Transmisión vía web acerca de las ciencias Núm. 3: Lengua y alfabetización a través de las ciencias

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Jean Simpson: Welcome to discovering science. This is episode three of our four-part series on building the foundation for science in the early years. My name is Jean Simpson. I am an education specialist in the division of Educational Development and Partnerships at the Office of Head Start. Thank you for joining us today.

During the first webcast, we explored what science looks like in the early childhood classroom and we discussed some of the challenges in creating quality learning opportunities. In the second webcast, we focused on the development of science process skills from birth to five. During today's webcast, we will reveal ways for teachers and parents to integrate science across early childhood learning experiences and environments with an emphasis on young children's language and literacy.

Our experts for this webcast are Dr. Shari Ellis and Barbara Dowling. Shari is the senior early childhood science advisor for the Office of Head Start and she is also project director of the Center for Informal Science at the Florida Museum of Natural History. Barbara is a head start teacher in South Dakota and a 2008-2009 national head start fellow in the Office of Head Start. Shari?

Shari Ellis: Thank you, Jean. It's great to be back with all of you. You can download a copy of the learner's guide for this webcast by clicking "learner's guide" located on the lower portion of your screen. After each webcast, we will provide a list of resources for further study. We will also e-mail a feedback form, inviting your comments on this webcast and your suggestions for future webcasts.

If you want to watch these webcasts again, or you want to refer a friend or colleague, this series is also available on the web through the Early Childhood Learning and Knowledge Center, also known as the ECLKC. Barbara?

Barbara Dowling: Thank you, Shari. Let me start by thanking all of you for the thoughtful questions and comments you shared about the first two webcasts. Here’s one from Neal Bickman, an education specialist in Levy County, Florida.

Neal Bickman: "For many years I wondered how to incorporate science in the classroom, as I thought it was an area that was weak in every classroom, I monitored including my own child care setting. Little did I know that scientific thinking was happening in my interactions with children by the open-ended questions asked and enabling children to discover the things in their environment whether inside or out of the classroom.

Science does not have to be some things in one small corner of the room. It is all over our room when we allow for discovery and exploration. Open ended questions need to be asked as children explore with their senses, observing, classifying, investigating and making predictions. Teachers need to give children the chance to explore on their own and make mistakes and learn from them without us doing it for them.

Science is all around us - the food we eat, how things work, the wonder of nature, the information that we get from our investigations, how things are classified and categorized. Once children are given the opportunity by our teachers creatively changing the classroom environment, they will be better equipped to do higher order thinking, reasoning, and communicating. Looking forward to more ideas and knowledge of science in our classrooms through these webcasts."

Barbara Dowling: Neal, thanks for sharing your insight. Your e-mail nicely summarizes science in the early childhood classroom. In this webcast, we are going to further explore how science can foster the development of process skills and dispositions and promote language and literacy, as well as learning across domains. Shari?

Shari Ellis: As we discuss how science can support development across domains, it is important to describe how this can happen. One approach, perhaps the one you are the most familiar with, is to select a science idea or topic, and follow it in different interest areas or centers. Programs you've seen such as family, community helpers or a harvest time to organize daily activities already use a version of this approach. Teachers also can begin with a science idea or question and then expand exploration throughout the classroom. By definition, however, quality science explorations are going to involve language, literacy, social-emotional skills and approaches to learning.

Depending on the experience, mathematics, motor development and creative skills may also come into play. Therefore it is not necessary to formally integrate science across instructional areas in order to intentionally support children's developing skills. This is one of the most exciting and powerful aspects of science in the early childhood classroom.

Rather than having an idea, concept, or theme reflected throughout the classroom, the teacher uses science as the method to support the development of a wide range of skills, knowledge, understandings, and attitudes. Let's work through an example with a science idea, how about wheels and how they work?

During an exploration of wheels, the teacher supports children's language development by asking questions that elicit answers of more than one or two words such as, "How do wheels help us? What would happen if a car did not have any wheels? What if it had only two wheels? Tell me about the biggest wheel you have ever seen." As part of the process, the teacher would introduce new vocabulary -- words such as wheel, axle, tread, and spoke.

The teacher could also easily incorporate mathematics. It would be natural to talk about how many wheels different kinds of vehicles require. Throughout this large or small group interaction, children can practice important social-emotional skills such as waiting their turn to speak, sharing, and engaging in peer conversation. As part of the investigation, children could draw a wheel or discuss wheels in their journals -- thereby practicing literacy and representational skills. And children's curiosity and interest in learning more about wheels can lead them to a book.

These examples make the point that science explorations offer many opportunities to foster learning and development across domains. Now, this way of thinking about science and the approach in which science is integrated across the classroom are not mutually exclusive. One can incorporate multiple domains of development into a science exploration and then fully integrate the science ideas or topics throughout the curriculum.

It is important to distinguish these approaches though for two reasons. One, it highlights the rich opportunities afforded in any science exploration. It is those opportunities that are the focus of our webcast today. Two, not every science idea can be easily integrated throughout the curriculum. But that doesn't necessarily mean that the idea is not worthy of science exploration.

Barbara Dowling: With these approaches in mind, how do teachers, decide what phenomena to study? We accomplish this through careful observation of the children, by examining the environment of our classrooms and what it affords as areas of study, and by observing the changes in nature outside and the happenings in our communities. Let's look at three examples. While on a walk, the children asked, "How does frost form on the sidewalk?" When Maya's baby sister came to class, the children asked, "Why can't babies walk?" While creating in the art area, Leah wondered, "How can I get the paper to stick together?" Each of these areas offers a myriad of events, phenomena, and experiences that can become rich projects or areas of scientific study.

Shari Ellis: Now let's explore in more detail how science experiences can foster development across all domains. To begin, we're going to watch a short video clip of a teacher and small group of children creating a new substance -- "clean mud." As you view the video, please make note of the ways this single experience involves multiple domains of development.

[Video begins] Sarah Eytcheson: Now we're going to mix the soap and the toilet paper. Isabel, you want to do that? Pour it all in there. Child: Put it in. Sarah Eytcheson: By looking at this -- what do you think we're going to do with the water?

Child: Pour it in here. Sarah Eytcheson: We're going to pour it. Watch where -- remember, we only want two cups. So how much more? Child: Taking all the toilet paper out! Sarah Eytcheson: There you go. Perfect. Good job. Let's look at the recipe. It says we're going to gradually add water. What do you think gradually means?

Child: Pour the water in. Sarah Eytcheson: What do you think gradually means? Child: I don't know.

Sarah Eytcheson: Are we going to dump it all in at one time, or are we going to -- we're going to gradually add it. We're going to add it a little bit at a time and mix it up. Mix it like you're making bread. Let it mix more. Let's everybody feel it and mix it. Squeeze it. On our recipe book when I read it, it says the mud is ready when it feels like whipped cream. What does whipped cream feel like?

Child: It feels soft. It feels like whipped cream. Sarah Eytcheson: Does it feel like whipped cream? Did we follow all the steps of the recipe book? What did we do first? What did we do to the toilet paper first, though? Child: We ripped it. Child: We ripped it. Were to the toilet paper up, right? Logan, what did we do after we ripped the toilet paper? [Video ends]

Sheri Ellis: How many domains did you observe? Clearly this science experience included literacy skills. Children also used both receptive and expressive language skills, practiced conversational rules, and heard a few new words such as recipe, grater, and gradually. The experience also involved several kinds of mathematical skills and understandings. The steps in the creation of "clean mud" were represented by numbers in the recipe book, the steps were followed in a sequence, and the recipe called for two measured cups of water.

Creating "clean mud" also involved motor skills. The experience was also demanding of children's social skills. They needed to take turns using some of the materials. Some steps -- such as measuring -- could only be performed by one or two children and the others needed to simply wait.

When all hands were in the mixing bowl, the children needed to make room for their classmates and not get too upset when someone got too close. And of course there is the science. What science ideas were addressed in the experience? I hope you saw several. One was surely that it is possible to create a new substance by mixing others together.

Barbara Dowling: The potential of science explorations for fostering growth in skills in understanding across domains of science has been notifying a growing number of teachers and researchers. One is such team is Kathy Conezio and Lucia French at the University of Rochester. This team developed a science center intervention designed to foster children’s language and literacy skills. Let's listen to Lucia and Kathy talk about their work with teachers.

[Video begins] Lucia French: Once we started focusing on science, we saw a number of changes in the classroom. One of the very first and most dramatic changes was in the area of behavior. Science and exploring the world around them is very engaging for children, and when they're engaged, they don't misbehave. So all of the sort of disruptive nudging and budging sorts of things transform into children working together to find out the answer to their science questions, and we also saw changes in the teacher behavior because the teachers really enjoy doing the exploration with the children.

Kathy Conezio: I would add on to that that teachers become very involved with the children and become co-explorers. Through their co-exploration, they build language around activities, and so you see teachers and children engaged in a lot more conversation.

Lucia French: One of the other major changes we've seen we could just call talking. There's a lot more real talking with real information being exchanged in the classroom. And so many classrooms, most of the teacher talk is behavior management, which is a big deal when you have a lot of little four and five year olds to manage, but with the science activities, there's also a great deal more talk about real information, real questions being asked to the children.

The children begin using real language to ask real questions, to give explanations, to disagree with someone else's explanation, so the more talking that they're engaging in, the more language skills they're developing and the more ready they will be for school.

Kathy Conezio: A good example of that is a week or so ago I was in a classroom where the children were studying wheels and axles and they were building model vehicles and they were challenged to build these out of recyclable materials. So they decided that perhaps you could build a wheel and axle for their vehicle out of a pipe cleaner and some cardboard wheels, but they had to have real conversations with each other and with the teacher about whether that worked, and when they found out that it didn't work, it wouldn't support the weight of the car, then what could they do next to change their design?

We, of course don't have an assessment for preschool children's science vocabulary, but anecdotally we hear parents coming back to us all the time saying I can't believe the words my children are using. He was asking me the other day, did I know what a constellation was or did I know that the window in our house was transparent. And so, we have children using very sophisticated language to talk about science, in ways that they understand because they've had the experiences.

Lucia French: One mother came back after her child had been with us as a three year old and was coming back as a four year old. And it is beginning of his four year old year, she reported that they had been in a park, he had gone underneath a tree and picked up a log and her first reaction of course was put down that dirty thing. But he says, “Mom, it's a bug habitat. Come look. There's ants and there’s sow bugs.” He was all excited about it being a habitat and that changed the mother's perception of it, too, of course.

Children are taking these sorts of activities home. The parents understand them, and it makes for a really rich home school connection when we're doing activities that are framed around science but really about the everyday world. The fifth area that we see a lot of change in is in literacy. We always start a science activity with a book. But after their science activity, we also have a report that the children are co-constructing with the teacher and that can take a variety of different forms.

Kathy Conezio: I brought a couple of examples of those today. One of them is charts, such as the one I have here, and the children had been studying solids and liquids, the difference between solids and liquids, and as their report, they brought up pictures that the teacher had provided them of some of the materials that they had talked about, and as you can see, they've taken whatever their object was, put it on the chart, and then, of course, signed their name.

And what's exciting to me is that this teacher is asking children to do their own writing of their name, not she isn't doing it for them, although she's also added her version of it. Another thing that we do in the classroom is create books. This one is actually a song that the children learn to sing as we're studying light and shadows. It's called "Shadow, shadow, who can you be."

And what the teacher and the children do is take pictures of the children behind the shadow screen so that you see the child's shadow and then a photograph of the child without the shadow screen, so the children have a wonderful time singing the song, reading the book, and also being a part of a literacy activity that incorporates their science knowledge.

Lucia French: There's a lot of emphasis in preschool on literacy development and that's as it should be. But literacy needs to be about something, and so science provides a content as well as a context for literacy activities. [Video ends]

Barbara Dowling: Clearly science exploration abound with opportunities to learn new vocabulary that lays the foundation for reading. One thing I find so exciting in science is that all of the elements that research has shown to foster language development are a natural part of the experience. Let's briefly review some of this research, especially the work of Betty Hart and Todd Risley -- authors of a book titled "Meaningful Differences in the Everyday Experience of Young American Children."

Scientists estimate that between the ages of eighteen months and six years, children learn an average of about nine words per day. By age six, children's vocabulary may include 14,000 words. How is that possible? Research shows that while some words need to be directly taught, young children learn most of their words through conversations with

other people, especially adults. The importance of conversations for children's vocabulary development was clearly demonstrated in the Hart and Risley study which followed children from diverse families for over two years during the time children were learning to talk.

Each month, beginning when the children were seven months of age, observers visited homes and recorded the spoken interactions between children and parents. What did they discover? That the average American toddler hears around 1,500 words per minute and there are very large differences in the quality of language environments of young children. The children in this sample that were living in poverty heard an average of only 600 words per hour, while those in families with professional parents heard more than 2,000.

If you sum these numbers over the first three years of life, the difference in the number of words heard by children in different environments is staggering. A child in a low income household is likely to hear a total of 10 million words, which seems like a lot.

But children in the professional families would have heard 33 million words. This study also reported that children with more talkative parents have larger vocabularies than children with parents who talk with them less often. By age three, the children reared in poverty knew an average of 500 words, while the average vocabulary of children of professional parents exceeded 1,000 words.

Shari Ellis: You may be thinking, what does this have to do with science? Let me explain. One of the issues that Hart and Risley wondered about was whether parents who did not talk with their children and those who did, talked about the same things or different things. What the scientists discovered is that all the parents in this study used similar amounts of what is called "business talk," or as what some refer to as "regulatory talk."

This kind of talk includes directives, negatives, and prohibitions. Things such as "stop that," "put that down" "hold still," or "give me your hand." This talk is low in cognitive demands on the child. More talkative parents engaged in conversational talk, or chit-chat, about things other than "business talk.” Also worth noting is that this "extra" conversation was designed to keep toddlers engaged. And, if you think about this for a moment, it makes sense.

Toddlers, or even older children, simply allowed to wander will most likely hear a lot of talk designed to keep them from hurting themselves, other people, or things, or punitive talk after the fact. To engage children requires a completely different kind of talk. In this study, quality talk was shown to involve lots of words, complex ideas, subtle guidance, and positive reinforcement. In contrast to directives and the like, this kind of talk is high in cognitive demands.

Observations of parents talking with young children in their homes and community settings, such as museums, reveal that science experiences are natural contexts for extended quality conversations. Research shows that these early conversations not only teach children important conversational skills, but also concepts. Let's listen to a description of some research findings from Dr. Jennifer Jipson.

[Video begins] Jennifer Jipson: Children's experiences with science begin years before they encounter science in a classroom settings and they continue both in and out of classroom settings throughout life. In my work, I've focused specifically on better understanding of how parents and children engage in everyday conversations about science. In conversations with parents, children may have opportunities to develop what can be thought of as scientific literacy. They may begin to learn the language of science. For example, concepts such as gravity or metamorphosis.

They may learn about the kinds of causal explanations that are used in scientific theories, for example, the day/night cycle results from rotation of the earth. And they may become familiar with the procedures used to answer scientific questions such as testing hypotheses and controlling variables. But in addition to learning about science-related topics and processes, children may also learn whether asking these sorts of questions is valued in their community and about how to begin to find answers.

I've been particularly interested in a form of communication that my colleagues and I call explanatory conversations. Such conversations often include episodes of question-asking and explanation generation and seem to be an important

setting in which children learn about the issues that they find puzzling and interesting. Taking a close look at what children talk about with their parents serves as a window into the topics that they find interesting. A recent study found that when actively engaged with an adult, three to four year old children ask an average of 76 information-seeking questions per hour.

This is more than one question a minute and shows just how motivated preschool age children are to make sense of the world around them. When we look at the topics that children at this age are concerned with, we find that they're fascinated by many phenomenon that adults would categorize in the fields of biology and physics and other scientific disciplines. For example, preschool children often seek information about complex scientific phenomena such as how machines work, where babies come from, why does the moon change shape, and why don't robots grow? Once more, these questions are not indicative of fleeting curiosities.

Children persist in asking questions until they receive or discover a satisfactory answer. So asking questions is one way in which children are inviting others into their world of exploration and experimentation, and although parents do sometimes miss opportunities to enter this world, they often accept them. If the parent bites, and enters the child's world of problem solving, they the help children to extend their investigations and consider new ways of thinking about the things that interest them.

When we look closely at what parents say to children, we find that parents rarely articulate complex scientific principles, but this does not mean that parents are not contributing to their children's science learning. One thing that parents seem to do is provide bits and pieces of explanatory information about particular events as children experience them.

For example, while playing with a crystal growing kit, one parent offered, “It's a rock that grows.” Then she paused. “Well, it doesn't really grow because it's not alive. But it adds more and more of the rock to it.” So although the parent didn't actually explain the process of crystal creation, and probably could not have, and neither could I, her explanation may have been very powerful in helping her child hone in on the biological nature of the concept of growth and the types of things that rocks are or are not.

There's reason to believe that this level of exploration is more helpful than those that are packed with detail after detail. In fact, like adults, children can be prone to explanatory satiation, or explanation overkill. Taking a more piecemeal approach may allow children to gradually accumulate their understanding to develop a broader understanding of a phenomenon. Whenever I talk about parent-child conversations about science, I'm undoubtedly asked whether parents provide misleading or incorrect information.

The answer is of course. But I'd argue that the accuracy of particular comments may be less important than a discourse style that helps children figure out how to ask and find answers to questions. Even incorrect explanations may help children to explore their own ideas about a topic and to further their understanding in the long run. Of course, I'm not suggesting that parents make things up.

Children respond quite well when parents admit that they do not know something, as long as they pair it with some suggestion about ways that the child might find the answer. Parents can support children's science learning without intentionally focusing on instruction. Just by attending to children's spontaneous questions, by commenting on their actions and creating environments rich with experiences, parents may be making powerful contributions to their children's emerging scientific literacy.

If this approach sounds familiar, it should. It's remarkable that across groups of parents, we generally seen a tendency for parents to respond to their children's curiosity in ways that are suggested by excerpts and practiced by early childhood educators. They contextualize concepts and experiences by relating them to familiar topics and follow their children's lead by taking their questions as an invitation to reflect on and discuss complex phenomena.

Barbara Dowling: Dr. Jipson's point about discourse being more important than accuracy is very interesting. In some ways, it parallels a point we made in our first webcast -- that it is more important to foster a child's wonder and curiosity than worry about science facts. That said, of course, in Head Start we want both accuracy and meaningful

discourse. Science conversations frequently involve the use of new and complex words.

Research has shown that the sophistication of children's early vocabulary is linked to both later vocabulary and reading comprehension. Unfortunately, adults sometimes avoid using new or difficult words with young children. Given the proven benefits of a sophisticated vocabulary, what can adults do to help children learn new and complex words? We know that children learn most words in conversation. A child will learn a word more easily if they hear it used often, and in many different contexts.

Sometimes, however, it is helpful to explicitly teach vocabulary. To help us think about the situations in which it is helpful to define a word, let's review the four different kinds of word learning that occur. We can readily see examples of each kind of learning in science. The first kind of word learning involves clarifying or enriching the meaning of a known word. For example, when children are first learning labels, they often over-extend use of a word.

So, a child might use the word "dog" to refer to any small furry animal with four legs. Sometimes, however, a child's definition of a word is too narrow. There are children, for example, who think "dog" refers only to their dog, Fluffy. Most children have an overly narrow definition of the word "plant." For example, they may limit their use of the label "plant" to plants that are in pots, or to plants that are about 12 inches tall -- not grass and not trees. Let's watch how one teacher expanded the children's definition of plants.

[Video begins] Sarah Eytcheson: We started our plant life experience with the basics -- the parts, the plants and everything, the kids mostly associated plants with flowers. I wanted to incorporate that trees are also plants, grass is a plant, and to do that, we did the parts of the plant on our playground and I drew a map of our playground. When we went out, I let them -- we went around and we showed the parts of the plants and we picked little parts and we glued them where they were at in the playground.

And it was fun because after we did it, they were like, where does that plant come from? Because all of them were coming from all areas, getting all the parts and telling them where that they found them. So then we'd go back to that area and find -- like they were even picking up bits of mulch and we incorporate that that, that that is a plant we use, and we went in to that soap is made out of plants and baskets and keep incorporating it all together. [Video ends]

Barbara Dowling: We also know that children gradually fine tune word meanings as their understanding of the world grows. A second type of word learning involves learning a different meaning for a known word. Children may be familiar with the gas that we put in our cars or the scale that they stand on at the doctors' office. These meanings may need to be directly addressed when teaching that gas is a state of matter, or that scales are a protective body covering. The third kind of word learning involves learning a new word for a concept -- be it an object, action, category, or whatever else.

This kind of word learning is rich with opportunities to expose children to juicy words! Children are usually quite familiar with dirt, but can use the word soil with equal ease if given the opportunity. Science also provides many opportunities to learn descriptive words that are just fun to say. Slippery, for example. The fourth kind of word learning is the most difficult. It is learning a new word associated with an unfamiliar concept.

One reason that these words are difficult to learn is that the concepts they represent may themselves be difficult to grasp. And children's understanding of the concepts may be limited. Take metamorphosis for example. This process in which the body of an animal such as a frog or butterfly is so completely transformed is almost unbelievable.

Most of us probably do not understand it very well. But, we can use the word, metamorphosis, and so can young children. Learning juicy grown up, sophisticated words can jumpstart a cycle of positive learning. In addition to helping with later reading, especially comprehension, children's use of juicy words impresses parents and leads to higher expectations for their children. Dr. Patton Tabors, an expert in language development, explains.

[Video begins] Shari Ellis: During science conversations, what do children learn about language use other than just vocabulary? Patton Tabors: Let's think a little bit about what the children do in terms of language development. What's the process they're going through? First, children listen to language. That's their starting point. And then eventually

they begin to learn to use language themselves.

Adults are very critical, and crucial in this situation. What adults do, and why conversations in science are a wonderful context for this, is they ask some questions, they spend some time describing, they are able to summarize what the children have learned, and by using their language in those ways, they're showing the children, they're modeling for the children what kinds of questions children want to ask themselves. So that if the children are investigating on their own, they've got a little tape recorder in their head that's going, let's see, what does this do?

Oh, if I do that, how does that work? And they're asking themselves these questions. Why is this happening? And they've learned how to do that because the adults have modeled those questions for them in the course of having that conversation. So, two wonderful things are happening. First, the conversations are helping the children learn concepts, build understanding, gaining knowledge about how the world works, but at the same time, they're building information about how language use operates as well.

So children are learning how to make explanations about what they're seeing, to make arguments about how do you know that that's happening? These kinds of use of language we consider higher level conversational use of language or a language development, and the research does show that this kind of language use leads to excellent literacy acquisition later on. New Speaker: What about vocabulary and science?

Patton Tabors: I think probably one of the questions people want to know is, should I be using the big words with little kids? Is that too much for them? Isn't that something they really can't take on? And again, I think we need to think about how the children learn language and learn vocabulary words. Well, the way they do that is that they hear these words in the context that's exciting and interesting and meaningful to them.

So that if it's a word that is being used in that situation, being used intentionally by the teacher to demonstrate or describe or to show or to tell the children what's happening, then that's a word that the children will want to use themselves later on. So I don't think any words should be off-limits. I think any time that a science conversation is started, the words should flow that describe everything that's going on.

Shari Ellis: There are some words that describe or define science practice skills, like predict, hypothesize, chart maybe. Can you give an example of how a teacher should best introduce a word like predict?

Patton Tabors: I think we undersell how well children gather the meanings of words from the context they're being used in. I think there are certainly times when it makes sense to define a word for children. If you have an object that's right in front of the child that you want to talk about, go ahead and, you know, give the vocabulary that matches the object you're holding. So there's a quick one to one correlation.

But for things like process words like predict and explore and experiment, I think children get a better understanding of those words by hearing them as the teacher is showing what they mean, not that she stops and says, now, by the way, here's what this word means. Because children really don't need that explicit use of language.

They really just need to hear the words in the way that lets them pick up what the idea is And they need to hear it more than once. They need to hear it over and over again, and, you know, if you're doing science investigation, if you're having science conversations, those are the words that they're going to be hearing and they'll begin to figure out very quickly what those words mean. [Video ends]

Barbara Dowling: Let's listen to Dr. Tabors' suggestions for engaging young dual language learners in science conversations.

[Video begins] Patton Tabors: I think having science conversations with second language learners is a wonderful situation. I think it's going to again matter that a teacher takes the time to think about how this is going to be working in her classroom. What they need to be thinking about is what can these children in particular, individual children or language-grouped children take away from a particular lesson? There are a lot of different options.

If you're in the situation where someone could come in and give the lesson initially or give -- or having the conversation initially or begin an investigation, in the child's home language, this is a wonderful place to start, because what we're building is concepts. It's not a question of them immediately knowing what's being talked about in English. What you want them to understand is what's going on. And that is best expressed in a child's home language if that can be arranged. Not always possible

If there are the resources to go that way, that's a wonderful place to start. Then having the concepts, the children can pick up on the English language vocabulary, and that will be a wonderful lead-in to their learning vocabulary and English.

A second thing you can do is you can decide whether or not you want to group children either in a mixed group, some English speakers and some English language learners, or if you want to tailor your presentation or your work with children or your science talk to a group of children who all speak the first language or who are all second language learners so you can be very careful about the language that's use inside that context and again, bring along the vocabulary as you feel the children are prepared and ready to use it.

It takes more effort. It takes a lot more planning. But it is, again, a wonderful situation because the context for talk is right there in front of the children. And that's how second language learners learn best, is to know what it is you're talking about and to be able to make guesses about the words that they're hearing actually mean. [Video ends]

Shari Ellis: Children also learn word meanings from listening to others read to them. Researchers have identified two strategies that are especially helpful in teaching children new words through shared book reading. One strategy is to provide synonyms or definitions when you encounter words that are unfamiliar to the child.

A second strategy is to ask children questions that repeat new words, or require children to repeat the new word in their answers. In this next video clip, we see a teacher introducing new terms for familiar seeds, and then reinforcing their use later in the context of a science exploration.

[Video begins] Stacy Thomas: Can you tell where, Sebastian, in this apple, can you tell me where the seeds are? Yes. And do you know that apple seeds are pips? Can you say pips? Pips. In a lemon, can you tell me where all the seeds are, Oliver? Where are they in the plant? In the fruit, where are they? Are they on this white part or are they in the middle part? Child: In the middle part. Stacy Thomas: You're right.

Stacy Thomas: Allie, can you tell me where the avocado seed is? Do you know that it's called a stone? An avocado seed is called a stone. A stone. Because look at it. Is it bigger or smaller than the apple seeds? Child: It's bigger. Stacy Thomas: It's bigger. You're right.

I always try to start any kind of science or math experience with some sort of literature. In this case, I used a reference book, nonfiction, that actually showed seeds, showed the fruits and vegetables so they had ideas to start with, and we can sort of elicit whatever was hiding in their brain and then get ready for the activity. Its just a way to bring a cohesiveness to the lesson. I'm a firm believer in using fiction and nonfiction and letting the kids see real pictures and then explore the real fruits. I think it just makes the experience so much richer for them.

Now, do we remember what's in the avocado? Child: Yeah. Stacy Thomas: A what? One black seed. Do you remember what it's called? Child: A stone. Stacy Thomas: Oh, my gosh, you guys are so smart! Ready? One, two -- it's kind of blackish brown, huh?

Child: Yeah. Stacy Thomas: You can touch it. I'm going to start with Sebastian and tell me about it. It's slimey. What's another word? Child: Slippery. Stacy Thomas: Good! Do you think, what do you think? Child: Black, small. Stacy Thomas: You think black seeds, but small? Ok. What do you think? Child: They're going to be white. Stacy Thomas: White seeds? Big or small?

Child: Small. Stacy Thomas: Small. What do you think? Child: Big.

Stacy Thomas: You think big? Why do you think they're going to be big, Ollie? Child: Because that thing's big. Stacy Thomas: Because the fruit is big, you think they are going to be big? Allie, how about you, why do you think its going to be big? Child: Because the fruit is big. Stacy Thomas: Ok, are we ready? Count it out. One, two, three. Whoa! Child: I was right! Stacy Thomas: You were right, Asta.

I think there's a value in both. Using the vocabulary like predict, but then explaining it to them in simple terms, predicting means what do you think about something. I want to elicit their response, their ideas. I don't really care about my ideas. I want to see what they have in their brains, what's mulling around. Asking them what do you think, what do you see, how does this work, why do you think that? Those are important questions to elicit responses from them that are meaningful. [Video ends]

Shari Ellis: Experts point out that we often miss opportunities to foster new vocabulary growth when reading with young children by asking questions that can be answered with only yes/no, one word, or no words at all. That said, it is important to adjust the level of questioning to children's knowledge level. It is often a good idea to begin with low demand questions.

These questions allow children to feel successful. Low demand questions also keep children engaged and motivate them to try to answer more challenging questions. Of course, books do much more than teach vocabulary. Books involve children in the world of representations, inspire the imagination, convey factual knowledge, help make concepts concrete, and foster curiosity and a desire to learn more. I recently spoke with Dr. Linda Lamme about the importance of quality science books for children's science learning.

[Video begins] Dr. Linda Lamme: I think the reason we need books is because you can put a book right in the hand of a child and they can touch it and feel it and interact with it. It's very hard to interact with television. It's very hard to interact with the internet. But it's fun to look at it. It's fun to watch it. Children are tactile. They need to touch things. I think it's really important to have books because they can turn pages, they can stop, they can point. They control the learning, whereas in television, they have no control over what learning goes on, it makes them passive learners.

So books are awfully important. Check the book out to see if it's accurate science. Facts being correct in the text, but they need to be correct in the illustrations, too. I think even very young children need to be exposed to accurate science, and there's a lot of cutesy stuff in early childhood literature isn't accurate. So, accuracy, number one. Two, attractiveness. A book that a child can look at and be interested in, clear pictures, presenting clear information. And books that are interactive in some way. The child can either point to or in some way get excited about.

Books that entice young children into the book, to explore them, to make them want to read the book. And we need to have the processes of science need to jump out on every page. In other words, not just content, but the processes so they can see that science is doing something, it's not just a static thing. People where people are actually animals. You know, animal characters, but they are really people. Those kinds are books are not, I don't think the best books to use. [Video ends]

Shari Ellis: Dr. Lamme highlighted several criteria for choosing science books for young children. She emphasized, very strongly, the importance of the accuracy of the science -- in terms of both the text and the illustrations. And, she warned against using books that have animals with human characteristics. Off camera, Dr. Lamme explained to me that she believes nonfiction books are better suited to science than fiction books.

Teacher Stacy Thomas began her seed experience with a nonfiction reference book. But she said she strongly endorses using both fiction and nonfiction books in early childhood science. Barbara, let's talk briefly about the issues involved in using both nonfiction and fiction books to support science in early childhood classrooms. What are some of the advantages of using nonfiction books?

Barbara Dowling: Nonfiction books are a great source of background knowledge for the children and for the teachers. They are also a great source of new vocabulary. Nonfiction books also create links between what is in the books and what is observed in nature. Some of the best nonfiction books to use are those with photographs, especially photographs that show things close up or magnified.

For example, it may be difficult or perhaps unsafe for children to get a really good look at a live bee, but they can see a bee in a close up photograph. Big books with amazing photographs are clearly designed for young children. Other books, even some for adults, contain beautiful photographs that can stimulate wonderment and conversations. “A Collaboration With Nature,” by Andy Goldsworth is one of the favorites in my classroom.

Shari Ellis: Two features I like in nonfiction books, are high quality, realistic illustrations, and books that read two ways. A simple version and one with more details included. For example, there is a series of books by Cathryn and John Sills with titles such as "About Reptiles" and "About Birds." These books have beautiful illustrations and minimal text, but more detailed information is available in the back of the book for those who are interested. I think that is helpful when children start asking questions.

Barbara Dowling: Another series of nonfiction books that the children in my classroom enjoy are the First Discovery books. These contain overlays that allow the children to see inside objects, or changes that take place over time with objects and the environment. Can you imagine how surprised children are when they can see the chicken in the egg, or what lives inside the shell?

Shari Ellis: What do you think about using fiction books to support science? Barbara Dowling: I think fiction does have a place. The children often find the stories engaging. You can point out real world relevance, such as, remember when we did...? Or, have any of you ever seen or done...? One of my favorite fiction authors is Lois Ehlert who has written wonderful books such as Leafman, Nuts to You, Planting a Rainbow. Ehlert often incorporates facts and information about the topics at the end of the book.

Shari Ellis: There are books that are technically fiction, but they are very much based in the real world. Some of my favorites are by Henry Cole. The illustrations really invite close observation and study. When we select books in our work at the museum, we are primarily concerned with accuracy and avoiding misconceptions -- whether the book is fiction or nonfiction.

So, we avoid books that have dinosaurs and people interacting, because dinosaurs and people never co-existed. We also review books carefully to see that they classify animals correctly. You would be surprised by the number of books supposedly about insects that also talk about spiders and worms -- neither of which are insects.

Let's return to Dr. Lamme's point about animals with human characteristics. That is pervasive in children's literature, and is hard to avoid. I You need to evaluate each book. One book we use in our project that does include animals that talk is an out of print title called "Mr. Archimedes Bath." We elect to use this book because the science content is so strong. The strength of the science content in this book outweighs its portrayal of the animals.

[Video begins] Teacher: Mr. Archimedes’ bath always overflowed. What does that when it overflows? What happened to us over at the water table? Child: Its drippy. Teacher: That’s right. Then they all got in, and what happened to the water? Child: Started making -- it makes a lot of mess.

Teacher: It overflowed and made a mess again. Look at that. You are exactly right. The friends decided he should have the bathtub all to himself this time. So he climbed in. And they watched as the water rose. He climbed out, and the water fell again until it was just about the same amount as Mr. Archimedes had put in. Mr. Archimedes got very excited now, and he jumps in and out and in and out and in and out to make the water go up and down and up and down. Eureka, I figured it out! I found it, he shouted. Jump in, everybody! And what happened again? The water overflowed again. That's right.

See, Mr. Archimedes said. I have it figured out. We're the ones who make the water go up. There are just too many of us in the bathtub. That's all.

Tatiana, can you carefully put your rock inside our bathtub? Very gently lay it in there. And everybody else is going to watch the water and see if it gets higher when she puts it in. Oh! He's doing fine. Good job. Look at where the little marks are on the sides. We're almost getting up to that next one. Bring your rock. Put your rocks in. Oh, look. It's

getting higher and higher. Well, we're not overflowing, but look. The water is almost up to the top. Now, if we take the rocks out, the same thing happened as happened for Mr. Archimedes. When everybody got in, the water got higher and higher.

Child: Then we took it out and it goes down. Teacher: You think that will happen? Child: Yes. Teacher: Ok. Let's try it. [Video ends]

Shari Ellis: It always amazes me how exciting children find it to be to put a bunch of rocks in a cup of water. It is interesting that both of the science explorations we viewed today began with a book. Some early childhood experts argue that science investigation should begin with children's direct experiences, not with a book. Barbara, I am interested in your perspective on this.

Barbara Dowling: Books can be used to spark children's interests or to provide further information about a topic they have begun to investigate. If you choose to introduce a scientific concept through literature, you will need to engage in careful observation of the children to make sure the children are interested in that topic and that there is potential for further exploration and study.

Shari Ellis: Thank you, Barbara. I'd like to return to another point made by Dr. Lamme -- the importance of quality pictures in books, because pictures are one form of representation of the world. Quality pictures are especially helpful for younger children. Research shows that young children can readily learn new words via picture books, but in order to connect the picture to the real world, the pictures need to be realistic.

Children have difficulty making connections between cartoon-like pictures and real objects. In fact, studies show that young children are able to make the link between a photograph and the real object it represents before they can make the connection between illustrations and objects. Photographs are very valuable tools necessary in helping children learn science ideas and practice science process skills such as observing, describing, and comparing.

I would also like to talk about another kind of representational tool we can use to support science, and that is models. Models are three-dimensional representations. A globe is a model of the earth, for example. A mobile with the sun, moon, and planets is a model of the solar system. A puppet, if sufficiently realistic, can be a model of an animal. Research has shown that models are more difficult for children to understand than two dimensional representations such as drawings or photographs.

The difficulty has to do with being able to simultaneously see the model as an object in and of itself, and as a symbol or representation of something else. Consequently, models are used more effectively used with older children than with toddlers. We can use models to support science in many of the same ways we use photographs or illustrations. Using a 3D model of an insect may be a more effective way to help children learn to identify body parts than by looking at a small, live insect or an illustration.

For example, we can see the body parts of the dragonfly in the illustration, but it is much easier to appreciate the position of the legs by looking at a model. The model also conveys some sense of how the wings might move. Of course, only an actual specimen like one encased in plastic can reveal how fragile the wings really are.

Let's look at another example. How might we use these illustrations of dinosaurs? Well, we could explore the mouths and talk about the likely diet of each dinosaur. In fact, scientists believe that T-Rex was a carnivore, see all those sharp teeth, while the Ancylosaurus ate plants. Or, we could ask the children to compare the legs of the two animals, and to speculate how each might move. It is easier to think about how the animals might have moved however, using the models. Clearly, the T-Rex had to walk or run on its two hind legs. And science and relative size are often difficult to depict in 2-dimensional representations.

Keep in mind, some believe that dinosaurs are not an appropriate topic, in general, for early childhood science. Between now and webcast 4 we encourage you to think about why. The print and graphics in books, photographs, and models are all representational tools that can be used effectively to support science in the early childhood classroom. But these are only a few.

Science offers many, many opportunities to use a wide range of representational tools that not only support children's understanding of science, but also the development of representational competence -- that is, the understanding that things can be symbols for something else. Other representational tools include shared writing, posters, charts and graphs, and maps.

Barbara Dowling: So far, we have talked about how teachers can use representations, or written language, photographs, 3D models, or maps to support children's science learning. Children's understanding is enhanced when they are encouraged and they can create their own representations. Children can represent their knowledge in a variety of mediums that contribute to literacy. These representations of visual forms can include drawing, painting, and creating 3D models. Let me illustrate with a few examples of visual literacy.

In webcast two we talked about classifying treasures and found objects that children brought from home. These materials were used in the design and execution of models, and in drawings of those models using visual language. Each of these approaches or strategies asks children to extend their learning by engaging in careful observation and by recognizing shapes, forms, patterns, color, texture, and relationship between the parts of the models, objects, or pictures.

Sometimes children’s representations do not perfectly reflect the real world, but they do accurately represent the child’s understanding, and serve as a window into their thinking. Let's look at four examples. Leah drew a picture of the squirrel we saw on our walk one day. This picture led to a conversation that included the change of season, why squirrels gather and store nuts and whether or not squirrels hibernate. Children can also create representational drawings from information and knowledge they have -- from a memory or from what they see like Samantha, a child in my class.

A relative was to have surgery and Samantha's mom had talked with her about what was going to happen. Samantha was then able to create this drawing of the organs of a body and share her knowledge with the other children in the classroom. The examples of children's representations we have discussed so far have all involved 2-dimensional drawings or representations.

Of course, children can also represent understanding by making three dimensional models, or even by combining two and three dimensional approaches, as we see Isabelle and Caleb doing in these photos. One day, Isabelle declared, she wanted to make a plant out of Playdough. She insisted though, she first draw it, or make a plan. Another time, Caleb asked me to build a castle. My response was, blueprints are created by architects. Do you think you could draw a blueprint for a castle? Then we will know how to build the castle you would like.

Shari Ellis: Many teachers regularly use journals to foster children's representational competence. Let's hear why literacy mentor and former teacher Michelle Jones thinks journaling about science ideas is valuable.

[Video begins] Michelle Jones: We work a lot with language and literacy skills. I go into the classrooms, I role model with the teachers, I try to make sure that I do journaling with the students and when we do journaling, we try use a lot of vocabulary. We try to do a lot of sentence structure, getting them to be very expressive in what they're learning, and we try attach that with a theme, whatever we're learning about, we try to focus that when we do our journal work.

I really try to encourage the teachers to do journaling, even if the children are just scribbling because scribbling is the first step to writing skills. And they have to have those scribbling skills before they can reach the next steps. And then really have them draw the picture, talk about it, get those vocabulary words. I think the great thing about science as far as language and literacy goes is the ability to get all those vocabulary words.

We like to call them shiny words, but there are so many words that are associated with science that we try to focus on with the children; absorption, metamorphosis, thorax, antenna, all kinds of great science words lend their self to journaling. It really opens up the children's vocabulary. Also, as far as the experiences go, there's a lot of ways that you can -- when you do the experiences, you can talk to children about beginning, middle, and end. You can talk to them about the processes that they're going through that help with the language and literacy skills. [Video ends]

Shari Ellis: Here are a couple of the journal entries that were created that day. These entries were created at the end of a project on plants. The goal of the journaling that day was to show what children could recall about plants. And I think these entries reveal that these children knew quite a bit. Another way to use journals is to have children draw what they see. Let's hear about this approach from Dr. Kimberly Brenneman, who has been researching journaling practices in preschool classrooms.

[Video begins] Shari Ellis: Good afternoon, Dr. Brenneman. Kimberly Brenneman: Hi, Shari. Shari Ellis: I'm very interested in your work with journaling with young children. I was wondering if you could tell me a little bit about what journaling is and how you use it to support science in the classroom.

Kimberly Brenneman: A lot of teachers already use journals for literacy or for art. And we've introduced them as tools for science. For recording observations or drawing a prediction, what you think might happen in investigation. We give children their own individual notebooks. They can be spiral bound or they can be the special kind that have blank at the top and lines at the bottom for writing. And we usually start quite simply by giving the children the journals, letting them decorate them as they wish on the cover.

And giving them usually a single object, something they've been looking at or observing in the classroom, maybe something simple like an apple or a pumpkin. And we sit with them. What do we observe about this? What do you notice about it? How does it look? How does it feel? Listen to what they have to say and guide them a bit. And then we ask them to draw that. And we use the word record or document or draw and they do that. And we often will sort of guide that a bit, because we would like them to be paying attention to the details of the object.

We guide a bit sometimes with color. What color did you say that that was? They pick up a blue crayon, for example, to draw an orange pumpkin, that sort of thing. So we start off very simply like that and then we spend some time with the child asking them to describe what it is that they have recorded and what they've drawn. And that brings in quite a bit of language and literacy at that point.

Shari Ellis: Do you think it's important that the science journal be separate if they do other journaling, or does it matter if they do the science journaling in with the regular journal? Kimberly Brenneman: We keep those separate. That's been our practice, because we do want children to perhaps think a little bit differently when they're using their science journals. It is a different mode of thinking, a more careful and detailed observation of something that is happening in the world, some objective reality.

Shari Ellis: Great. I think this information will help teachers use their journals much more effectively. Thank you very much. [Video ends]

Barbara Dowling: Earlier, when Shari spoke with the Dr. Patton Tabors, she asked for suggestions she might have when journaling with dual language learners in order to make the experience more meaningful.

[Video begins] Patton Tabors: I think many of the things that have been suggested are really relevant for using the second language learners in journaling. What you're asking of children is that they demonstrate for you what they're thinking is, and they can do drawings, they don't have to be writing, in order to be able to demonstrate that they understood or they were beginning to have ideas and concepts. So it's a perfect way of allowing a young child who perhaps doesn't yet have enough of the English language to express ideas that they can draw, or they can demonstrate that way, that they really got it, they really knew what was going on.

Shari Ellis: The focus of this webcast has been on the potential that science has to foster children's representational skills -- specifically language and literacy. We have discussed how best to support children's word learning in science, talked about some criteria when selecting and using science books, explored how other representational tools such as photographs, models, and maps can support children's science understanding, and reviewed how and why to engage children in making their own representations.

Now we're going to take a short break and when we come back we're going to turn things over to our audience for our

live Q and A session. We'll see you in three minutes. [Music]

Narrator: The Office of Head Start is actively seeking new Head Start and Early Head Start grant reviewers. Please visit the website on your screen to get involved in the effort to provide and expand quality Head Start services across the country.

Shari Ellis: Welcome back! Now it's time to answer your questions and here to help Barbara and me in doing so is Dr. Jean Simpson from the Office of Head Start.

Jean Simpson: Thank you, Shari. It's not too late to send your questions in. Remember you can type your question into the "Ask a Question" form on the browser. Our first question is for you, Shari. A lot of information was presented about the Hart study. Can you give a one or two sentence summary of why that study is important to teaching science?

Shari Ellis: I think it's important because it says the best way to foster language development in young children is just have lots of conversations with them about really interesting things, and science is really interesting. Jean Simpson: Thank you. Barbara is next question is for you. Does Head Start have a plan to develop a science guide for parents to help them with their children?

Barbara Dowling: One of the things I do know is that a number of years ago the Office of Head Start collaborated with the Department of Education and they produced a guide for parent entitled, “Helping Your Child Learn Science.” This publication can be retrieved at the link below that you'll see on your screen. Jean Simpson: Thank you, Barbara. Shari, a question for you. Would you please summarize what it means to be an intentional teacher?

Shari Ellis: Well, I think being an intentional teacher primarily involves planning and reflection. I think you carefully observe your children and establish learning goals and do research on ways to best achieve those goals and then reflect, you know, watch how things go and reflect on how well they worked. Barbara, what do you think?

Barbara Dowling: I think it's important that when you are in a classroom, that the items and the programs you’re going to introduce to your children, that you have carefully considered and you have thorough information on. And then you bring those forward to the children in an intentional way, not just letting things just happen in your classroom, but actually learning from their interests and expanding and exploring those interests with the children in very much of a way that you have explored and studied.

Jean Simpson: Thank you. Barbara, there's a question for you. I realize now that I engage in too much explanatory talk. Can you give me some ideas on how I can start to change this?

Barbara Dowling: One of the very first things you need to do is just to stop, and wait. And ask your children an open-ended question. That would be one of the best ways for you to stop over-explaining things. The other thing is if you do start to explain something to the children, you need to gauge their interest and their comprehension of what you're saying, and maybe you need to ask them, well, what do you think about this?

Or, how do you think that might happen? And get their opinion. It makes you stop and think about, is the explanation you're offering applicable to what the children are really asking? And so just being thoughtful, waiting, pausing, waiting for the children -- I think that helps you in over-explaining the information.

Jean Simpson: Thank you. Shari, the caller says thank you for including birth to five, parents and videos in these webcasts. Ask the question, can you give examples of community partners that might support Head Start access to science experiences?

Shari Ellis: Well, first of all, we have to, especially in this webcast, highlight the role of the public library. Our project at the University of Florida, did involve partnerships with two public library systems. It's not possible for any program to have access to all the books or own all the books, that you really need to do science well, so your public library is essential. But also there's museums, there's science centers, there's hobby groups that are, like, master gardeners. And parks systems that I think would be wonderful partners.

Jean Simpson: Thank you. Barbara, do you have any tips for engaging children who seem inattentive, uncooperative, or exhibit challenging behaves?

Barbara Dowling: If you have behavior issues in your classroom, you really need to stop and think long and hard about the behavior and what are possible causes for the behavior. Then you need to carefully observe the children and find out what are those interest areas for those children? What might they be wanting to talk about and be interested in? Then do some research, find some activities that are interesting for those children and engage them in those activities.

When you have interesting activities for children to be engaged in, when you have enough materials for all the children to be working with, then your behavior problems actually decrease. And so it's just really important to remember to be with the children and to figure those things out. And then I think your behavior issues will be less than you would imagined.

Jean Simpson: Thank you. Thank you Shari and Barbara, and thanks to all of you for your thoughtful questions. As we leave you today we would like to offer you two questions to reflect on: what opportunities do we give children to represent their learning and to communicate their own scientific thinking in a variety of mediums? How do we encourage and support children to explore and to take risks as they justify their scientific thinking?

This concludes our third science webcast. It is our final episode in this series on Thursday, May 21st, we will talk about creating environments that promote science learning. In the meantime, please visit the ECLKC for additional information concerning science, and please feel free to send any suggestions you have about these webcasts by email to the address at the bottom of your screen.

Once again, thank you for taking the time to be with us today. I hope you are inspired to discover the science that happens around you every day. We'll see you May 21st at our final webcast. Until then, take care.
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