

Using emWave[®] Technology For Children With ADHD

An Evidence-Based Intervention



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INSTITUTE OF HEARTMATH[®]
Connecting Hearts and Minds

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Introduction

Over the last few years, there has been a surge of interest in the emWave® technology for children, ages 7 to 18, diagnosed with ADHD. Both parents and educators are drawn to this technology because it helps children reduce stress and improve impulse control.

With the current push to improve academic performance and test scores in school environments and the oft-cited behavioral and learning challenges many ADHD children experience, emWave technology is increasingly being integrated as an important part of a larger package of strategies to help children be more successful in their home and school experiences.

Most children find the emWave technology fun and appealing, and there is ample evidence learning this technology teaches self-regulation skills and can help them cultivate better relationships and improve academic focus. This is especially true for children with ADHD, who know from experience their behavior sometimes get them in trouble. The emWave's software games motivate them to improve their scores and performance levels, and parents and educators appreciate that the emWave is self-directed and user-friendly for recording and reviewing session data.

What is the emWave® Desktop Technology?

The emWave Desktop technology trains children and adults to reduce stress, gain greater self-control and increase resilience. Using either an ear sensor or finger sensor connected to a USB module running on emWave software, it monitors and displays an individual's heart-rhythm patterns and *coherence* levels on a computer screen.

Coherence is defined as an optimal state in which the heart, mind and emotions operate in sync and are balanced, which has been proven to have numerous mental, emotional and physical benefits. <http://www.heartmath.org/research/research-home/coherence.html>



By practicing self-regulation techniques, people change their coherence levels. Each individual session automatically is recorded and stored so users can track their progress over time. The emWave Desktop includes: 1) an application called the Coherence Coach®, which teaches a self-regulation tool that uses a breathing pacer 2) three colorful interactive games that add layers of fun and novelty to the overall experience.

Overview of This Booklet

Over the next 18 pages, you will gain knowledge about how to use the emWave technology with children, ages 7 to 18, diagnosed with ADHD. Included are suggested best practices, protocols from two studies and comments from clinicians about how they use the emWave with young ADHD clients. The science behind the emWave is highlighted to provide an understanding of the physiology underlying the emWave and the dynamic relationships between the brain, nervous system and heart. In addition, several checklists and support resources are added to further strengthen your knowledge and skill for using the emWave with children diagnosed with ADHD.

What is ADHD?

Attention-deficit/hyperactivity disorder, or ADHD[†] is the most commonly diagnosed behavioral disorder experienced in childhood. Generally, children with ADHD frequently interrupt, experience impulsivity and inattentiveness, become hyperactive, have difficulty following directions or exhibit any combination of such symptoms. It affects about 3% to 5% of school-age children. ADHD is diagnosed much more often in boys than in girls. Although ADHD can run in families and numerous studies suggest genes play an important role, its exact cause remains a mystery.

[†] Note that ADHD previously was known as ADD, or attention-deficit disorder. The H was added in 1987 to reflect the prevalence of hyperactivity in a high percentage of ADD cases. Although the American Psychiatric Association's current *Diagnostic and Statistical Manual's* uses ADHD and ADHD subdesignations, there are some who still object to being labeled ADHD. A number of written materials, especially older ones, continue to use ADD.

Symptoms of Children With ADHD^{††}

Consider what children are required to do in a typical school setting: Sit still. Listen quietly. Pay attention. Follow instructions. Concentrate. These are the very things children with ADHD have a hard time doing, not because they aren't willing, but because their brains won't let them.

Children with ADHD:

- Are in constant motion.
- Squirm and fidget.
- Do not seem to listen.
- Have difficulty playing quietly.
- Often talk excessively.
- Interrupt or intrude on others.



- Are easily distracted.
- Do not finish tasks.

That doesn't mean, however, that children with ADHD can't succeed at school. There are many things parents and teachers can do to help children with ADHD succeed in the classroom. Start by evaluating a child's individual weaknesses and strengths, and then come up with creative strategies for helping the child focus, stay on task and learn to his or her full capability.

†† **Note:** Most of the information for Symptoms of Children With ADHD comes from the following section on the www.helpguide.org website: Signs and Symptoms of Attention Deficit Disorder in Children. Click for further reading.

Incorporating emWave Desktop Technology Into Behavior Treatments

Behavior treatment for children with ADHD involves changing some aspects of the home and school environments to promote more successful social/emotional interactions and academic growth. These adjustments include creating more structure, encouraging routines, putting in place behavior-management strategies and clearly stating expectations for the child. The emWave ties in well with all of these.

Preparing Children With ADHD to Use the emWave®

Before training a child to use the emWave, there are a few strategies regarding instructions and learning that will help prepare you and the child.

- Consider creating a plan that incorporates small rewards for small victories on the emWave such as achieving a relatively high score or sustaining attention in the learning process. Give larger rewards for bigger accomplishments such as applying impulse control to real-life situations. Children with ADHD respond best to specific goals, rewards and daily positive reinforcement.
- Write down important instructional information so the child can understand it and keep it in a place where he or she can easily access it. For instance, print out several key operational instructions, with their accompanying helpful visual guides, from the emWave software tour located in the software program's informational folders. Some clinicians and educators place brightly colored instructions and photos on blank chart paper to aid them in their one-on-one coaching sessions.
- Long sessions potentially can turn off a child's interest, so when introducing the emWave Desktop, divide each session into mini-sessions of three to five minutes at first to help sustain interest and attention. Be brief when giving directions, allowing the child to complete one action. Then, if necessary, have the child come back to find

out what he or she should do next. If the child gets off track, give a calm reminder, redirecting in a calm but firm voice. The goal is to stretch out the child’s use of this self-regulation technology over as many sessions as possible to build greater focus and confidence in impulse control. That can mean delaying the use of the more entertaining software games until a solid understanding of the Quick Coherence self-regulation technique and goal setting is realized.

- By learning the basics of the emWave technology first, you, as a parent, clinician or educator, can then guide the child confidently in the beginning stages of instruction. As often happens, when children remain engaged and interested, their proficiency with the emWave likely will surpass yours in a short period of time.

Best Practices: Using the emWave® Desktop With ADHD Children

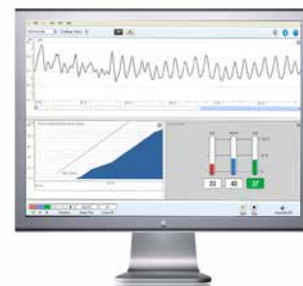
Years of feedback from educators and clinicians has led to the following best practices for maximizing use of the emWave technology with children diagnosed with ADHD. These practices are aimed at sustaining a child’s interest and learning.

- Keep lessons relatively short: three to five minutes in the beginning and five to 10 minutes later on.
- Add incentives and variety to sustain interest. That means adding new features to the child’s experience such as introducing a new game, one of several graphic-image visualizers, increasing the challenge level or incorporating the emWave2® handheld device or the Dual Drive™ car-racing game.
- Learning the emWave technology is not something done in isolation from real life. The goal is to transfer what is learned in each session to specific life situations in which the child is required to exercise self-control. Real-life applications ensure a higher quality of learning.
- Regularly assess the child’s progress so you can make adjustments, if necessary.

Although certain environments and circumstances will dictate some modifications to these practices, generally, they have proven successful when using the emWave.

Session 1 Introduce the emWave Desktop

Before demonstrating the emWave, it is important to build rapport with the child. Practicing the Quick Coherence® Technique a few minutes before the first face-to-face meeting and having a casual conversation about a child’s interests helps put him or her more at ease. Many children with ADHD experience performance anxiety and this can affect their use of the emWave.



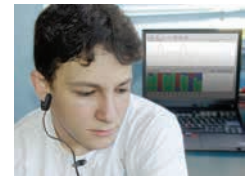
Introduce the emWave by describing it is as a new technology that helps people of all ages deal with stress and perform better. You can tell them it currently is being used by tens of thousands of people, including professional and amateur athletes, businesspeople, nurses, doctors, police officers and students. Next, connect the emWave's finger or ear sensor to the child and insert the USB module into either a laptop or desktop computer.[†]

[†] **Note:** *Connectivity problems: Establishing an adequate signal, as seen in the pulse waves, is challenging in some cases either because a child has small or cold earlobes, making it hard to pick up a pulse signal, and thus inhibiting connectivity. Without a pulse signal, the emWave software will not function. Sometimes, rubbing the earlobe between the thumb and index finger will help. If connectivity remains a problem, consider purchasing a finger sensor from the www.heartmath.org website.*

Turn the emWave on and, after 20 to 30 seconds, point out how thoughts and emotions affect heart rhythms – as seen on the computer screen. Now introduce the child to the Quick Coherence® Technique. Explain that this technique is simple to do and can be done anytime, anyplace.

Steps of the Quick Coherence® Technique

- 1: Heart Focus.** Focus your attention on the area around your heart, in the center of your chest. To model the technique in the beginning, place your hand over the center of your chest to help maintain your attention in the heart area and promote a more kinesthetic experience.
- 2: Heart Breathing.** Breathe deeply, but normally, and imagine that your breath is coming in and going out through your heart area. Continue breathing with ease until you find a natural inner rhythm that feels good to you.
- 3: Heart Feeling.** As you maintain your heart focus and heart breathing, activate, or think of a positive feeling. You can do this by recalling a positive feeling, a time when you felt good inside, and trying to re-experience the feeling. One of the easiest ways to generate a positive, heart-based feeling is to remember a special place you've been to or the love you feel for a close friend, family member or treasured pet. To help root this experience, consider adding inspirational photos or other visuals to a vision board so the child can more easily access this feeling.



While the child remains connected to the emWave Desktop, slowly guide him or her through the three steps of the Quick Coherence Technique. Point out that using this self-regulation technique changes the pattern of heart rhythms from *incoherence*, when it is first connected, to coherence. The technique also helps the child learn greater self-control. If necessary, repeat the breathing process several times to make sure the child has a good understanding.

Afterward, call up the program’s Coherence Coach and point out the breathing pacer. Once the child becomes proficient with the emWave at a basic level, you can tell him or her that some fun software games will be available.

When first introducing the child to the emWave, explain that low scores are normal at the beginning, but with practice, they will improve. As scores improve, the child can go up to the next challenge level; there are four levels.

Session 2 Begin With the End in Mind: Applying Quick Coherence Toward a Short-Term Goal

Before the child uses the emWave Desktop on a regular basis, explain the importance of learning the Quick Coherence® Technique, and begin applying it toward a specific short-term goal. Among the great features of the emWave technology are that it helps you learn to focus better, reduce stress and gain greater self-control. It is important for children to understand that most of the time, when they are at home or school, they won’t have access to the emWave technology, so it is essential to practice what the emWave teaches you when you are not using it.

Practice what the emWave teaches you when you are not using it.

Ask the child if he or she thinks there are any areas of stress that need attention or where more self-control is needed? Together, create one simple short-term goal – it should be for about one week – in which the child practices the Quick Coherence Technique several times a day.

Here are some examples of goals:

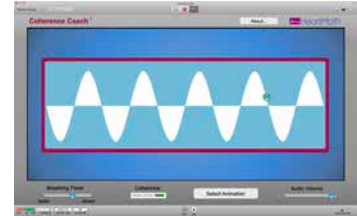
- Participate more and interrupt less in math class.
- Be more patient when reading.
- Be kinder to your younger brother or sister.

Parental support with these goals is strongly encouraged. In the case of some schoolchildren, guidance may be necessary with certain goals they are trying to achieve at school or home.

Remember, becoming skilled in the Quick Coherence Technique takes practice, but the emWave will help a lot. The child should practice Quick Coherence independent of the emWave for two to four minutes each time, depending on his or her age or needs. Younger children or those who become more agitated or lose focus easily when doing tasks this long may have to start by doing the technique for less time. Experiment with shorter times in the beginning and gradually increase to the full two to four minutes.

Session 3 Start out With the Coherence Coach®

Begin emWave practice by having the child use the Coherence Coach or breathing pacer. If necessary, consider bumping the challenge level up from Level 1 to 2 or higher if the child is achieving high coherence scores – at least 80% in the green, or more as measured by the coherence ratios in the bottom right area of the computer monitor. Some children need higher challenge levels in the beginning, and others need encouragement if their scores are low. Review the session by clicking to the heart-rhythm screen (heart icon at the top middle of the screen) and looking at the coherence ratio scores. If the child has a score of at least 80% red or more, they need more focused time on the Coherence Coach. A score of 50% or more on the blue level (midlevel coherence) is required to play the software games. Otherwise, a child will not do very well.



Session 4 Revisit the Child's Short-Term Goal

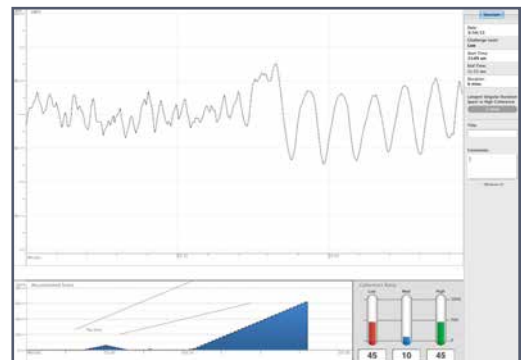
State that the purpose of the emWave is to transfer skills the child learns with it to normal daily situations in which he or she may feel too much stress and not enough self-control.

Revisit the short-term goal by asking the child how practice is progressing. Are you having any success reaching the goal? Does the goal need to be revised, simplified or reworded?

Ask whether the child understands how to do the Quick Coherence Technique and its purpose? If necessary, review the steps, and, if appropriate, do another session in Coherence Coach. This added practice will strengthen the child's basic practice in the Quick Coherence Technique.

Session 5 Focus on the emWave's Heart-Rhythm Display Section

Instruct the child to practice the emWave with the Heart Rhythm Display open, and once again, coach the child in the Quick Coherence Technique. These initial sessions should be short, two to four minutes at the most. Afterward, praise the child for any small improvements in coherence scores. Ask if they notice any difference? Do they feel calmer. Remind the child of the short-term goal.



Sessions 6-9 Move on to the Software Games

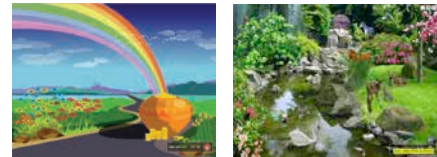
When a child's results have improved to a level at which the coherence score is 50% or less in the red bar (low coherence), he or she is ready to begin playing the software games.

Scores of higher than 50% in low coherence (red bar) will not produce positive results in the software games. Start with the three-minute Garden Game. Then move on to the five-minute Rainbow Game. If progress has been made, have the child try the 10-minute Balloon Game. Children can use the Emotion Visualizer™ to add variety to their sessions.



Session 10 Check Regularly With Students on Their Progress

With steady progress, a child eventually can choose whatever game or emWave feature he or she prefers. Some parents and educators build the use of the emWave into a five- to 10-minute daily routine so children can solidify the learning results. By monitoring a child's use of the emWave, including checking on scores and goal success, a child gains confidence that is internalized as a life skill.



Session 11 Add the emWave2® and Dual Drive® Pro Racing Game

If available, add the emWave2 handheld device and the Dual Drive Pro® auto racing game as further incentives to sustain a child's interest. (You can introduce these as early as Session 5 as incentives to pique interest, but the child should not use them yet.) The variety of these additional tools may further motivate a child and enhance the desire and ability to learn coherence. When a child completes the emWave® Desktop's software games, instruct him or her to begin using the emWave2. When children gain proficiency with the device, they



can move on to Dual Drive, a competitive car race in which the speed and operation of a child's race car – multiple colors and models are available – are determined by how much coherence is generated. When coherence declines, the car runs out of gas and a fog descends on the race course. Practicing the Quick Coherence Technique can power the car back up so it can continue racing. Click the following links to learn more about the [emWave2® handheld](#) and [Dual Drive Pro® racing game](#).

Challenges and strategies for sustaining focus and engagement

Engaging or sustaining the interest of some children can be difficult because they genuinely are not interested or have too much performance anxiety. Shorter sessions spread out over

time with short-term goals can help greatly in sustaining a child's interest. Progress toward goals, especially if the child sees personal benefits, also will help.

You can try different strategies to help reduce performance anxiety:

- Consider having another child be a mentor. Sometimes, the straightforward approach and confidence of mentors can help motivate disinterested children.
- Try making the emWave technology experience more like a play experience. De-emphasize results and focus more on some of its cool features. Talk about the fun you can have with the various games and exercises; how you actually can see your heartbeat with emWave® Desktop and control your heart rhythms with it or the emWave2® handheld.
- Tell the child that firefighters, police officers, soldiers, athletes, performers, doctors, nurses and other children are among the many people who use and enjoy the emWave.
- Under no circumstances should a disinterested child be pressured. This defeats the purpose of the emWave technology, which is to encourage children to experience coherence. Instead, try to find another source of activity that calms and helps engage the child.

Practices From Clinicians Who Treat Children Diagnosed With ADHD

Dee Edmonson, RN, director of the Neurotherapy Center of Plano, Texas

At our clinic, I work with children and adults diagnosed with a wide range of disabilities. For almost eight years, I have been using the emWave Desktop technology with children ages 8 and over who are diagnosed with ADHD. Besides helping the child, I also try to bring the parent into the overall treatment plan. If parents are not calm in their interactions with a child, that gets transferred to the child who, more than likely, is already struggling with worry and agitation. By having the parents use the emWave technology, either at the same session or separately from the child, the child gets important reinforcement and modeling for learning new behavior-management skills from a calmer parent.

To begin with, I will hook a child up to the emWave Desktop technology and assess their current status in terms of heart-rate-variability patterns and coherence ratios. This is the beginning baseline. Then I immediately instruct them in the Quick Coherence Technique with a big emphasis on breathing.

To jump-start the breathing practice, I have the child place his or her hand on the chest and feel the breath coming in and then going out. Five seconds on the in-breath and five

seconds on the out-breath. They feel the breath with the hand. It becomes a kinesthetic experience. Meanwhile, I am paying attention to the amplitude of the heart-rhythm wave on the computer screen. Bigger waves mean deeper breaths and more oxygen being distributed into a child's brain, more autonomic nervous-system balance and the stoppage of cortisol production.

After a short while, a child becomes noticeably calmer and quieter. I point out the difference between their current state and the state they had when they first came in.

Each session on the emWave lasts between three and eight minutes. Normally, it will take five sessions before I think they are ready to advance to the software games. This criteria is based on a child's ability to calm down as indicated by body language, but also from the visual evidence of the taller wave forms (in the heart-rate-variability pattern).

They enjoy playing the games very much. Making the balloon go higher, adding coins to their bank account (Rainbow Game) or coloring a garden adds fun to the learning experience. If I work with a child for four to six months, there is a good chance we will see positive benefits both at home and at school.

Madeline Falcone, MFT, director of the Falcone Institute, San Diego, Calif.

The Falcone Institute specializes in helping youth address academic difficulties, neurological disabilities, depression and family conflict. It has used the emWave Desktop technology for years to help clients manage stress.

With children who are diagnosed with ADHD, the staff at the Falcone Institute first make sure there has not been a misdiagnosis. Occasionally with ADHD diagnoses, there has been unrecognized trauma or other secondary causes which manifest ADHD-like symptoms in a child. Diagnostic assessments from a pediatrician or development psychologist are reviewed to make sure the profile is accurate. In addition, several exercises are carried out with the child to see if the typical symptoms of impulsivity, inattentiveness and hyperactivity show up.

After the diagnosis is confirmed, the child is then exposed to a series of structured activities to help with greater self-control. This includes using the emWave Desktop technology along with movement exercises, soothing music, and tapping. In order to have any effectiveness with the emWave, a child begins with basic breathing exercises. Often, the staff will have a child lie down on a massage table where he is better able to relax while practicing deep, rhythmic breathing. Once deep-breathing skills are established, then the child is ready for the other features of the emWave, including the games and Emotion Visualizer®.

The results are very encouraging. Because parents want fast results (a minimum of eight weeks) in behavior regulation, the emWave plays a crucial role in teaching these children self-regulation skills.

Summaries of Two Studies

[Coherence Training in Children With ADHD: Cognitive Functions and Behavioral Changes](#), conducted by Anthony Lloyd, Ph.D., David Brett, B.Sc., Keith Wesnes, Ph.D., England. (Click link to read the study.)

This randomized controlled study evaluated the impact of self-regulation skills and the emWave Desktop technology on a population of 38 schoolchildren with ADHD and ranging in age from 9 to 13 in Liverpool, England. The group was randomly divided into a control group and an experimental group. Logistical difficulties and other limitations led to the groups being organized into the following two groups:

- 1) An experimental group of 14 children who only received individual HeartMath training for six weeks. Their training included use of the emWave and several self-regulation techniques.
- 2) A control group of 22 children who participated in both an active placebo group (playing with Legos) for the first six weeks and then the same HeartMath intervention the experimental group received during the next six weeks. Legos were chosen as an active placebo because there is evidence that shows their benefits as a therapeutic method for children with ADHD. Two children were eliminated from the final study results because they changed schools.

The interventions for both the experimental and control groups were carried out by a learning support/research assistant and other designated staff members. Both control and experimental interventions had daily sessions lasting 20 minutes in the same room with the same staff member over a period of six weeks. Before any formal learning, rapport was established between the facilitator and the student. The prospect of participating in this study had to be interesting for the child. Otherwise, discouragement or disinterest would undermine the intervention. Self-concept was already weak for many of these students with performance anxiety being the dominant stressor. If the study appeared to be some kind of academic performance challenge, it probably would have turned off a number of students. Instead, the invitation to participate was framed as something fun and interesting such as an art project or sports activity.

An adult learning assistant who supervised the experimental group's practice over the six weeks taught them three HeartMath emotional self-regulation techniques. Two of the techniques, Neutral® and Quick Coherence, are designed as emotion-refocusing tools, and the third, the Heart Lock-In®, is an emotion-restructuring technique. All of these techniques involve shifting one's focus of attention to the area around the heart and breathing easily and slowly as if one were breathing through the chest area. The Quick Coherence and Heart Lock-In techniques include activating a positive emotion.

Practicing self-regulation techniques at school and home

Participants were encouraged to use the techniques regularly in school and at home. They began with simple breathing exercises aided by the Coherence Coach. Later, they practiced the Heart Lock-In Technique, a longer, sustained version of Quick Coherence that also entails self-generating and sustaining a positive emotional state for five to 10 minutes. This became the primary technique practiced in the one-on-one sessions with the learning assistant.

The emWave Desktop helped participants learn the Heart Lock-In Technique and was used to show that students were attaining a state of increased psychophysiological coherence.

During the emWave sessions, children received visual feedback of their coherence levels as they played one of the program's games. Players' coherence levels drive the games, so, as their coherence increases, success in the games increases.

The children started with the Rainbow Game, which lasts for five minutes. They were instructed to play it twice during the 20-minute sessions. Two other games were available for students to play when they had mastered the Rainbow Game.

The emWave Desktop's tracking function, which records and stores cumulative data on physiological coherence ratios from session to session, monitored the children's progress.

Using visual aids

Vision boards, on which the children could place photographs and images of heroes, pets, sports, etc., on a large board to help trigger positive emotions, helped strengthen their practice of the techniques. Visual cues were essential in helping these children solidify their experience of positive emotions. Otherwise, it would be more difficult to conceptualize the feeling of a positive emotion. Also, visual cues were placed strategically around the classrooms to help reinforce learning. Other support materials included bookmarks with the steps of some of the self-regulation techniques and pocket cards to remind them of what to do.

Research results

The *cognitive drug research computerized assessment system (COGDRAS)*[†] was used to assess cognitive functioning as the primary outcome measure. Secondary outcome measures assessed teacher and student reported changes in behavior. Participants demonstrated significant improvements in various aspects of cognitive functioning such as delayed word recall, immediate word recall, word recognition and episodic secondary memory. Significant improvements in behavior also were noted. The results suggest that the intervention offers a physiologically based program to improve cognitive functioning in children with ADHD and improve behaviors in a school environment.

[†] The COGDRAS is a battery of tests developed to measure positive and negative drug effects on cognition in a variety of patient populations.

[*Effects of Game-Based Relaxation Training on Attention Problems in Anxious Children*](#), conducted by Michele Knox, Ph.D., Jennifer Lentini M.D., and Stacey Aiton, University of Toledo College of Medicine, Toledo, Ohio. (*Click link to read the study.*)

This study examined the effects of using computer-based games from both the emWave Desktop technology and Wild Divine technologies along with psychoeducational behavioral practices on 23 participants, ages 9 to 17, who were clinically diagnosed with anxiety disorders.

The anxiety was strong enough in these children that they had ADHD-like symptoms. Because everyday situations are perceived as threatening, the attention levels of children with anxiety disorders are dramatically compromised. Anxiety and worry rob these children of their capacity to pay full attention or concentrate on details in normal environments such as home or school. The average age of the children was 12.7 years. Twelve children were assigned to the intervention group, and the other 11 were placed on a waiting-list control group (those waiting to participate in an intervention after final measures are taken).

Results and measures

The Attention Problems Scale from the Child Behavior Checklist (CBCL) was used to measure pre- and post-results. The CBCL is a questionnaire, which parents complete, that measures children and youth's emotional and behavioral symptoms. Parents completed the CBCL before and after the intervention. Results showed significant differences in the post-test part of the Attention Problem Scale between the control group and intervention group. On the questionnaire, parents reported significant improvements in their children's attention compared to the waiting-list control group.

Eight sessions of treatment

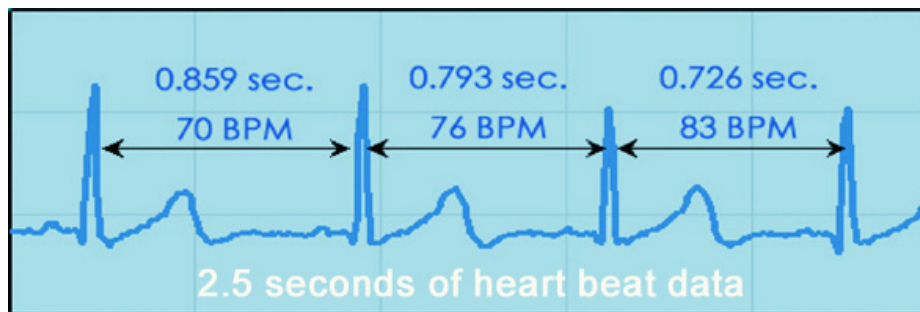
Each session began with some form of discussion about how stress affects people, how relaxation can relieve or prevent stress and when and how to use relaxation techniques in normal daily activities. Discussion points included questions such as: What are some of the everyday stressful feelings – anxiety, frustration, etc.? Which situations trigger anxiety? Where does tension show up in the body? What are common examples of negative thinking?

The sessions, which lasted 45 minutes to an hour, relied heavily on use of the emWave Desktop (previously called the Freeze-Framer®) and Wild Divine technologies. Relaxation techniques were routinely practiced, including deep breathing, peaceful imagery or focusing on positive memories. Parents or others were encouraged to ensure that children did relaxation practices and worked on other goals at home in the coming week.

The Science Behind emWave® Desktop Technology: The Heart's Changing Rhythm

<http://www.heartmath.org/research/science-of-the-heart/introduction.html>

The heart at rest was once thought to operate much like a metronome, faithfully beating out a regular, steady rhythm. Scientists and physicians now know, however, that this is far from the case. Rather than being monotonously regular, the rhythm of a healthy heart, even under resting conditions, actually is surprisingly irregular, with the time interval between consecutive heartbeats constantly changing. This naturally occurring beat-to-beat variation in heart rate is called heart rate variability (HRV).



Heart rate variability is a measure of the beat-to-beat changes in heart rate. This diagram shows four consecutive heartbeats – they appear as peaks in between the straight horizontal arrow lines – that were recorded on an electrocardiogram (ECG). Note the variation in the time interval between the heartbeats; there is a different heart rate, shown as beats per minute, for each interbeat interval.

The normal variability in heart rate is the result of the synergistic action of the two branches of the autonomic nervous system (ANS) – the part of the nervous system that regulates most of the body's internal functions. The sympathetic nerves act to accelerate heart rate, while the parasympathetic, or vagus nerves slow it down. The sympathetic and parasympathetic branches of the ANS are continually interacting to maintain cardiovascular activity in its optimal range and to permit appropriate reactions to changing external and internal conditions. The analysis of HRV therefore serves as a dynamic window into the function and balance of the autonomic nervous system.

The moment-to-moment variations in the heart rate are generally overlooked when average heart rate is measured. For example, when doctors or nurses take your pulse, they calculate how many heartbeats you have per minute – 70 is a typical number – but they don't look at the heart-rate variations between beats. What the emWave technology does is allow you to observe your heart's changing rhythms in real time. Using your pulse data, it provides a continuous measure of your HRV by plotting the natural increases and decreases in your heart rate.

Why HRV Is Important?

Scientists and doctors consider HRV to be an important indicator of health and fitness. It is a marker of physiological resilience and behavioral flexibility, reflecting our ability to adapt effectively to stress and environmental demands. A simple analogy illustrates this: As the shifting stance of a tennis player about to receive serve provides balance and a greater ability to react to where the ball lands, the heart in healthy individuals similarly is responsive, resilient, primed and ready to react to all sorts of circumstances.

Additionally, HRV is a marker of biological aging. Our heart rate variability is greatest when we are young, but as we age the range of variation in our resting heart rate becomes smaller. Although the age-related decline in HRV is a natural process, having abnormally low HRV for one's age group is associated with increased risk of future health problems and premature mortality. Low HRV also is observed in individuals who have a wide range of diseases and disorders. Practicing HeartMath's coherence-building techniques regularly can help reduce stress-induced wear and tear on the nervous system and aid in the body's natural regenerative processes.

The emWave measures the time interval between each heartbeat and displays these changes as your heart rhythm on the screen. The beat-to-beat variability/HRV plotted over time is referred to as the heart rhythm. HRV is a complex wave that reflects many different things that are occurring inside our bodies, and is used and interpreted in many ways by scientists, doctors, researchers, etc.

Typically, the smoother the HRV pattern – HRV is displayed as a sine wave – the more synchronized the nervous system is. The greater the irregularity and jagged pattern in HRV, the less synchronized the nervous system is.

HRV Patterns/Heart Rhythms And Emotions

Many factors affect the activity of the ANS, and therefore influence HRV. These include our breathing patterns, physical exercise and even our thoughts. Research at the Institute of HeartMath has shown that one of the most powerful factors affecting the heart's changing rhythm is our emotions.

HeartMath research has found that the emotions we experience directly affect our heart-rhythm patterns, and this in turn tells us a lot about how our bodies are functioning.

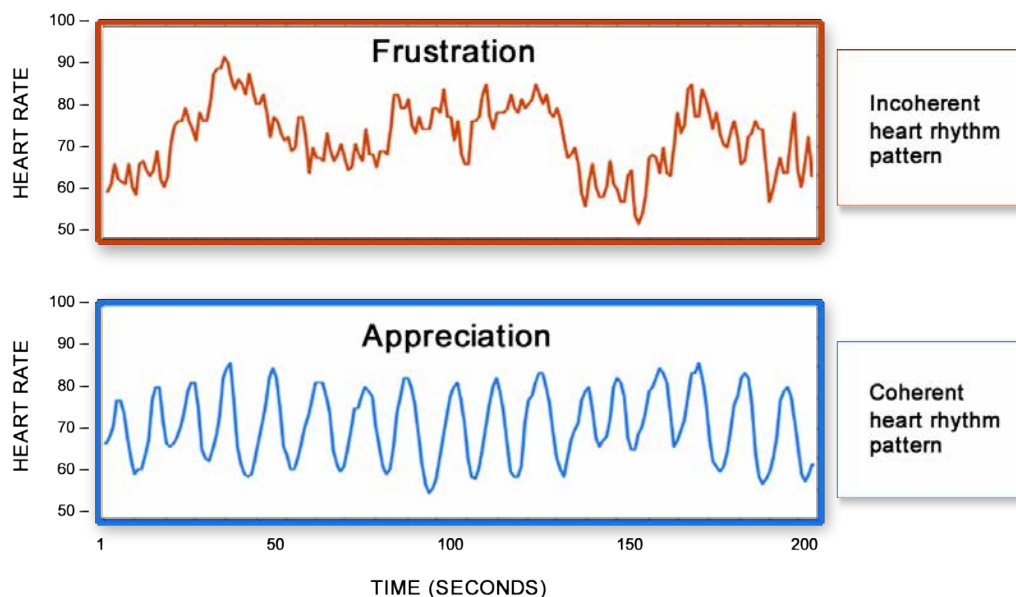
Generally, emotional stress stemming from anger, frustration and anxiety among other emotions, creates irregular and erratic heart-rhythm patterns: the HRV waveform looks like a series of uneven, jagged peaks (see figure on next page).

Scientists call this an incoherent heart-rhythm pattern. This pattern indicates that the signals produced by the two branches of the ANS are out of sync with each other.

This can be likened to driving a car with one foot on the gas pedal – this would be the sympathetic nervous system – while simultaneously having the other on the brake – this would be the parasympathetic nervous system. What you get is a jerky ride and greater gas consumption, and it isn't so great for your car.

Likewise, the incoherent patterns of physiological activity associated with stressful emotions can cause the body to operate inefficiently, deplete energy and produce extra wear and tear on a person's entire system. This is especially true if stress and negative emotions are experienced often or sustained over long periods.

In contrast, positive emotions send a very different signal throughout our bodies. When you experience uplifting emotions such as appreciation, joy, care and love, your heart-rhythm pattern becomes highly ordered, appearing as smooth, harmonious wave (*see figure below*). This is called a coherent heart-rhythm pattern. As we generate coherent heart rhythms, activity in the two branches of the ANS is synchronized and the body's systems operate with increased efficiency and harmony. It's no wonder that positive emotions feel so good: They actually help our body's systems synchronize and function more efficiently.



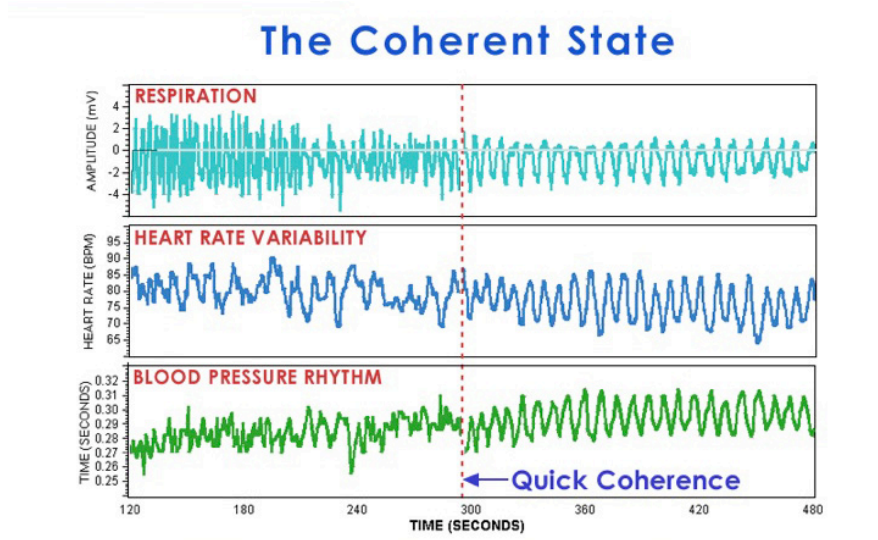
The smoothness or jaggedness, essentially the quality of the heart rhythms, is reflected in the coherence levels and ratios, which the emWave technology is able to measure and display.

Coherence: A State Of Optimal Function

The Institute of HeartMath’s research has shown that generating sustained positive emotions promotes a bodywide shift to a specific, scientifically measurable state. This state is called *psychophysiological coherence* because it is characterized by increased order and harmony in both our psychological, or mental and emotional processes, and physiological, or bodily processes. Psychophysiological coherence is a state of optimal function. Research shows that when we activate this state, our physiological systems function more efficiently, we experience greater emotional stability and we have increased mental clarity and improved cognitive function. Simply stated, the body and brain work better, and we feel better and perform better.

The coherence state is marked by the development of a smooth, sine-wavelike pattern in the heart rate variability trace, or graph. This characteristic pattern, called heart-rhythm coherence, is the primary indicator of the psychophysiological coherent state and is what the emWave system measures and quantifies.

A number of important physiological changes occur during coherence. The two branches of the ANS synchronize with each other, and there is an overall shift in autonomic balance toward increased parasympathetic activity. There also is increased physiological *entrainment*, which occurs when a number of different bodily systems synchronize to the rhythm generated by the heart (*see figure below*). Finally, there is increased synchronization in heart and brain activity.



Physiological entrainment during coherence: The top graphs show an individual’s respiration rhythm, heart rate variability and blood-pressure rhythm, or pulse transit time over a six minute period. At the 300-second mark, the center dashed line, the individual used HeartMath’s Quick Coherence® Technique to activate a feeling of appreciation and shift into the coherence state. At this point, the rhythms of all three systems became entrained: Notice that the rhythmic patterns are smooth, harmonious and synchronized with one another, rather than jagged and out of sync.

emWave® Desktop Proficiency Checklist

For basic operating instructions, follow this checklist to become familiar with the emWave before training a child in basic emWave operations.

Starting up the emWave, after downloading the software

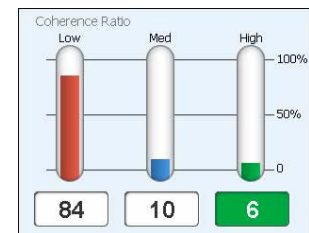
- ❑ Open up the main application window. This top bar (as shown below) contains most of the basic operational choices with the Start and Stop buttons at the bottom.



- ❑ Start a new session by clicking on the Start icon at the bottom.



- ❑ Practice the Quick Coherence steps until the red bar (low coherence) falls below 50%. In this case, it is still relatively high at 84%.



- ❑ Stop session. Click Save Session icon.



- ❑ Add comments, save comments.

Coherence Coach/Games

- ❑ From the Home Screen, select the Games button and then select the Coherence Coach.

Click on the balloon icon to open up the games menu and then click on the Coherence Coach.

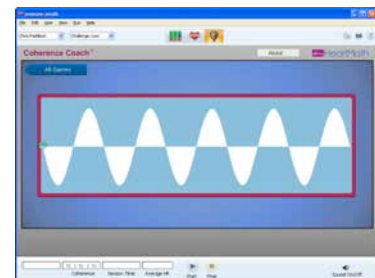


- ❑ Practice the Quick Coherence steps as you complete the Coherence Coach, adjusting the breathing pacer to the appropriate speed of the user.

- ❑ Click exit button, view your coherence ratios and HRV pattern after using the Coherence Coach.

- ❑ Move onto the following games, beginning with the shorter Garden game, next the Rainbow game, and finally the ten-minute long Balloon game.

- ❑ After each session, review the scores.



Review Saved Data

- ❑ From the Home Screen, click on the Review Progress icon at the top of screen.



- ❑ View accumulated session history.

- ❑ Select any saved sessions and review them.

Click on the 3 bars to review previous session.

Student: _____

Date: _____

emWave® Learning Checklist

Instructions: Rate the child's proficiency levels in the following emWave® functions and features by filling in the circle for each statement below that best applies.

	Poor	Fair	Good	Excellent
Basic understanding of the main operational features				
1. Starting and ending a session.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Reviewing previous sessions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Playing the games.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Using Coherence Coach.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Performance				
5. Knowledge of the Quick Coherence Technique steps.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Knowledge of the Quick Coherence Technique's purpose.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Describe a short-term goal for the application of the Quick Coherence Technique.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Success at meeting this goal.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Achieving steady progress in emWave scores – from low coherence to medium-to-high coherence.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Achieving steady progress in using different emWave features, and in advancing from the Coherence Coach to the Balloon Game.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

emWave® Desktop Technical Support

For technical support or further instructions, visit or contact the following:

<http://heartmath.helpserve.com>

Telephone: (800) 538-0984 (toll free)

Telephone (international): (831) 338-8750

Email: support@heartmath.com

Additional Resources For Working With ADHD-Diagnosed Children

[*Homework Help for ADHD Children*](#) – Practical and detailed descriptions of homework strategies for children with ADHD. (About.com)

[*Supporting School Success*](#) – A range of suggestions about supporting your child with ADHD at school, including how to get your child organized, enlisting the school's help and seeking evaluation. (American Academy of Child Adolescent Psychiatry)

[*Motivating the Child with Attention Deficit Disorder*](#) – Clear and concise information about how ADHD symptoms interfere with classroom expectations and how to realistically motivate your child with ADHD.

Resources for Teaching Students With ADHD

[*Teaching Students with Attention-Deficit/Hyperactivity Disorder: A Resource Guide for Teachers*](#), prepared for the Special Programs Branch of the Ministry of Education in British Columbia, Canada. Click the link to read the document on this website, which covers much more than teaching strategies. It includes virtually every aspect of ADHD that can affect the classroom.

[*Teaching Children with ADHD*](#) – In-depth guide to teaching children with ADHD. Includes articles on lesson planning, instructional techniques, behavioral strategies and communication with parents. (Teach ADHD)

[*Teaching Children with Attention Deficit Hyperactivity Disorder: Instructional Strategies and Practices*](#) – Must-read guide for teachers dealing with ADHD in school, full of tips for the classroom and innovative teaching strategies. (U.S. Department of Education)

[*Suggested Classroom Interventions for Children with ADD and Learning Disabilities*](#) – Practical suggestions for teaching children with ADHD that can be used in the regular classroom as well as the special education classroom. (Child Development Institute)

[Strategies for Teaching Youth with ADD and ADHD](#) — A wide range of ideas that can help focus students with ADHD and make your lessons more interesting for all students.

Special Education Resources for Children With ADHD

[Attention Deficit/Hyperactivity Disorder](#) (PDF) – Briefing paper for parents and teachers. Section III addresses school issues and special education for students with ADHD. (National Dissemination Center for Children with Disabilities)

[Advocate for Your Child: Getting ADHD Accommodations](#) — Eight steps for meeting your child’s educational needs with ADHD accommodations at school. (ADDitude)

[All About the IEP](#) — *Guide to the Individualized Education Program (IEP)*. Details this important document, which is developed by the child’s parents and school staff to address the special education services the child will receive.



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