

Sensorimotor development: Hands-on activities for infants and toddlers

Claire clings to Ms. Rocca. Ray sits up, watching and listening as the musical ball rolls away from him.

Jessica pulls herself up to standing in order to reach a red block.

José makes “mmmmmm” sounds when he smells the roasted sweet potatoes—his favorite.

And Kasher is ready to lick the finger paint off her finger, but Mr. Hay redirects her to the paper: “Paint goes on paper. Only food goes in the mouth.”



In common, these babies, 2 months to 32 months old, are fine tuning their sensorimotor skills. They are learning about their world through tasting, touching, seeing, hearing, and smelling. For each child, the senses initiate, propel, and refine fine and gross muscles into practiced balance, precision, coordination, agility, and stability. Through sensory and motor stimulation, each child is building strong cognitive connections.



Claire receives reassurance of her worth through her attachment to Ms. Rocca.

Ray prepares to risk a topple

from his balanced bottom in order to follow the ball.

Jessica practices holding on to the sturdy shelf with one hand, while she reaches for the block with the other.

José anticipates the taste of his favorite lunch food with its sweet, roasted aroma.

And Kasher, always eager to explore with her mouth, accepts Mr. Hay’s words and presses her finger to the paper.

Why is early sensorimotor development important?

Infants and toddlers, like the babies above, use their senses to take in stimuli from the environment and respond through reflexes and motor activity. Although much development follows genetically determined patterns, a great part comes from the environment. As babies respond to the environment,



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they build neural connections in the brain. Actually, the degree to which the brain responds to environmental events—its plasticity—is greatest during the first few years of life.

An infant's or toddler's sensory experiences affect both the size of individual neurons and their interconnections. Research has shown that the brains of infants with rich sensory experiences are physically larger and heavier and have more neuron activity than the brains of infants born in severely deprived circumstances. That research indicates that the day-to-day interactions with people and the environment influence the brain's physical structure and thus the functions the brain directs.

Further, researchers point to an infant's **sensitive periods**—specific but limited times when an organ-

ism is especially susceptible to environmental influences. The sensitive periods suggest that without environmental stimulation an infant may fail to develop capabilities that cannot be remediated.

Brain development, especially in these youngest learners, depends upon **responsive** care in which adults recognize and respond to the needs of a particular child. Responsive caregivers build on three basic concepts: attention, approval, and attunement—concepts that are founded on understanding children's needs, respecting children as individual and unique learners, and being aware and reflective of interactions that lead to security, autonomy, and competence (Swimm 2013).

The senses

Piaget's theory of cognitive devel-

opment (1952) described the first four months of life as part of the sensorimotor stage—that is, infants get information through cycles of sensory and motor activity. Beyond the theory, however, it's apparent that the senses, coupled with the movements the senses stimulate, are the foundation for much of the learning that takes place during the first three years.

Skilled and responsive caregivers incorporate their background knowledge of children's sensory capabilities into planning developmentally appropriate activities, the environment, and their own expectations and interactions with babies.

Vision. Researchers have explored three aspects of vision: acuity, color, and depth perception. Visual acuity—the ability to see fine detail—is limited in newborns and develops over the first year from 20/150 to 20/20 (the distance it takes a person with typical vision to read a letter 20 feet away). Color discrimination seems to be relatively mature in a 6-month-old infant. And depth perception seems to be intact by the time infants begin to crawl.

Each of these vision milestones guides teachers and caregivers in the selection of materials, equipment, and décor for environments in which infants spend time. When "...development proceeds normally, infant vision seems perfectly adequate for the things that infants need to do" (Hainline 1998).

Hearing. What we know about infant and toddler hearing is similarly informed by clinical research. Even before birth, a fetus responds to loud sounds and, some research suggests, the

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rhythm of the mother's conversations (De Casper and Spence 1986). At birth, infants typically respond to loud sounds and the human voice, and by 6 months they respond to music and the sound of their own name.

Hearing and its associated

developmental milestones closely align with communication skills and language development.

Because language is a medium of thought, children's ability to hear and speak is critical to the development of their thinking skills.

Although babies generally get

their first hearing test shortly after birth, caregivers, parents, and teachers need to monitor children's hearing and communication skills throughout the preschool years. The chart below, from the American Speech, Hearing, and Language Association (2013), lays

Developmental milestones in hearing and speech

Hearing and Understanding

Birth – 3 months

- Startles to loud sounds
- Quiets or smiles when spoken to
- Seems to recognize your voice and quiets if crying
- Increases or decreases sucking behavior in response to sound

4 – 6 months

- Moves eyes in direction of sounds
- Responds to changes in tone of your voice
- Notices toys that make sounds
- Pays attention to music

7 months – 1 year

- Enjoys games like peek-a-boo and pat-a-cake
- Turns and looks in direction of sounds
- Listens when spoken to
- Recognizes words for common items like *cup*, *shoe*, *book*, or *juice*
- Begins to respond to requests (e.g. "Come here" or "Want more?")

1 year – 2 years

- Points to a few body parts when asked
- Follows simple commands and understands simple questions ("Roll the ball," "Kiss the baby," "Where's your shoe?")
- Listens to simple stories, songs, and rhymes
- Points to pictures in a book when named

2 years – 3 years

- Understands differences in meaning (go/stop, up/down, big/little, in/on)
- Follows two requests ("Get the book and put it on the table")
- Listens to and enjoys hearing stories for longer periods of time

Talking

Birth – 3 months

- Makes pleasure sounds (cooing, gooing)
- Cries differently for different needs
- Smiles when sees you

4 – 6 months

- Babbling sounds more speech-like with many different sounds, including /p/, /b/, and /m/
- Chuckles and laughs
- Vocalizes excitement and displeasure
- Makes gurgling sounds when left alone and when playing with you

7 months – 1 year

- Babbling has both long and short groups of sounds such as "tata upup bibibibi"
- Uses speech or noncrying sounds to get and keep attention
- Uses gestures to communicate (waving, lifting arms to be picked up)
- Imitates different speech sounds
- Has one or two words ("Hi," "dog," "Dada," "Mama") around first birthday, although sounds may not be clear

1 year – 2 years

- Says more words every month
- Uses some one- or two-word questions ("Where kitty?" "Go bye-bye?" "What's that?")
- Puts two words together ("more cookie," "no juice," "mommy book")
- Uses many different consonant sounds at the beginning of words

2 years – 3 years

- Has a word for almost everything
- Uses two or three words to talk about and ask for things
- Uses /k/, /g/, /f/, /t/, /d/, and /n/ sounds
- Is understood by familiar listeners most of the time
- Often asks for or directs attention to objects by naming them

a framework for what to expect as typical hearing and language skills—both receptive (interpreting sounds) and expressive (producing sounds).

Smell and taste. Newborn infants express their reaction to certain odors and tastes just as adults do—with pursed lips, wrinkled noses, and turned heads. The research of Marlier and Schall (2005) describes infants 3 or 4 days old who indicate a preference for the smell of their mother’s breast milk to that of formula, even if the baby is fed with a bottle. Further, sweetness is favored over sour by neonates who indicate their pleasure by sucking sweet solutions longer than less sweet ones (Crook 1987).

Infants and toddlers typically explore with their mouths more thoroughly than with their eyes, ears, or noses. In providing learning activities, caregivers need to be ready to redirect infants to toys they can safely mouth, and follow sanitary procedures for cleaning them.

Touch. Tactile activities abound in infant and toddler classrooms. The sensory table—sometimes just a small dish tub—invites exploration of water, snow, sand, play dough, confetti, shaving cream, and even leaves, bells, and small plastic animals.

Some children are cautious about tactile experiences. Some seem to prefer not to be messy, and others may have true sensitivities to light, sound, and touch. With these children, caregivers can introduce tactile activities slowly, inviting children to move at their preferred paces.

Caregivers can also share familiar objects with different textures

—a dry and a wet sponge, for example. Enclosing play dough and other gooey materials in a zip-close bag gives toddlers the opportunity to poke and prod without getting their fingers sticky.

Reflexes and intermodal perception. Reflexes—the involuntary movements made in response to environmental stimuli—are well integrated into a baby’s sense of touch. When someone touches an infant’s cheek, the child turns the head in the direction of that touch (**rooting reflex**). If something touches the lips, the infant sucks (**sucking reflex**). And if an object touches an infant’s palm, the baby will grasp, wrapping fingers around it (**grasping reflex**).

As their brains and nervous systems continue to develop, babies begin to coordinate, combine, and integrate sensory input in what researchers call **intermodal perception**. Voluntary movements gradually replace reflexes, and coupled with increasing muscle strength and sensory perception capacity, a baby’s hard-wired need to explore and learn is ready to be satisfied.

Activities for infants and toddlers

Responsive caregiving—meeting infants and toddlers where they are developmentally and without a preplanned agenda—requires some environmental basics. Safety considerations are paramount in all parts of the environment, including equipment, tools, and play materials. Consistent places for diapering, sleeping, preparing food, and feeding instill trust and confidence in both babies and

their family members.

Learning centers best reflect the ages, developmental skills, interests, and needs of the babies using them. Ideally their location and props are kept stable, because frequent and capricious changes in the environment are disturbing to babies. When alterations are essential, it’s important to maintain the look and location of the environment’s most important elements.

Infants and toddlers need safe spaces filled with opportunities to explore, discover, and learn through the sensory experiences that reinforce developing motor skills. Sensorimotor development is built on this premise of looping and spiraling discovery, reinforcement, and new discovery. It’s the fundamental tool for infant and toddler learning.

Use or modify the following activities and materials to build sensorimotor skills in infants and toddlers. Adapt the activity according to the sequence of developmental milestones the babies seek to achieve. Tweak the activity to offer new challenges gently, and tweak again to avoid boredom or frustration.

Swat it, grab it, hold it *(visual acuity and motor skills)*

Infants often see something they would like to touch and hold but are thwarted by unrefined muscles in the arms and hands. Expect the youngest babies to swipe and swat; grasping what they see happens only accidentally.

With improving hand-eye coordination the baby may grab an object but still lacks the skills to hold on to it. With even more

practice the baby will be able to grab and hold on to an object. A milestone for toddlers is to hold an object in one hand and transfer it to the other.

Your careful observations will help you decide how to modify this activity to accommodate the baby in your care.

Here's what you need:

- clear plastic bottle with lid
- colored tape
- large metallic confetti or cut-up colored paper bits
- glue

1. Wash the bottle thoroughly and let it dry. Use lengths of boldly colored tape to decorate the outside surface of the bottle. Put about ¼ cup of large metallic confetti into the bottle. Replace the lid and seal it with glue.

Newborns: With the baby on your lap or on a flat floor mat, hold the bottle about 12 inches from the baby's face. Move it slowly across the baby's field of vision, shaking the bottle occasionally to hold the baby's interest. Notice how the baby tracks the bottle with the eyes and later by moving the whole head.

Infants: Place the baby on a flat floor mat and hold the bottle in the air above the baby's feet.

Shake the bottle to focus attention and watch as the baby swats at the bottle with the feet, sometimes making contact.

Sitting infants: Place the bottle within the baby's arm reach. Notice whether the child swats at the bottle or grabs it. Does the baby try to follow the bottle when it tips over and rolls out of reach?

Variations: The classroom is filled with materials that encourage this kind of sensorimotor learning. For example, thread sturdy cord through the holes in a Wiffle® ball. Hold one end of the cord for tracking, swatting, and grabbing exercises, remembering to remove the cord from the children's play area after use.

Scarf play

(object permanence, visual acuity, cause and effect, and motor skills)

At around 8 or 9 months of age, babies become aware that an object can exist even when they cannot see it. This awareness is referred to as **object permanence**. It explains a younger infant's delight and surprise in playing peek-a-boo.

Here's what you need:

- paper towel tube
- markers, crayons, colored tape (optional)

- scarves or translucent fabric squares

1. If desired, decorate the paper towel tube. For a longer lasting prop, use as 12-inch length of plastic pipe or bamboo.
2. Collect a variety of scarves or 12-inch squares of lightweight fabric.
3. Adapt the activity to the children's developmental needs and interests.

Newborns: Simply brush an edge of the scarf over the baby's head, face, arms, and legs. Talk with the baby about the sensation and use words like *tickle, breeze, feel, soft, and brush*.

Sitting infants: Play peek-a-boo with the scarf. Cover your face and encourage the baby to pull the scarf away. Cover the baby's face and cheer when the scarf is removed.

Young toddlers: Stuff a scarf into the tube, leaving one corner protruding. Encourage fine motor skills by helping the toddler grab the edge of the scarf and pulling it out of the tube.

Older toddlers: Tie the corners of several scarves together and stuff them into the tube. Watch for the toddler to use alternating hands to pull the scarves out of the tube. Share the toddlers'

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delight and surprise when the colors and textures of the fabric change.

Touch, sense, and know

(tactile sensation and fine motor skills)

During the first year of life, babies in cultures around the world are fed, carried, cleaned, and comforted through touch. Tactile sensation provided by parents and caregivers not only helps satisfy an infant's physical needs but also affects emotional development. Research suggests that severe tactile deprivation can result in learning delays and cognitive impairment. Gentle tactile activities can enhance exploration and learning.

Here's what you need:

- colored file folders

- squares of differently textured materials
- glue
- scissors

1. Cut each file folder in half from the fold to the open end.
2. Gather 3-inch squares of textured materials, such as satin fabric, fake fur, aluminum foil, corrugated cardboard, sandpaper, and carpet.
3. Glue matching squares of each material in the two halves of each folder to make pairs.

Young toddlers: Introduce the texture folders to one or two children at a time. Choose one material, open the folder, and invite the children to touch the material. Offer descriptive vocabulary for the material including color, texture, and other appropriate features.

Older toddlers: Introduce more of the folders to small groups of children. Encourage the children to describe the materials and how they might be used. When the children are familiar with each of the texture folders, show them in pairs. Invite the children to explore the textures with both hands at the same time, one on each folder. Extend this into a matching game (with folders open) and later into a game of concentration matching the two textures.

Variation: Newborns and infants won't be able to gain much information from the textures that they touch. However, you can stimulate the sense of touch in babies with simple materials like a large pom-pom. With the baby in your lap or on a flat floor mat, show the pom-pom and describe its color, size, and texture. Tell the baby that you're going to rub the texture on the arms, legs, and face. Watch for the baby's accepting responses (smiles, waving arms, and kicking feet) as an invitation to continue the activity. If the baby turns away or squirms uncomfortably, acknowledge (and label) the emotion and discontinue the activity.

Sticky play

(large and small motor skills, memory, and visual acuity)

During the first year of life, babies are busily developing large motor skills: learning to sit up, stand, crawl, and walk. Alongside these skills, babies are developing small, or fine, motor skills by using their hands and fingers to grasp and manipulate objects. By building on these skills, children

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gradually learn to do such things as eat, dress, and clean themselves as well as to turn pages of a book, use writing implements, and work a puzzle.

Here's what you need:

- cardboard box with lids, no larger than 8 inches on a side
- clear, adhesive-backed vinyl
- colored, adhesive-backed vinyl
- scissors
- photos

1. Seal the box closed and cover with patterned vinyl or paint as desired.
2. Cover the outside of the box with clear, adhesive-backed vinyl, sticky side out.
3. Gather pictures—for example, family photos or food, pet, or face pictures from old magazines. To make the pictures more durable, encase them in clear, adhesive-backed vinyl or laminate.
4. Invite the toddlers to hang the pictures on the box. The babies will position and reposition the photos being engaged with both the stickiness and the image in the photo. Be sure to talk with the toddlers about the pictures they choose.

Variation: Instead of photos, invite toddlers to use collage materials (string, paper scraps, foil, gift wrap, cotton balls, straws, craft sticks, leaves, and twigs, for example) to decorate the box.

Shakers and movers

(auditory discrimination, hand-eye coordination, and motor skills)

Typically babies have good hearing at birth. But it takes a while

for them to understand and distinguish sounds and to respond appropriately. Playing with noisemakers helps babies develop auditory discrimination, and talking, doing finger plays, singing, and reading help them develop language.

Here's what you need:

- matching plastic or metal containers with lids
- permanent glue, such as Super Glue
- small, dry noisemakers, such as pebbles or seeds
- patterned adhesive-backed vinyl

1. Collect several containers. You might use, for example, peanut butter jars, 16-oz. soda bottles, spice jars, or coffee tins.
2. Cover the outside of the container with patterned vinyl.

3. Pour about $\frac{1}{4}$ cup of dry noisemakers—pebbles, bolts, spools, sand, bells, or seeds, for example—into the different containers. Leave one container empty.
4. Cover the containers and use permanent glue to secure the lids in place.
5. Introduce the shakers, one at a time.

Sitting infants: While the baby is sitting on the floor or at a table, show a container and give it a shake. Position the container within the baby's reach and watch. Is there an effort to reach the container? Does the baby use both hands to reach and grasp? Can the baby repeat your shaking motion?

Young toddlers: Share two containers with distinctly different sounds—bells and bolts, for example. Talk with the child



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about the sounds and encourage rhythmic shaking with simultaneous full-body movement.

Older toddlers: Introduce the shakers and place all the containers on a low shelf. Encourage children to explore them independently, listening to the different sounds and sensing the different weights. Help the toddlers notice that one of the containers is empty—there is no sound or weight.

Find it and reach

(visual acuity, auditory discrimination, and gross and fine motor skills)

Because we put babies to sleep on their backs to prevent Sudden Infant Death Syndrome (SIDS), infants need to spend some of their play time on their stomachs for healthy development. Tummy time strengthens neck and upper back muscles, which allow infants to hold up and turn their heads. Tummy time also gives infants a different view of the world.

Here's what you need:

- ½-inch wide sewing elastic
 - collection of attractive and unbreakable objects, such as measuring spoons or toy animals
 - construction-strength stapler and staples
 - sturdy vertical surface
1. Cut the elastic into 18-inch lengths.
 2. Securely tie one end of the elastic to one of the collected objects. Rattles, plastic measuring tools, toy animals, and mirrors are good examples of appropriate objects.
 3. Staple the end of the elastic to a

vertical surface like the back of a heavy bookshelf or a wall so that the objects are about 6 to 8 inches from the floor.

4. Position a baby on the tummy and point to the toys. Encourage the baby to balance and reach the object. Watch how the baby uses the hands—sweeping, making contact, grasping and pulling?

Note: As always, attend to safety. Make sure the objects don't pose a choking hazard and that there is no chance the baby could topple a shelf or get caught in the elastic.

Fill and dump

(motor skills, hand-eye coordination, and tactile stimulation)

At first, infants don't connect looking at objects with touching them. Around 6 months, however, they begin to put looking and touching together. With practice, they refine this hand-eye coordination and gain dexterity in exploring objects and the environment.

Here's what you need:

- large manipulatives such as plastic clothespins
 - empty containers with handles, like milk jugs and plastic buckets
1. Gather large (too big to be a choking hazard) manipulatives like plastic clothespins, Duplo® bricks, or plastic linking rings.
 2. Make available empty containers. Make sure the opening in the container will easily accommodate the manipulative.
 3. Watch toddlers engage in the favorite game of fill and dump. Note whether the toddler

engages with these materials spontaneously or if you need to introduce the activity. Does the child find more pleasure in filling rather than dumping? Does the child use the materials in other ways? Does the child pick up the manipulatives with one hand or both? Is the movement fluid?

Musical wall

(auditory discrimination, motor skills, and cause and effect)

As children develop motor skills, they learn the important principle of cause and effect. Hitting an object with a mallet, splashing water, pushing a toy truck, and similar movements help them understand that they can change their environment. It gives them a sense of delight and power.

Here's what you need:

- variety of objects that make interesting sounds when hit with a mallet
- heavy cord
- small wooden mallets or dowels
- secure area of playground fencing

1. Gather an array of objects that can be hung on the fence. Include objects like a toy xylophone, a metal triangle, a hubcap, a metal pot lid, wind chimes, a metal trash can lid, metal pipes, large metal food containers, and a bike tire with metal spokes.
2. Determine a section of the playground fence on which to mount the musical wall. Because this will be a semi-permanent installation, consider an area in the shade and away

- from wheel toy traffic.
3. Attach all the objects to the fence, including the mallets, at toddler height.
 4. Introduce the musical wall by beating out a rhythm on one of the objects. Hand a mallet to a child and encourage continued music and movement.

Crunch, crackle, and pop

(auditory discrimination and motor skills)

Listening is a critical skill that humans use in communication and learning. As babies listen, they begin to distinguish sounds, sense rhythms, and process what they hear. By listening to sounds and voices, they lay the foundation for language.

Here's what you need:

- sheets of various paper types

Infants: Crunch a sheet of paper near the baby and note the response.

Sitting infants: Provide sheets of paper for the baby to grasp, crunch, and tear.

Young toddlers: Place a variety of paper types in the art center. Include heavy construction paper, printer paper, tissue paper, paper towels, toilet tissue, and foil. Encourage tactile exploration with questions.

Older toddlers: Introduce bubble wrap and the opportunity to stomp or hammer the bubbles to pop them.

It's on the floor

(tactile stimulation and discrimination)

Many sensorimotor activities require common materials often in minimal amounts. Parents may be happy to donate materials from their homes and offices, and it gives them a chance to practice recycling. Make sure that all materials are clean and free of potential hazards, such as loose parts, sharp points, and toxic chemicals.

Here's what you need:

- variety of flooring materials
- heavy tape
- scissors

1. Gather a variety of textured flooring materials. Ask for donations such as a tufted bathroom mat, low-pile carpet squares, a rubber bathmat with suction cups, outdoor (fake grass) carpet, a door mat, fake fur, adhesive-backed vinyl, and bubble wrap.
2. Plan a texture path through the classroom or in a hall.
3. Tape all edges of the flooring materials to the floor. Make sure the edges are smooth to prevent tripping.
4. Invite children to experience the path.

Newborns: Choose a section of textured flooring that can be easily laundered—the tufted bathroom mat, for example. Place infants on the tummy and encourage grasping and brushing the texture.

Sitting infants: Choose different sections of the textured flooring for unique sensory experiences throughout the day. Notice each infant's preferences of materials. What did the infant seem to notice in each?

Toddlers: Scooters, crawlers,

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toddlers, and beginning walkers will notice the differences in each texture along the path. Notice toddler preferences. Compare the reactions to the sticky vinyl with the bubble wrap, for example. Did toddlers avoid some of the textures?

References

- American Speech-Language-Hearing Association. Typical Speech and Language Development. Retrieved on 4 Nov. 2013 at www.asha.org/public/speech/development/01.htm.
- Crook, C. K. 1987. Taste and olfaction. In P. Salapatek and L. B. Cohen (Eds.), *Handbook of Infant Perception, Vol. 1*. New York: Academic Press.
- Hainline, L. 1998. The development of basic visual abilities. In S. Slater (Ed.), *Perceptual Development: Visual, Auditory, and Speech Perception in Infancy*. East Sussex, U.K.: Psychology Press.
- Marlier, L. and B. Schall. 2005. Human newborns prefer human milk: Conspecific milk odor is attractive without postnatal exposure. *Child Development*, 76.
- Piaget, J. 1952. *The Origins of Intelligence in Children*. New York: International University Press.
- Swimm, Terri Jo. 2014. *Infants and Toddlers: Curriculum and Teaching, 8th Ed.* Belmont, Calif.: Wadsworth/Cengage Learning. ■