with children during small or large group activities. Developmentally appropriate fiction and non-fiction books will enrich children’s study of weather and seasonal changes, will provide a focus for discussion and comparisons, and will also expand children’s vocabulary related to the topic. The books should present scientifically accurate information, and should be engaging, informative, and relevant to the group’s current interest. Children may learn through books about weather and seasonal changes that are different than what they experience in their environment, and may discuss similarities and differences between the weather described in the story, and what they usually experience in their area.

Preserving the Environment

As children observe and experience the natural world and notice the changes taking place, they are more likely to connect to the world around them and develop an appreciation and awareness of their role in protecting and caring for their environment. Nature walks, studying and caring of plants and animals, playing with and exploring water, sand and rocks, observing weather and seasonal changes, are all experiences that enhance children’s curiosity and love towards their natural environment, and build their disposition to participate in environmentally relevant activities in their everyday life. In addition, the preschool teacher can raise children’s awareness of the importance of caring for and respecting the environment, and engage children in practices related to its care.

Interactions and Strategies:

- **Model and discuss respect for the environment.** Young children can become sensitive to basic environmental issues, and develop pro-environmental attitudes and behaviors, especially if the adults in their environment model environmentally sensitive practices, and engage them in discussions about what we can do to protect our environment. Children can understand concepts such as recycling things, caring for animals, keeping the environment clean, and not wasting resources. These are concepts within their capacity to act and change. Issues of air and water pollution or overcrowding are not issues young children can actively prevent, and therefore are less appropriate to discuss in preschool. Model care and responsibility for the environment through every day practices in the preschool environment, such as not leaving water running or lights on, reusing paper, recycling and utilizing recycled materials, and keeping the environment clean by picking up trash.

- **Engage children in practices of caring and protecting the environment through every-day routines in the preschool environment.** These may include showing responsibility in turning off water after washing hands, taking turns in being the room's light keeper, saving paper and other materials, participating in sorting out recyclable items, and going on a "trash hunt" to clean the yard. While outdoor in nature, as they explore and investigate earth materials, plants and animals, remind them to act in a way that keeps animals and plants safe, and show respect for living and nonliving things in the natural environment. This would include observing rather than collecting insects and animals and releasing the ones they find and study back into their habitat.

Bringing It All Together: Earth Sciences

Observing the Valley Oak Tree in the Yard

The children in Ms. B's group spend a lot of time exploring the outdoor environment. Ms. B always looks for opportunities to observe with them the natural world around them. While outdoors, whether in the yard, or when taking a walk around the center, she talks with the children about the weather, and is always excited to draw their attention to different trees and plants and how they change or grow, and to any birds or bugs that the children come across in their environment. There is one particular tree that the children in her group follow very closely and track its changes over time. Ms. B decided to focus on the oak tree in their yard, in order to give children an opportunity to see the pattern of seasonal changes throughout the year. The Valley oak tree is native to California's valleys. In autumn its leaves turn a yellow or light orange color, and become brown by mid to late fall. , By mid-winter the oak tree is leafless. In the spring, the oak tree sprouts new leaves, and in the summer, it has heavy, green foliage.

Every month the children observe the oak tree outdoors, and keep records of how it changes from month to month. Ms. B. encourages children to make drawings of the tree, and together with the children, she takes photos of it once a month. In the fall, children collected fallen oak acorns and leaves. They were fascinated with of its deeply lobed leaves, and some of them made drawings of the oak leaves in their journals. They also observed the acorns and talked about what these are, and what other trees around have dry fruit similar to the acorn.

Before children go out for their tree observation, they look at their last drawings and photos to remind themselves of what they have seen and noticed about the tree during their last observation. Ms. B helps them to reflect on their previous tree observation by asking questions such as, "What did you observe last month? She will also encourage them to predict the changes they may notice, "How do you think the tree will look different this time? While observing the tree outdoors, Ms B invites them to share their observations, "What changes do you see?" Why do you think the tree changed like that?" Through such discussions, Ms. B helps children to begin to draw the connection

between the changes they observe in the tree, and the changes in weather and season. For example, one of the children suggested that the oak tree lost its leaves because it is fall. Ms. B asked her, “Why does it loose its leaves in the fall? How does it help the tree to lose its leaves?” Ms. B creates a class book with the observational drawings, children’s words, and photographs documenting the changes the children observe each month. By the end of the school year, the book will include their documentations of the tree in order, in the fall, winter, spring and summer (Based on example by Chalufour and Worth, 2003).⁷²

The yearlong focus on the tree gave the children an opportunity to observe the pattern of seasonal changes, and raised their awareness of changes in the plant life around them. This project illustrates the natural connection between earth sciences and life sciences. Through regular observations and recordings of the Valley oak tree throughout the year, children notice changes in the tree, and how these changes coincide with weather and seasonal changes. Ms. B enhances children’s awareness and involvement in the process by encouraging them to describe and record their observations, and by making recordings and documentation materials visible to children. This allows children to see the changes in the tree over time, and provides the context for rich discussions, in which the children can share their observations with others, compare current images of the tree to previous ones, and share their ideas about why the tree or plant has changed. Experiences of ongoing observations in the outdoors enhance children’s connection to nature, and raise their awareness and understanding of changes in their natural environment.

Engaging Families

- **Support families in facilitating children’s curiosity and learning about their world.** In the course of their daily life, children ask for explanations about how the world works, for example, why the moon is sometimes invisible, how the seasons change, why we cannot see the sun at night. Children’s “why” questions are expressions of everyday intense curiosity about the world. Help parents understand that they play a critical role in encouraging and supporting children’s curiosity and learning about their world. When parents show curiosity and interest in learning about their natural environment, children follow their lead and demonstrate even greater interest. You may need to explain parents that preschool children are not yet ready to understand scientific explanations for earth phenomena such as day/night changes and weather and seasonal changes, but they can observe and talk about such changes in their environment. Children’s direct contact with the natural world enhances their connection to nature, and supports their development. Communicate to families the value of children observing the world around them. Certain topics really require families to help children, like observing the night sky during summer. Engaging families and

sharing the children's excitement and your own will support families in bringing the natural world into their consciousness.

Provide parents with tips to support children's awareness and understanding of their natural environment. For example, how they can encourage children's inquiry about the natural world, key vocabulary associated with these experiences, sample questions they may ask to spark some conversations, and ways they can support children in looking for explanations.

- **Share with parents children's experiences of inquiry in Earth science.** Explain parents that earth science for young children is about nurturing children's curiosity and fascination with the natural world, and building their awareness and appreciation of earth materials and phenomena. Share with parents how you provide children with opportunities to explore earth materials, and the strategies you use to encourage children to question, explore and investigate changes in the environment. Invite parents into the preschool or host a family night where parents can learn about the science curriculum, observe documentations of children's work, and experience firsthand explorations of earth materials. Developing "What we are observing now" columns in the center newsletter, email or website announcements, or on a bulletin, give families topics to discuss and ways to engage with their children. A list of open-ended questions to use with their children is also helpful, along with some suggested activities. The teacher might also provide a list of suggested outdoor places they can visit and children's books that are related to earth sciences (e.g., earth materials, objects in the sky, weather, and seasons)
- **Involve parents as volunteers and rich resources in the study Earth sciences.** Encourage family members to assist as volunteers with explorations of. They can provide children with guidance and help them focus and observe more deeply. Parents with certain expertise or interest (e.g., geologist, naturalist) can be invited to the preschool to share their knowledge in a particular area of study. They can make presentations to children, tell children what they do, set up exhibits, or engage children in different activities. They can also share tools, books and stories related their work. Parents' visits enhance children's learning and the home-school connection.

Questions for Reflection

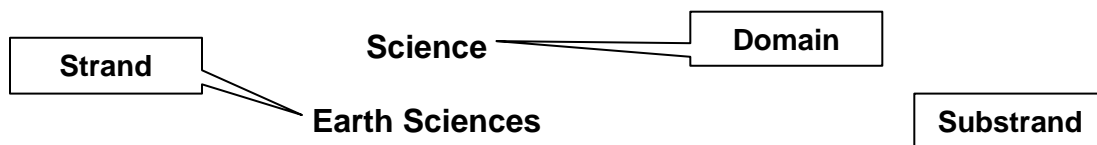
1. How do you use the outdoors for engaging children in explorations and observations of earth materials and phenomena? What could you add or change in the way you use the outdoors to enhance children's explorations of the natural world?

2. How does your preschool environment encourage children to initiate their own playful experiences with earth materials?
3. How do you engage children in observing and describing characteristics of the weather, and its changing conditions (e.g., wind, rain clouds)?
4. What opportunities do you provide to encourage children to collect, explore, compare, and sort earth materials?
5. How can you engage children in year-long observations of seasonal changes in their immediate environment?
6. How do you support children in developing an awareness of the importance of caring and respecting the environment? How is it reflected in the behaviors of the children in your group on a daily basis?

Concluding Thoughts

Young children have a sense of wonder and a natural curiosity about objects and events in their world. Through exploratory play and experimentation with objects and materials, they discover how to make their car go downhill faster, or how to control the movement and flow of water. They are excited to find out what's inside a pumpkin, how trees change over the year, how the rain feels and smells, and why pill bugs curl into a ball. The preschool environment nurtures children's dispositions to observe and seek information, and guides their curiosity into opportunities to observe, explore and inquire about objects and phenomena in their environment. Teachers provide children with purposefully-planned, play-based, supportive environment that expands their explorations, deepens children's understanding of concepts in science, and develops their attitudes, skills and language of scientific inquiry. While investigating concepts from physical, life and earth science, teachers encourage children to ask questions, to observe and investigate, to predict and experiment with objects and materials, to draw conclusions, to document their work, and to share their observations and ideas with others. Such experiences not only develop children's scientific inquiry skills, but also provide the context for learning and developing their language, literacy, mathematics and social skills. Preschool science prepares children for the scientific skills and knowledge they encounter later in school. It fosters a joy of discovery, a positive approach to learning, and the development of skills and attitudes necessary for many areas of learning throughout life.

Map of the Foundations



1.0 Properties and Characteristics of Earth Materials and Objects

At around 48 months of age	At around 60 months of age
1.1 Investigate characteristics (size, weight, shape, color, texture) of earth materials such as sand, rocks, soil, water and air.	1.1 Demonstrate increased ability to investigate and compare characteristics (size, weight, shape, color, texture) of earth materials such as sand, rocks, soil, water and air.
Examples	Examples
<ul style="list-style-type: none"> • Observes different rocks collected on a nature walk (using the senses of sight and touch). Sorts out all the smooth rocks. • Plays with rocks and discovers that she can use a rock to draw on a sidewalk. • Fills up a bucket with soil and comments, "We need water to make it more squishy." • While playing in the sand box, pours sand through a funnel to fill a bottle with sand, and communicates to his friend in his home language, "I can fill up the bottle with sand all the way up." • While outside, observes a windmill spinning. Responds, "I can feel the wind, the air is pushing it." • A child who is visually impaired holds different rocks and communicates, "This one is really smooth, but this one is not very smooth." 	<ul style="list-style-type: none"> • Pours water on sand, and compares the dry sand to the wet sand (e.g., "The wet sand sticks together."). Demonstrates how you can make a cake with wet sand by filling up the bucket, and then turning it over. • Pours water in the sandbox to form craters, lakes and dams. • Investigates the surfaces of different rocks, and sorts the rocks based on how shiny they are. Communicates, "Here are very shiny rocks, and here not so shiny rocks." • While playing with a funnel near the water table, notices that air is coming out the small hole when he pushes the funnel down, and communicates, "I can feel the air."

**Teacher Resources
(To be developed)**

DRAFT

References
(To be developed)

DRAFT

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Families and Culture: The Social Context of Teaching and Learning in Early Childhood

“The family and its culture and language play a central role in early learning and development.”

(California Infant/Toddler Learning and Development Foundations, p. xii)

Introduction

Family and culture powerfully shape the development of young children. Even with the increased reliance on out of home care, children under the age of five will continue to spend most of their early lives within the confines of the family. Underscoring the importance of families, the California Preschool Learning Foundations acknowledges explicitly the central role of families and culture in children’s readiness for and healthy adaptation to the early childhood setting. Guided by cultural beliefs and values, families selectively provide experiences, convey attitudes and impart knowledge to prepare children for adult life. Consequently, specific knowledge of the child’s cultural background and life at home can be a key to effective teaching and learning. This knowledge provides an invaluable tool for connecting what the child already knows and values to the new competencies programs seek to nurture. To the extent that a program’s policies and approach are informed by, reflective of, and congruent with the child’s experiences at home, children will find it easier to adapt to the behavioral requirements of the program and meet the program’s expectations for achievement.

Chapter Goals and Scope

This chapter aims to assist early childhood professionals to advance beyond passive acceptance of the importance of family and culture to actually applying knowledge of families and culture to teaching and learning. Moving successfully from theory to practice requires that program staff develop an inclusive perspective, follow a well informed strategy, and sustain implementation of those strategies over time. Such a proactive stance is consistent with the universal design approach to pursue different pathways to make learning relevant to the diverse population of California’s children.¹ To accomplish its goal of assisting programs, the chapter begins with a discussion of culture and the social issues affecting life in diverse families. It poses questions that can guide efforts to learn about cultural groups. Next, it turns to early childhood curricular domains and discusses how considerations of culture and family life might be reflected in the content or teaching methods used in those domains. The concluding section offers guiding principles to be considered as program staff attempt to address cultural and family diversity in teaching and learning. The chapter is written with early childhood program staff as the intended audience though administrators, families, and parent advocacy organizations may find some of the information useful in their roles.

Ethnic Diversity in Early Childhood Settings

The challenges that teachers face in understanding the conditions children experience at home is complicated by the wide diversity of the children attending preschool programs. Just inside many early childhood settings one often finds cubicles in which each child stores outdoor clothing and personal objects brought from home. Each cubicle is labeled with the name of each child. The name labels provide indisputable evidence of the ethnic and cultural diversity of the children. Some names such as Megan, William and Brent suggest the expected Anglo-Saxon and Western roots. Ayesha, Aponi, Sepulveda, Sanchez, and Simon suggest ancestry of Native Peoples, African Slaves, Spanish colonists or links to more recent immigrants from Mexico, Latin America and the Caribbean. Others hint at familial connections to more distant nations in Africa, Asia, and the Middle East such as Adebayo, Arjuna, Bayani, Cho Hee, Hasan, Mei-li, and Nguyen. These children represent the rich array of ethnic, racial and social groups often found in early childhood programs. Much of this diversity is due to high levels of immigration. Foreign-born persons represented 12 percent (32.5 million) of the US population in 2002, with almost 50 percent of that group coming from Latin America (Mexico, Cuba, Dominican Republic, El Salvador), 25 percent from Asia (the Philippines, China, Vietnam and India) and 20 percent from Europe.² This diversity of people and the cultures they represent constitute an opportunity and a resource. Human diversity offers exposure to a range of experiences and world views which can broaden the perspectives and enrich the lives of individuals. For program staff this diversity can be a resource that enriches but it can also bring with it a set of challenges to grow and expand their intellectual horizons. Depending on the teacher's background it may mean that the teacher cannot rely on personal experiences to understand how their children think, see, hear and why they act as they do. Conditions and experiences teachers may have taken in the past as normative may not be for some of their children.

I. Culture

What is Culture?

Understanding cultural differences can open staff up to new ways of thinking about themselves and the world. But what is the nature and source of these cultural differences? Culture is a broad concept that incorporates family roles, rituals and values, communication patterns, emotional expression, social interactions, and learned behavior. Culture also refers to a shared way of life that includes social norms, rules, beliefs, and values that are transmitted across generations.³ Culture has been described as arising from "a dynamic system of social values, cognitive codes, of behavioral standards, worldviews, and beliefs used to give order and meaning to our lives..."⁴ Culture infuses and is reflected in routines of daily living. Culture is a primary source of beliefs, attitudes, language, and personal efficacy, belief that one has control over and is responsible for what happens in one's life) sense of time (whether time is thought of in large chunks such as hours and days rather than precisely in terms of

minutes and seconds) and perceptions of personal space. Culture is the source of the symbols we use to represent important aspects of reality. Culture conveys a set of beliefs about how social relationships should be ordered and how the world operates. Cultures attach value to specific life skills and dictate the practices used to promote them. Cultural groups promote child development through socialization norms and practices and the emotional relationships they foster. Families differentially reinforce specific behaviors and nurture specific skills, while permitting others to languish. Culture transmits messages about how much the world and life events are predictable and subject to personal control versus pre-determination, destiny, and chance. These cultural beliefs reinforce the tendency towards active problem solving or resignation; planfulness versus surrender to fate; individualism or egocentrism versus the collective and cooperative orientations.

Language is a central and defining feature of culture. Reliance on a common language is the principal means through which culture is conveyed and cultural identity maintained.⁵ Through language children are exposed to particular sounds and vocabularies needed for their language, while the capacity to distinguish sounds not used in their language disappears. Culture embodies an ethnic group's identity, its collective aspirations and the wisdom it has developed over time about life and how it should be lived. A. Malraux has described culture elegantly as "...the sum of all the forms of art, of love and of thought, which, in the course of centuries, have enabled man to be less enslaved."⁶

Distinguishing Ethnicity and Culture

Culture is not to be confused with ethnicity or national origin. Though closely related these are distinct concepts. National origin is rooted in politics, geography and place; ethnicity, in individual psychology and identity. Ethnicity refers to a group's identity and denotes a people bound by a common past and a shared future. Members of an ethnic group often share ancestry, history, language, and place. To the extent that they share these things, members of ethnic groups may be said to have a common culture. Accordingly, members of ethnic groups espouse common values and beliefs and engage in similar practices of daily living. Because of its link to ethnicity, culture is also associated with nationality, common ancestry or immigration experiences. Consequently, whereas culture is expressed in social processes and structures, ethnicity is rooted in individual psychological processes. Ethnicity is important because it offers a group identity and a sense of belonging. Culture is important because it offers a template for how people should live in and think about the world. Culture and language are the glue that binds members of ethnic groups together.

Why is Culture Important for Early Childhood Educators?

Early childhood educators have as their primary mission the facilitation of child development. At its core early development is a cultural act.⁷ Rogoff argues that development occurs as a result of children's changing participation in the socio-cultural activities of their communities.⁸ Development through participation in cultural activities also contributes to the strengthening of identity with ethnic group and family. Viewed in

this way, development is conceived as a process of introducing a child into a particular way of being, looking at and acting in the world. From birth children internalize the perspectives, worldviews and problem-solving strategies they observe and learn from the family.

What happens in families prior to the start of preschool lays a foundation for social-emotional and cognitive development that will affect adjustment to the early childhood setting. Cultural influences on development may be discerned in the array of practices utilized, beliefs expressed, materials and artifacts used, the attitudes conveyed, the routines followed, the expectations given, and the roles defined. Language transmission is one of the most important cultural aspects of development. Culture provides specific experiences that impact a child's perspective of the world and fosters specific worldviews that shape their behavior, create expectations about themselves and point to the prospects of their future. Together these impact how the child begins preschool: the knowledge they possess, the emotions they express, their understanding of social rules, the skills they have acquired, their receptivity to learning and their acceptance of behavioral limits.

Children are primed by their neurological heritage and prepared by their cultural heritage to acquire language. The support of the language acquisition by the cultural group is one of its key accomplishments and a principal means through which cultural transmission occurs. Language is important not only because it is a means of social connection and communication but also because it represents an important way to access culture and it reinforces group identity. Before formal education begins children are schooled in the competencies and skills that the cultural group considers important for maturation and independence as an adult. As a consequence of all these factors, early childhood teachers will best position themselves to promote children's development by deepening their understanding of the changing cultural practices and circumstances children face at home and within their cultural communities. This means that to understand where the child is, it is necessary to have insights into families cultures, what they value, and the skills they are attempting to impart. Early childhood educators often acknowledge this point in recognizing the importance of the family as the child's first teacher. Through experience many have learned that cultural differences sometimes mean that families do not value to the same extent the skills and competencies valued in early childhood settings. Because development is fundamentally a cultural process, program effectiveness will depend on an understanding of the cultural group of which the child is a part. Cultural differences in conceptions of childhood, the roles of families and teachers in socializing children and even in the purposes of education force teachers to rethink many personally cherished assumptions, values and attitudes about what is the right and proper way to care for, educate and socialize children. This will involve the development of cultural competence which is the ability to see cross-group similarities and to understand and appreciate differences.

Learning about Cultures

Culture can encompass a wide span of issues across the entirety of life. In trying to understand individual cultures, the operative question is values, attitudes, norms, practices and beliefs about aspects of life. To educate the child effectively requires an understanding of the child, the child's culture and their family lives at home.

Understanding families' cultural frameworks increases the likelihood of successfully partnering with families to increase children's readiness for school. Without such an understanding, early childhood program staff are working with one hand tied behind their backs. They are lacking an important tool for achieving the goal of preparing children for school. Through such an understanding teachers and program staff are better able to adapt strategies and approaches that are congruent with family life and culture. They will increase the likelihood of engaging families as partners in education for children. Showing respectful curiosity about the child's world is a starting point. This can lead to learning about family history, home language and rituals, how the child spends time at home, what resources children have access to, what symbols and artifacts children are exposed to, and so on.

Instead of attempting a detailed account of each cultural group, this chapter identifies questions to ask to facilitate learning about a culture. Given the diversity and dynamism of cultures represented in the state's early childhood programs, efforts to profile cultural groups would be quickly outdated. Questions can guide the gathering of useful information about a cultural group. Box 1 identifies promising dimensions of family culture and lists questions that can be posed to obtain information about each dimension. These questions have special relevance for early development and learning. They probe the specific ways in which a group nurtures development and establishes identity. Raising these questions and reflecting on the responses they generate can deepen understanding of the values, beliefs, perspectives and practices cultural groups rely on in promoting development of children.

Box 1. Sample Questions to Pose in Learning About a Culture

Family Structure

Who is considered a member of the family unit? How rigid or flexible are the boundaries that define family membership? How are responsibilities, privileges, decision-making authority and power allocated among family members?

Socialization Goals

What competencies and knowledge are cultivated? What traits are considered moral and virtuous? How important is it to develop knowledge of the home language and cultural practices? What moral virtues are promoted in its stories? How are cooperation, empathy, equity, fairness and justice treated in daily life?

Conceptions of Childhood	What is the group's view or conception of children? For example, are three- to four-year-olds seen as innocent, vulnerable and incapable of making choices or as sturdy and independent? Do four-year-olds possess intentions, motives, and personalities at this age? What capacities are seen as typical and expected by age three or four? How much independence is tolerated and promoted? What responsibilities do young children have to the family?
Child Rearing Practices	What are the best and most appropriate methods for raising a child? Does the group have a notion such as "spoiling" a child? What is it? What methods are deemed appropriate for reinforcing the desired behavior and sanctioning unacceptable behavior? What is the place of support, affection, or parental responsiveness to the child's expressed needs and wishes? How acceptable is the use of corporal punishment or psychological coercion, and under what conditions and limitations? Are there limits to adult authority over children?
Gender Roles	To what extent are males viewed and treated differently than females? What skills, attributes, prospects and expectations are held for each gender? Are resources, opportunities and responsibilities allocated differentially by gender?
Identity	What themes surface in the narrative or history of the group? Who are its heroes? Are music and the arts important to its self image?
Individualism	To what extent is identity personal and defined within the individual or the collective? Are individual achievements and behavior a reflection on the group? To what extent must individual wishes and needs be subordinated to collective well-being? Do individual rights trump responsibilities to the collective?
Spirituality	Does the group express a set of beliefs about the non-material aspects of existence? What is the nature of its spirituality? What metaphors are used to understand, note or celebrate life transitions? Is there

	a notion of good and evil?
Emotional Expression	To what extent are emotions and their expression tolerated and accepted? Under what conditions are children permitted to express their feelings openly and which feelings are they forbidden to express?

In pursuing answers to these questions about individual cultures two common intellectual traps must be avoided: essentialism and overgeneralization.

Essentialism is the belief that the complexities of culture can be adequately captured within a finite set of facts. In truth, it is nearly impossible to reduce the essential and distinguishing features of any culture or cultural group to descriptive statements or lists of characteristics. In learning about a cultural group it is easy to believe that what one has learned about a group such as values and practices capture the essential nature of that group and that the group is distinguished from all other groups by that characteristic. Unless care is taken, discussions of cultural differences can easily slip into reinforcing stereotypes about a group. Therefore, descriptions provided in response to queries should be interpreted loosely as a partial depiction and not as capturing the essence or distinguishing feature of a group. For any feature or characteristic ascribed to one group can often be applied to other groups. Just because a feature is ascribed to one group is not that other groups cannot be similarly characterized. Trait behaviors attributed to one group may be found in other groups but that does not necessarily mean it is a basis for distinguishing one group from another.

Cultures are dynamic and continuous. Once someone has made the effort to learn about a group, it is convenient to believe that it will apply to all members of the group under all circumstances and over time. Even though a particular characteristic may be accurately ascribed to an ethnic group many members of the group may lack that feature or behave in a different way. This is the intellectual trap of **over-generalization**. In fact there are considerable within-group variations and culture changes over time. The shared system of beliefs, morals, values, attitudes, practices, roles, artifacts, symbols, and language that make up a culture are in constant flux. Customs, beliefs and practices develop within a specific context of challenges and life problems to be solved. Old solutions give way to new ones in the face of new experiences, newly acquired knowledge, and the failure of old ways. Old ideas must be revised to accommodate emerging trends and changes in culture. Cultures change in response to strains, opportunities, and altered social landscapes. Learning and re-learning must take place continually. In describing cultures, the best we can achieve are time limited snapshots.

Families and Households

Family Life and Child Outcomes

Like cultures, the nature and forms of family life are dynamic and change over time. In the U.S., many common forms of family life and household arrangements have come into existence and evolved in response to changing social and economic conditions. Each has strengths and limitations but all are significant to understand in terms of their unique contributions as settings in which children are being raised. When viewed as systems nested within community networks, families give rise to life experiences that vary considerably in ways that can have important implications for how children present, act and view the world by the time they enter early childhood programs.⁹ What are the most important things early childhood staff should know about factors that affect lives and outcomes of children in the families and households in which they are being raised? This chapter identifies three features that are central to the relation of family to child outcomes: family structures, social strains, and resources (See Box 2). Family structure reveals how households are organized and family relationships are ordered. Social strains are the serious stressors families confront and daily difficulties with which they must cope. Resources refer to the cultural strengths which help families cope with stress and determine the extent to which they thrive. In the face of seemingly overwhelming odds and signs of family difficulties, it may be easy to overlook cultural strengths and underestimate their importance in working with families. Each of the three dimensions can be used to pinpoint key features of children's experiences at home that shape children's development.¹⁰ Together they provide a convenient way to organize information about family functioning and its impact on child development.

Box 2. Dimensions of Family Life Critical to Early Child Development

Family Structure

- Single adult household, "girlfriend" network
- Multi-Adult household
- Multi-Generational household
- Complex multi-family households
- Extended family, **fictive kin** (i.e., persons who are not related by blood but who are viewed and treated the same as blood relatives)
- Grandparents as primary caregivers
- (In)Visibility of Fathers, Men
- Role of siblings in household and care of the young
- Stability/Instability of family composition and household membership

Family Strains

- Economic hardship, unemployment, poverty
- Immigration status: documented vs. undocumented; voluntary vs. involuntary

- Stigma, racism, discrimination
- Acculturation, assimilation
- Residential instability, homelessness

Family Strengths (Cultural Resources)

- Familism, reliance on extended kin networks
- Ethnic group identity, solidarity
- Bilingualism
- Beliefs in personal control and responsibility and the existence of discrimination
- Coping styles: striving; persistence in the face of obstacles and setbacks
- Resourcefulness, making do, problem-solving style
- Spirituality
- Oral traditions, story telling

Family Structure

Family Composition

Who is family? There is increasing diversity in the ways that families and households are structured and in the criteria used to determine family membership. In an analysis of household composition reported in a representative sample of American families, over seventy different family household configurations were reported. These configurations were defined in terms of the number of generations present, and the relationship of people living within a single residence.¹¹ In addition to the nuclear family, these family configurations include single adults raising one or more children; households in which multiple adults of the same generation such as siblings or friends raise children together; single gender couples with children; households in which children live with parents, grandparents and great grandparents and any combination of the above. Recent economic downturns have resulted in an increase of two or more families, some unrelated by blood, living together, sharing household expenses and duties and exchanging child care. Often these arrangements are temporary, and shift as economic fortunes wax and wane with employment.

There has been an increase in the number of elderly persons who have been thrust by circumstances into caring for young children. When biological parents are not able to carry out their roles, grandmothers are the surrogate parents of choice. For example, in the wake of an epidemic of drug addiction and incarceration that occurred since the 1970's, grandparents have increasingly been pressed into service as primary caregivers for their children's offspring. Grandparents- particularly grandmothers- also play an especially important role in many families in providing support for mothers in caring for their children.

In some ethnic groups, very close family friends not related by blood are elevated to the position of a relative and accepted as part of the family. These fictive kin may be an Auntie, comadre, compadre or just a close friend with whom the family has had a close enduring relationship. In some single parent families the mothers “girlfriend” acts as a confidante, a source of help and a person whose opinions and advice is highly influential on mothers.

(In)Visibility of Fathers and Men

There is wide variation in father availability between and within cultural groups. In some groups fathers are omnipresent and take a leadership role in relation to the early childhood program. In some families, men adopt more flexible gender roles and take on a much broader array of household duties and may have primary responsibility for the care of children than is true in other groups. Although the proportion of single adult households headed by women is high, men continue to play key roles in their families and contribute significantly to the effectiveness of family functioning. Even in the household structure that is nominally female headed, men in general, and biological fathers in particular, play an important role. In other families, fathers are sadly invisible to the child and have little contact with staff. Census data pointing to increasing rates of births to unmarried women among all ethnic groups often overlook the functional emotional importance of non-residential biological fathers to their children. The relationship between mothers and the biological fathers who do not reside with their children often dictates the level of involvement non-custodial fathers have with their children. When mothers report that the relationship with the child’s biological father is good, it is often a sign that fathers have a relationship with, or care for and provide a level of financial support for the child. If biological fathers are minimally involved, other figures such as step-fathers, grandparents, uncles, cousins, and non-married partners may be instrumentally and regularly involved with the children. They can be an important resource in working with children and should be explicitly invited to programs intended for children’s families. Another phenomenon is the increase in the numbers of single men who have taken on responsibility for the raising of their children. Though small in number this is a trend about which early childhood professionals should be aware and take steps to address in their programming.

Older Siblings Caring for Younger Siblings

In many families, siblings make important contributions to family functioning that affect the well-being of young children. When partners, grandmothers or other adults from the extended kin network are not available in the household, older siblings, especially female siblings, take on the responsibility to assist the mother in the care of the household. When single parents are required to work multiple shifts and to be away from home during non-school hours, siblings supervise, feed, admonish and protect younger siblings. In some groups, children as young as four- and five-years-old may act as caregivers for younger siblings or elderly, infirmed relatives living in their homes. Responsibilities delegated to children in this way promote early maturation and independence. Children used to being responsible and caring for others face interesting dilemmas when they bring these behaviors and approaches to early childhood settings.

They may be deemed inappropriate, bossy, impatient or even oppositional because they are expected to defer and wait for adults to meet their needs and the needs of their peers and direct movement from one activity to another when they are used to serving others and making decisions about activities for themselves.

The concept of the family as the child's first teacher takes on a broader meaning when these changes in family composition are considered. Culture and family circumstances influence which adults are most involved in a young child's learning and development. The adults who are responsible for a child on a day-to-day basis have a deep understanding of the practices, beliefs, and values that guide a child's developing behavior. Accordingly, staff will need to expand their view to include these extended family members, fictive kin, and "girlfriends" when they reach out to parental figures caring for the children served in early childhood settings. For example, a grandparent, a fictive kin, an aunt, or an uncle may be able to give insights into the life of a young child and work together with teachers to support the child's continuing learning and development. To build connections between home and the preschool program, teachers need to partner with the adults who are most active and influential in a child's life.

Family Social Strains

Economic Hardship, Poverty and Unemployment

Economic downturns have a way of accelerating and highlighting a disturbing secular trend in the economic status in America, namely the impoverishment of children. Poverty implies insufficiency of economic resources to meet basic needs for food, clothing and shelter. In 2008, about one in five American children were poor. More than a third of African-American and Latino children were growing up in families that face hardships associated with poverty. The deprivation associated with poverty is bad enough in itself but poverty contributes to a host of other troubles, including maternal depression, which often deprives children of responsive available mothering, low educational attainment, limitations of coping resources, residence in distressed and sometimes dangerous communities, high levels of housing mobility and food insecurity and with these a host of physical illnesses and inadequate medical care. All of these have dire consequences for children's health, well-being and development of skills needed for success in school.

Residential Instability and Homelessness

In the absence of accessible employment and subsidized housing poor families have increasing odds of residential instability and of becoming homeless. Coping with low incomes means that families may have to move often as they fall behind in rent or mortgage payments and are forced to relocate to less costly housing. Initially some families cope by moving in and doubling up with another family. As a long term strategy, moving in often proves unworkable and is just a stop gap, short-term solution to a long term problem, which if not resolved leads to homelessness. In the direst of circumstances, unemployment not only means losing one's livelihood but also losing

home and a way of life. Once homeless it is very difficult to rebound and resume their previous life. Homeless people often become ineligible for social services because of the lack of a permanent address. Children face a difficult time enrolling in preschool or remaining in one after they have lost their homes. Within the space of a single year it is not uncommon for children to move multiple times, sometimes doubling up with relatives or family friends. The movement goes two ways. It can also mean having relatives or friends move in when they have lost their homes or income. The composition of a given household may fluctuate as children and adult kin are shifted from one household to another. This is sometimes reflected in the short term verbs children use in response to questions about their residence. When asked about their address children may use the word “stay with” instead of “live at” as in, “I stay with my grandmother” to convey that it is an episodic, transient or temporary arrangement and that they are without permanent roots.

Immigration Status

Immigration represents another form of uprooting that is a significant source of strain for many families. Immigration poses challenges to families and children, whether it is voluntary or involuntary. The sheer environmental change and the pressure to acculturate places significant burdens on families and children. Mastering a new language, learning new ways, accommodating to new customs, understanding and conforming to different legal systems are just a few of the challenges facing new arrivals. If these were not burdensome enough, immigrants are often stigmatized, disparaged and discriminated against. Other dilemmas are faced by families with respect to socialization of children. For many families concerned about the adjustment of their children to a new setting, questions arise about how much to immerse the child in the language and customs of their new home versus supporting the language and customs of their country of origin. Families are not certain about what is best for their children. Since learning one language does not impair the ability to learn a second, and because fluency in multiple languages is an asset, it seems reasonable to encourage retention of home language at the same time the child is learning English. Often ambivalence due to fear about making the wrong decision leads families to not make a choice. As a consequence they may not choose or know how to take sufficient steps to assure that the child is developing appropriate literacy skills in both languages. When left to chance this sometimes means that the child does not develop adequate skills in either language. Early childhood programs can make important contributions by assisting families with information and reading materials in both languages so that the child develops the language proficiencies needed to communicate with their family in their native language and to use English for learning in the early childhood program and interactions with peers.

There are several implications of family stressors for program staff and the potential success with children whose families are affected. The effects of these stressors are cumulative. Stressors such as economic hardship, unemployment, homelessness and immigration status may make it more difficult for families to establish a strong relationship with families. The instability they cause and the lack of resources may

mean that families are unable to reach out and take part in activities programs design for families. Residential instability affects children's routines for eating and sleeping. They may impact the child's attendance and their behavior and attitude toward learning when they do attend. To serve the child effectively, program staff need to be aware of disruptions in the child's life due to economic conditions and other difficulties the family faces. In these situations, program staff may need to go beyond their typical methods for reaching the family to make sure they establish contact with the difficult to reach families. They should follow up when they see changes in the child's behavior, fatigue level, grooming and disposition. When the family is in distress, program staff should do everything possible to keep the child in the program. It may be one place in the child's life that is free of turmoil and may make a significant contribution to the child's ability to cope with family distress.

Family Resources

Resilience and Coping

Many families must deal with the stressors associated with economic hardship, residential instability and immigration. Most are resourceful and resilient and have faced the difficulties by relying on a range of coping strategies. In times of difficulty, families often turn to personal and cultural resources that include culturally-based spirituality, ethnic identity, social support from extended kin and community and interpretive frameworks or worldviews that help them to adapt to problems psychologically by placing them in a broader context.¹² One of the most important aids to successful coping is access to social support. As noted earlier, many families are grounded in extended family and community social support systems that provide emotional instrumental resources to assist in coping with life problems.

For some, religion and spirituality is another critical resource for coping. It provides a foundation for coping by connecting them to a providential and protective higher power with which they have developed a personal and comforting relationship.¹³ In addition, spirituality provides additional benefits through participation in a social network of members who belong to the same spiritual institutions and who provide instrumental aid and emotional support. The development of externalizing interpretive strategies for coping with racial slights and discrimination also forms an important part of the socialization experiences of some children. By knowing who they are and in identifying strongly with their ethnic group, families forge a strong sense of identity by which they buttress themselves and join with others to overcome the challenges of racism. This perspective on the self and sensitivity to discrimination helps them to sustain efforts when times are difficult. Cultural resources such as kin support, spirituality, and ethnic identity over time have been important factors in strengthening the capacity of some families to cope with adversity.

Use of Extended Kin Networks

The extended family structure and supportive kin networks are highly important to the capacity of families to cope with adversity. This is especially true of households headed by single mothers. Even when single mothers and their children do not reside with other kin, money, time, child care and emotional support that kin folks lend substantially enriches single parent households.

Valuing Achievement, Effort, and Persistence

In *some* ethnic groups there is an explicit articulation of the value of effort and the importance of hard work. Children raised within these cultural traditions tend to exhibit learning styles that are very facilitated toward learning and achievement. In the face of competencies that are difficult or challenging to acquire, they need relatively little encouragement to persist in their effort in spite of the early failure. For other groups that were not explicit, feedback about progress and reinforcement may be needed to move beyond initial discouragement and frustration to help them sustain their efforts when they encounter learning difficulties. With a keen awareness of the reality of racism in their lives, children in some groups are exhorted to recognize what they are working against and understand the necessity of working twice as hard to succeed in life. For staff, a greater success in early childhood programs will be achieved by acknowledging and responding to these differences in worldview and approaches to motivation used by the family.

II. The Social Context of Teaching and Learning: Implications for Early Childhood Curriculum

Are there ways to make use of our knowledge about the diversity of children's experiences in family and culture? Can convictions about the importance of these early experiences for children's school readiness guide adaptations of early childhood curriculum to make them more responsive to and successful with ethnically and culturally diverse children? This is the issue that will be tackled in this section of the chapter. This section of the chapter extends discussion of insights about family functioning and culture as it relates to the California Preschool Curriculum Framework domains. The purpose of this section is to review research findings and scholarly insights that may be useful to those implementing the components included in the early childhood curriculum domains as established by the California Department of Education. In particular, the chapter will summarize findings and insights about what families do (family practices); what they believe (perspectives) about the skills children need to be ready for school; and the methods they use to guide, socialize, admonish, train, and explain phenomena to their children.

We receive general help in this task from the work of Bernal, Bonilla, and Bellido who proposed a model to guide the modification of educational interventions to make them more culturally responsive.¹⁴ The value of this model is its identification of the places we should attend in thinking about curricular adaptations. This chapter translates the

elements of their model into a checklist that program staff may use to guide and evaluate their efforts to make their practice more culturally relevant (See Box 3).

Box 3. Checklist for Enhancing Cultural Responsiveness of Teaching and Learning

Content	Become familiar with the values of the cultural groups with which you work.
Context	Identify ways that the preschool program's culture is different from home culture.
Persons	Think deeply and often about the role of culture in your personal relationship with a particular child or group of children.
Language	Use culturally appropriate language and alternative modes of communication to promote understanding.
Metaphors	Incorporate culturally meaningful symbols, sayings, and images of persons in the early care setting in posters, wall hangings, assignments, and communications with families in everything you do and in the environment you create. It is important to be inclusive, and incorporate the symbols into the classroom. Include representations and symbols of children's culture in the physical space. Children need to see reflections of their culture in materials and symbols of their presence in the environment.
Goals	Frame child learning objectives in ways that reflect the values of and that resonate with goals espoused by children's culture.
Methods	Consider how the teaching methods used in the preschool program fit within the children's cultural context and values. Modify teaching and communication strategies to match those of the children.

Implications of Cultural and Family Experiences for Teaching and Learning

The concept of young children as meaning makers weaves through this curriculum framework. Young children actively make sense of their experiences and search for connections. As teachers observe and listen to children, they discover the children's minds at work and find ways to join in the children's diverse learning experiences. Understanding the context out of which children's meaning making arises allows teachers to deepen their understanding of children and offer experiences that facilitate

exploration and learning. The context includes all of the factors described in the preceding section of this chapter: The family's culture and ethnicity, its composition, strains or stresses on the family, and its resources blend together and uniquely contribute to the individual child's learning and development. To be responsive to children, teachers need to understand the different experiences of each child. Preschool teachers who open themselves up to the experiences of the children as well as their own experiences establish a supportive environment for active learning. Children form a sense of belonging and become aware of their teachers' interest in them. Supportive, responsive relationships with teachers encourage children's play, exploration, and making meaning and create the possibility for sharing meaning and learning together in all developmental domains.

This model delineated above proposes several dimensions that should be included in considerations of culturally responsive educational practice. They are: content, context, persons, language, metaphors, goals, and methods. Before focusing on the diverse cultures represented in the lives of the children, staff should begin with reflection on their own cultures. These have shaped staff view's of the world and the judgments they make about what is good and appropriate and what is not. It is important to consider the things you take for granted because of your cultural perspective.

As a starting point, learn as much as possible about the content of the child's culture especially the history, arts, values, and practices. The modes of communication and the content of what is communicated are so intrinsically bound to culture that it is necessary to identify the modalities that work best with the cultural groups you serve. At the heart of the cultural sensitizing of educational practice are language and metaphors. Using culturally compatible methods of communication and incorporating cultural symbols or metaphors are two of the most powerful ways to increase the cultural relevance of education practice. The use of familiar language, communication styles and symbols convey a sense of acceptance of the other culture and goes a great length to communicate acceptance and valuing of the other. The final and the highest level of cultural adaptation is in the area of teaching practice. Considering culture in establishing learning goals and in the teaching methods used for achieving those goals is not easy and requires constant rethinking and imagination. In the end, it is expected that these efforts will reap significant benefits in the improved performance of culturally diverse groups of children. Comparisons are inevitable and help in understanding others. It is also helpful for staff to reflect on how the context of the preschool program's environment is similar to and different from the home environment as a result of cultural differences. It is critical to compare with respect and without criticizing. This is important because relationships with specific children or groups of children may be inadvertently influenced by unexamined cultural differences.

The following section summarizes information relevant to the early childhood curriculum domains established by the California Department of Education. It considers implications from observations and research on culture and family life for teaching in the preschool curriculum. The goal is to consider how the content, materials, process for

teaching and learning might be configured to build on and be responsive to cultural and family experiences of the children. Specifically it reviews what is known about what families do, what they believe (perspectives) about the skills children need to be ready for school, and the methods they use to guide, socialize, admonish, train, and explain phenomena to their children.

Language and Literacy

Brody, Stoneman and McCoy have proposed a cultural context model to account for variations in children's literacy development.¹⁵ They assert that families possess and adhere to developmental goals and expectations that promote literacy, influence the availability of the literacy-related activities at home and patterns of family interactions around literacy. Learning about what those goals are is helpful. Family practices also have their effect on literacy, by creating a different social-emotional environment during literacy promoting activities. The literature on reading development points to several practices which seem to play a significant role in the development of reading competence. These include regular joint reading between family members and child; encouraging of reading; providing access to books in the home and modeling by adults who use printed materials; expressing positive attitudes towards reading; having frequent conversations between adults and child. Siblings and other adults in the household also play an important role. The family's emotional climate is important here as well. A positive emotional climate in the family engenders favorable sibling relationships in which older siblings are more willing to engage younger siblings in reading and other literacy activities. Creating a positive emotional climate around literacy activities in general means that children will be more likely to attend to and engage in informal reading and respond more positively to formal instruction.

Joint storybook reading has been considered an especially helpful introduction to skilled reading but appears to be effective principally when reading is truly interactive and a creative experience. In many homes when families start reading with very young children, the experience includes interruptions and dialogue often about issues extraneous to the narrative. But all is good; even these off-topic conversations are helpful in that they engage the child actively around the use of words and the expression of ideas, which ultimately is fundamental to reading. As the children get older families begin to be less tolerant of interruptions and are more directive.¹⁶ This transition from reading as fun and creative to reading as directed and sanctioned may be an unfortunate development...one that should be discouraged by staff.

Cultural differences were found in the purposes attributed to reading. In some groups reading is a form of entertainment, and others, it is utilitarian, instrumental or an occasion to master a skill. For the latter group the common focus of literacy and reading is to solve practical problems, to conduct affairs of daily life (e.g., bill paying, use of resource directory) or maintain social relationships.¹⁷ For the children it is an occasion for skill acquisition activities replete with the use of learning aids such as flash cards.

For some groups, oral experiences are key to children's development of language and foundational reading skills.¹⁸ For example, some families engage frequently in oral language activities such as singing, enactment of plays and dramas created by family members, and mealtime conversations. The combination of family practices and beliefs about the importance of literacy play a major role in children's early literacy development. In many ethnic groups, children are growing up in families with a strong oral tradition in which story-telling and singing are central to their experiences at home. The oral and listening skills associated with singing and storytelling provide a rich base of experience with narrative that is an important and often overlooked resource in the promotion of language, literacy and reading in children. Although the practices of reading and the use of printed materials are less common in working with families from different cultural groups, it is necessary to understand and learn about their choices of literacy experiences through conversations with families about what happens at home. Often families are very open to suggestions about things they might do and graciously receive materials that early childhood programs might give or lend to promote reading skills in their children.

Dual-language learning is another issue that has relevance for literacy and language curriculum. As noted earlier, families may be ambivalent and undecided about how to address language development and how much to reinforce their native language. The ambivalence is linked to a fear that they may stunt the child's growth in the use of English. At the same time they are hesitant to have their child lose their connection to the family's country of origin. This concern about maintenance of the native language is driven as much by a desire to retain the culture as the practical concern that the child be able to communicate with family in the native land, especially grandparents. Staff can help families by reassuring them that maintaining the home language can help not hurt, by suggesting or providing home language materials the family can use at home and by legitimizing the home language by introducing and using its vocabulary for names, numbers, parts of the body to all the children in the class.

Mathematics

Children's early mathematical knowledge and skills develop and are strengthened through the math related experiences they have at home.¹⁹ As a consequence, a majority of children from all ethnic and cultural groups possess basic and pre-verbal number competencies by the time they enter the early childhood setting. Partially as a consequence of differences in cultural emphases and home experiences, children do come to preschool with different sets of skills and different sense of number.²⁰ This is particularly true with respect to the understanding of number words and symbols. Moreover, children differ in their ability to determine set size, to compare quantities, and to carry out calculations. It is important to note that these differences are principally a consequence of differential experiences and emphases by families rather than limitations in the child's capacity to learn. Barbarin, et al found that some families accorded relatively little priority and attention to development of math skills beyond the ability to recite the number string from 1-10.²¹ Families regarded reading and social competence as more critical to school readiness than mathematical knowledge. Though

emphasizing memorization of the names and symbols for numbers, few emphasized an understanding of the conceptual and abstract elements of early math such as the sequential nature of the number string, the nature of numbers as representing quantity, cardinality, and one-to-one correspondence.

To be clear, children from all ethnic groups display fundamental mathematical competence (e.g., recognizing small quantities and differentiating common shapes) but differences in other math skills have been observed. Differences in language and its development are central to the ethnic differences observed in early mathematical performance. For example, ethnic differences are greater on mathematical tasks dependent on vocabulary or verbal knowledge than those independent of word knowledge. In addition to ethnic variations in mathematizing everyday experiences in family life, ethnic differences occur with respect to the ability to use words to describe what they perceive and can do mathematically or to comprehend what is required in verbally mediated math tasks. Differences in children's performance of mathematical operations are less striking when verbal knowledge is not required. This effect of differential verbal skills on the early math competence is one that can be balanced by appropriate learning experiences that introduce and highlight names for numbers, quantities (e.g., big, little; tall, short; heavy, light) and spatial relations (e.g., near, far; above, below) . For example, early childhood curricula could supplement what the child receives at home with frequent exposure to symbols for number, increasing familiarity with words for shapes and numbers, providing opportunities to count things and to experiment with number relationships and comparisons. Helping children develop an understanding of the cardinal meaning of numbers is especially important because without it children will have difficulty with number operations such as addition and subtraction.

Health

Volume 2 of the early childhood curriculum covers topics related to health habits, safety and nutrition.²² This section points to differences in families' practices and beliefs surrounding food and food choices. The practices influence children's eating habits and what they regard as desirable food. In this way the home has a major impact on children's burgeoning understanding of nutrition and on their eating habits. Children come to preschool programs with a variety of habits, knowledge, beliefs about health and health protective practices. Children's reasoning about health is shaped by their experiences in their home by the examples of choices they see adults make regarding food and drink. They are influenced by families' choices regarding nutrition, physical activity, oral health practices and injury prevention.²³ In some cultures, children are discouraged from being independent with respect to food choices. Adults make all the decisions regarding the type and quantity of food to be eaten. In addition, when children have grown up in families that have experienced extreme economic hardship and persistent food insecurity, children have exhibited behaviors such as gorging and hoarding of food.

History-Social Science

Ethnic Identity development is in its early stages in preschool. Children are aware of ethnic diversity and differences in cultural practices related to food, music, symbols and celebrations. A key implication of culture and family life is that children should be supported in learning about their own culture and valuing their own ethnic identity while avoiding the danger of disparaging or criticizing others. This can be accomplished by a combined strategy of emphasizing the many similarities among diverse cultural groups and exposing children to the cultural practices and celebrations of children in their program who come from a different culture than their own. It may also be helpful to sensitize children to the idea that not all children have the privilege of food security and housing stability. This can lead to notions of sharing and helping others. For preschool, it is more focused on recognizing differences and celebrating our connectedness as a group. An understanding of family differences might focus on family decision-making. For example, children and staff might discuss how families make decisions together as a family group and how that may be different from how decisions are made in an early childhood program.

Social-Emotional Development

How might differences in cultural values and family experiences be reflected in social-emotional development? Early social-emotional development is most apparent in regard to self-understanding, relationships with others, and acquisition of social-emotional competence.²⁴ Ethnic, cultural and family differences have been observed in the outcomes families valued and in the methods they deemed appropriate for attaining those outcomes. In some families the sense of self is subordinated to the sense of belonging to a family. Individual well-being is judged in terms of how well the family unit is doing. This means that the good of the family as a whole is paramount and that satisfaction of individual desires and needs must not be pursued if indulging them would result in harm or adversity for the family. These families control misbehavior by pointing to obligation all members have not to bring shame to the family.²⁵ In other families, individual autonomy is paramount. The ability to make personal choice is highly valued and individual misbehavior is not viewed as reflecting on the family.

In regard to methods for achieving desired outcomes, Deater-Decker and Dodge observed that some groups of parents emphasized strict discipline and valued unquestioning obedience to adults.²⁶ These parents held traditional views of children and their relationship to adults. These views emphasized unquestioning obedience, respect, and deference to adult caregivers and teachers.²⁷ The practices associated with these traditional beliefs involve strategies by which adults direct, re-direct, and involve themselves intensely in the details of the child's life. Traditional practices involved control of the child's behavior based on parental authority alone in the absence of explanation or negotiation. In these cases the guidance provided to children is direct, intensive and highly controlling. These traditional approaches often arise out of and are adaptive in situations where children are valued highly, where environments are risky, where children face frequent exposure to hazards and high probability of harm and where families feel that their ability to monitor, supervise and protect children is not

adequate to the challenges. Strict discipline often occurs within a context of warmth, support and affection. For example in some families, this combination of warmth with strictness tends to moderate the negative impact that coercive regimes and physical punishment would otherwise have if implemented alone.²⁸ Traditional approaches may contrast with the indirect and autonomy promoting strategies taught in many early childhood training programs. These approaches emphasize compliance with rules but behavior is controlled not by coercion and physical punishment but by the natural consequences of the choices children make when they violate established rules and expectations. Moreover compliance is gained through adult explanations of the rules and expectation, respect for personal autonomy, and the freedom of the child to negotiate exceptions to meet personal needs.²⁹ The assumption is that children will learn best when they are permitted to make choices. When children's choices are not optimal, they must live with and suffer the consequences of their decisions and actions. The important point here is that children from families with traditional approaches to guidance come into the preschool programs with different expectations about their relationships with adults and about the form and content of rule setting and behavior control. Informed by an awareness of these differences, program staff must orient children to their approach and help children to make transitions from one disciplinary regime at home to the one under which the program operates.

Family differences also exist in rules that govern expression of emotions and aggression. Some families have relatively relaxed rules about the range of emotions children are permitted to express, while in other families children are expected to keep the expression of negative emotions to a minimum. In these cases it is unacceptable to express anger or fear. There may be especially stringent rules about emotional expression in boys. For example, acknowledgement of physical pain, injured feelings and crying may receive harsh sanction. Young boys who cry may be ridiculed not only by peers but also by adults in their families. Directly and through innuendo they are given the message that little boys are little men who don't cry. Only girls and sissies cry. By delegitimizing emotions, boys are socialized not to recognize and acknowledge what they feel.

The extent to which children are permitted to display physical aggression also varies widely among families and cultural groups. Some families tolerate and permit children to employ physical aggression in interactions with family members and peers. Aggression against families is accepted as a natural expression of frustration. With peers, some groups condone and even insist on the use physical aggression with peers, as long as the child did not instigate a fight. Children are told: "Don't start a fight, but you had better finish it". This advice is seen as a way of the child defending herself against bullying when adults are not around or not able to provide protection.

Independence, the ability at a young age to take care of self and younger siblings is treated as virtue in some families. For others early childhood is a time of extended dependence in which children rely on adults to have their needs met.³⁰ These differences reflect variations in how childhood is conceptualized and in values about

cooperation and competition. For some groups competition is discouraged and cooperation is encouraged. Excelling at school or in other aspects of life is discouraged in some groups. In these cases children are given the message that they should avoid standing out and being seen as better than anyone else. They should not bring attention to themselves by standing out and performing better than their peers. Perhaps this flows from traditional wisdom that the “head that sticks up will get chopped off.”

It is important to note that families of some cultural groups value and promote competencies that preschool programs encourage and regard as adaptive in that setting: the ability to sit still and focus, ability to follow rules that contribute to order and decorum in the class room, ability to communicate needs using words, dependence on adults, and a high capacity for behavioral and emotional regulation. There are other families for whom these traits have little value. Moreover, some families adopt a style that may on the face of it appear authoritarian, strict, coercive and involve the use of physical punishment. Many early childhood staff will find it difficult to embrace these approaches. Helping children to bridge and adapt to the two very different regimes of discipline when home and in the preschool program are not congruent is a major challenge in many programs.³¹

Visual and Performing Arts

Visual and performing arts are closely linked to culture, ethnicity and family life. Consequently, art, dance and music as part of visual and performing arts offer remarkable opportunity for linking up with permitting culturally diverse companies to give expression. Curriculum for visual and performing arts should be open to forms of performance and visual representation represented in different groups. In some cultures singing and music are central to their daily lives. The visual and performing arts can be used to increase positive interactions between diverse families and preschool programs. Dramatic presentations, poetry readings, singing shows, and art displays offer helpful ways to build bridges between diverse cultures and curriculum. This understanding can be used to build on what the child knows and believes to develop the skills and knowledge needed for academic success. For some groups, drumming is a traditional form of performance that is especially suited for early childhood. For others graphic arts, weaving, quilt making, sewing, and writing are endemic to the culture and are common forms of self-expression and social cohesion. These events can be a two way street. They offer resplendent opportunities to expand an understanding of children’s experiences at home by bringing in family performers and artists.

Physical Development

To be developed.

Science

To be developed.

Conclusion

It is not enough to proclaim that family and culture play a critical role in child health and development. It is necessary to consider what it means for early childhood teachers. Cultural diversity should not be viewed as a potential source of conflict to be managed but as an opportunity and challenge for program staff to think creatively about how cross-cultural differences can enrich their work, their lives and the education they provide to the children in the program. To make the promise of diversity a reality and incorporate it in the day-to-day operations of education programs, it is necessary to learn about what is happening in families and to develop a sense of the conditions children face and the experiences they have in their daily lives at home. It is also essential to develop an intuitive appreciation of how what happens at home influences children's skills and attitudes towards learning. Teachers must understand what families do in a realistic way, and appreciate the extent and limits of their capacities to further the learning goals that early childhood programs have for their children. Cultural differences such as those in educational goals, discipline practices, and worldviews may create tension and contribute to misunderstandings between families and program staff. Responding to and understanding cultural differences in a positive fashion begins with the critical examination of one's own culture and the dilemmas that differences present. Acknowledging differences and recognizing similarities can bear the fruit of a deeper understanding of self and others. Teachers must look for strengths in families that may be concealed. A deeper knowledge of what is happening helps teachers to understand the experiences of children at home. Only then can we build on the strengths of families and value them as true collaborators in the education of the child.

Several things must happen to reach toward the ideal of cultural responsiveness and competence.

- **Adopt a posture of cultural respect.** The key to successful work with diverse cultures is respect. Cultural respect leads to acceptance of the other, embracing them on their own terms before trying to change them. It is not an end in itself. It is a means to an end—forming a partnership, a true collaboration with the goal of educating the child. Respect for cultural diversity does not mean agreeing with or supporting every difference. It does not mean condoning practices or behaviors that are indisputably harmful to the child.
- **Strengthen your cultural competence.** Cultural competence is used to connote the knowledge, attitudes and skills that can facilitate management of and smooth over any difficulties arising from cultural incongruities or differences. Conceptually, cultural competence has cognitive, affective and behavioral dimensions. Cognitive cultural competence involves an understanding of the perspectives and worldviews of diverse families. Affectively, it involves an acceptance of and empathy and respect for those diverse worldviews. Behaviorally, it involves a set of strategies and skills that make it possible to negotiate differences between family life and preschool

life in a way that leads to positive outcomes for children. To become culturally competent will require the expenditure of resources (time, money, emotions).

- **Be mindful that social class is not the same as culture.** Customs, language, beliefs and values associated with social class are not the same as the attributes ascribed to cultural groups across class. It is sometimes difficult to discern the difference between factors attributed to cultural differences and those that are more properly attributable to social class or property. It may not be possible to distinguish a clear line between the two but it is possible to reduce the confusion by understanding these factors play a role. In the case of immigrants, social class and culture are particularly confounded because some groups disproportionately occupy the lower rungs of the socioeconomic ladder. Which of the observations are attributable to poverty and which are properly attributed to cultural difference?
- **Increase the visibility of ethnic or cultural groups represented by the population you serve.** Elevate the attention given to different cultural groups. Do not leave them on the margins and in the shadows of your programs.
- **Expand the presence of men in early childhood settings.** Reach out to the men in children's lives: their father, uncles, grandfathers, brothers, cousins. Tell stories about them. Make them an important presence in the program and support their role in the lives of children. Create special events designed to recognize the connection they have and the importance of their role in the lives of the children.
- **Collaborate with families.** Successful partnerships are by no means assured on the basis of good intentions. Continuous effort, outreach, mistakes, and forgiveness are necessary ingredients in building relationships that work for children.³²

An anticipated outcome of these efforts is that teachers will come to appreciate how culture, ethnicity and family life interact with and are highly relevant to the children's acquisition of the skills and knowledge early childhood programs seek to impart. In that way, cultural differences can be seen as a positive resource.

It has not been possible within the limited space of this chapter to cover comprehensively and in detail the values, beliefs, and practices of diverse ethnic groups. Nor was it possible to provide a thorough account of what life is like in a wide range of families. However, the questions raised and the frameworks proposed are a starting point for reflecting on ways to incorporate consideration of culture into practice. This reflection is valuable to the extent that it energizes teachers' work with diverse families and helps them to formulate more effective strategies for embracing and collaborating with diverse children and families. Their success will depend on how well they build upon and maintain the integrity of children's cultures and at the same time impart to children the knowledge and skills that are needed for later success in school. By reflecting on the issues covered here, it is hoped that they will be able to address

with confidence the issues that arise and expand their level of comfort when working with families who are different from them in culture, ethnicity, or socioeconomic status.

DRAFT

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