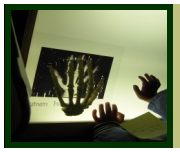
# Investigation: Bones



IN THE GREEN ROOM

Abstract: In a multi-age laboratory preschool, an in-depth study of Bones takes center stage as children creatively construct knowledge spanning across a wide range of developmental areas in unique ways. The investigation highlights the potential to stretch children's thinking, build on content knowledge, and extend across a variety of developmental and curriculum.

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## What is an *Investigation*?

The Child and Family Development Resource Center at Eastern Connecticut State University uses a Vygotsky-inspired framework known as Investigations Curriculum. The underlying principles are as follows:

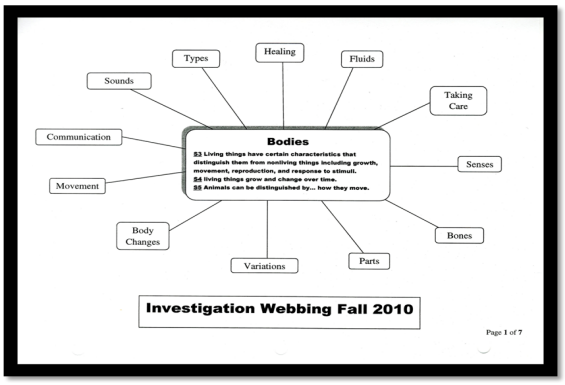
- Preschool children actively make sense of the world through the use of prior knowledge and skills.
- Content knowledge, critical thinking skills, and learning processes are equally important.
- Children have a natural curiosity about the far away, long ago, nature, and the world.
- Young children can construct content knowledge about any phenomenon as long as they can build on prior knowledge.
- Unique content can lead to curiosity, exploration, and a sense of wonder that stretches thinking.
- Aspects of the physical environment are important to shaping children's content knowledge as well as across disciplines.

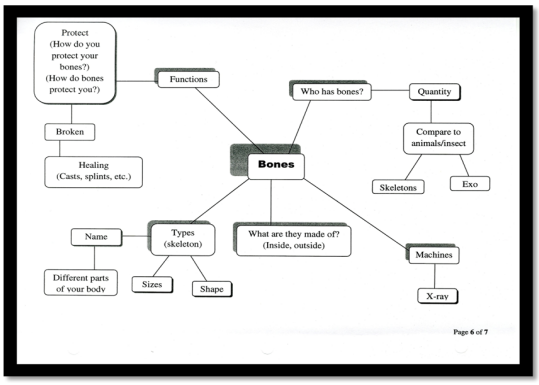
The planning and implementation of the *Investigations* Curriculum involves brainstorming ideas (adults, children, families and any combination thereof), webbing of related ideas, and what is referred to as a 'zooming in' whereby a branch of the general web takes focus. For example, a general web may begin with the broad concept of *Body* and be narrowed down, or 'zoomed in', to *Bones*. Teachers then begin to en-

***Teachers engaged in an initial webbing sessions (Bodies) before zooming into a more specific area of study (Bones).***

# What is an Investigation? (Con't)

gage in a research process and learn about the topic. Teachers choose a few key content standards and begin to develop experiences leading to children constructing knowledge. The role of the teacher is to mindfully observe children and determine critical times to step in and scaffold.




*Above are examples of a general web on Bodies and a zoom web on Bones.*

## HOW IS A TOPIC SELECTED?

Topics are selected based on the interest of the child, family, and/or teacher. The topic will be meaningful, unique, and will stretch children's thinking. The above guiding principles play a significant role in topic selection. We aim to select topics in which children have some prior knowledge to build upon yet not omit topics which children may not directly have experience. An investigations such as Bones, for instance, at first glance may seem challenging for preschoolers as bones are not visible. However, teachers can access what children already know, prior to the formal introduction of the topic, during day to day conversation. Before the investigations, teachers spend time talking to children about bodies, movement, arms, legs, across the curriculum. For instance, in blocks a teacher might ask "How did you reach that block" or in art "How are you able to pick up that tiny bead?", in literacy, talking about the main character in a text that fell and broke her arm, for example. Teachers can take the background knowledge, different for each child, and build upon it by choosing a topic which expands thinking. In *Investigations*, topics are studied in depth. Our Bones investigation for example, continued for over 14 weeks allowing ample time for exploration.

*Comparing skeleton parts to self and measuring*

# Bones: Setting the Stage

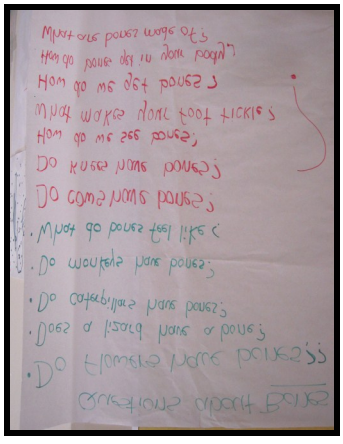
*The teacher initiated the Bones Investigation by sharing a letter from a friend.*

The investigation on bones begins slowly in order to gage children's prior knowledge and plan accordingly. The teacher initiates the lesson by sharing a story about her friend, who broke her foot, along with an x-ray and a letter explaining why she could not visit. During the week, the class reads a variety of fiction and nonfiction books on the topic: Cassie's Cast, by Katherine Lewis, a story about a little girl breaking her arm, was especially captivating. It inspires a great amount of conversation about breaking legs, arms, and wearing casts. Teachers note that children, at the time, mention breaking a "leg" or "arm" with little reference to **bones**.

*Children trace each other's hands marking where they feel bones.*

*Children draw and label where they think their teacher's bones are after sketching her.*

The investigation begins with an awareness phase through the use of guiding questions such as: What are bones? Who has bones? What do they feel like? Can you see them? These question help teachers plan activities in which children make discoveries to answer some of these questions as well as raise new ones. A few of the activities used to promote awareness of bones include feeling their own hands as well as hands of others, using a marker to mark bones on a gloved hand, tracing a teacher and drawing in bones, movement activities, and reading both nonfiction and fiction text about bones. In addition to tapping into prior knowledge, these activities, provide opportunities for heightened awareness of bones.



*Children generated questions they have about bones during a shared writing activity.*

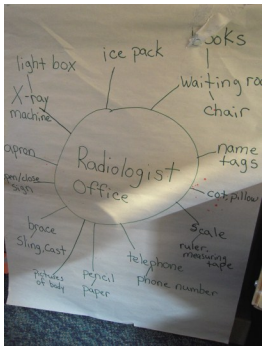
# Preparing for Radiologist Office

During the Awareness Phase, several texts inspire interest in broken bones and x-rays leading to a new dramatic play center: *The Radiologist Office*. The class creates a web including items needed for the center, different roles available as part of the center, etc. The web serves as a working 'check list' as we set up the center over the course of several days. When children assist in the preparation of a center, several great things happen! During the process, they continue to acquire knowledge about content (in this case bones) while building their background knowledge surrounding the center. For example, while creating the center, children research types of x-ray machines before creating one for the office. They expand their knowledge as they discover the uses of x-ray machines as well as the need for safety precautions (wearing a lead vest). With increased background knowledge, children are better able to take on roles associated with the center (i.e. using the language and vocabulary, creating play scenarios and stories, and trying on a variety of roles.

***Above: Doing research on the types of x-ray machine.***
***Below: After the research is complete, children create an x-ray machine with recycled materials.***


***Above: Creating names tags for radiologists.***


***Above: labeling book basket for radiologist office.***



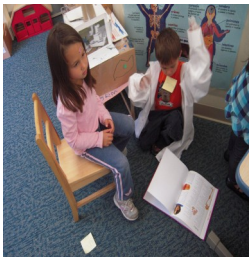

***Children and teachers create a web of materials they think they will need for radiologist office.***

# Dramatic Play: Radiologist Office

*Alex gets ready to see patients in the radiologist office.*

Dramatic play, or pretend play, benefits development across a variety of domains such as personal/social, cognitive (including language), scientific thinking, problem-solving, and mathematical reasoning), cooperation, and creative expression. During pretend play, children have opportunities to negotiate roles (i.e. who will be the radiologist/ patient, etc), engage in perspective-taking (seeing another's point of view), and problem solve just to name a few things. The process by which the dramatic play center comes to be is a large part of the experience adding increased opportunities for experiences across the domains mentioned. For example, while setting up the Radiologist Office, children have a large part in the creation of it as they built the x-ray machine, made signs for the center (open/closed), and set up the center. As children actively take part in various ways, they develop a sense of pride and ownership. With the creation of each new item for the center, children expanded their knowledge adding to their ability to engage in the center accordingly (i.e. assume the role of a patient, x-ray technician, etc.). In order for the center to offer experiences across domains, (provide ample opportunities to promote literacy and mathematical thinking and problem-solving opportunities) specific materials must be included. For example, a variety of paper and texts are available to promote literacy, rulers and tape measures to promote mathematical thinking are just a few examples. It is the role of teachers to model the use of materials in ways which support play while simultaneously demonstrating the purpose of writing (i.e. in this case to make an appointment, to remind their 'employer' that they can't go to work). The way teachers do this is so planful and mindful that child's play should never be interrupted but always respected and supported. Below, from an article by Sue Bredekamp, is a description of the role of teacher/adult in pretend play setting:

***TEACHERS PLAY THREE KEY ROLES: OBSERVER, STAGE MANAGER, AND CO-PLAYER. SUE BREDEKAMP***



*Using nonfiction text to diagnose a patient.*

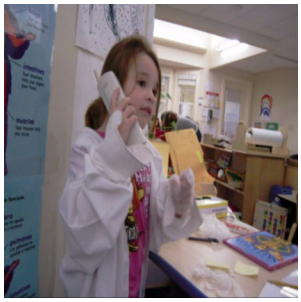
# Dramatic Play: Radiologist Office

*Children engaged in role play as radiologist and patient.*

***Teachers play three key roles: observer, stage manager, and co-player. The observer role is to that played in which teachers observe carefully to determine how children are playing and using materials, whether she/he needs to make appropriate changes, and what to plan next as a result. The role of stage manager and co-player are particularly important to make certain that dramatic play develops and is continued and that individual children who may need additional support receive it. As stage manager, teachers can organize play by providing appropriate materials, space, time, and assistance. As co-player, the teacher carefully engages in the play, providing support as needed with (scaffolding) language, supporting and extending the play. In this context, the most helpful teacher support can include demonstrating, modeling, and guiding as well as elaborating and extending children's language by engaging in one-to-one conversation.*** **(Bredekamp, p.21, 2004).**

The teacher, through scaffolding, can assist children expanding literacy opportunities in dramatic play centers and raise children's mathematical thinking and problem-solving abilities. For example, the center, equipped with tape measure, rulers, gauze has potential for mathematical thinking to occur. Teachers, through observation and knowing when to be present and when to scaffold (at the right time) ask open-ended questions such as :" How do you know how long to make the gauze?", "How long do you think it will take to get to the office from the house?" or "How do we know when she has healed?" promoting children's language and cognitive development.

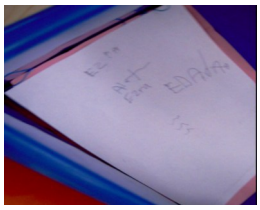
*Skylar is ready to be seen and the radiologist suggests she wear a "sling"." Children use language associated with centers*



*Calling the 'house' to make a follow-up appointment: "You have to come back!" said the radiologist.*

Attention to connecting one dramatic play center to another center is key: two dramatic play centers boost pretend play opportunities. Below, Itzel 'calls' the house (house- keeping center) to schedule an appointment with a patient. She then proceeds to give directions on how to get to the office. The dual centers work together to increasing pretend play and literacy opportunities. Dramatic play and play in general, is a valuable part of the curriculum. A well-designed dramatic play center can positively impact children's development across a variety of domains.

# Radiologists, and Literacy, in Action



*Sign in sheet at the radiologist office*

Dramatic play centers have the potential to help young children develop their oral language, phonemic awareness, alphabet awareness, concepts about print, and early inventive writing in fun and meaningful ways. These components are essential for later literacy success.

*Using a reference book to show patient her "arm is broken."*

Children develop oral language in dramatic play as they learn and practice the language associated with the center. For example, in this specialized office, children use language specific to a radiologist such as: "Let me take your x-ray", "You need a sling", or "Your bone is broken over here".

Children have many opportunities to write in purposeful ways in dramatic play centers when meaningful writing (i.e. signing in daily "so we know you are here") are a part of the overall literacy environment. Teachers must be prepared to scaffold the function of writing with each center. For example, asking questions such as "How will I know it is my turn for the doctor to see me? " or "I am never going to remember all you said about my arm, can you write it down for me?" Based on their response, a teacher must be prepared to scaffold further and to assist children in providing the materials needed to 'sign in when they get to the waiting room, record a patient's history, write the next appointment down. These opportunities underscore the purpose of writing and give children experience with the form (an appointment card has a different form than taking notes on a patient's health, for example), feature (the letters, words, spacing), and functions of print (the way it serves them; the purpose). Even when creating the x-ray machine, a teacher asks "How will I know where to turn the machine on and off?" and children quickly add and label buttons accordingly! (Owocki, 1999). When planning our center, children said "We need a waiting room." Upon prompting for further information, children were able to recall experiences where they went to a doctor and had to wait.

# Radiologists, and Literacy, in Action (Con't)

***Above: Jaylena notes her patients concerns about her leg as she asks "What happened to you?"***
***Below: Dr. Itzel lets her patient know "You have to sign in."***

The role of the teacher is critical as he/she must be available to model and pose the appropriate questions in order for children to begin to view writing as powerful.

The writing children engage in, tells us a great amount about where they are in their literacy development. It is important to note that we accept their attempts. A child may scribble a note and read it as "You have to stay home." The important principle here is that he/she has made a connection that oral language can be represented on paper!

We also make sure we offer a variety of print for children in centers: occupational (related to radiologist such as reference books), recreational (books, magazines to read in the waiting room), informational (a White Pages so we can look up phone numbers, a calendar), and environmental (signs reading Open/Closed). This variety reinforces the idea that print serves a different purpose; each type of text in the center has a unique function. The charts placed up on the wall (informational) help a doctor show a patient where they are hurt, a nonfiction text can also assist a doctor and patient about injury (Owocki, 1999). Based on their experience at doctor's offices, children suggest we have books to read while waiting.

**" YOU HAVE TO REST FOR 60 DAYS. YOU CAN'T GO TO WORK UNTIL YOU FIX YOUR ARM. " ITZEL**

**Itzel writes a note for patient to stay home.**

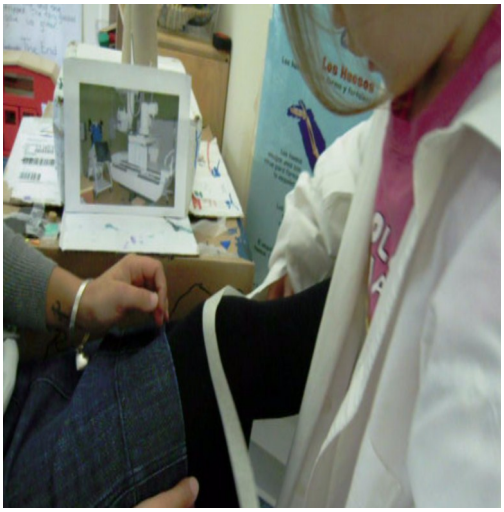
Dramatic play lends itself well to what Vivian Paley refers to as *'doing stories.'* While observing play, the teacher listens to and notes a story being played out in the radiologist office and notes "Ahh, this sounds like a story." Together with children, she scaffolds elaboration of the story taking it as far as children wish to go (i.e. write a book, illustrate, act it out). The result: a book called Car Crash, Car Crash authored and illustrated by two children.

*Owocki, G., **Literacy through play;** Portsmouth, NH: Heinemann, 1999*

# Literacy Meets Numeracy

## Opportunities to develop number sense

Dramatic play offers opportunities for numeracy as well as literacy. With the appropriate materials and teacher scaffolding, children begin to think mathematically using math talk such as "It's not long enough." or "It's too big." In the radiologist office, such opportunities to foster math talk can be abundant. Children, while measuring patients for casts, often problem-solve as they used a variety of strategies to determine the length of a bandage. Children engage in trial and error as they roll a piece of bandage or tape, determined the size and then either cut or rolled the excess back.



***Left: The radiologist determines the patient needs a cast. She asks for tape to use as a cast and begins to roll it around her patient's knee demonstrating problem-solving.***
***Right: The doctor determines how much bandage is required to wrap her patient's leg: "This is long enough" she states using math talk.***

***A child decides to make an x-ray of a visitor in the classroom. The teacher seizes the math possibilities by asking: "Is your paper as long as Sudha?" Child responds: "No, I need more pieces." He gets more pieces and attaches them together with tape. Sudha lays on the sheets and he continues to trace her from head to toe.***

# Problem-Solving and Mathematical Thinking

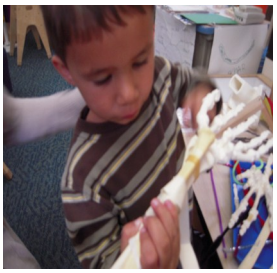
***Itzel stuffs a 'bone' with types of materials she hypothesizes are inside a bone. After stuffing the bones, she notices the materials fall out of the ends: "I know, I can tape it with paper."***

## Math in the Blocks

Alex uses blocks to build a skeleton. He begins this project after realizing that a certain block looked like "the pelvis." He begins with that block, adds legs, and continues on to make the whole skeleton. He puts black blocks inside the circle that was the head. When asked what those blocks are, he replies, "They are the head bone and, and, and the brain stuff."

He, then, compares the pelvis to the pelvis-shaped block. Afterwards, he decides to make a "baby skeleton." He chooses smaller blocks "cause babies are smaller than big people." He finds another block similar to the pelvis-shaped block and again, begins there. He measures the big skeleton and little skeleton with links to see which is larger and finds that, like his prediction, the larger one is bigger. He counts to see how many blocks it took him to make the big skeleton. He counts 24 and "records" it in his notes.

# Problem-Solving and Mathematical Thinking



*Alex attempts a variety of strategies to repair the broken bones; he uses rubber bands and they pop off quickly. He then asks for tape and, through trial and error, determines amount, and type of tape, he will need.*

*Jenesis measures the skeleton using yarn. Her teacher asks her "Who do you think is taller; you or the skeleton'? She then measures herself and they compare.*

*Eternity attempts to bead with a splint on her fingers. Her teachers asked her to describe what it feels like: "It's hard to do this." she exclaims!*
*This activity was designed for a purpose; to highlight that joints help our fingers bend and this is what makes it easier for us to do things like bead. It also highlights challenges people with limited use of fingers may confront.*

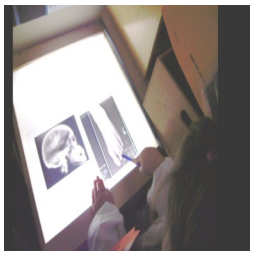
*Right: Dominic measures his teacher with links. After the teacher asks Who is taller?, Sam gets into the outline and Dominic quickly replies "not Sam."*

# Scientific Inquiry

***Awareness Phase: Where are our bones? This leads to a better understanding of what bones feel like as well as joints and bedding..***

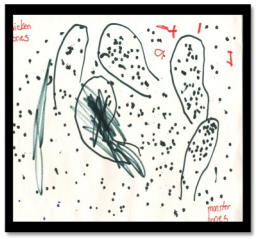
Studying bones naturally lends itself to scientific inquiry. From the initial stage of the investigation, *Awareness Phase*, children explore where humans have bones, how they know this, and they raise questions about what else has bones. Their curiosity leads to a variety of explorations such as feeling and tracing their own hand, their teacher's and/or friend's hand. They draw in where they think the bones would be and offer explanations: "It feels hard over here." They also did this with the entire body as they traced a teacher and added in where they thought she might have bones. In addition to reflecting their curiosity, these experiences give teachers information about what children already know and what they want to know. Building upon bones, we begin to learn about joints and how they move and bend. Below are photographs of children repairing fingers of a hand: they are trying to repair the fingers "because they have to bend" one child exclaims.

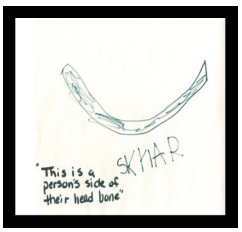
Looking at x-rays is yet another opportunity to engage in scientific inquiry. Children, after determining the part of the patient which hurt, sift through animal and human x-rays finding just the right picture to show patients. This requires an understanding of the specific body part being 'examined' The ability to distinguish a left foot from a right foot, or a human foot from a dog paw x-ray provides opportunity for further scientific inquiry. The class also observes and comments on chicken bones using their senses to describe bones and make predictions about what is inside. In an experiment designed to illustrate what healthy bones need, children predict whether bones placed in soda versus milk would break. They then place bones in each liquid, wait a few days (checking daily), remove them and observe them carefully. These processes are necessary for children to begin to hypothesize predict, and explore their world.



**"IT LOOKS LIKE YOU BROKE YOUR BIG TOE." SADIE**

# Scientific Inquiry






*Left: children's sketches of bones.*

*Above left: A child examines chicken bones and notes they are 'hard to break."*

*Above right: Children, after tracing their teacher, add where they think she has bones. With the teacher's support, they label the parts..*

*The students above attempt to repair the bones of a hand. They know that the bones of a finger are in two parts and that one part bends. The activity where children carefully examined their own and others' hands helped them problem-solve.*

# Scientific Inquiry

*Above: Prediction chart filled out by children.*

Experiment:

After reading books about bones, and examining chicken bones closely, children predict which is better for bones; milk or soda. After reviewing HOW we would find out, children suggest placing[ sanitized] chicken bones in each liquid and see what happens. They predict that the milk would be 'better' (meaning "the bone can't break in milk").

This experiment demonstrates children engaging the process of inquiry: making a prediction and designing the experiment while the teacher provides the background information and the materials.

**"I CAN'T DO IT. THE MILK IS GOOD. YOU BROKE THE ONE IN SODA AND I CAN'T BREAK THIS. CAN YOU TRY?" ALEX**

**"THIS IS SO HARD TO BREAK AND BEND!" SKYLAR**

***Top: Skylar observes the chicken bone while it is soaking in the soda: "It is black now." she said.***

***Second: Sadie sorts the bones (milk, soda) and decides we should label the trays in order to keep track.***

***Third from top: Alex attempts to break the bone in the milk container.***

***Left: Skylar attempts to break bone in soda and notes "It's bending."***

# Scientific Inquiry

***Eternity has a variety of experiences with this activity; she traces her teacher's hand, she allows her teacher to trace her hand, and she traces her own hand. Each experience adds to her awareness of bones in hands in rich ways.***

## Bones: Awareness Phase

As part of the **awareness phase** on bones, children feel the bones in their hands making marks on the gloves. Some did this on a friend, some on themselves, while others chose to do both. The purpose of this activity was to increase children's awareness of where they have bones, where they do not have bones, what bones may feel like, and to foster a sense of wonder about bones.

***Itzel pays close attention to the bones in her own hands as they observe using her senses of sight and touch. She carefully draws in the bones. Itzel examines her palm and feels bones on that side of her hand as well.***

***Sam chooses to trace her teacher's hand. She carefully feels each area, stopped, and made a dot at the area.***

# Creativity

## Opportunities for children to construct and create

During the process of setting up a dramatic play center, as well as when in use, there are numerous opportunities to facilitate creativity. For example, since we do not have an x-ray machine, children decided to make their own. After looking up machines on the computer, they begin to rummage through the art station including our basket of recycled items (such as cardboard, tubes, etc). The result: a collaborative x-ray machine! Referring to the web we created, children make slings out of paper, sketch bones to hang in the office as reference, and create an apron to wear while having an x-ray taken. These opportunities, coupled with the role-playing in the radiologist center, contribute greatly to children's creative development.

***Above: After researching x-ray machines on the internet, children worked together to create one for the radiologist office. In the process, the learned the parts of a machine .***

***Top: The teacher wears an apron during an x-ray.***

***Middle: Sketching a bone to hang as reference in the office***

***Bottom: Radiologists give her patient a sling made by children.***

*Visit The Child and Family Development Resource Center at Eastern Connecticut State University at http://www.easternct.edu/cfdrc/philosophy.htm*
*Visit the Center for Early Childhood Education at Eastern Connecticut State University: http://www.easternct.edu/cece/about.html*

# Family Involvement

## Special Guest: Helping children further extend knowledge

*Chris showed children replicas of bones he uses to teach surgeons how to repair broken bones. Children had the opportunity to touch and feel the materials.*

Inviting a special visitor to the classroom can have positive impact on expanding children's knowledge. When the specialist is a relative of the child, the experience is that much more significant.

Chris (Dominic's father) works alongside orthopedic doctors as he trains them to repair broken bones. He brings replicas of bones and talks about the different parts of our skeleton. In preparation for the visit, we put together a skeleton in large group, hung it up, and began labeling it with both common terms and medical terms. The purpose is for children to become familiar with the parts that make us move and function as opposed to memorization of the terms. It was abundantly clear that our investigation thus far on bones is proving valuable to children as they listened attentively to every word and asked wonderfully insightful questions. Chris brought hands-on materials for children to explore as they learned about bones adding richness to the experience.

*Dominic's father, an expert training surgeons in the repair of bones visits.*

# Cooperation:

## Promoting social-emotional development and collaboration

***Children working together in small cooperative groups to create a body part. They sketched on one day and created on a subsequent day.***

### Cooperative Activity

Cooperative activity, a time set aside daily for small groups to work together towards a common goal, is a large part of our curriculum. Children engage in activities together to promote social-emotional development, sharing and collaboration, appreciation of differences, and often work alongside someone they would not typically. Investigations offer a great opportunity to foster social skills and promote collaboration. The example illustrates one of our cooperative activities related to our *Bone Investigation*. The project, spanning over two days, includes an initial planning phase followed by assembling the project. Children, in their small groups, make a decision about what body part they would like to create from a variety of materials. Together, they sketch the body part they would like to represent. Following the sketch, they make a list of materials they thought they would need to create their project. They list some of the steps involved (first, second…). On Day 2, they review their sketches, check their materials, review their steps, and made decisions about who would do what part.

The process, listed above, has so many benefits to young children's social-emotional competence (negotiating tasks, accepting others' views, expressing feelings), cognitive development (inclosing mathematical reasoning, problem-solving, and language), creativity, and motor development.

# Cooperation:

## In Dramatic Play

Dramatic play has many opportunities for cooperative play. Dramatic play, by nature, has elements of collaboration and cooperation built in. In this center, as with most centers, teachers initially take the time to model or act out a scenario. With this, children begin to see and hear one example of a script and how the different roles can work together. There are many opportunities to engage in social situations where problem-solving will occur: *Who will be the radiologist? Who will be the patient? What do I do if I have to wait?* As children enter the center, they soon realize they may have to negotiate roles.

Prior to the opening of the office, children work together to create an x-ray machine. This collaboration allows children to make decisions both independently and with peers regarding the design of the machine as well as materials to be used. While in the center, children, work cooperatively to create a script of their own.

In no other center is the exchange between children (verbal or not) as necessary to keep the play going underscoring the importance of communication, collaboration, and cooperation. If one child walks away, the play can end abruptly.

During the Radiologist Office dramatic play center, children traded off roles: "Now, it's your turn to be the doctor and I'm going to be hurt" are among common phrases overheard. In doing so, not only are children negotiating roles but they are also trying on other roles and switching perspectives (going from doctor to patient, for example). Role switching, or perspective-taking, in and of itself assists with problem-solving as it affords children yet another opportunity to see things from another person's point of view; necessary in conflict resolution and social-emotional competence.

***Top photo: Group collaborating to create an x-ray machine***
***Bottom photo: Children in the dramatic play center have just switched roles; took turns..***

# Science Fair

## Early Childhood Education Department Interfaces with University Laboratory Preschool

As a university laboratory preschool, the CFDRC is at a great advantage. Interfacing with the early childhood education department has provided countless opportunities for both children, university students, faculty, and teachers. Collaboration with faculty is so vital as the science fair demonstrates. Each semester, as part of their Core requirements for early childhood teacher preparation, students, under the guidance of Dr. Sudha Swaminathan, plan science experiences for young children. The process begins with Dr. Swaminathan sharing our investigation with her students. Next, her students devise lesson plans pertaining to our investigation, share the plans with the preschool teachers, meet to discuss and modify plans, and finally, execute the science fair. The morning of the science fair, children, in small groups, visit each center (anywhere from 6-8 centers are available). Students conduct the initiation, scaffold, observe, document, and reflect over their lessons. Children benefit greatly as the centers reinforce concepts they are exploring in their classrooms. Below are just a few highlights of the science fair related to the Bones Investigation.

Left: Education students create a variety of activities supporting the investigation including children placing layers of "muscle" and "skin" on a skeleton. Children's prior knowledge helps them with this and other activities.


Left: Child examines joints on a skeleton.

Right: Children experience yoga and focus on parts of their body that move as well as how.