

What are Executive Functions?

How Executive Functioning skills work, and what you can do to help a child improve them.

LearningWorks
for kids playing smarter in a digital world.



What are Executive Functions?

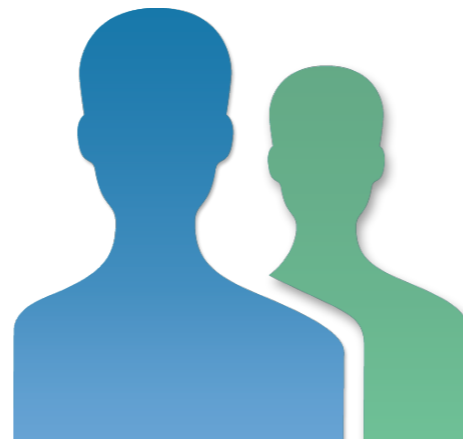
How Executive Functioning skills work, and what you can do to help a child improve them.



What are Executive Functions?

What Executive Functions are all about, and how to tell if your child needs to improve them.

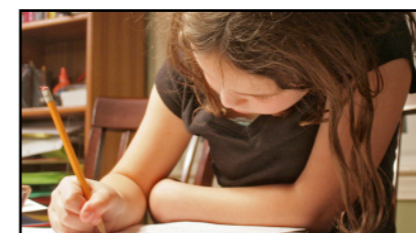
Page 2



The 12 Executive Functions

How each of the 12 Executive Functions work.

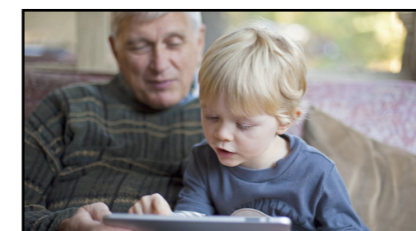
Page 4



Executive Functions and Childhood Development

How developing strong Executive Functioning skills can help your child.

Page 6



Executive Functions and Academic Performance

How Executive Functions affect academic performance.

Page 8

What are Executive Functions?

Executive Functions Help With:

- “What to do” skills like starting tasks, paying attention, persevering on a task, and remembering information.
- “How to do” skills like planning, organizing, shifting strategies, and managing time.
- Social and emotional skills like managing perceptions and thoughts, assessing actions, and engaging in social interactions.

Executive functions are brain-based cognitive skills that facilitate critical thinking and self-regulation. Executive functions call upon the prefrontal cortex of our brains to help with goal-setting and decision making. Executive functions include a set of related skills that help

prioritize, regulate, and orchestrate an individual’s thoughts and behaviors. The executive functions help individuals manage their feelings and actions, monitor their behavior, and attend to their experiences from the past and the present.

Psychologists have described executive functions with dozens of definitions, including those by Russell Barkley, Thomas Brown, and Peg Dawson and Richard Guare. The consensus is that executive functions orchestrate various brain functions that integrate a person’s perceptions, experiences, cognitions, and memories toward goal-directed behavior.



We have chosen a modified version of the model described by Peg Dawson and Richard Guare as the basis for our descriptions of executive functions. We believe that their description is an excellent fit for understanding how children use executive functions in their day-to-day lives. It is important to note that this list of executive functions is neither comprehensive nor categorical. For example, specific skills seen in planning may also be described in organization. In addition, examples of executive dysfunctions, such as problems in completing homework, often involve many executive function skills, such as time management, perseverance, and sustained attention.

Many children and adults have difficulties with one or more executive functions. It is not uncommon for parents to report their own problems with Organization or Working Memory. Task initiation and Time Management difficulties are often seen in school and work settings. In fact, most people who struggle with executive functioning are never “diagnosed” with a problem but simply see it as an area of weakness for them. In today’s complicated, and

disconcerting world, deficits in these skills can cause problems in managing one’s life and getting things done efficiently.

Children with psychiatric issues, such as Attention Deficit Hyperactivity Disorder; learning disabilities; and problems in social, emotional, and behavioral functioning, often display impairments in their use of executive functions. They may display difficulties in getting started on tasks, sustaining attention and effort levels, following multi-step directions, staying organized, and managing time effectively. It is important to note that many children will display executive strengths in certain areas and dysfunctions in others. These differences can often be explained by both biological and environmental factors.

Other childhood psychiatric conditions, such as Autism, Aspergers Disorder, Anxiety Disorders, and Tourettes Disorder, may be significantly impacted by executive dysfunctions. For example, a child with Aspergers Disorder may be extremely rigid, with limited executive functioning skills in the areas of flexibility and social thinking.

The 12 Executive Functions

The 12 function model of Executive Functions is based upon the theories of Peg Dawson and Richard Guare.

At LearningWorks for Kids, we have chosen to condense the 12 Executive Functions into eight core Thinking Skills. Functions that have been combined into one of LW4K's 8 Thinking Skills have been noted at the beginning of each description.



Flexibility:

The ability to be adaptable, to improvise, and to shift approaches to demands.

Flexibility involves developing novel strategies and shifting attention from one task to another is often necessary. Recognition of the need to utilize different problem-solving strategies,



including reflective, careful approaches or a trial-and-error / random approach is seen in flexibility.

Flexibility is often utilized in social situations and in dealing with peers. It is an important part of a child's ability to transition between activities. It helps individuals to deal with disappointments and shifting expectations. It helps children deal with unexpected events and changes in routines.

Metacognition

Part of the Thinking Skill of Self-Awareness

The ability to assess one's own actions, to self-monitor, and observe.

Metacognition is an opportunity for children to check on their efforts and assess their successes and failures. It is a particularly important function for helping children to gain some perspective on their decision-making and skill development. Metacognition facilitates taking a birds'-eye view of the impact of one's actions on others, checking on how one has done.

Metacognition implies a degree of thoughtfulness about one's activities and responsiveness to others in one's environment. It involves asking oneself questions that facilitate defining problems, developing solutions, and assessing successes.

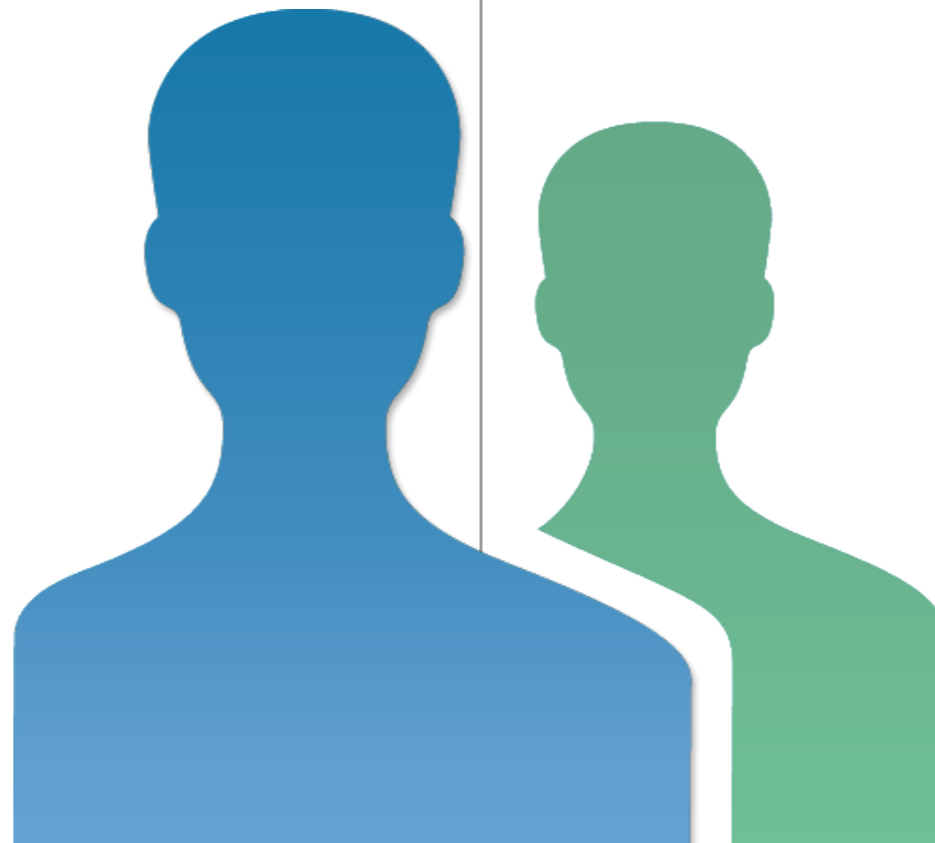
Social Thinking:

Part of the Thinking Skill of Self-Awareness

The ability to understand social conditions and respond to them appropriately.

Social thinking involves the ability to label and describe one's feelings and to realize the causes of one's emotional experiences.

This Executive Function helps individuals to understand the needs of others, is important in perspective taking, and is the key to cooperation in social settings. Social thinking requires the ability to read / understand nonverbal cues, understand social conventions, and express care and concern towards others.



Organization:

The ability to use a systematic approach to achieve a goal or complete a task.

Organization involves the capacity to arrange elements into a functioning whole. It involves the ability conceptually to organize all facets of an activity to create a unified approach. Organizing involves a systematic approach that facilitates goal-directed behavior. It may involve sequencing, analysis of a complex situation, and promotes efficiency and task completion.



Organization involves taking care of one's schedule, as well as materials necessary to complete a task. Organization often requires that one is able to obtain necessary information, make it accessible, and then be able to use it for decision making.

Planning:

The ability to develop a set of strategies in order to accomplish a goal.

Planning involves the development of a roadmap or set of strategies in order to accomplish a goal. Components of planning include prioritization, sequencing, and foresight. It may involve both short and long-term goals and taking all aspects of a situation into consideration while making a plan. Responsiveness to the environment as well as social cues may be important. Planning may involve estimation and possible anticipation of outcomes.

Planning skills are needed in many aspects of a child's life. At home, planning is important in extending invitations to friends for a playdate, completing one's homework so that a child has time to watch her favorite television show and complete a chore before his/her parents get home.



Regulation of Affect

Part of the Thinking Skill of Self-Control

The ability to manage one's feelings effectively for decision-making and task completion.

Regulation of affect involves the ability to manage one's feelings effectively in order to make decisions, control behavior, and complete a task. One must be able to sustain one's effort in the face of frustrations and difficulties. Individuals who can effectively regulate their feelings display the capacity of self-control. They are able to label and describe their feelings and are generally able to recognize what is behind or the cause of what one feels.

Effective regulation of affect involves an ability to recognize the connection between one's thoughts, feelings, and actions. There is a clear developmental component, in that temper tantrums, appropriate to age 2, are no longer seen as acceptable behavior as a child moves into elementary school.

Response Inhibition

Part of the Thinking Skill of Self-Control

The ability to stop or delay an action rather than display impulsive behavior.

Response inhibition involves being able to stop or delay an action and to be able to reflect rather than display impulsive behavior. Response inhibition is a very important skill for safety, displaying socially appropriate behaviors, and efficient problem solving.

Self-control allows a child to stop ineffective and inappropriate (destructive / irresponsible) actions so that the child can plan, consider, and display appropriate behaviors. Self-control is important in a child's ability to size up and monitor a situation before acting. This skill is important in noticing the nonverbal and social cues that help guide behavior. Self-control is important in understanding acceptable behavior in a particular situation and is a necessary component for one to consider the possible consequences of one's behavior.

Goal-Directed Persistence

Part of the Thinking Skill of Focus

The ability to persevere with tasks that require sustained effort.

Goal-Directed Persistence involves the ability to set a reachable goal and display ongoing effort and attention towards its completion. This persistence is needed when a task becomes boring, when it is interrupted, and when one needs to change strategies. It involves sequencing, willfulness, and the ability to learn from experience.

Goal-Directed Persistence is very helpful in development of a skill such as playing an instrument or learning individual and team-based skills for a sport. It involves a willingness to delay gratification and to be able to visualize or imagine the future.

Sustained Attention:

Part of the Thinking Skill of Focus

The ability to maintain one's focus and attention in the presence of distractions.

Sustained attention involves the ability to maintain one's focus and attention in the presence of distractions and other activities. It involves the ability to return to an activity when interrupted and persist in attending to a tedious or boring task. It may also involve the process of attending to multiple sources of information and being able to selectively choose what is most important to attend to.

Task Initiation

Part of the Thinking Skill of Focus

The ability to initiate a task without procrastination.

Task Initiation skill is demonstrated when one starts directly on a task, such as doing homework or completing chores. Getting started involves having an understanding of what is expected, the wherewithal to ask appropriate questions if there are misunderstandings, and the skills to redirect one's attention from a previous involvement.

Time Management

The ability to respond to things in a timely fashion.

Time management involves the ability to respond to things in a timely fashion, estimate the time necessary to complete tasks, and have the ability to make and follow a schedule. It often involves monitoring one's effort and actions, having an appropriate sense of urgency to complete tasks, and having the ability to follow a step-by-step procedure.

Effective use of time management helps children to be more efficient and more effectively juggle a number of activities. For older children and teenagers, this might involve being able to do their homework and be involved in a sports time or extracurricular school activities, and still have time for their friends or work. Younger children will show independence skills such as being able to get themselves ready for school in the morning and still have time to watch a favorite television show or play outside before school.

Working Memory

The ability to remember relevant information and apply it to the task at hand.

Working memory involves the ability to maintain information in mind so that an individual can use it for learning, reasoning, or producing a result. For example, this might involve shutting off a television while remembering to gather one's coat, keys, and bag before leaving the house on a trip. In school, working memory is very important in taking notes, following multi-step directions, and doing mathematical calculations in one's head. Working memory involves storing information temporarily and using that information in problem solving, motor activities, and self-control.

Working memory plays an important role in reading comprehension and, for younger children, in the development of decoding skills to create reading fluency. It is a measure of the capacity of individuals to hold information in mind with the purpose of completing a task and helps them to remember the rules within a game or task.

Executive Functions and Childhood Development



How do Executive Functions develop throughout childhood?

Executive functioning skills develop throughout childhood and early adulthood. Children as young as eight-months-old are observed displaying consciously-controlled behaviors that reflect executive functions. As children get older, they display increasing skill in solving problems and maintaining thoughts and images in their minds. Demands for increasingly complex executive functions arise throughout childhood, but problems may not be noticed until children reach the middle-school years, when demands for organization and planning for the future become prominent.

Executive functions may be slow to develop in

“Younger children may benefit from visual reminders of their sets of strengths and weaknesses.”

some individuals. Neuroscientists have indicated that the prefrontal portion of the cortex, the area of the brain most responsible for executive functions, is among the last regions of the brain to mature. In the past, it was often believed that brain-based capacities could not be changed. However, recent research linking a number of brain exercises to the development of new neural networks in the brain suggests that training can promote improvements in brain activity.

The first signs of executive functioning in infants begin to emerge when a child approaches the age of 1. A child's ability to consciously control his/her thoughts, actions, and emotions can be observed when he/she begins to search for an object that has been hidden by a parent or sibling. This type of activity, described by Philip David Zelazo, Ph.D. as a form of "hide-and-seek," suggests executive functioning skills, since the baby is able to keep the hidden object in mind and perform an action. This process is considered to constitute a conscious effort in the pursuit of a goal.

As a children approach the age of 2, they begin to show the ability to comply with verbal rules and directions. In addition, children at this stage begin to keep verbal rules in mind and use them to guide their behaviors. By the age of 4, children begin to display more flexible behavior rather than the persevering behaviors that they may have demonstrated at the age of 3. Their decision-making capacities, and, in turn, their executive functioning skills, allow them to begin considering more than one possible answer.

The development of executive functions directly parallels brain growth and development in children. The synapses, or connections, among neurons in the brain reach their peak density between the ages of 1 and 2. These synapses are then pruned, or deleted, so that the stronger connections in the brain remain. This process helps the frontal lobe of the brain form stronger links to the rest of the brain, facilitating executive functioning. Individuals with significant damage to their frontal lobes and prefrontal cortex have numerous deficits in executive functioning, including high levels of impulsivity, poor judgment, irresponsibility, and

numerous difficulties with decision making and monitoring their behavior.

As a child's brain matures, it not only grows in size through a regeneration of neurons but also develops an extraordinary number of branches that allow for nerve cells to communicate with each other, increasing the capacity for complex thinking and decision making. Executive functions do not operate independently in decision making and are highly dependent upon the quality of information that the brain receives. Of particular importance are environmental factors and learning experiences that contribute to brain growth and development. The quality of executive functioning skills may be based upon accurate sensations of one's world, emotional and motivational states, memory capacity, and the ability to use language.

One prominent theory of executive functioning development was formulated by Russell Barkley, Ph.D., who proposed that, within the first 6 to 12 months of life, children are developing the executive function of behavioral inhibition. Behavioral inhibition allows a child to think before acting and to decide when, or if to respond to a situation. Barkley suggests that the skill of



Working Memory, which involves holding events in the mind, occurs next. This skill is followed by the internalization of speech, which involves the use of language to aid in decision making. The next stage involves the self-regulation of affect, emotional self-control, and the regulation of motivation and energy in order to achieve a goal. This stage is followed by what Barkley refers to as reconstitution, which involves the capacity to analyze and monitor one's behavior and the ability to develop strategies for using one's skills in order to solve new problems.

Executive functioning in children appears to develop in a sequential fashion. Distinct growth patterns have been observed, indicating periods of intense development between the ages of 5 and 7, 9 and 12, and during adolescence. Between the ages of 5 and 7, children typically begin to display the capacity for longer periods of sustained attention and the use of silent verbal mediation to guide themselves.

Information-processing capacities, accuracy, and fluency dramatically increase between ages 9 and 12. Adolescence brings the capacity to consider “what if” situations and also precipitates increased planning, organizational, and problem-solving skills.

Interestingly, recent research indicates that the prefrontal cortex is not fully developed until an individual reaches his/her early to mid-30s. This long-term development may account, in part, for why individuals choose to “settle down” when they reach this age. Other recent studies indicate that the circuitry in the frontal and temporal areas of the brain shows a maturational delay in children with ADHD and problems in executive controls. The most recent research data from the National Institute of Mental

Health are somewhat unclear as to whether individuals with ADHD/executive dysfunctions eventually “catch up” in the development of these brain areas. The recent advances in neuroscience and brain imagery techniques all point to the same conclusions — that environment, experience, and enrichment can lead to the growth and development of brain connections; that these gains can occur over an extended period of time; and that such progress can contribute to the development of executive functioning skills.

In school settings, such differences in developmental maturity may play an important role with regard to the varying degrees of academic success. Students who experience delays in the development of the prefrontal cortex, are likely to struggle with self-management skills and encounter difficulties with school-based tasks, such as long-term projects or lengthy writing assignments, that require the coordination of many executive skills. These students will benefit from a proactive approach that provides training and support from parents and teachers and creates opportunities for students to practice these executive functioning skills.



Executive Functions and Academics

Why are Executive Functions Important for Academic Performance?

A number of executive skills are easily identifiable as being crucial to classroom success. For example, the executive skills of Organization and Planning help students to write down their homework, remember to do it, and return it to class the next day. Executive skills

such as task initiation, sustained attention, and task persistence are necessary for starting and completing long-term projects.

Executive functions are also directly related to the development of many academic skills. For example, Working Memory skills, used when a child is able to keep different sounds of a word in mind while sounding it out, are necessary for word-decoding.



Working Memory skills are also required for reading comprehension, when a child needs to keep in mind what has occurred in previous sentences and then integrate this information in order to achieve a cohesive understanding of the text. Metacognition, the capacity to think about one's thinking, has become a crucial skill in the new math, in which children are required to not only provide an answer, but to also explain how they arrived at their answer. Executive functions play a role in other academic tasks, including reading fluency, written content, math computations, and note-taking.

Links Between Academic Skills and Executive Functions

Reading

Working Memory

- Learning how to decode words.
- Keeping track of various elements of a story.
- Using context clues to aid in comprehension.
- Recalling previously-learned vocabulary.

Flexibility

- Manipulating and identifying sound patterns when decoding words.
- Integrating new content with background knowledge.
- Making inferences.

Focus

- Sustaining attention during a reading task.
- Persistence through distractions and frustrations.

- Taking time to absorb the material that is being read.

Metacognition

- Making connections before, during, and after reading.
- Self-checking and monitoring comprehension.

Planning

- Forming comprehension goals before reading.
- Devising a plan to monitor and reach goals.

Organization



- Using graphic organizers to keep track of information.
- Ordering and sequencing story events.

Writing

Focus

- Being able to focus on ideas as they come.
- Sustaining levels of attention and effort with regard to the physical act of writing.
- Not giving up when frustrated.

Task Initiation

- Being able to get ideas down on paper with little hesitation or self-doubt.
- Brainstorming and writing down all ideas to keep from getting stuck.

Metacognition

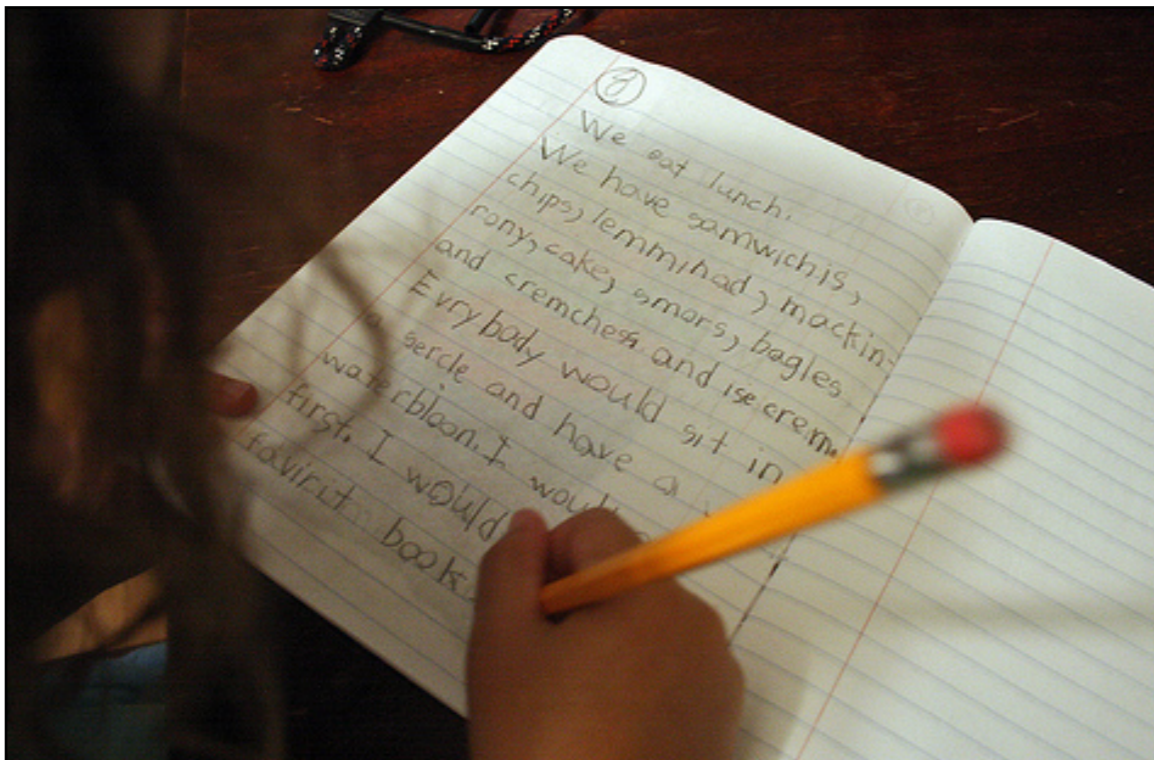
- Thinking about one's ideas and how to best express them through writing.
- Revising and editing one's own work.
- Self-evaluating one's product.

Time Management

- Using time effectively to organize ideas and generate a product.
- Gauging the amount of time needed to produce a response for a test/quiz question or prompt.

Planning

- Brainstorming and outlining ideas (pre-writing).
- Thinking ahead about audience, purpose, and clarity of ideas.



Working Memory

- Keeping multiple ideas in mind at once.
- Being aware of sentence flow.
- Recalling spelling and grammar rules.

Organization

- Presenting ideas in a logical order.
- Prioritizing information.
- Transitioning between ideas.
- Identifying main ideas and supporting details.
- Following the multiple stages of writing (pre-writing, drafting, revising, editing, publishing).

Flexibility

- Being able to shift things around in one's writing and make appropriate revisions.
- Understanding that writing is a recursive process, thus being able to revisit and modify previous work.

Math

Working Memory

- Keeping track of multi-step problems.
- Recalling which formulas to use when solving various problems.
- Recalling and applying problem-solving strategies.

Focus

- Sustaining attention to a problem-solving task, even when it becomes difficult.
- Staying focused on each step of a problem in order to solve it.

Planning

- Thinking ahead about the kind of problem that one is solving and the steps that one needs to take in order to solve it.
- Prioritizing problem-solving strategies.

Organization

- Organizing one's notations / images on paper in a clear way.

- Organizing the information in word problems and multi-step problems.

Metacognition

- Being able to explain and communicate in words one's own mathematical reasoning.
- Thinking about one's reasoning and determining whether or not it makes sense.
- Self-evaluating / checking one's work.

Flexibility

- Shifting between different presentations of problems (i.e. word problems, equations, etc.).
- Shifting one's strategy or approach according to the present problem.
- Shifting between the modes of representation of one's work (i.e. notations, written sentences, charts or graphs, drawn pictures, etc.).

LearningWorks for Kids

Today's most innovative learning tools, personally selected for your unique child.



Proven
Cognitive Skill
Assessments



In-Depth
Technology
Learning Guides



Expert Advice
and Parenting
Strategies



Customized
Game & App
Recommendations



Why Try LW4K?

Simple: LearningWorks for Kids turns screen time into learning time by creating a customized prescription of learning games and apps for your unique child.

Try it free today:

learningworksforkids.com/members