Enhancing and Practicing Executive Function Skills with Children from Infancy to Adolescence
Introduction

Executive function and self-regulation skills provide critical supports for learning and development. Just as an air traffic control system at a busy airport manages the arrivals and departures of many aircraft on multiple runways, executive function skills allow us to retain and work with information in our brains, focus our attention, filter distractions, and switch mental gears. There are three basic dimensions of these skills:

- **Working memory** — The ability to hold information in mind and use it.
- **Inhibitory control** — The ability to master thoughts and impulses so as to resist temptations, distractions, and habits, and to pause and think before acting.
- **Cognitive flexibility** — The capacity to switch gears and adjust to changing demands, priorities, or perspectives.

These skills help us remember the information we need to complete a task, filter distractions, resist inappropriate or non-productive impulses, and sustain attention during a particular activity. We use them to set goals and plan ways to meet them, assess our progress along the way, and adjust the plan if necessary, while managing frustration so we don’t act on it.

Although we aren’t born with executive function skills, we are born with the potential to develop them. The process is a slow one that begins in infancy, continues into early adulthood, and is shaped by our experiences. Children build their skills through engagement in meaningful social interactions and enjoyable activities that draw on self-regulatory skills at increasingly demanding levels.

In infancy, interactions with adults help babies focus attention, build working memory, and manage reactions to stimulating experiences. Through creative play, games, and schoolwork, children practice integrating their attention, working memory, and self-control to support planning, flexible problem-solving, and sustained engagement. By high school, students are expected to organize their time (largely) independently, keep track of their assignments, and manage projects to completion.

As children develop these capacities, they need practice reflecting on their experiences, talking about what they are doing and why, monitoring their actions, considering possible next steps, and evaluating the effectiveness of their decisions. Adults play a critical role in supporting, or “scaffolding,” the development of these skills, first by helping children complete challenging tasks, and then by gradually stepping back to let children manage the process independently—and learn from their mistakes—as they are ready and able to do so.

The activities that follow have been identified as age-appropriate ways to strengthen various components of executive function. Although scientific studies have not yet proven the effectiveness of all these suggestions, their presence here reflects the judgment of experts in the field about activities that allow children to practice their executive function skills. Practice leads to improvement. These activities are not the only ones that may help; rather, they represent a sample of the many things children enjoy that can support healthy development.

Finally, please note that when websites and products are referenced in these activity suggestions, it is because they are helpful resources or examples. Their inclusion does not imply endorsement, nor does it imply that they are the only, or necessarily the best, resources.

Acknowledgements

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Executive Function Activities for 6- to 18-month-olds

These activities encourage infants to focus attention, use working memory, and practice basic self-control skills. During this stage of development, infants are actively developing their core executive function and self-regulation (EF/SR) skills. Supportive, responsive interactions with adults are the foundation for the healthy development of these skills. However, particular activities can strengthen key components of EF/SR.

In using these activities, adults should attend to the infant's interests and select activities that are enjoyable, while also allowing the infant to determine how long to play.

Lap games for younger infants

Generations of families have engaged babies in games while holding them in the lap. Different games practice different skills, but all are predictable and include some basic rules that guide adult and child behavior. Repetition helps infants remember and manage their own behavior to fit the game's rules.

- **Peekaboo** — Hide-and-find games like this exercise working memory, because they challenge the baby to remember who is hiding, and they also practice basic self-control skills as, in some variations, the baby waits for the adult to reveal him or herself. In other versions, the baby controls the timing of the reveal; this provides important practice regulating the tension around an expected surprise.

- **Trot, Trot to Boston; This is the Way the Farmer Rides; Pat-a-Cake** — Predictable rhymes that end with a stimulating yet expected surprise are well-loved. Infants exercise working memory as they develop familiarity with the rhyme and practice anticipating a surprise, inhibiting their anticipatory reactions while managing high levels of stimulation.

Hiding games

Hiding games are a great way to challenge working memory.

- **Hide a toy under a cloth** and encourage the infant to look for it. Once infants can find the toy quickly, hide it, show the child that you have moved it, and encourage the child to find it. Make more moves to increase the challenge. As the child remembers what was there and mentally tracks the move, he or she exercises working memory.

- **Older infants may enjoy hiding themselves** and listening to you search loudly for them while they track your location mentally.

- **You can also hide an object** without showing an older infant where it is and then allow the infant to search for it. He or she will practice keeping track of searched locations.

- **Another challenging version** of these games involves putting a set of cups on a turntable (or “lazy Susan”), hiding an object under a cup, then spinning the turntable. Hiding more than one object can also increase the challenge.
**Imitation or copying games**

Infants love to copy adults. When they imitate, they have to keep track of your actions, remember them, wait their turn, and then recall what you did. In doing so, they practice attention, working memory, and self-control.

- **These games have a variety of forms**, from taking turns making simple gestures (e.g., waving) to organizing toys in certain ways and asking children to copy you (e.g., placing toy animals in a barnyard) or building simple buildings by putting one block on top of another and perhaps knocking them down to rebuild.
- **As infants’ skills improve**, make the patterns they copy more complicated.
- **Adults can also demonstrate** ways to play with toys, like making a toy horse gallop or rocking a baby doll. This introduces the concept of using toys as symbols for real objects.

**Simple role play**

Older children in this age range enjoy doing the tasks they see you do.

- **Take turns with any activity** that interests the child, such as sweeping the floor, picking up toys, dusting, etc. These games introduce the basics of imaginary play and practice working memory, self-control, and selective attention, because the toddler must hold the activity in mind to complete it while avoiding distractions and inhibiting the impulse to do other things.
- **Children can remember and play out** more complicated roles as they get older. They will also begin to initiate activities. Providing the necessary materials (e.g., a broom, a toy box, a dustcloth) can help children enjoy and sustain this type of play.

**Fingerplays**

Songs or chants with simple hand motions are a lot of fun for infants, and develop self-control and working memory as well as language. Infants can learn to copy the movements to a song and, with practice, will remember the sequence. *Eensy Weensy Spider; Where is Thumbkin?;* and *Open, Shut Them* are examples, but these fingerplays can be found in many languages and cultures.

**Conversations**

Simply talking with an infant is a wonderful way to build attention, working memory, and self-control.

- **With younger infants**, start by following the infant’s attention and naming aloud the things holding his or her attention. The infant will likely maintain his or her attention a little longer, practicing actively focusing and sustaining attention.
- **As infants get older**, pointing out and talking about interesting objects or events can help them learn to focus their attention on something the adult has identified. As babies learn language, they also develop their memory of what is said, eventually mapping words to objects and actions.
- **Conversations in any language** besides English are also helpful. It has been found that bilingual children of many ages have better executive function skills than monolingual children, so experience using an additional language is an important skill.

**Resources**

**Songs and games**

- [www.turben.com/media-library/8702756_infanttoddlerplaybook.pdf](http://www.turben.com/media-library/8702756_infanttoddlerplaybook.pdf)
During this stage of development, children are rapidly expanding their language skills. Language plays an important role in the development of executive function and self-regulation (EF/SR), as it helps children identify their thoughts and actions, reflect on them, and make plans that they hold in mind and use. Language also helps children understand and follow increasingly complex rules—both those that regulate behavior and those that apply to simple games. Additionally, bilingualism is associated with better EF/SR, so parents who are fluent in more than one language should use those languages with their children.

### Active games

At this age, toddlers are actively developing many important physical skills, and they love physical challenges. The following activities require toddlers to focus and sustain their attention on a goal, inhibit unnecessary and ineffective actions, and try things in new ways if a first attempt fails. They may not always succeed, but the practice is very important. This is a learning process. Many of these activities will require frequent reminders from adult organizers, and they may not last very long!

- **Provide many materials and opportunities** to try new skills, such as throwing and catching balls, walking a balance beam, running up and down an incline, jumping, etc. Set up simple rules to follow for added working memory and inhibition challenges—for example, take turns running to a “finish line” and back.

- **Older toddlers can enjoy simple imitation games**, such as *Follow the Leader*, or song games like *Punchinella* or *Follow, Follow* (“Follow, follow, follow [child’s name], follow, follow, follow [child’s name]”—all children imitate [child]). These are great tests of working memory as well as attention and inhibition.

- **Games that require active inhibition** can be fun, too, like *freeze dance (musical statues)*, although don’t expect children to “freeze” without a few reminders. Also effective are song games that require children to start and stop, or slow down and speed up, such as *Jack in the Box*; *Popcorn*; *Ring Around the Rosie*; or *Motorboat, Motorboat*.

- **Song games with many movements** are also fun. Examples include *The Hokey Pokey*; *Teddy Bear*; *I’m a Little Teapot*; or *Head, Shoulders, Knees, and Toes*. These require children to attend to the song’s words and hold them in working memory, using the song to guide their actions.

- **Fingerplays, or songs and rhymes with hand gestures** to match, continue to be popular with children this age, similarly challenging children’s attention, working memory, and inhibitory control.
Conversation and storytelling
As children develop more spoken language skills, they can begin to engage actively in conversation with adults and tell simple stories.

- **Simply watching and narrating their play** can be a great way to help very young children understand how language can describe their actions. As children get older, questions can be added, such as “What will you do next?” or “I see you want to put the ball inside the jar. Is there another way to do that?” These comments help children pause to reflect on what they are trying to do, how what they have tried has worked, and how to plan their next move.

- **Telling stories about shared events** can be a great way to reflect on these experiences. The experience must be held in working memory while the child considers the order in which things happened, why things happened the way they did, and what the experience meant. These stories can also be written or drawn into simple books and revisited.

- **Talking about feelings** is also important, either by labeling children's feelings as they are noticed (“It looks like you are really angry right now!”) or by telling the story of a time a child became upset. By giving children language to reflect on their feelings, these conversations can support the development of emotional regulation, which is essential for engaging executive function.

Matching/sorting games
Children this age are able to play simple matching and sorting games, which require children to understand the rule that organizes the activity (sorting by shape, color, size, etc.), hold the rule in mind, and follow it.

- **Ask children to play a sorting game** in which you take turns sorting objects by size, shape, or color.

- **Engage older toddlers in a silly sorting game**, such as putting small shapes in a big bucket and big shapes in a small bucket.

Children tend to put like with like, so a change is challenging, requiring them to inhibit the expected action and engage their selective attention and working memory.

- **As they get older, toddlers also start to enjoy simple puzzles**, which require attention to shapes and colors. Adults can ask children to think about what shape or color they need, where they might put a certain piece, or where they might put the piece if it doesn’t fit, thereby exercising the child’s reflection and planning skills.

Imaginary play
Toddlers are beginning to develop the capacity for simple imaginary play. Often, toddlers imitate adult actions using objects that they have available (such as sweeping with a broom or pretending to cook with a pot). When they reach this age, these actions are not simply imitative, but can be sustained and show signs of simple imaginary play plots. For example, after “cooking” in the pot, the child will put the pot on the table and pretend to eat.

- **Ask children questions** about what they are doing. Narrate the things you see happening.

- **Play along with the child**, and let the child direct the play. Give the child a chance to tell you what role you should play and how you should do it. Regulating the behavior of others is an important way that children develop their own self-regulation skills.

- **Provide a variety** of familiar household objects, toys, and clothing items to encourage children’s imaginary play.

Resources

**Music**
- fun.familyeducation.com/toddler/music/37371.html

**Other activities**
- www.fun.familyeducation.com/toddler/music/37371.html
Executive Function Activities for 3- to 5-year-olds

Children’s executive function and self-regulation skills grow at a fast pace during this period, so it is important to adapt activities to match the skills of each child. Younger children need a lot of support in learning rules and structures, while older children can be more independent. Ultimately, the goal is to shift children away from relying on adult regulation, so when the child seems ready, try to reduce the support you provide.

Imaginary play
During intentional imaginary play, children develop rules to guide their actions in playing roles. They also hold complex ideas in mind and shape their actions to follow these rules, inhibiting impulses or actions that don’t fit the “role.” Players often take ideas from their own lives, such as going to the doctor’s office. They might act “sick,” be examined by the doctor, and receive a shot. The “doctor” talks and acts like a doctor (calm and reassuring), the “sick child” talks and acts like a sick child (sad and scared), and the child in the role of “parent” talks and acts like a concerned parent (worried and caring). While younger children tend to play alone or in parallel, children in this age range are learning to play cooperatively and often regulate each other’s behavior—an important step in developing self-regulation.

Ways to support high-level imaginary play:
- Read books, go on field trips, and use videos to make sure that children know enough about the scenario and roles to support pretend play.
- Provide a varied set of props and toys to encourage this type of play. Younger preschoolers may need more realistic props to get the play started (e.g., toy medical kits), while older children can re-purpose other things to turn them into play props (e.g., paper towel tube that is used as a cast for a “broken arm”). Reusing familiar objects in a new way also practices cognitive flexibility.
- Allow children to make their own play props. Children must determine what is needed, hold this information in mind, and then follow through without getting distracted. They also exercise selective attention, working memory, and planning. If the original plans don’t work out, children need to adjust their ideas and try again, challenging their cognitive flexibility.
- Play plans can be a good way to organize play, as shown by one early education program designed to build self-regulation, Tools of the Mind. Children decide who they are going to be and what they are going to do before they start playing, and then draw their plan on paper. Planning means that children think first and then act, thus practicing inhibitory control. Planning play in a group also encourages children to plan together, hold these plans in mind, and apply them during the activity. It encourages social problem solving, as well as oral language.

Storytelling
Children love to tell stories. Their early stories tend to be a series of events, each one related to the one before, but lacking any larger structure. With practice, children develop more complex and organized plots. As the complexity of the storytelling grows, children practice holding and manipulating information in working memory.

Ways to support children’s storytelling:
- Encourage children to tell you stories, and write them down to read with the child. Children can also make pictures and create their own books. Revisiting the story, either by reviewing pictures or words, supports more intentional organization and greater elaboration.
Tell group stories. One child starts the story, and each person in the group adds something to it. Children need to pay attention to each other, reflect on possible plot twists, and tailor their additions to fit the plot, thereby challenging their attention, working memory, and self-control.

Have children act out stories they have written. The story provides a structure that guides children's actions and requires them to attend to the story and follow it, while inhibiting their impulse to create a new plot.

Bilingual families can tell stories in their home language. Research indicates that bilingualism can benefit a variety of executive function skills in children of all ages, so fostering fluency in a second language is valuable.

Movement challenges: songs and games
The demands of songs and movement games support executive function because children have to move to a specific rhythm and synchronize words to actions and the music. All of these tasks contribute to inhibitory control and working memory. It is important that these songs and games become increasingly complex to interest and challenge children as they develop more self-regulation skills.

Provide many opportunities for children to test themselves physically through access to materials such as climbing structures, balance beams, seesaws, etc. Setting challenges for children—such as obstacle courses and games that encourage complex motions (skipping, balancing, etc.)—can also be fun. When children are trying new and difficult activities, they need to focus attention, monitor and adjust their actions, and persist to achieve a goal.

Encourage attention control through quieter activities that require children to reduce stimulation and focus attention—such as using a balance beam or yoga poses that include slow breathing.

Play some music and have children dance really fast, then really slowly. Freeze dance is also fun, and it can be made more difficult by asking children to freeze in particular positions. (Tools of the Mind uses stick-figure pictures to direct children.) When the music stops, children must inhibit action and shift their attention to the picture to imitate the shape depicted.

Songs that repeat and add on to earlier sections (either through words or motions) are a great challenge to working memory, such as the motions to She’ll Be Coming 'Round the Mountain, the words to Bought Me a Cat, and backward-counting songs, such as Five Green and Speckled Frogs and songs repeating a long list (the Alphabet Song).

Traditional song games, like Circle ‘Round the Zero are also fun. Complex actions, including finding partners, must be accomplished without becoming distracted.

Quiet games and other activities
Matching and sorting activities are still fun, but now children can be asked to sort by different rules, promoting cognitive flexibility. Children can first sort or match by one rule (such as by color), and then immediately switch to a new rule (such as by shape). For a more challenging version, play a matching game, but change the rule for each pair. Quirkle and S’Match are commercially available games that challenge cognitive flexibility in this way. Or play a bingo or lotto game, in which children have to mark a card with the opposite of what is called out by the leader (e.g., for “day,” putting a chip on a nighttime picture). Children have to inhibit the tendency to mark the picture that matches, while also remembering the game’s rule.

Increasingly complicated puzzles can engage children this age, exercising their visual working memory and planning skills.

Cooking is also a lot of fun for young children. They practice inhibition when waiting for instructions, working memory while holding complicated directions in mind, and focused attention when measuring and counting.

Resources
Pretend play suggestions

Montessori activities – Walking on the line

Songs
- kids.niehs.nih.gov/games/songs/childrens/index.htm
References


AAP recommends developmental surveillance. CDC has FREE resources to help.

CDC’s *Learn the Signs. Act Early.* milestone checklists make developmental surveillance easy. The checklists:

- Help you systematically conduct developmental surveillance as recommended by the American Academy of Pediatrics (AAP)
- Correspond with health supervision visits 2 months to 5 years
- Are based on developmental milestones from the AAP
- Are completed by parents, preparing them for more accurate responses to developmental screeners

Developmental surveillance and screening together are more likely to identify the 1 in 6 children with a developmental disability than either one alone.

To identify these children so they can get the help they need:

✔ **Perform** the 6 steps of developmental surveillance at each health supervision visit:
  1. review checklists/developmental history;
  2. ask about concerns;
  3. assess strengths and risks;
  4. observe the child;
  5. document; and
  6. share results with others.

✔ **Encourage** parents to monitor milestones between visits and share results with you:
  - Print, hang, and share flyers for CDC’s *Milestone Tracker* app; ask families to use the app to complete milestone checklists.
  - If paper is preferred or for other languages, print and share milestone checklists ([www.cdc.gov/Milestones](http://www.cdc.gov/Milestones)); laminate and reuse as needed.

✔ **Conduct** early childhood screenings using validated screening tools at recommended ages or whenever there’s a concern, as recommended by the AAP ([bit.ly/AAPScreeningRecs](http://bit.ly/AAPScreeningRecs)).

✔ **Refer** children with concerning results for further evaluation AND to your state’s early intervention program ([www.cdc.gov/FindEI](http://www.cdc.gov/FindEI)).

www.cdc.gov/ActEarly  |  1-800-CDC-INFO (1-800-232-4636)
Resources to help with developmental surveillance

Most materials are available in English and Spanish; checklists are available in six additional languages.

Print FREE materials directly at www.cdc.gov/ActEarly/Materials.

Promote CDC’s FREE Milestone Tracker app for families and other care providers: learn more and print flyers for your clinic at www.cdc.gov/MilestoneTracker.

Customize materials by adding your practice’s logo and contact information and print them yourself. To get the files, email ActEarly@cdc.gov.

Visit www.cdc.gov/ActEarly/Healthcare for a free CME/MOC activity and other developmental surveillance resources developed by AAP and CDC.

www.cdc.gov/ActEarly   |   1-800-CDC-INFO (1-800-232-4636)

Learn the Signs. Act Early.