

# Exploring Light & Shadow with Infants and Toddlers

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## PURPOSE OF EXPLORING LIGHT AND SHADOW WITH INFANTS AND TODDLERS



Young children encounter light and shadow from birth. They sense from the beginning that shadow is a significant presence and become curious when they notice light change or shadows appear. "Like holes, shadows exist only because of concrete objects. They are confusing because they represent a paradox—existence and non-existence" (Lewin-Benham, 2010, p. 145).

Light and shadow investigations are a natural fit for infant and toddler classrooms. Educators can support infants and toddlers' exploration of light and shadow phenomena that occurs naturally and/or provoke infants and toddlers' exploration with natural and human-made light sources. Through observation, educators discover what infants and toddlers are naturally drawn to investigate and the kinds of problems that they create for themselves when engaged in play with open-ended materials. With careful planning and creative use of materials, light and shadow is a STEM center that is inexpensive, accessible, and where early learning standards can be easily addressed.

## INQUIRY LEARNING WITH INFANTS AND TODDLERS

The **Infant Toddler Inquiry Learning Model** is a way of thinking about inquiry with infants and toddlers. The inquiry process is not linear, demonstrated in this model. Infants and toddlers move freely from one part of the process to another as they explore materials, try new strategies, and evaluate resolutions to problems they pose for themselves.

When educators present new materials, the youngest children typically begin the inquiry process by exploring physical characteristics in the **Wonder** process. Young infants will gaze at the materials, then move their bodies excitedly as educators move the items around. The infants may reach and grasp materials. Older infants may mouth, shake, strike, or throw items as they **wonder**. Mobile infants and toddlers explore more actively by moving the materials around and combining them in ways they find interesting.

After a variety of experiences with open-ended materials, infants and toddlers continue to **rely on previous methods** of exploring and investigating but also **devise new ways** to use the materials in order to see what happens. They may move back and forth between the new strategies, and the tried and true strategies that are familiar. With time, they may begin to **combine approaches, observe how the materials work or don't work**, and then **try again**. When presented with interesting materials the ability to attend for sustained periods of time may amaze teachers. Infants and toddlers may not attend to the materials as their caregiver expected, and instead find some property or aspect of the materials that fascinates them and explore the properties in surprising ways.

Children may also show persistence, with the child eventually **resolving** their chosen problem. That solution may or may not be one that the adults would consider to be correct. If the child appears to be satisfied, we need to accept that approximation, since the solution is a notable step on the way to the adult's perception of *correct*. Children may repeat their resolution process as confirmation that they accomplished what they set out to do. Returning to the same materials later also affirms the child's problem-solving abilities. Older toddlers may wish to demonstrate their solution to another child or to an adult, but many will opt to just continue their inquiry with new materials. Older toddlers may communicate their thinking more openly than infants or young toddlers, since older children's communication skills are generally more well developed. Young children with language delays or who experience languages other than English at home may also speak less about what they are doing. Often we can guess about their thinking, but sometimes we don't know. Continued observations can help educators in understanding this part of the inquiry process.

### Infant Toddler Inquiry Learning Model



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## THE ROLE OF ADULTS IN SUPPORTING INFANTS AND TODDLERS IN LIGHT AND SHADOW INVESTIGATIONS

In our work with early educators, we have found when they are introduced to the science of light and shadows, they are as intrigued by the many interesting possibilities with the materials as their infants and toddlers. It is important for teachers to experiment with the materials before presenting them to children in order to understand how to best choose and introduce materials that will inspire the children in their setting.

Light and shadow investigations require an inventory of the environment and careful observation of the natural light during various times of the day. Planning for the use of the available lighting during optimal learning periods for the children also implies that teachers may need to alter the daily schedule or group children according to their individual daily routines. Infants and toddlers are strongly influenced by the environments and routines they experience each day. The planning process necessitates establishing a learning environment that accounts for what we know about the individual needs and temperaments of the children who will be engaged in the experience.

Begin by introducing a few materials to gauge the children's response. Limiting variables allows the teacher to more accurately observe what children are noticing and how they are using materials. Give children ample time to investigate the materials that you have selected. Consider having more items available to add if children do not respond to the initial offerings. Teachers can be ready with questions and comments in order to scaffold the learning that takes place with light and shadow investigations. Mindful teachers know when to stand back and when to join in the investigation so that their efforts to scaffold learning can serve as a guide rather than a restriction.

## INVESTIGATING LIGHT & SHADOW WITH YOUNG INFANTS (4-9 MONTHS)

Light & shadow experiences can begin with a variety of transparent and translucent containers filled with human-made light sources such as fairy lights, colored tea lights, and closet push lights. Additional materials may include a "moon ball" that changes colors as the children move it, and child-friendly flashlights. Place lights on a low table in a corner or on the floor of the darkened classroom within babies' reach.

*Which infants are moving toward the lights? What do you notice about how the youngest infants respond to the array of lights? What are some specific things the infants do with the materials? Is there a way to engage the infants in a different way with these materials? What else might interest them?*

Create a "hidey-hole" by removing the doors of a lower cupboard that infants can safely crawl into. Add a push light to the side. Adding a curtain allows adults to adjust the amount of outside light into the "hidey-hole." Educators who observed the infant's interest in the closet push lights added battery-operated fairy lights to the inside. They covered the lights with clear, heavy plastic allowing infants to observe the lights without interfering with how they were hung inside.

An overhead projector can be of great interest to infants. They may first be most interested in the glowing bulb itself. Over time, they notice the image on the wall or screen and how it could be altered. Plastic chains, string and yarn, laminated sheets of tissue paper, pieces of foil, or feathers will enable infants to manipulate materials safely as they begin to notice the images on the screen or wall.

A portable artist light pad can be placed on a low table for infants to access. Moving the table next to a wall with an outlet can help to keep the cords out of sight so that infants can focus on the phenomenon of light. Educators can gather a variety of safe materials to position nearby. Infants and toddlers begin to place these objects on the light pad and observe how light interacts with them.



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## OLDER INFANTS AND TODDLERS (APPROXIMATELY 12-24 MONTHS)



Mobile infants and young toddlers are curious about everything and are quick to notice when changes are made to the classroom. They are curious when the teachers move the furniture into a different arrangement or when their favorite toy or book is placed in a basket rather than a shelf. They notice differences in the lighting whether it be the amount of natural light that is streaming into the room or the way in which the human-made light is altered. This kind of subtle change in the environment is a way to start the investigation of light and shadow. What do they notice when the classroom light is altered? What do they notice when the sun is streaming in the classroom window or on a cloudy day when they look at the bottles of colored water that the teacher has placed on the window sill? These are the kind of natural provocations that can be a signal to the teacher that the infants and toddlers are interested in light and shadow.

Light and shadow investigations might begin by using a blind or curtain to change the light in the classroom and observe how the children respond to altering the light or begin to notice their shadows. Darkening the classroom and introducing a variety of light sources might be a next step. There are many child-friendly flashlights with easy to operate on-off switches or that require squeezing or turning to operate. Be sure to have enough so that all who are interested can try out a flashlight. Find a dark place such as a bathroom with the light turned off or a closet with ample space. Flashlights are sure to interest children and learning to turn them on and off has a number of benefits including fine motor skill development and approaches to learning such as perseverance and curiosity. Introduce them by turning some off and some on so that toddlers are intrigued when they compare the lights. Negotiating conflict may be another learning opportunity as children try out the light sources. Observation of flashlight play can certainly be an occasion to identify schema play- you will see children dropping flashlights into baskets and boxes for transporting, rotation and circularity when rotating the handle to activate a flashlight, and trajectory when flashlights are dropped from the loft!

Light tables and the interesting objects that accompany them will be a source of great interest with this age group. Children are delighted with the transformation of familiar classroom toys when placed on the light table. Teachers will observe the differences in what children are drawn to, how they combine objects, and what they gather from around the room to try out. Attention spans at the light table can be astonishing! It is important to plan ahead so that children have ample time to investigate and that there are other interesting things to explore in other parts of the classroom. Introducing the flashlights and the light table at the same time may ensure that all of the children have a novel experience that they find engaging.

Teachers may also want to introduce the overhead projector (OHP) to this age group. Materials similar to those introduced to infants will also interest toddlers. Opaque, translucent, and transparent objects as well as teacher-made laminated overlays with interesting materials that can be combined on the bed of the projector will encourage exploration. Children will first be interested in the bulb and will gradually begin paying attention to the bed and the wall. Given time and support they will begin noticing how they can change the image that is projected.

## OLDER TODDLERS (APPROXIMATELY 24-36 MONTHS)

Children between 24 and 36 months may notice their shadows on the playground and be interested in the differences and similarities between their shadow and their teacher's shadow or how their shadow changes when the light changes such as a cloud covering the sun temporarily. This may be the ideal provocation for light and shadow work. Children may be interested in comparing shadows, drawing around them with sidewalk chalk, or trying to step on each other's shadows while playing.

When the investigation is taken inside, older toddlers will be interested in operating a variety of child-friendly flashlights that can be placed in a center during work time. They will notice the differences and similarities in the flashlights that are available and will delight in sharing flashlights from home that will provide a language experience activity as children tell about the light they have contributed to the center. They will transport flashlights to other centers to discover what else might be illuminated with additional light. They will have a feeling of accomplishment as they master this new technology. Teachers can take note of how individual children tackle the problem of turning a flashlight on or off. Does the child exhibit frustration when the flashlight is difficult to activate? Does the child seek or accept help from a trusted adult or ask a peer when it can't be figured out? Does the

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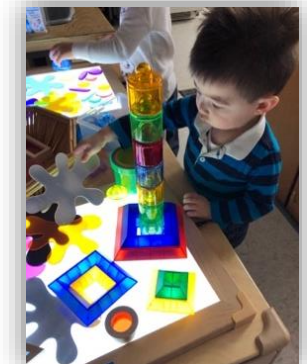
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child try new strategies when the old ones don't work? The opportunities to see early learning standards played out are endless with this STEM experience!

Children of this age love to find places to hide or play in enclosed spaces. Try making a blanket fort or throwing a sheet over your indoor climber. A simple structure can be made with pvc pipe and an opaque curtain so that children can take their light sources inside a space that is darker than the classroom. On some days it is possible to darken the entire classroom for light and shadow investigations and on other days the "cave" can be a place for enthusiastic children to continue their work when others have moved on. Observation of student interest is necessary so that teachers can determine how to accommodate all children in STEM investigations. There may be some older toddlers who want to continue with light and shadow experiences for months.

Light tables and overhead projectors will be of interest to children in this age group. Use of the same or similar materials that teachers have gathered for the younger children will provoke interest and investigation. Introducing at least two of the light and shadow interest areas simultaneously will give all of the students something new to investigate. This will help with classroom management and adult supervision and scaffolding. Children may also be interested in the process of gathering materials. The teacher could ask, "*I wonder if there is anything on the toy shelves that we could use on the light table or on the projector?*" Children will be eager to help and may even find objects and materials that the teacher had not thought about for the light and shadow center.

Older toddlers are beginning to demonstrate spatial understanding by using spatial words such as in, on, under, up, or down and to follow simple directions related to these position words. Light and shadow investigations are a perfect vehicle for children to develop understanding of these spatial concepts as well as to demonstrate awareness of their body in space. Developing a space in the classroom where a large screen can be used with a battery-operated LED light is a provocation that older toddlers cannot resist. Teachers can start by giving children space to explore with body shadows and for them to go in front and behind the screen so they can begin to make sense of what they are seeing. Children of this age will need many opportunities to investigate and explore with their own shadows and will be interested in puppets and other materials that they can use in order to figure out where they need to be in order to make a shadow. Hand shadows are also interesting for children to see and many will attempt to make things that are recognizable.



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## MATERIALS AND EXPERIENCES TO OFFER INFANTS AND TODDLERS

Do a mental inventory of the materials in your setting. **What materials do you already have that could be used for light and shadow investigations?** Which materials would be safe for infants and toddlers to use? Many classrooms have loose parts such as plastic buttons, wooden shapes, glass beads, or a variety of transparent, translucent, or opaque objects that are large enough for infant and toddler exploration. Other materials that can often be found in infant and toddler classrooms are wooden unit blocks, magna-tiles, scarves, puppets, or large farm or zoo animals. Families may be willing to save their recyclables or contribute materials (even temporarily) that will lend themselves to exploration such as LED work lights from the garage, flashlights from a camping trip, or an old shower curtain liner to be used as a screen. Teachers can use ribbons, paper scraps, tissue paper to make laminated overlays for the overhead projector.

Below are some things that we gathered and used in our light and shadow explorations with infants and toddlers.

- Overhead Projector: An OHP combines a magnifying lens, a projecting lens, a light source, and a bed. When children place items on the bed of the projector they can create and manipulate light and shadow. These can be hard to find but some schools have a few hidden away in storage closets. You can also find some on eBay.
- Light table or light pad: We used a stand-alone light table with the older toddlers, but found the small, portable light pads designed for artist use to be best as they were portable and took up little space.
- Wall Washer: A wall washer type of light that “washes” a wall or part of a wall with illumination rather than shining a focused beam on one particular area or downward toward the floor. When a wall washer is used it illuminates the vertical surfaces and enables you to play with shadows without completely darkening the room. They come in sizes with a variety of lumens. We purchased a wall washer with a remote control that allowed us to change colors with the touch of a button. Some families may have wall washers that are used for holidays to light up an outdoor display.
- Large screen (made with PVC pipes and sturdy white fabric) with wooden or binder clips to attach it at the top. We also made a simple screen with a shower curtain liner and clips attached to a clothesline in a doorway. It is important to find a spot where the children can be in front of the screen or behind it rather than display the light on a flat wall.
- Small screen (made from plexiglass) with wooden “feet” to hold it in place on a low table
- Black-out curtains for windows and door
- Small LED flashlights with simple on-off button
- Medium-sized flashlights made for children
- Closet push-lights
- Re-chargeable LED lights
- Battery-operated fairy lights to place inside the clear containers
- Key chain lights
- Mini Maglites
- Disco ball light: A disco ball is a spherical object that reflects light directed at it in many directions, producing a complex display. Our disco light was “found” material that was stashed in a classroom cupboard. It was hand-held rather than mounted so required an adult to hold it and move it for the infants and toddlers. Newer versions are available at various online sources.
- A variety of transparent and translucent containers with lids including clear mailing tubes, plastic “shoe-boxes” with clear lids, food storage containers with clear lids, and zippered clear bags such as those used for blankets or curtains.
- Small laminated sheets with feathers, tissue paper, ribbon, and string pressed inside to use on OHP and light table (these were teacher-made)



**Safety is the prime consideration when choosing materials so try out all of the light sources before introducing them to make sure they do not give off excess heat. Check any objects to be explored to be certain they pass the choke test.**

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## RECOMMENDED RESOURCES/READING

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