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ADDITUDE

The ADDitude Guide to Brain Training for ADHD

Learn how cognitive training and neurofeedback work for ADHD brains.

ADDITUDE

Strategies and Support *for* ADHD & LD

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The ADDitude Guide to Brain Training for ADHD

Unsure what constitutes ADHD brain training? You're not alone — this alternative treatment means different things to different people, and encompasses a wide range of programs and treatments — some more reputable than others. Use this FAQ and chart to understand and find popular brain training solutions.

BY CARL SHERMAN, PH.D., MAGGIE JACKSON, PAMELA MICHAELS, PAUL GILBERT, DEVON FRYE, JANICE RODDEN

Search "brain training" and you'll find countless apps, games, and tools promising to make you smarter, slow cognitive decline, and/or boost creativity. From Lumosity to CogniFit, brain training has overtaken the mainstream and seeped in to ADHD treatment plans — through at-home apps, in-office neurofeedback programs, and everything in between — claiming to improve attention, lower impulsivity, or boost brain-based skills like processing speed or working memory.

But what do these tools actually do, and do they make any real, measurable impact on symptoms of attention deficit disorder (ADHD or ADD)? In this FAQ and accompanying chart, we dive into what brain training comprises, how various programs work, and what you or your child can expect from popular solutions.

ADDitude readers review popular brain training programs at **http://additu.de/review**

What is brain training?

"Brain training" is used to describe a vast and diverse range of solutions, programs, exercises, or tools meant to strengthen the brain — either by changing its structure, altering brain waves, or improving specific brain-based skills like working memory or processing speed. Brain training is based on the idea of "neuroplasticity," which is a relatively recent theory positing that the brain is malleable, and can be changed by experience (for better or for worse) at any age. Through exercises and experiences specific to each solution discussed below, brain training aims to aims to target and improve particular brain-based skills.

Dig deeper into studies on neuroplasticity and ADHD brain training **http://additu.de/neurostudy**

What does "brain training" mean for ADHD?

Brain training, as you can imagine, is a broad concept, and it can mean a lot of things. When we talk about it for ADHD, however, we're typically referring to one of two things: neurofeedback or cognitive training (though some ADHD experts, like Sandy Newmark, M.D., don't consider neurofeedback to be a type of brain training). Each of these can be done in an office with a professional, or at home, with or without a trained clinician. We explain them in greater detail below.

"Brain training is an umbrella term that accompanies so many different specific applications that generalized conclusions about the value of brain training for ADHD are essentially meaningless," says David Rabiner, Ph.D. "Instead, it is important to examine the claims and evidence of specific applications. Making a general conclusion about brain training for ADHD is almost like making a general conclusion about medication for ADHD, where medication would include not just meds specifically developed for ADHD but a much wider range of medication."

What is neurofeedback?

Neurofeedback is a form of biofeedback — the process of learning how to change physiological activity using real-time monitoring of biological data — that uses electroencephalography (EEGs) to help patients train their brains to improve focus, impulse control, and executive function.

Brain scans show that ADHD brains produce more low-frequency delta or theta brain waves than do neurotypical brains, and often show a shortage of the high-frequency beta brain waves linked to focus and impulse control. The goal of neurofeedback is to increase the brain's capacity for beta waves, while diminishing the frequency of delta and theta waves.

To achieve this, individuals are provided real-time feedback on their brainwave patterns and they are taught to produce and maintain patterns consistent with a focused, attentive state. This is often done by collecting brainwave data from individuals as they focus on stimuli presented on a computer screen. Their ability to control the stimuli — for example, keeping the 'smile on a smiley face' — is contingent on maintaining the brainwave pattern being trained. Neurofeedback proponents believe that learning this skill during training applies to real-world situations and results in improved attention and reduced hyperactive/impulsive behavior.

What is cognitive training?

More often, when people refer to "brain training," they're referring to some type of cognitive training. Cognitive training programs focus on building specific skills — like attention, problem solving, or reading comprehension — often through the use of games and exercises. Most modern brain training programs (particularly those available for home use) utilize video- or computer-game formats; some in-person programs use physical games or worksheets.

What about working memory training?

Working memory training is a specific type of cognitive training aimed at improving that particular skill, which is thought to be especially critical for learning. This type of training is commonly utilized for people with ADHD, who frequently struggle with working memory. Working memory training makes use of memory exercises, like N-back training — where subjects try to remember a stimulus they saw earlier in a sequence — to (in theory) increase memory capacity over time.

The program Cogmed markets itself as ADHD-specific working memory training, and is explained in further detail below.

SELF-TEST

Could your child have a working memory deficit?
http://additu.de/wmd

What about brain training apps?

Brain training apps — including Lumosity, Peak, and countless others — have grown increasingly popular over the last decade, growing in lockstep with the proliferation of smartphones. Though few claim to specifically target ADHD, many claim to build cognitive skills that people with ADHD often find deficient, like visual processing, problem solving, or attention. Some of these claims have been challenged by the Federal Trade Commission, however, when it sued the company behind Lumosity for making false claims in its advertising.

Despite that, however — and despite the occasionally weak research behind some of the biggest apps — they've exploded in popularity because they're easy to access, relatively cheap, and (usually) fun for users. Some of the biggest brain-training apps — and the research behind them — are outlined in the chart below.

Does brain training work for ADHD?

This is a complicated question.

"Brain training encompasses a wide range of different approaches and applications," Rabiner says. "Rather than paying attention to any generalized conclusions about the effectiveness of brain training, parents should carefully investigate the claims and research support for any particular approach they are considering."

FREE WEBINAR

What Parents Should Know About Neurofeedback
http://additu.de/neurofeedback

Critics of Brain Training

That said, many programs have demonstrated that they produce improvements in certain brain-based skills like working memory or visual processing, but the studies were often criticized for being poorly designed or for being conducted by representatives of the programs — which may call their objectivity into question. Many of the studies occurred over a short time period, too, making it unclear whether any gains seen would last long after each particular brain-training program concluded.

And even when the studies used adequate controls or were undertaken independently, experts continue to disagree about whether any noted gains translate outside the context of the brain-training programs. In other words, a child (or adult) may improve his scores in a working memory game, but not necessarily show working memory improvements in his or her day-to-day life. One particularly striking example of this is a 1980 study[1] where a college student, after undergoing weeks of practice, was able to repeat strings of numbers that were read aloud to him, up to 79 digits. But when asked to do the same with letters, he could only recall 6 at a time — indicating to the researchers that he had only improved in the esoteric skill of repeating numbers. His working memory capacity, as a whole, appeared unchanged.

At the other end of the spectrum is an article entitled "Brain Games Are Bogus," published in *The New Yorker* in 2013, wherein "A pair of scientists in Europe recently gathered all of the best research — 23 investigations of memory training by teams around the world — and employed a standard statistical technique (called meta-analysis) to settle this controversial issue.

The conclusion: the games may yield improvements in the narrow task being trained, but this does not transfer to broader skills like the ability to read or do arithmetic, or to other measures of intelligence. Playing the games makes you better at the games, in other words, but not at anything anyone might care about in real life."[2]

Proponents of Brain Training

Counterbalancing studies such as these are many parental reports of significant ADHD symptom control, sustained beyond the end of neurofeedback sessions. These testimonials, combined with positive study results touted by solution providers like Cogmed, have persuaded some medical professionals — particularly some in the ADHD community — to recommend brain training to their patients as a supplementary treatment. Many are optimistically anticipating the results of further research.

RECOMMENDED READING

Neuroplasticity and the Brain Training Promise
http://additu.de/plas

What's more, a meta-analysis published in February 2018 in *European Child & Adolescent Psychiatry* came to a very different conclusion. According to the study, "There are sustained symptom reductions over time in comparison with non-active control conditions. The improvements seen here are comparable to active treatments (including methylphenidate) at a short-term FU of 2–12 months. As such, [neurofeedback] can be considered a non-pharmacological treatment option for ADHD with evidence of treatment effects that are sustained when treatment is completed and withdrawn."

"The potential for brain training as a new therapeutic tool is phenomenal," says Amit Etkin, Ph.D., assistant professor in the department of psychiatry and behavioral sciences at Stanford University. "By understanding brain circuitry, we can tailor interventions that medication or psychotherapy do not access or improve. The great advantage is that these programs are not invasive, have minimal side effects, and are, for the most part, fun."

The Consensus on Brain Training

The bottom line? Today's data makes it impossible to say whether brain training, as a whole, works to improve ADHD symptoms. In their ADDitude webinar David Rabiner, Ph.D., and Edward Hamlin, Ph.D., cite four encouraging though small studies[3] [4] [5] [6] of neurofeedback on children and young adults with ADHD. The meta-analysis of these studies and others, demonstrated a not-insignificant reduction in inattention and hyperactivity. But Rabiner and Hamlin still advise patients to approach (and pay for) neurofeedback cautiously. The exact program chosen matters; not all solutions work equally for all people, so blanket judgments about the efficacy of brain training in general are not helpful.

"Existing research does suggest that neurofeedback can result in improved attention, diminished hyperactivity, and enhanced executive functions, including working memory, for some patients," say Rabiner and Hamlin. "However, some of the most important researchers in the ADHD field would argue that the efficacy of neurofeedback for ADHD has not been conclusively established. The bottom line is that research support for both simulant medication therapy and behavior therapy is stronger than it is for neurofeedback at the moment."

Before investing money or a time in a brain-training program for yourself or your child, it's important to do your homework — and be wary of biased testimonials or skewed research. See the chart at the end of this article for brief summaries of the research behind each of the most popular programs.

What brain training programs are designed for ADHD?

While many brain-training programs target general cognitive challenges, several were developed specifically to treat ADHD and related conditions. Some of the biggest names include:

1. Cogmed for ADHD

Cogmed is a working-memory training software program commonly used as a complementary therapy for ADHD. It's a computer program comprising 25 online training sessions, each one 30 to 45 minutes long. Users age 7 and up are advised to complete five sessions each week at home or at school.

How Cogmed Works

Trained professionals instruct a child in using the software and coach him through the tasks and goals, if needed. Training is done at home or in school (Cogmed for Schools is supervised by a teacher). The program is web-based, and is compatible with any computer that supports Flash.

When a child sits at his computer, he is presented with eight tasks (games). He must complete all of the tasks in each session, doing them in any order he chooses. The Cogmed program automatically adjusts the degree of difficulty based on the user's performance, so that the child is always challenged but not overwhelmed.

The "Visual Data Link" exercise, for example, asks users to remember and repeat the exact sequence in which lights are illuminated on a 4×4 panel on the screen. Each time the user repeats a new sequence correctly, he or she advances in the game. In the "Input Module" exercise, users must listen to a sequence of numbers read out to them, and then repeat that sequence in

reverse order to advance in the game, which tests verbal working memory. The exercise interfaces look like elementary video games.

Research on Cogmed

Since 2002, at least 25 articles about Cogmed have been published in scientific journals. Many of the studies describe themselves as randomized and double-blind, and most show similar results: around 80 percent of those who finish Cogmed training see significant improvement in working memory capacity. This, in theory, leads to improved attention, behavior, and the capacity to learn.

However, during that same time period, other scientists have criticized this research for using inadequate controls and parent and teacher behavior ratings rather than cognitive-skills tests. At least two university-based research teams have attempted to reproduce the results of these Cogmed studies, but with more careful controls and more cognitive-skills tests. Teams from Georgia Tech[7] and Case Western Reserve University[8] both found insufficient scientific evidence to support the claim that working-memory training improves intelligence or ADHD symptoms like inattention any more than do other, less complicated changes — like adopting a healthier lifestyle, for example.

2. Interactive Metronome (and BrainBeat) for ADHD

Interactive Metronome (IM) doesn't fit easily into either of the main brain training categories discussed above. Developed in the early 1990s, the program has children complete physical exercises in certain pre-determined rhythms, relying on a concept called "neurotiming" to improve a child's focus, coordination, processing speed, and working memory. BrainBeat is a home version of IM.

A DEEPER DIVE INTO BRAINBEAT

http://additu.de/brainbeat

How Interactive Metronome Works

The program requires the user to synchronize a range of hand and foot exercises with a precise computer-generated tone heard through headphones. A child tries to match the rhythmic beat with repetitive motor actions. An auditory-visual guidance system gives immediate feedback, measured in milliseconds, and keeps score. Over time (a typical course of treatment lasts 15 to 20 sessions), IM improves the brain's sense of timing through exercise and practice — which, in turn, is thought to improve a wide range of other cognitive skills.

Research on Interactive Metronome

The principle behind both Interactive Metronome and BrainBeat — neurotiming — has been studied for more than 10 years. Most of the results have

been positive: a 2011 study[9], focusing on 54 students in grades 2 through 8, found that, after training with BrainBeat for 20 sessions, participants' reading and math skills improved by an average of 20 percent. Common ADHD trouble spots like attention levels, listening ability, and emotional control improved, too — by an average of 30 percent.

Another study, from 2012[10], compared traditional reading intervention methods with an interactive metronome program. Results indicated that children who practiced with the metronome program — in addition to the traditional reading intervention methods — had greater gains in reading skills than did the children who used traditional methods alone.

Still, some experts aren't convinced that Interactive Metronome or BrainBeat result in lasting changes for children with attention issues. Many of the studies conducted on IM were small; it's difficult to say whether their results would hold true in a larger ADHD population.

3. LearningRx for ADHD

LearningRx is in-person brain training conducted at one of more than 70 LearningRx centers around the United States. The program consists mainly of physical cognitive exercises — card games, worksheets, and the like — but is frequently supplemented with computer-based exercises, conducted either in the center or at the student's home. LearningRx has been used by more than 100,000 children and adults to improve cognition and improve IQ score. According to the LearningRx web site, "More clients come to us diagnosed with ADHD than any other condition," and an internal study of 5,416 clients with ADHD revealed gains in attention, processing speed, and working memory, among other skills, after participating in the brain-training program.

> "LearningRx was a game changer for my ADHD son." — *coloradomom*

How LearningRx Works

Participants start with an hour-long cognitive skills assessment at a LearningRx center, which evaluates the seven core skills that LearningRx seeks to improve: attention, working memory, long-term memory, logic and reasoning, processing speed, visual processing, and auditory processing. The results are used to structure the program so that it bolsters weak skills.

Following the assessment, participants meet with a LearningRx brain trainer for one hour daily for 12 to 32 weeks. At the end of the training period, participants take a second assessment to measure cognitive improvement.

Research on LearningRx

On its web site, LearningRx lists dozens of studies, presentations, and articles that study the program's impact on everything from short-term memory to log-

ic and reasoning and oppositional behavior to attention. Many of these peer-reviewed studies, published in journals such as Psychology Research and Behavior Management and Applied Cognitive Psychology, reported statistically or clinically significant improvements in subjects who participated in the LearningRx program. One study, undergoing peer review now, noted "statistically significant differences in working memory, long-term memory, logic and reasoning, auditory processing, and IQ score" in its sample of children with ADHD aged 8-14. Another small study of 39 students[11] found "statistically significant differences between groups… on all three measures of memory, on both auditory and visual processing, on processing speed, and on logic and reasoning."

Many of the researchers who conducted these studies sit on Learning Rx's scientific advisory board or otherwise work closely with LearningRx, however all of the cited studies were reviewed and approved by a federally-registered Institutional Review Board, and published in peer-reviewed journals. In addition, all of the cognitive training research cited in its studies was done in collaboration with independent researchers working at various universities.

In 2015, before advertising standards for brain-training companies existed, the Federal Trade Commission sued LearningRx for deceptive advertising; the company settled and agreed to withdraw its marketing claim that it raises users' IQs. According to LearningRx, the company "now meets the FTC standard for advertising the ability to increase IQ scores based on the results of randomized controlled trials."

4. Play Attention for ADHD

Play Attention is a learning system that combines both types of brain training —neurofeedback and cognitive training — with coaching, nutrition advice, and parent training.

"Play Attention literally changed my life."
— *henrytourist*

The game Play Attention — the main component of the complete program — uses a specialized armband to read brain signals that are indicative of focus or concentration. When someone is engaged or paying attention, the company claims, the brain emits a signal or "attention signature." The armband monitors this signal through the body and transmits it wirelessly to the computer to control the game. In essence, the user's mind becomes the mouse or joystick as he or she plays the video games and completes the interactive exercises. Play Attention's games aim to help users improve focus, ignore distractions, develop memory skills, and finish tasks.

How Play Attention Works

The game on the screen responds to the participant's attentive state, rather than to a mouse click or joystick command. To perform well on challenges and advance in the game, users must focus consistently during their one-

hour weekly sessions, strengthening their attention skills with practice. Players receive motivating rewards after completing challenges, and a calendar feature allows them to schedule sessions and track progress.

Play Attention also provides parents with nutrition tips, coaching, and access to an app called Nanny's Circle, which helps children exercise by managing routines and providing rewards.

Research on Play Attention

Two randomized, controlled studies[12] [13] in Boston public schools conducted by Tufts University School of Medicine found that students who used Play Attention had greater improvements in attention, hyperactivity, and executive functioning than did students who used cognitive training programs, commonly known as brain games; one additional follow-up study[14] found that the results persisted over a period of six months. However, the studies were relatively small, and the most recent study listed on Play Attention's website was completed several years ago, in 2014.

Take-Aways on Brain Training

- The term "brain training" is used to describe a vast and diverse range of solutions, each one targeting a unique skill set or brain function. While it is impossible to say whether brain training, on the whole, helps reduce ADHD symptoms, it is possible — and necessary — to investigate the research conducted on specific applications or programs.
- Various brain-training approaches tout promising study results, however most experts agree that further research is needed to prove its efficacy for patients with ADHD, specifically. Research on medication and behavior therapy is more thorough, more voluminous, and more conclusive regarding the positive effects on ADHD brains.
- Brain training is not a quick fix; results take weeks or months to appear. Especially for children with severe ADHD, a supplemental treatment plan is appropriate and often necessary. Delaying medication, for example, in order to try neurofeedback could allow academic, behavioral, and social problems to spiral out of control.
- Some children reject brain training because it requires sustained effort for very delayed benefits. An unwilling patient may not reap the full benefits of brain training.
- "As with any treatment, it is important to carefully monitor what impact the treatment is or is not having," Rabiner said. "Getting systematic feedback from the teacher on ADHD symptoms displayed in the class, and on other aspects of a child's functioning, is essential for making an informed decision about the value of any treatment."

> "Your brain can change, at any age, due to daily experience."
> — *Ned Hallowell, M.D.*

PROGRAM	WHAT IT IS	HOW IT WORKS	RESEARCH	WHO IT'S FOR	CONDITIONS OR SYMPTOMS TREATED	COST	FURTHER READING
IN-OFFICE NEUROFEEDBACK							
BrainPaint	BrainPaint is neurofeedback software administered by professionals. It is designed to improve brain function by training patients to recognize the difference between a focused state and a day-dreaming state, without requiring a brain map. It is also available as a home program for certain users who live more than 50 miles from a BrainPaint center.	Patients first complete a 90-question symptom assessment. Then, while wearing EEG sensors, patients listen to audio tracks and watch visuals on a computer screen. The patterns and music that induce a relaxed state are reproduced (or "painted") to help the patient practice becoming calm. Protocols are updated as the patient makes progress over time.	One study found that BrainPaint improved impulsivity and inattention for people with attention deficits who were attending a residential substance-use-recovery program. Another small study, published in *The Journal of Behavioral Health Services & Research*, found that BrainPaint improved ADHD symptoms and behavior.	Children and adults	ADHD, anxiety, autism, brain injury, mood disorders, fibromyalgia, sleep disorders, headaches	Rates vary widely based on location and practitioner credentials. Many physicians will provide a discount for a series of sessions. The at-home program costs $675 per month with a two-month minimum, and a $100 per month fee for each additional user.	Learn more or find a practitioner at neurofeedbackdefined.com
AT-HOME NEUROFEEDBACK							
ATENTIVmyn	ATENTIVmynd is a specialized video game, soon to be available for computer or mobile devices, designed to help children identify and strengthen their "attention muscle."	Users wear a headband containing an EEG-based brain-to-computer interface that measures their attention levels as they play. When the child pays attention, her avatar moves faster. When the child loses attention, it slows down. The program requires 8 hours over a period of 4 to 8 weeks.	Nine studies have been conducted on children; one has been conducted on senior adults. The company reports that attention and impulse control improved in all studies, with results lasting for at least 3 to 5 months after the program ended.	Children ages 8 to 18, adults, seniors	ADHD, other attention- and inhibition-related challenges	Products will be available for pre-order late in 2018; pricing is not currently available	Visit atentiv.com to learn more or be notified when the product is available

PROGRAM	WHAT IT IS	HOW IT WORKS	RESEARCH	WHO IT'S FOR	CONDITIONS OR SYMPTOMS TREATED	COST	FURTHER READING
Myndlift	Myndlift is a mobile neurofeedback app — used with an accompanying headset — aimed at improving focus and attention.	Myndlift uses real-time brainwave measurements and visual/auditory feedback to help patients learn to regulate their brain activity. It requires supervision by a trained therapist, but can be completed at home; average training sessions last 20 to 30 minutes, with improvements typically seen in 4 to 8 weeks.	Myndlift cites studies on the efficacy of general neurofeedback, but does not appear to have any studies on its specific program. Many studies on neurofeedback have been criticized for their small size, lack of randomization, or inconclusive results.	Children, adults	ADHD	Prices vary by clinician	Clinicians and patients can go to myndlift.com to learn more or request a quote
NeuroPlus	NeuroPlus is a game-based application for training attention skills. It incorporates the same neurofeedback protocols used in clinical settings on a home computer or tablet.	Wearing a wireless EEG headset, users are challenged to activate patterns of brain activity associated with focus. The headset also monitors users' movement; the program encourages users to remain as still as possible.	One study conducted by Duke University found that children with ADHD between the ages of 8 and 13 showed "significant" improvement in their symptoms after 8 weeks of NeuroPlus. However, the study was small and may have lacked adequate controls.	Adults and children ages 5 and up	Attention-related challenges	A subscription costs $30/month; the headset costs $249	Go to neuro.plus to learn more or sign up

PROGRAM	WHAT IT IS	HOW IT WORKS	RESEARCH	WHO IT'S FOR	CONDITIONS OR SYMPTOMS TREATED	COST	FURTHER READING
Play Attention	Play Attention is a computer-based attention-training system that uses an armband to measure brain activity and provide visual and auditory feedback.	During one-hour, weekly sessions, users must focus consistently to advance through the exercises, theoretically improving their attention over time.	Three studies conducted by Tufts University found that students who used Play Attention had greater improvements in attention, hyperactivity, and executive functioning than did students who used other cognitive programs.	Adults and children ages 6 and over	ADHD, executive function deficits	Prices vary for professional and personal use. Request a quote by calling 1-800-788-6786.	Visit playattention.com to learn more
Wild Divine/Unyte	Wild Divine/Unyte is an at-home computer training program that uses three IomPe finger sensors to measure a user's heart beat and skin conductance — common indicators of stress or anxiety. The user works to control these stress indicators while using the game.	Players use meditative and breathing exercises to move through the game's levels, like crossing a pathway by consciously making their bodies calmer (as measured by the sensor). If a player becomes frustrated, the game prevents her from advancing.	One small study found that 24 children with ADHD showed significant improvements in disruptive behaviors after using the breathing and relaxation techniques of Wild Divine/Unyte 1 to 3 times weekly for 12 weeks.	Children, adults	Emotional regulation challenges	The IomPE sensor costs $129.95; other games, packages, and tools are available from $14.95 to $699.99	Learn more at wilddivine.com, or call 1-866-594-9453

PROGRAM	WHAT IT IS	HOW IT WORKS	RESEARCH	WHO IT'S FOR	CONDITIONS OR SYMPTOMS TREATED	COST	FURTHER READING
IN-OFFICE COGNITIVE TRAINING							
Cogmed	Cogmed is a web-based working memory training program supervised by a trained practitioner.	Cogmed is a five-week course — typically lasting one hour a day, five days a week — where participants complete exercises in a video-game format.	More than 25 studies have shown that around 80 percent of those who finish Cogmed see significant improvement in working memory. However, some of these studies have been criticized for using inadequate controls.	Children, adults	ADHD, brain injury, age-related cognitive decline	$1,500 – $2,500 for the five-week course	Visit cogmed.com for more information or to find a practitioner
LearningRx	LearningRx is an in-person brain-training program with 78 locations around the U.S. Most sessions are run face-to-face with a trainer, but some use supplemental computer-based exercises.	Participants start with an hour-long cognitive skills assessment. The results are used to structure the program; users meet with their trainer one hour a day for 12 to 32 weeks. A final cognitive assessment is used to measure improvement.	LearningRx gathers data on each participant, and its internal studies suggest that 37 percent of children with ADHD were able to reduce their dosage of ADHD medication after completing the program. Numerous peer-reviewed journals have published studies of LearningRx that show statistically and clinically significant improvement in working memory, attention, and cognition, among other skills.	Children and adults	ADHD, learning disabilities, traumatic brain injury, autism, age-related cognitive decline	The cognitive skills assessment typically costs between $199 and $299. Total cost of training varies by program and location. Some online reviews place the cost of each program between $2,500 and $4,000 with a total cost of around $10,000. Others estimate the cost at $80 to $90 per hour of training.	Learn more or find a center near you at learningrx.com

PROGRAM	WHAT IT IS	HOW IT WORKS	RESEARCH	WHO IT'S FOR	CONDITIONS OR SYMPTOMS TREATED	COST	FURTHER READING
AT-HOME COGNITIVE TRAINING							
ACTIVATE	Developed by neuroscientists from Yale University, ACTIVATE is a home-computer program (also available on mobile devices) that uses cognitive games to enhance memory, attention, and other cognitive skills.	ACTIVATE comprises 6 games, each targeting a specific set of skills. The program evaluates areas of strength and weakness, and adjusts the time spent on each exercise to improve areas of weakness. The company recommends 3 to 5 sessions a week, each lasting 20 to 30 minutes.	A controlled study, designed by the founder of ACTIVATE, found that executive function and working memory improved after using the program. An independent study on ACTIVATE concluded in September 2016, but its results have not yet been published.	Children	ADHD, autism, executive function disorder, other cognitive deficits	$195 for a 3-month subscription; requires PC, Mac, iPad, or Kindle	Go to C8sciences.com to learn more
AttenGo	AttenGo is a web-based brain training program designed to help people with ADHD, learning disabilities, and other cognitive impairments; the company claims it does this by regulating brain waves and increasing the beta waves responsible for attention.	After answering a questionnaire and completing a brief assessment, users begin a customized program based on age, conditions, and symptom severity. The program consists of neurocognitive exercises that train attention, memory, and focus. AttenGo recommends using the program for 25 to 30 minutes, 3 to 4 times a week, for six months.	One study compared 34 adults who used AttenGo with 26 adults who used a dummy program. The study found that symptoms of ADHD and executive skills improved for both groups, possibly indicating the results were due to the placebo effect.	Adults and children ages 6 and older	ADHD, learning disabilities, other cognitive impairments	Subscriptions start at $129/month	Learn more or sign up at attengo.com

PROGRAM	WHAT IT IS	HOW IT WORKS	RESEARCH	WHO IT'S FOR	CONDITIONS OR SYMPTOMS TREATED	COST	FURTHER READING
BrainBeat	BrainBeat is a home version of Interactive Metronome, a neurotherapy program used by more than 20,000 therapists nationwide. IM — and BrainBeat — require users to clap along to a beat.	Wearing specialized hand and head gear, children participate in fourteen 20-minute sessions in which they listen to and clap along with beats. The program is based on the concept of "neurotiming," which is thought to be important for memory, focus, and language.	A 2011 study found that, after completing 20 BrainBeat sessions, participants' reading and math skills improved by an average of 20 percent. Attention, listening ability, and emotional control improved by an average of 30 percent. Studies on neurotiming going back to at least 1999 have provided similar results.	Children between the ages of 6 and 12	Focus, concentration, and organizational difficulties	$249 for a kit including headset and hand gear; each kit can be used by up to 5 children	Go to brainbeat.com to learn more or place an order
BrainHQ	BrainHQ is an online program consisting of 29 exercises that claim to improve attention, processing speed, people skills, and intelligence.	Exercises are separated into six categories. Participants can design their own training plan or allow the program to choose exercises for them, based on regular performance assessments. Exercises each take less than 5 minutes; 30 minutes of training, 3 times a week, is recommended.	BrainHQ claims that more than 100 independent studies have shown substantial improvements in attention, cognition, processing speed, memory, and more. Some studies found that results lasted as much as 5 years after the program was discontinued.	Adults	BrainHQ markets itself to any adult who wants to improve brain function, and is not designed to treat any specific condition.	Subscriptions start at $14/month	Go to brainhq.com to learn more or sign up for free exercises

PROGRAM	WHAT IT IS	HOW IT WORKS	RESEARCH	WHO IT'S FOR	CONDITIONS OR SYMPTOMS TREATED	COST	FURTHER READING
BrainTrain	BrainTrain is a set of computerized cognitive-training systems focused on brain training and cognitive rehabilitation, offering tools to assess ADHD symptoms, improve reading, and exercise the brain. BrainTrain can be used at home or provided through medical professionals.	A child or adult chooses which games he wants to play based on the symptoms he wants to improve. The program advances to the next level automatically when the student has mastered the previous level. The program generates detailed reports so that professionals or parents can trace a student's progress.	Numerous studies have been conducted using BrainTrain software. Some suggest that the programs can improve memory and attention, but others found they had "limited effects" on ADHD symptoms.	Children, adults	ADHD, brain injury, general cognitive improvement	BrainTrain products start at $395 for a single user	Learn more or make a purchase at braintrain.com
NeuroTracker	NeuroTracker is a unique cognitive training program that uses a 3D visual tracking program to improve mental and physical performance.	Users wear specialized 3D glasses and complete a visual exercise where they're shown a number of balls moving around their screen, and then asked to track the highlighted balls with their eyes. NeuroTracker claims users will see improvements with just 18 minutes of training per week.	NeuroTracker lists 32 studies on its website that all support the company's claims of improved cognitive function, athletic ability, and healthy aging. Many of the studies, however, were conducted in the Faubert Lab at the University of Montreal, which is run by one of NeuroTracker's cofounders, Jocelyn Faubert.	Children, adults	ADHD, learning disabilities, autism, general cognitive challenges	Personal packages start at $29.97/month, including 3D glasses	Go to neurotracker.net to sign up or learn more

PROGRAM	WHAT IT IS	HOW IT WORKS	RESEARCH	WHO IT'S FOR	CONDITIONS OR SYMPTOMS TREATED	COST	FURTHER READING
Play Attention	Play Attention is a computer-based attention-training system that uses an armband to measure brain activity and provide visual and auditory feedback.	During one-hour, weekly sessions, users must focus consistently to advance through the exercises, theoretically improving their attention over time.	Three studies conducted by Tufts University found that students who used Play Attention had greater improvements in attention, hyperactivity, and executive functioning than did students who used other cognitive programs.	Adults and children ages 6 and over	ADHD, executive function deficits	Prices vary for professional and personal use. Request a quote by calling 1-800-788-6786.	Visit playattention.com to learn more
MOBILE APPS, GAMES & OTHER							
Brain Age	Brain Age: Concentration Training is a game for Nintendo 3DS that uses math and logic activities to exercise working memory and other cognitive skills.	Nintendo recommends training for 5 or more minutes each day using one or more of the 8 main types of games, which all train different skills. Users can only play each type of game once daily to prevent over-training. Difficulty levels change in real time based on correct and incorrect answers.	Two studies, conducted by the neuroscientist who designed Brain Age, claimed that people who played it experienced greater improvement in processing speed and executive function than people who played Tetris. In 2014, however, a group of researchers concluded that there was insufficient evidence to claim that Brain Age's benefits translated to life outside the game.	Adults, children (parents should exercise caution and restrict 3D mode for children under the age of 6)	General concentration- and memory-related challenges	$29.99; players must have a Nintendo 3DS handheld console to play ($199.99)	Learn more or purchase Brain Age at brainage.nintendo.com

PROGRAM	WHAT IT IS	HOW IT WORKS	RESEARCH	WHO IT'S FOR	CONDITIONS OR SYMPTOMS TREATED	COST	FURTHER READING
Brain Fitness Pro	Brain Fitness Pro is a video game, developed by MindSparke, designed to improve IQ, academic performance, and impulse control. It comes in a variety of forms, including "Jr." (for children 6 to 11) and "IC" to help with impulse control.	Users follow a pre-defined set of exercises designed to improve focus, problem-solving, and memory. The difficulty increases over time, and the game adjusts based on your "personality," according to MindSparke's website. It recommends playing 4 to 5 times a week for at least 2 months, starting with 15 minutes a day and increasing in duration to 30 minutes.	Brain Fitness Pro is based off the Jaeggi/Buschkuehl training method. One study, published in 2008, found that subjects who trained with this method showed significant gains when compared to control subjects. Another study, published in 2011, concluded that the method increases IQ over the long term. However, both studies were conducted by the researchers who designed the method.	Children 6 and up	Academic- and impulse-related challenges	Two weeks free; subscriptions start at $19.95/month	Go to mindsparke.com to learn more or start a free trial
CogniFit	CogniFit is a mobile app that uses personalized activities to challenge key cognitive skills like focus, memory, and attention.	CogniFit consists of an unspecified number of games focusing on spatial perception, memory, coordination, and more. The app's makers recommend playing the games for 20 minutes a day, 3 times a week, for best results.	CogniFit lists more than a dozen studies on its website, each supporting its claims of cognitive fitness. Most of these studies were extremely small.	Children, adults	ADHD, depression, dyscalculia, dyslexia, general cognitive challenges	Free for basic version; Premium version starts at $19.99/month	Go to cognifit.com to download the app or learn more

PROGRAM	WHAT IT IS	HOW IT WORKS	RESEARCH	WHO IT'S FOR	CONDITIONS OR SYMPTOMS TREATED	COST	FURTHER READING
Elevate	Elevate is an app for iOS and Android that claims to improve cognitive skills — like memory, processing speed, or comprehension — through regular training sessions.	Elevate consists of more than 40 games that focus on different cognitive skills. The app tracks users' progress and designs personalized workouts to help users improve their most deficient skills. Elevate recommends training at least 3 times a week.	One study, conducted under the supervision of Elevate, found that Elevate users improved in four key cognitive skills, 69 percent more than a control group. No independent studies are listed on Elevate's website.	Children, adults	Focus, speaking abilities, processing speed, math skills, memory	Free for basic version; $39.99/ year for Pro	Go to elevateapp.com to learn more
Fit Brains	Fit Brains is software designed by Rosetta Stone that claims to target 6 major brain areas to improve concentration, emotional intelligence and problem-solving. It's also available as a mobile app for iOS and Android.	Fit Brains consists of more than 60 games that adjust their difficulty based on the user's skill levels. Fit Brains recommends that users play at least once per day or play an equal number of games each time.	No studies have been done on Fit Brains' efficacy.	Children, adults	General cognitive challenges	Subscriptions start at $9.99/ month	Learn more at fitbrains.com
NeuroNation	NeuroNation is a website and app that utilizes brain games to improve attention, working memory, processing speed, and decision-making. It's used by more than 10 million users worldwide, according to the company's website.	NeuroNation consists of more than 50 games, divided into 5 categories. It's recommended that you play NeuroNation games for ten minutes a day.	Ongoing research is being conducted on NeuroNation worldwide. Currently, the German health insurance provider Deutsche BKK offers clients reimbursement for NeuroNation subscriptions, based on the results of this research.	Children, adults	Concentration, attention, math and reading skills, general cognitive challenges	Free to download; Premium starts at $5.99/ month	Go to neuronation.com to learn more or sign up.

PROGRAM	WHAT IT IS	HOW IT WORKS	RESEARCH	WHO IT'S FOR	CONDITIONS OR SYMPTOMS TREATED	COST	FURTHER READING
Lumosity	Lumosity is a brain-training program, available online or as a mobile app, with more than 50 games based on cognitive psychology, such as the Eriksen flanker task and Corsi block-tapping test.	After establishing baseline scores through a Fit Test, Lumosity creates a personalized training program of games designed to challenge each user in the five core areas of his or her highest-priority cognitive abilities.	One study, funded by Lumos Labs, found greater cognitive functioning improvements in participants who used Lumosity for at least 15 minutes, 5 times a week, for 10 weeks, when compared to a control group. Five of the seven authors are employees of Lumosity. An independent study examined more than 130 existing studies on the efficacy of brain training and found that much of the positive evidence Lumosity references on its website comprises non-peer-reviewed studies.	Adults and children over age 13	Cognitive challenges	Memberships start at $11.99/month	Learn more or sign up at lumosity.com
Peak	Peak is a popular brain-training app developed in conjunction with an advisory panel comprising experts in neuroscience, cognitive science, and education from Yale University, University of Cambridge, and University College London.	Peak consists of more than 40 games targeting areas like emotional control, coordination, or creativity. A feature, known as Coach, tracks your progress and identifies areas where you can improve.	One small study, conducted by Peak's developers, found that 22 adults with schizophrenia improved their memory after 4 weeks of using the app. The study's small size and connection to the company may call its results into question.	Children, adults	ADHD, schizophrenia, learning disabilities, Alzheimer's, general cognitive challenges	Free to download; upgrade to Pro starting at $4.99/month	Learn more or download the app at peak.net

Footnotes

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