



calmconnect™
From Me to We

created by **PrioHealth**

calmconnect™

From Me to We

Building Co-Regulation, Safety, and Affiliation

Roberta Scherf and Chris Bye

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Prio comes from proprioception, which is the body's sixth sense: The ability to sense its location in space. Proprioception may be disturbed in many neurological disorders (including autism, sensory processing disorder, post-traumatic stress disorder, traumatic brain injury, ADHD, Alzheimer's Disease/Dementia) as well as anxiety and depression. PrioHealth helps people to find, or return to their place in the world.



Welcome

Thirty years ago, a confluence of events changed my life.

When I was seven months pregnant on one of the coldest nights of the year in rural Wisconsin, my husband and I went to bed, and while we were sleeping, our house burned down. The fire inspectors called it an “unsurvivable fire” and said it was a miracle that we made it out alive, but that miracle came with a heavy price. After the fire, I had a healthy baby boy, postpartum depression, and PTSD.

Three years later, I gave birth to another wonderful, amazing child who happened to have autism and whose struggles with communication and anxiety coalesced with my own lingering trauma and depression. We both needed help. Repeated efforts with therapy and medication offered neither improvements nor coping mechanisms; I knew I had to find a way through this.

Years of research and experimentation, along with the invaluable work of co-creator Chris Bye, led to the development of CalmConnect. This scientifically based, patented, non-pharmaceutical behavioral health program taps into our primitive and intuitive need for safety and affiliation. It calms the nervous system and increases social connectedness to shift users from “fight or flight” to a more regulated state.

The global COVID-19 pandemic clearly demonstrated the significance of social connection, relationships, and community in maintaining emotional, mental, and physical health. CalmConnect helps people of all ages and abilities settle their nervous system and increase social connectedness, making it easier for individuals and families to engage with others in the world.

We hope CalmConnect helps you, your family, students, or patients.

With best wishes,

Roberta Scherf



Part One: The Program



Introduction

In a perfect classroom in an ideal world, twenty-four healthy children arrive each morning after leaving their happy home with a good night's sleep and a balanced breakfast. They love their teacher and their friends in the classroom. They are curious and excited to learn.

In the real world, teachers must do much more than simply teach. We received this email recently from an early childhood teacher (pre-K) in a large urban area, *"I have lots of different behaviors this year for a variety of reasons. I have students going through meth withdrawal, and some are in behavioral therapy, as well as children rescued from living in human trafficking with their mothers. Not what I started with in my career, never dreamed I would deal with this on a regular basis."*

In classrooms around the country, there are students who are struggling. There are students who are dysregulated and those just a step away from becoming dysregulated, those who have very low energy and those of high energy, and students who are anxious, traumatized, or living with a variety of challenges. The incredible challenge for teachers is to help all their students regulate their nervous system and brain functions in ways that allow them to focus and engage those cognitive processes needed to learn.

CalmConnect was created to:

- Meet the diverse regulatory needs of all students of all abilities in the classroom without singling out those individual, sensory, and behaviorally challenged students in need of occupational or behavioral therapy.
- Eliminate the need for special equipment or reconfiguration of the classroom.
- Feed the universal need of all children through social engagement and the resilience that develops from experiencing positive connections with others.
- Be easily used by parents at home as well as by occupational therapists and pediatricians in clinical and medical settings as a supportive intervention.
- Take no more than a few minutes to complete in consideration of the unbelievable demands on teachers' time.
- Enhance children's self-regulation/ behavioral organization, attention, expressive language, and learning.

When we designed the program we envisioned a brand-new teacher, overwhelmed in a room bursting at the seams with more than thirty animated second graders, many behaviorally challenged, speaking a variety of languages, seeking an intervention that could quickly settle the class, making it easier for students to learn together.

Many classrooms use the program at the beginning of the day, after lunch or recess, before field trips, testing, or learning a new or difficult concept. Therapists use it with individuals and groups of students. Parents find it particularly helpful before and after school, before homework and at bedtime, prior to stressful appointments, and to prevent meltdowns, in many cases eliminating them entirely.

CalmConnect is easy to use; simply log into the program, choose a category, and then a sequence. Quietly listen to the music, watch the smiling faces, and follow along with the movements of the people on screen if you can. Everyone present in the room (all the adults and students) should participate; no one should be engaged in a different activity than the rest of the group. To get the most benefits, we've found that it's often helpful to understand some of the mechanisms behind the program's efficacy, as well as best practices.

Nancy Lawton-Shirley, an occupational therapist specializing in sensory processing disorders, wrote, *"Within minutes, it calms even non-verbal students with autism in distress."*

(To view how she uses CalmConnect in her practice, watch "[CalmConnect in Classrooms, Clinics, and at Home.](#)")



What is CalmConnect?

In order to learn new things and navigate socially through the world with ease, our brain needs to be calm and alert, something that happens when we feel safe and connected to other people.

The human brain is designed to exist and thrive within a network of caring relationships. When we're isolated or cut off from other people, our emotional, cognitive, and physical health suffer.

While CalmConnect delivers many of the same benefits of meditation, mindfulness, and movement practices, it provides something other programs do not. CalmConnect promotes co-regulation, fostering cooperation and collaboration within and between groups, as it helps build relationships and create community.

One of the most important determinants of mental health is the ability to feel safe with other people and have healthy relationships. That need for connection is hardwired into our bodies and cells, as safe connections are essential for a meaningful life. Feelings of sadness, shame, and invisibility are all symptoms of the social isolation and loneliness that have been exacerbated by the pandemic and magnified by the proliferation of social media that promises connection but delivers none.

CalmConnect provides the building blocks for social relationships that are so critical for good mental health.

CalmConnect is an easy-to-use program that has proven successful for thousands of people of all ages and abilities in addressing anxiety, depression, and trauma, whether struggling with self-regulation because of autism, PTSD, illness, dementia, or other challenges.

Our scientifically based, patented social engagement program calms the nervous system, shifting users from "fight or flight" to a more regulated state as it builds social connectedness.

The program, comprising a series of short (3 – 5 minute) video sequences, combines rhythmic music with comforting vocal frequencies and visual patterns, which are synchronized with the 'social muscles' (expressive features) of the faces and the movement of others. This integrated, multisensory practice simultaneously engages the user physically, cognitively, and emotionally. It supports a number of physiological and neurological functions in order to activate the parasympathetic nervous system and build neural pathways to strengthen social connectivity and mental health.

CalmConnect makes it easier for individuals and families to engage with others in the world – at school, at work, at home, and in therapeutic and care settings.

Benefits include the following:

- Quickly calms the body and mind
- Easier transition times between activities
- Reduces agitation, anxiety, and depression
- Eliminates or minimizes meltdowns
- Easier bedtimes and faster sleep
- Increases collaborative behavior
- Mitigates loneliness caused by social isolation
- Fosters connection within and between groups

CalmConnect is the only program to synthesize research from the polyvagal theory of emotion and attachment, the social pain overlap theory, mirror neurons, and audiovisual synchrony. It helps people of all ages and abilities calm their nervous system, regulate their behavior, and connect with others.



Important Considerations

The program was designed to be used by people of all ages and abilities in a group setting or individually. While there is no strict program assessment, these guidelines will provide the user with the greatest benefits. Maintaining quiet during use enhances the effectiveness of the program.

Do Together When You Can. The program is designed as a shared activity that can help the whole family or classroom to become calmer and connect with one another. Research shows that there are significant benefits leading to affiliation and collaboration when a group of people is engaged together in simultaneous shared physical movement. The emphasis is not on identical simultaneous movement but rather on the shared experience of being engaged in a singular activity at the same time. This does not mean that everyone needs to do the movement. **We realize that choice is an essential part of feeling safe.** Initially, some children may be more comfortable facing away from the screen. Our definition of participation is: **Everyone is participating as long as no one is engaged in a different activity than the rest of the group.** If the program is being used at home, the whole family should participate without looking at, assessing, encouraging, or correcting the performance of any other family member. The few minutes it takes to complete each sequence will make a difference.

Do Use as a Transitional or Priming Activity. The program works well as a transitional tool or priming activity. Many families use it in the morning before school, after returning home from school, before homework or a stressful activity, and/or before bedtime. Many schools use it at the beginning of the day, after lunch or recess, and/or before field trips, testing, and quiet learning activities. In clinical settings, CalmConnect is used at the start of a session. This will prepare students (and their nervous systems) to anticipate and welcome the calming sequences in the program. Some classes incorporate the program into a social and emotional learning curriculum as a daily compassionate practice.

Don't Use as a Competitive or Teaching Activity. The goal is not to learn to do any movements "correctly" or improve (although this is generally a natural outcome). When the focus is placed on achievement, it becomes a competitive activity, which invalidates its strength as a calming, self-regulation tool. Each person is unique and will respond to the movements in their own way. It's fine for a person to stand motionless or sit, rocking back and forth in time to the music. Everyone finds their own level of engagement, which may change over time. Remember, people can only respond to the degree that their personal physiology allows.

Don't Have Students Follow (Imitate) a Leader in the Classroom Instead of Those on Screen. One important aspect of CalmConnect that sets it apart from other programs is the consistency, reliability, and safety of the people on screen. They provide the same nonjudgmental, compassionate expressions every time and appear in exactly the same way at the same moment every time the sequence is played. Moreover, the variety of people in each sequence keeps the viewers engaged. This consistency delivers enormous emotional benefits, which disappear when a teacher, clinician, or parent leads the session.

Introducing CalmConnect to Students

Pre-K through second or third-grade students will need very little instruction, as they will often be immediately engaged. (To view a demonstration of the program, watch "[Kindergarten First Time Using CalmConnect.](#)") A first-grade teacher in a neurotypical classroom in Maine shared her experience:

"My class LOVES CalmConnect! They ask for it if I forget. We've been using it when they first come in and as they enter from recess. Instead of running in, they come in quickly and get started on CalmConnect. When it's done, I keep my tone quiet and ask them to have a seat on the mat so we can start our lesson. Transition time heaven! I've had several teachers stop by and even join in (it's hard not to). Our occupational therapists come in, and instead of pulling the kids right out, use that time as part of their therapy with the children."

As children get older and become more self-conscious about their behavior in a group, it's often helpful to introduce CalmConnect with a simple description of the brain and behavior, depending on age/grade level.

Here are a few of the ways that teachers have introduced the program to their class:

- The right side of the brain controls the left side of the body/vice versa. Certain sequences in CalmConnect will activate different parts of the brain.
- The top part of the brain is responsible for speech and language, learning new things, and building relationships with others, among other things. When we're anxious or stressed, we aren't able to use the top part of the brain, and we can be scared, angry, or forgetful as a result. CalmConnect calms the nervous system and helps us to use our whole brain. Some teachers use simple drawings of the brain to demonstrate this.

You may also give examples of some of the ways that CalmConnect has been used: Division I athletes and graduate students have used the program to improve their performance and recovery time in sports, in class, before playing video games, and to wind down before going to sleep.

Guidelines for Classroom Use

The program contains 29 sequences (each 3-5 minutes in length) in 6 categories (**rise, joy, focus, clarity, calm, and rest**) designed to calm the nervous system, help regulate behavior, and build social connectedness. Within each category, every sequence is identified by name, along with a screenshot of one of the people on screen, icons highlighting some of the movements, and its timed length.

- When students have become accustomed to the program, you may play selections from the **music** category to elicit some of the same benefits.
- You may also save sequences in the **favorites** category.
- We recommend doing only 1 - 3 sequences at a time.
- Although they may be used in any order, the first sequence in each category is the easiest, as they become progressively more challenging. Even though some sequences contain more challenging movements, they remain very popular with students of all ages and abilities. The goal is not to do each movement perfectly but to be engaged with the program.
- Students may enjoy a particular sequence and want to repeat it more often. One thing that sets CalmConnect apart is the consistency, reliability, and safety of the people on screen.



Below are some sequences that have proven beneficial for many students. Please keep in mind that people have different favorites. One person may prefer a sequence because of the music, while another may prefer certain movements or people (or dogs) onscreen. It's often hard to predict which sequences will be most liked, but there are no wrong choices.

- Generally, the sequences in **joy** and **rise** will energize students with low energy, while those in **calm** and **rest** frequently settle those with high energy. However, because everyone is different, what's calming for one person may be too invigorating for another, and vice versa.
- Excellent at calming groups and individuals: **rest one**, **rest two**, **calm one** (featuring children under the age of 13), **calm two**.
- Good for improving attention before learning new things: **focus one**, **clarity two**, **clarity three**.
- Lift the mood in the classroom: **joy one** (another sequence featuring only children under the age of 13), **rise one** (featuring mostly girls and women), and **rise four** (a small boy floats off-screen at the end – energizing students with very low energy).



CalmConnect: Implementation Fidelity

Preparations for Use

- CalmConnect is a transitional tool and priming activity used at the start of class or during transitions, e.g., after lunch or recess.
- Daily use is recommended.
- We suggest using one or two sequences per session. Sequences may be played in any order and across categories.
- Select a category: joy, rise, calm, rest, focus, or clarity.
- You may choose to identify and rotate between students who will select the sequences daily.
- It is often helpful to designate a part of the classroom to be used by students with behavioral challenges who may benefit from additional use for self-regulation throughout the day.
- You may also play the music alone (without accompanying video footage) during times when students are quietly working.

Facilitation

- When first implementing CalmConnect, introduce the program by reminding students that this is a quiet activity done with our bodies, not our voices.
- When using CalmConnect as a class, everyone should participate to the degree they are able. Some students may imitate/follow perfectly, while others may stand, seemingly disengaged. As long as they are not actively engaged in a different activity, they are participating in the program.
- All those present in the classroom should participate: teachers, specialists, classroom aides, and parents.
- Each person should be allowed to participate without assessment, encouragement, or correction. CalmConnect is a silent activity that regulates the nervous system. It is not about 'getting better,' learning a new movement, or mastering a specific sequence.

Evaluation

- You may use the evaluation form on the following page.
- Observe students for 30 minutes before using CalmConnect and record behaviors in desired categories.
- Use one or two sequences of CalmConnect.
- Observe students for 30 minutes following CalmConnect and record behavioral changes in desired categories.
- High fidelity is achieved when there is compliance with all of the elements in program preparation and facilitation.

Measuring Impact/Results:

Teachers and therapists frequently report a variety of immediate and long-term benefits. When used twice a day for a total of 15 minutes by adolescents with severe autism, they were observed to be more engaged and calmer in the classroom. Over the course of six weeks, there was a clear increase in social interaction and a decrease in undesirable behaviors due to an ability to communicate wants and needs more effectively (Titone, 2010).

A study showed that when a sequence was used in a behaviorally challenged SpEd classroom just twice a week for six weeks, on-task behavior improved by 25% (Locke & Stansberry, 2016).



Evaluation Form

Behavior Observed	Pre	Post
Ability to interact with others; Increased collaboration		
Talking out of turn		
Talking while others are talking		
Talking while a teacher is talking		
Getting up from desk		
Melt-down(s)		
Aggressive or destructive behavior (pounding, etc.)		
Not paying attention		
Unable to remain in class/participate		
Not completing assigned tasks		
Inappropriate or rude language to teacher/staff/student		

Other Observations:



Research

Wayzata Public Schools: 81% Reduction in Off-Task Behavior

Wayzata collected off-task behavior (not following directions, distracting behavior, talking out of turn, leaving seat, and being disengaged) from twenty-five classrooms (preK – 4) in four different elementary schools. Using a “pre-post” methodology with one school as a control group, “post” data was collected on weeks 1, 3, 5, and 13. CalmConnect provided an 81% reduction in off-task behavior (Lackner, 2018). Wayzata Public Schools is rated as the top district in the state of MN and one of the top school districts in the country (niche.com). (See the Appendix for additional study details.)

Saint Paul Public Schools: 59% Reduction in Off-Task Behavior

Saint Paul Public Schools measured CalmConnect’s efficacy in reducing off-task behavior during Spring 2017. ‘Prevent’ staff, school counselors, and school social workers observed students in four classrooms in two elementary schools (eight total) over a five-week period. The classrooms included three E1 Montessori classrooms (grades 1-3), three first-grade, one second-grade, and one fifth-grade classroom (Heinrichs, 2017). Saint Paul Public Schools is the second largest district in MN, serving almost 40,000 students. It is also one of the most diverse (niche.com). (See the Appendix for additional study details.)

Alton School District, IL: 71% Reduction in Off-Task Behavior

An Early Childhood Specialist conducted pre/post research with CalmConnect in her mixed pre/K classroom for a graduate study. Using CalmConnect approximately 4 minutes a day reduced off-task behavior by 71% (Radcliff, 2011).

NYC Public Schools, NYC: 48% Reduction in Off-Task Behavior

NYC Autism Specialists studied CalmConnect’s impact in the classroom during Summer Session 2017. CalmConnect was used in four classrooms in two schools. The classrooms included students from grades 4 and 5, and grades 6, 7, and 8. Students had severe autism and significant cognitive and behavioral challenges. After three weeks of consistent use CalmConnect was shown to reduce off-task behavior by an average of 48% (Bruder, 2017).

Additional Studies

- Teachers and therapists frequently report a variety of immediate and long-term benefits. When used twice a day for a total of 15 minutes by adolescents with severe autism, students were observed to be more engaged and calmer in the classroom. Over the course of 6 weeks, there was a clear increase in social interaction as well as a decrease in undesirable behaviors due to an ability to communicate wants and needs more effectively (Titone, 2010).
- A 5-year-old boy with severe autism showed improved mirror neuron functioning, as well as an increase in behavioral outcomes: speech and language, eye contact, and imitative gestures. The young boy and his family engaged in CalmConnect 5 minutes a day/5 days a week for 12 weeks. Along with significant behavioral changes, CalmConnect was a “protocol that is fun and engaging for children and their families to do at home together.” (Leigh, 2010, presented at the International Meeting for Autism Research, Philadelphia, 2010).
- We recommend using CalmConnect a few times each day, but even infrequent use delivers benefits. A study showed that when one sequence was used in a behaviorally challenged SpEd classroom just twice a week for six weeks, on-task behavior improved by 25% (Locke & Stansberry, 2016).

(To view some of the ways CalmConnect is used as part of a trauma-informed practice in schools in the United States and Canada, watch “[CalmConnect: In the Classroom.](#)”)



Program Reviews



I use CalmConnect every day with kids in my practice and have yet to see anyone who doesn't love it and benefit. I have looked at dozens of programs for relaxation, breathing, imagery, etc. and CalmConnect is still far and away the best one. We use CalmConnect as a component in an integrative approach to hospitalized patients and in our integrative medicine outpatient practice. I also recommend it for home use as a tool to help kids and teens quiet the mind and body.

Timothy Culbert, MD, FAAP

Developmental/Behavioral Pediatrician Medical Director of Integrative Medicine, PrairieCare Medical Group (affiliated with the University of MN)



I've been involved with neuroscience as a base of activity for a very long time and I'm so impressed with the foundations that CalmConnect brings. This is a very subtle way to come and change peoples' brains and behavior, and they don't even have to know it! I strongly recommend CalmConnect and I think as we go forward we're going to compile a lot more of the neuroscience that relates to this work. It looks like such a simple activity, but it's really not.

Patricia Wilbarger, MEd, OTR, FAOTA

Occupational Therapist and Clinical Psychologist, developed the concept of "Sensory Diet," Wilbarger Deep Pressure and Proprioceptive Technique (DPPT) and the Oral Tactile Technique (OTT) for sensory defensiveness



The apparent simplicity of this program can be deceptive, but the results of frequent or even intermittent use are quite startling. Clinically we are noting changes in calm state, social interaction, expressive language, attention, behavioral organization and imitation, and group unity.

Eileen W. Richter, MPH, OTR/L, FAOTA

Founder/Professional Development Programs, Richter Active Integration Resources, Co-Founder/Avanti-Camp Icohowan



CalmConnect reduced off-task behavior by 81% when used for only 5 minutes a day in Wayzata Public Schools.

Dr. Stacey Lackner, PhD.

Director of Research and Evaluation, Wayzata Schools



As an occupational therapist specializing in sensory processing, I have been thrilled at what CalmConnect is doing in classrooms, home programs, and direct therapy as it immediately calms and organizes children. Within minutes it calms even nonverbal children with autism in distress! Increased eye contact, decreased self stim, increased vocalizations, increased arm awareness, strength, and alert state are common and consistently seen. CalmConnect has been an exciting addition to the therapy routines!

Nancy Lawton-Shirley, OTR

Founder/ Points of Stillness, Co-Founder/ Avanti-Camp Icohowan, Lecturer/ Sensory Processing Disorders



Tiernan went from three meltdowns a day requiring physical restraint to none because of CalmConnect!

Dana Hopkins

Parent of adolescent son with autism



CalmConnect is the one program that should be used in every classroom.

Dr. Wiliam Steele

Founder of the National Center for Trauma and Loss in Children



One patient was hit in the head with shrapnel in Afghanistan in 2004 and has a history of PTSD/anxiety causing severe insomnia. Since using CalmConnect he is able to get to sleep faster and get better sleep. He told me that this has been the greatest help with his sleep far and above any drugs or meditation.

Kelly Hermann OTR

US Naval Hospital Rota, Spain



The transformation in the classrooms has been amazing. The students ask for it! The immediate peace that transforms the room is something that has to be seen and experienced. We are using it in pre-k through 3rd grade classrooms of various levels and even some low incidence middle school classes.

Brian Dowd

Assistive Technologist, Alton School District #11, Alton, Illinois



Part Two: Co-Regulation, Safety and Affiliation

CalmConnect is the only program to synthesize research from the polyvagal theory of emotion and attachment, the social pain overlap theory, mirror neurons, and audiovisual synchrony, helping people of all ages and abilities to calm their nervous system, regulate their behavior, and connect with others.

This section examines the benefits of integrating movement with music, vocal frequencies, and visual patterns synchronized with the expressive features of emotion and the movement of others. Each of these areas has undergone a multitude of research that supports the benefits being experienced by those who participate in this program.



Behavioral Challenges

Schools are overwhelmed by behavioral challenges that get in the way of learning (Brauner & Stephens, 2006). Many districts allocate significant resources for classroom management and teacher training. Large districts often employ “behavioral team specialists” whose role is to work with students identified by recurring and unmanageable behavioral challenges. Despite all the time and resources, it’s an almost impossible task that generates mixed results, in part because many protocols intellectualize what is essentially a physiological process (Barbetta, Norona & Bicard, 2005).

Imagine the decision-making process of a first grader with autism spectrum disorder on the way to a meltdown. *“I’m having a bad day and I feel overwhelmed. I’m also unable to communicate my emotional needs to my teacher, so I’m going to lose my temper even though I realize my emotional outburst will have consequences for those around me, but my emotional challenges are more important, so I think I will just go for it...”* This is a ridiculous example, but it highlights the fact that behavior is not determined intellectually. Yet, some behavioral interventions focus on consequences and outcomes. This works if the child’s nervous state is regulated, but once things get difficult and frustration sets in, physiology takes over, and consequences can become irrelevant.

Bottom Up, Not Top Down

Behavioral interventions that require processing by the prefrontal cortex are known as “top-down” approaches. CalmConnect employs a “bottom-up” approach, which activates the more primitive lower brain. With no instructions, words, or expectations, the program actively changes the user’s physiology and behavior, regardless of age or ability. Our body heavily influences our thoughts and behavior. The surprising research that demonstrates that our affinity or aversion toward another person may be determined by something as simple as whether we are holding a hot or cold beverage underscores just how much our physiology impacts our behavior (Williams & Bargh, 2008).

We need to think about the body and brain differently to see that emotions are rooted in biology. Our emotions involve not only the mind but also the heart and the gut. It’s helpful to know how the brain, nervous system, heart, and gut work together to regulate behavior.

We use our whole brain to learn new things, navigate socially in the world, and function well in our environment. The brain is designed to make the body move, to conserve energy, and, most of all, to keep us safe. Unfortunately, we don’t have easy access to our whole brain when it’s under stress.

The lowest, most primitive part of the brain is responsible for basic housekeeping functions (arousal, sleep, appetite), major organs (heart, lungs, endocrine, and immune systems), and coordinating basic energy levels. The primitive brain includes the limbic system, which is the seat of our emotions and ensures our survival by keeping us safe.

The highest layer of the brain includes the frontal lobes and prefrontal cortex, responsible for planning, evaluation, and conscious thought. The prefrontal cortex gives us the ability to use rational thought and language, pay attention, make choices, imagine the future, learn new things, and get along with other people.

The brain’s alarm system, threat detector, and arbiter of danger is the amygdala, located in the limbic system. The amygdala is constantly scanning the environment while communicating with the hippocampus, thalamus, and prefrontal cortex, as it weighs incoming information and past experiences for cues that might signal a threat. The amygdala receives information and quickly makes decisions about our safety, often determining whether something is a threat even before we are consciously aware of it. As soon as it determines a threat, it engages the brain stem and hypothalamus to activate the stress-hormone system, and the autonomic nervous system engages in a whole-body response (Sapolsky, 2004).

Both branches of the autonomic nervous system work reciprocally to balance and regulate the body’s energy flow. The parasympathetic nervous system (PNS) conserves energy as it works to help us “calm and connect” by lowering blood pressure, slowing respiration, and improving immune function, digestion, and wound recovery. The sympathetic nervous system (SNS) expends energy as it accelerates heart rate and blood pressure. The SNS increases respiration and blood flow to muscles to speed our escape from danger, activating the “fight or flight” response.

When the fight or flight response is activated, the body is flooded with stress hormones, and the parts of the brain not deemed essential to our survival are taken “offline.” The lower parts of the brain are now in charge, running things to keep us safe. In this state, “procedural memory” reigns supreme, and we are able to do things that have become routinized, or automatic, requiring no conscious thought (walking, driving, etc.).

With the nervous system in a high state of arousal and the lower parts of the brain in charge, it is difficult to have successful relationships with other people or to learn new things. So many children and adults go through part of each day in a state of fight or flight, frozen with anxiety, existing with less than their whole brain, unable to fully embrace what it means to be human.

There are many self-regulation programs that ask people to pay attention to and modify their behavior. Unfortunately, this kind of top-down approach is not effective when a person is in fight or flight and conscious, rational thought and language are not available. We can’t just tell people to calm down and behave when they can’t hear us. We might as well try to explain how much we need sleep to a crying baby.

Chris and I were speaking at a behavioral health conference in North Carolina a few years ago. It was a wonderful program, designed to provide resources and respite care for entire families at a weekend retreat. Right after our talk, a very animated man pulled us aside. His words tumbled out rapidly as he told us what had just happened. His 12-year-old son has severe autism and was in a constant state of arousal, sleeping barely a few hours each night. Always wound up and in motion, he was often destructive, using his fists more than his words. The man explained that someone had delivered a note during our talk, asking him to check on his son in the nearby activity room. He told us that he went with a heavy heart, fully expecting to pay for the hole that his son had likely punched in the wall, all the while trying to figure out how he was going to break the not-so-unexpected news to his wife and daughter, as this had happened several times before. He paused to take a breath and began to cry as he told us that as he entered the room filled with middle school children moving quietly to CalmConnect, all of the adults put their fingers to their lips for him to be quiet. Then they pointed to his son, sound asleep on the floor in the middle of the room, as the music played softly in the background.

Many dedicated teachers and therapists struggle to use top-down programs for children with severe trauma or high ACE (Adverse Childhood Experience) scores. As one behavior specialist told us, “I finally realized that I was wasting my time trying to tell children to be calm when they had no idea what calm was, and they couldn’t feel calm because they couldn’t feel safe.”

CalmConnect uses a visceral bottom-up approach to calm the lower brain and activate the parasympathetic nervous system (PNS). By design, there is no speech or language in the program, no directions or instructions. The program uses the body to calm the system and shut down the fight or flight response. It activates the PNS, changing the body’s physiology, and helps to sync our nervous system and brain by rocking or moving and soothes it with soft, reassuring, rhythmic tones and music. Once calm, the whole brain can now organize, regulate, empathize, and learn.



From Me to We: Social Engagement, Biology, and the Vagus Nerve

Social connection is an essential part of what it means to be human, to survive, and to thrive. Our safety was rooted in tribes and extended families as people cared for each other and kept each other safe. That need for connection is still hardwired into our bodies and our cells. Our very survival might depend on the connections that we are able to forge with complete strangers (Lieberman, 2013). Deep social connections can actually alter the way that DNA is expressed within our cells, affecting our health and well-being. Such connections increase our resilience, health, productivity, happiness, and even our longevity. The most important aspect of mental health is feeling safe with other people and having healthy relationships. Safe connections are an essential part of a meaningful life (Fredrickson, 2013).

For many people struggling with trauma and anxiety, the simple presence of another human being may be threatening (DSM-IV, APA 1994). Children and adults who struggle with the social world may be highly attuned to the slightest change in behavior. Their sensitized nervous systems can detect, magnify, and replay nuances invisible to other people. *How, then, is it possible to build social and emotional learning and resilience in a person who is so threatened by human contact that the very “milk of human kindness” is not available to them?*

There is nothing threatening about CalmConnect. This careful combination of rhythm, music, patterns, movement, and repetition fully engages the user in balancing their nervous system as they imitate those people they see on the screen. Ranging in age from 2 to 100, each person on screen looks at the user(s) with the same compassionate, caring, nonjudgmental, expressive features of emotion—every single time.

In a world that can be unreliable for many, the people found on CalmConnect are consistent, predictable, and safe. Countless teachers and therapists have told us that for some students, the people that they see on CalmConnect each day are often the only people who look at them compassionately and believe in them, making connections that will help those students build relationships with real people in the real world.

A program for homeless children in St. Paul uses CalmConnect multiple times daily. Living in the shelters, most of the children (2-7 years of age) have a high ACE (adverse childhood experience) score and a very small nuclear family. They crave the love and attention of other people. We visited the program one morning and were amazed to see that all of the children had “adopted” different people to be a part of their larger family. One of the biggest surprises was the group’s shared, tacit acknowledgment and recognition of “family members.” There were huge smiles all around as children pointed to people on the screen, calling out, “There’s your grampa! That’s my cousin! Look at your brother! I see your auntie!” We watched as the program buoyed their spirits, helped them to become calm and focused, and allowed them to feel safe and belong to the family they had created for themselves.

Synchronized Movement

Positive, safe social connections develop through shared synchronicity that comes from facial expressions, eye contact, attunement, activating mirror neurons, and moving rhythmically with others. When synchrony is surreptitiously produced in experimental situations it breeds feelings of “liking” another person and one’s self, cooperation, and compassion, as well as success in collaborative action. Studies show that more synchronized movement was associated with better relationship quality and better interactional outcomes. The quality of a relationship is thus embodied by the synchronized movement patterns emerging between partners (Ramseyer, 2013). Furthermore, synchronized gestures also reflect and trigger the release of oxytocin, a hormone essential for bonding and secure, safe attachments (Uvnas-Moberg, 2003). When we move together, we go from Me to We.

The Polyvagal Theory

Dr. Stephen Porges is a behavioral neuroscientist whose development of the Polyvagal theory (Porges, 2011) is changing the way we look at social and emotional behavior, particularly trauma and anxiety. Polyvagal refers to multiple branches of the vagus nerve, which connects the brain, lungs, heart, stomach, and gut. Dr. Porges’ theory

emphasizes the biology of safety and danger, as it examines the interaction between our body's internal states and the faces and voices of the people around us. We feel less stress when we're around people we trust because they make us feel safe. Once we understand that, we can work to change our nervous system's response so that we can change our behavior.

The theory emphasizes that our nervous system has more than one defense strategy, and that our defensive response is completely involuntary, beyond our control. Our nervous system constantly evaluates risk in the environment, making judgments and setting up priorities for adaptive behaviors that are beyond our conscious control, keeping us safe in the face of danger. One of the most interesting things about the Polyvagal theory is the way it moves beyond "fight or flight" to examine the important role that social relationships play in understanding safety, danger, and trauma. It is a primary mechanism for neurological recovery and behavior modification.

The Vagus Nerve and Vagal Tone

The Vagus Nerve (from the Latin for vagabond) is the longest pair of cranial nerves, connecting the gut, heart, and brain to the vocal cords and muscles involved in speech.

Scientists can measure the strength of the vagus nerve by tracking heart rate variability, which provides an index of vagal tone. Generally, a higher vagal tone indicates that your body can better regulate the internal systems essential for good health: cardiovascular glucose and immune responses.

When measured at rest, vagal tone tends to be stable over time. People with higher vagal tones are more flexible physically, mentally, and socially.

Positive Social Engagement

If our nervous system perceives that our situation is safe, then the polyvagal system will trigger the most sophisticated adaptive response to stress using the social engagement system. This response connects the "social" muscles of the face (eyes, mouth, middle ear, larynx, sinus) with the heart. This level activates the ventral vagal complex (VVC), regulated by a myelinated branch of the vagus nerve; it is the most evolved strategy for keeping us safe.

If we have a problem at this level of stress, we will call out to others for help, support, or comfort. This level of communication is the one we use to beg for forgiveness, negotiate a solution, and straighten out misunderstandings. It is activated by eye contact, vocal prosody, and gestures. It fully energizes our own facial expressions and eye contact, speech, and vocal prosody as we gesture communicatively, using our whole body (face, voice, gestures) to convey information. We are also able to listen well to others, in part through the contraction of the inner ear that allows us to distinguish the human voice from other sounds in the environment more easily.

The myelinated vagus sustains social relationships, sending and receiving emotional information that brings you closer to others and helps you feel calmer. You feel safe because you are affiliated with, accepted by, and connected to others.

We strengthen the various branches of our vagus nerve and their responses to stress and threat by connecting with others, who send signals of safety through their expressive facial features, eye contact, and voices. CalmConnect connects users to the salient aspects of human connection, emotion, and positive social engagement (facial expressions and eye contact, musical prosody in higher frequencies shared by the female voice, and simple, rhythmically attuned movements and gestures).

Mobilization through The Fight or Flight Response

If our sensory organs detect an internal or external threat at a greater level than our social engagement system (e.g., we have an accident or something jumps out at us), then the social engagement system shuts down immediately. The next level of adaptive response to stress is fight or flight, which is regulated by the SNS. During fight or flight, the body tenses, speeds up, and becomes very alert. The sudden flood of 30 different hormones gets the body physically prepared to deal with a threat and causes other changes in the body, as nonessential systems shut down to allow more energy for emergency functions. Digestion and immune systems shut down; peripheral vision and hearing are lost,

and there is significant difficulty learning new things, focusing on small tasks, and engaging with other people as the lower parts of the brain focus on a potential threat and how to keep safe.

Immobilization through the Freeze Response

When we sense life-threatening danger and social engagement, and fight or flight systems won't work, our bodies can go into "freeze" or an immobility response as a final attempt at self-preservation. The nervous system activates the dorsal vagal complex (DVC), shutting down the system and expending as little energy as possible by reducing metabolism. At this point, our gut stops working, our heart rate drops, and we have difficulty breathing.

Humans and most mammals instinctively use this when there is no escape. As a survival strategy of last resort, it's frequently dangerous in itself, although it can help us survive. During severe injury, it turns off our registration of pain and shuts down body systems as much as possible. With repeated trauma, the nervous system can grow habituated to using a "freeze" response, which can trigger shutdown and dissociation to any perceived threat.

Safety and affiliation are paramount; without them, we are lost. The children and adults that we work with are frequently isolated from other people because of trauma. Many of them are simply trying to survive.

We received this email from an occupational therapist at a level-one trauma center in the Midwest:

"We have been using CalmConnect for about a year at the hospital on our inpatient behavioral health floors. We have five floors with 20 adult patients each. The floor I work on is a high-security floor that includes two jail cells. Most of the patients on the floor have been in jail one or more times for anything from writing bad checks to robbery, selling drugs, assault, terroristic threats, and, very occasionally, 2nd-degree murder. Most are diagnosed with antisocial personality disorder, among other diagnoses. Most are unemployed, have chemical dependency problems, and many are homeless. Most have had terrible childhoods and lots of trauma, as you might guess. The patients on this floor are a highly multicultural group and the varied ethnicity on the screen was affirming and part of the reason they like it so well, I think.

The most recent time we did CalmConnect was just over a week ago: A patient in his 40's, 'J,' was homeless, had schizoaffective disorder, was suicidal with very disorganized thinking, and needed to be hand-coached to eat. He is also illiterate. He had been in the hospital over 60 days and was ready to leave. He was unable to remember the three-syllable name of the group home he was going to and told everyone the wrong place instead. I had been coaching him for about three days, syllable by syllable, on the name of his new home so he could tell people. He would say it very dysfluently, pronouncing syllables and sounds poorly, halting during the word. Halfway through CalmConnect, he suddenly called out ' _____ House!' and pronounced the name absolutely perfectly and fluently! He was super excited and proud of himself. He totally remembered it after that, all the way until discharge, saying it perfectly, telling everyone he saw.

'L,' a patient in his 30s, came in and was diagnosed with catatonic schizophrenia. He was mute and unresponsive at first and then was very bland in affect, low energy, little eye contact, usually stared at the floor or put his head on the table while we exercised, or made minimal efforts for 30 seconds or so if we prodded a bit. Really, nothing we tried, such as humor, reinforcement, asking him to choose or lead an exercise, etc., had motivated him. When CalmConnect came on, he smiled spontaneously, exercised spontaneously, moved through full range in the movements and kept his focus on CalmConnect."

The program connects users to the salient aspects of human connection, emotion, and positive social engagement (facial expressions and eye contact, musical prosody in higher frequencies shared by the female voice, and simple, rhythmically attuned movements and gestures) without the threat of a live, human being.

We strengthen the various branches of our vagus nerve and their responses to stress and threat by connecting with others, who through their expressive facial features, eye contact, and voice send a signal of safety.

When we go from Me to We, our entire physiology changes. When done as a group, the entire environment changes.



The Physical Pain of Social Isolation

Chris and I were presenting a workshop for occupational therapists when I noticed someone off to the side crying after we'd completed one of the sequences. I asked her if she was alright, and she nodded yes. She said that it was just so powerful to see people who looked like her up on the screen. She'd gotten so used to seeing people who looked a certain way—actors or models or influencers—that it caught her off guard, and when she realized how much it meant to her to see "people like herself," she knew how important that would be for her students.

That was our goal when developing CalmConnect. We met with more than a hundred people and showed them a few movements. They'd never appeared on camera before. Many were shy and had challenges moving in time to the beat; there were a few stumbles. But they were real people. The only thing we did was tell them that the people who would be using the program might be struggling, things might be hard, and they might be having a bad day. We asked them to think of those people and send them their love.

We began to test the program. An elderly woman started to rock back and forth in time to the music as she watched the people on the screen. She began to cry and hug herself when she saw a young boy point to her and smile. A middle school boy with severe autism and limited speech imitated an adolescent boy on the screen. He watched as the boy completed his final movement and spontaneously smiled with a big "thumbs up." The boy with autism stopped abruptly, stood up tall, laughed, and said, *"I think he likes me!"*

The dorsal anterior cingulate cortex (dACC) is a small strip of the brain located deep within the frontal cortex and part of the complex alarm system that was known primarily for picking up the distress of physical pain. Surprisingly, the dACC also lights up in response to social pain and isolation, even to simply being left out of a game (Eisenberger, Lieberman & Williams 2003).

The more emotionally distressing the social pain or isolation is to someone, the more the dACC is activated. To our brains, the pain of being socially isolated is the same as the pain from a physical injury or illness. That the dACC reacts so strongly to both physical pain and social pain is a measure of how important it is to be included/accepted and how damaging it is to feel left out.

Repeated social exclusion draws on painful experiences as a model for future social interactions and relationships. The dACC becomes more sensitized and reactive as the person anticipates more exclusion and then interprets each social encounter according to that expectation. The more times someone is left out or rejected, the more the experience of being left out is knit into neural pathways.

A competitive, judgmental, unaccepting environment increases the reactivity of the dACC, creating and reinforcing exclusion. An overactive dACC is the result and the cause of social exclusion.

Many children struggling with various challenges are isolated and set apart from their peers. Parents of children with challenges like autism often share heartbreaking stories of not being invited to a birthday party, as well as the anxiety that occurs after their child receives the coveted invitation.

Countless teachers and therapists have told us that for some of their students and clients, the people they see on CalmConnect each day are often the only ones who look at them with unconditional acceptance, making absolutely no requests or demands. CalmConnect provides a significant emotional and global connection through various people of all ages, helping users connect with the real world.



Adverse Childhood Experiences: Biological Embedding and the Lifelong Consequences of Early Stress

In the 1950s, American psychologists began to put forth the idea that mothers should show their children much less affection. They thought too much coddling or pampering could make them weak: Babies should not be “babied.”

Harry Harlow was a psychologist at UW-Madison who thought differently and used rhesus monkeys to study social behaviors, isolation, and maternal dependence. Harlow believed that mothers played a critical role in the development of their children, although his cruel and unethical methods ignited the animal rights movement and established standards for using animals in scientific experiments.

He created the “pit of despair,” separating baby monkeys from their mothers, left in the pit for up to one year after birth. Harlow wrote, *“One of six monkeys isolated for three months refused to eat after release and died five days later... the effects of six months of total social isolation were so devastating and debilitating that we had assumed initially that twelve months of isolation would not produce any additional decrement. This assumption proved to be false; twelve months of isolation almost obliterated the animals socially.”*

One of his most famous experiments presented baby monkeys with two mother surrogates: the first was a bare-wire surrogate that provided food, and the other was a surrogate that didn’t offer food but was covered with a soft cloth. The monkeys stayed with the soft surrogate, leaving it only briefly for food. For primates, there is a powerful biological need for connection that can be as powerful as our drive for food.

US Surgeon General Vivek Murthy wrote, *“...loneliness is like hunger and thirst...it’s a natural signal our body sends us when we’re lacking something we need for survival – in this case social connection.”*

What Happened to You? NOT What’s Wrong with You?

In 1990, Vincent Felitti presented the first study connecting childhood trauma to adult obesity at Atlanta’s Centers for Disease Control and Prevention (CDC). Dr. Felitti was an internist with an obesity clinic in San Diego, as well as chief of Kaiser-Permanente’s Department of Preventive Medicine, the largest medical screening program in the world at that time. While working with his patients, he discovered that many reported being sexually abused as children or experienced other significant traumatic events. His findings generated significant negative feedback as there was no precedent for that kind of causal relationship.

Fortunately, not all the feedback was negative. Dr. Robert Anda, an epidemiologist from the CDC, was curious about the impact that childhood trauma might have on adult health. He encouraged Dr. Felitti to begin a much larger study, drawing on a general population. Anda and Felitti became co-investigators of the CDC-Kaiser Permanente Adverse Childhood Experiences (ACE) Study, one of the largest studies of childhood abuse and neglect on later health and well-being.

The ACE Study was conducted at Kaiser Permanente from 1995 to 1997 with two waves of data collection. 17,421 Health Maintenance Organization members from Southern California agreed to complete confidential surveys regarding their childhood experiences (from birth to age 18) and current health status and behaviors.

The first ACE survey consisted of ten questions that covered carefully defined categories of early childhood trauma, including physical and sexual abuse, physical and emotional neglect, and family dysfunction. Each “yes” answer was scored as one point, leading to a possible ACE score ranging from one to ten.

The study’s disturbing results showed that traumatic life experiences during childhood and adolescence are much more common than previously thought. More than 60% had experienced at least one adverse situation, and 25% had experienced two or more. The ACEs Aware Initiative in California has found that almost 17% of the population has experienced four or more. Adverse childhood experiences occur across all levels of income and education. Substance abuse in the family is most common, followed by sexual abuse and mental illness.

The original study also showed that while adverse experiences are usually studied separately, they're actually interrelated. For example, a person doesn't usually live in a family where one person is in jail, but everything else is perfect. Incidents of neglect or abuse are not isolated events. For each additional adverse event, the toll of later damage increases exponentially.

Dr. Felitti wrote, "*Contrary to conventional belief, time does not heal all wounds since humans convert traumatic emotional experiences in childhood into organic disease later in life.*"

The impact of trauma is pervasive throughout a person's entire life. Higher ACE scores correlate with work problems, financial issues, and lower lifelong income. Chronic depression rises dramatically and exponentially, along with self-acknowledged suicide attempts. There is a 5000% increased likelihood of suicide attempts from an ACE score of zero to six. An increased ACE score is predictive of smoking, obesity, alcoholism, sexually transmitted diseases, asthma, heart disease, depression, and premature death.

The stress of chronic abuse may result in anxiety and may make victims more vulnerable to problems such as post-traumatic stress disorder, conduct disorder, and learning, attention, and memory difficulties.

Harvard psychologist and neuroscientist Charles Nelson was the first researcher to document the long-term effects of harsh conditions in Romanian orphanages. In 2000, he and his colleague, Dr. Stacy Drury, established a lab inside an orphanage to study the effects of early childhood neglect on the developing brain. Although the children received adequate food and shelter at that time, they were given very little affection or stimulation.

Nelson's work demonstrated that high doses of adversity experienced during critical periods of early childhood development, without the protection of nurturing caregivers and safe environments, led to the biological embedding of toxic stress.

Specifically, the research demonstrated the profound impact of early childhood neglect through the measurement of shortened telomeres. Telomeres are the caps at the end of each strand of DNA, which protect our chromosomes. Shorter telomeres, connected to premature cellular aging, are a physical measure of biological, rather than chronological, age. The number of traumatic events experienced as a child directly influences shorter telomere length as an adult. Early adversity lodges itself in the body through biological embedding.

Fortunately, Nelson's research team also showed that, while damage from biological embedding can be devastating, it can also be halted or even reversed if children are able to benefit from a more nurturing environment. A consensus of scientific data demonstrates that early detection and early intervention significantly improves health outcomes.

We believe that regular and sustained use of CalmConnect supports emotional well-being in the same way that eating healthy foods and exercising support physical and mental well-being. Thus, the safety and affiliation provided by CalmConnect may help to neutralize or, in some cases, even reverse the effects of adverse experiences, hopefully minimizing their effects.

Over the past twenty years, the original ACEs Questionnaire has been revised and updated. The ACEs Aware initiative in California is the first statewide effort to screen patients for Adverse Childhood Experiences (ACEs).

ACEs Aware was launched in January 2020 by the Office of the California Surgeon General (CA-OSG) and the California Department of Health Care Services (DHCS) with the goal of halving toxic stress in one generation. Since its inception, more than 1.5 million Medi-Cal members have been screened for ACEs, and thousands of individuals and clinicians have received training for conducting ACE screenings.

Their PEARLS (Pediatric ACEs and Related Life Events Screener) tool was created in partnership with the UCSF School of Medicine. There are currently several versions available in seventeen languages for different age groups and caregivers.

The original version of the ACE Questionnaire can be found in the Appendix.

Note: It is a screening tool rather than a diagnostic tool.



Brainwide Mirroring System: The Roots of Empathy

A small private school in New York uses CalmConnect several times each day in every one of its classrooms. Most of the students (ages 5-21) are quadriplegic or paraplegic; all are nonverbal. As we viewed pictures of the children, we were struck by how much shared 'motion' there was in the absence of physical movement.

The program director wrote:

"Not only has the program helped to calm the students who are overstimulated, but when the students are feeling tired and listless, we have also found the focus and joy programs stimulate them and help to energize them enough to be able to actively participate in the classroom once again. Even those students who had very limited movement or who could not move were still gaining the benefits of the program just by observing and listening. I cannot tell you how much your program has aided us. It has changed our classrooms and the way our students interact without distracting from our daily schedule, without needing excessive amounts of time or specialized training."

For these students, it may be that each movement is reflected primarily through their mirror neurons, as they have discovered that being engaged together in a calming, joyful activity changes their physiology (Ramachandran, 2011). It's not about doing the movements correctly, or even doing them at all, but participating as much as one is able.

Mirror Neurons

Giacomo Rizzolatti is a neurophysiologist at the University of Parma in Italy. In 1995, he led a team of researchers as they mapped the activity of the F5 area of the brain in macaque monkeys. F5 is in the premotor cortex and contains millions of neurons that specialize in "coding" for specific motor behaviors of the hand: Grasping, reaching, holding, and bringing objects (food) to mouth.

During a quiet break in monitoring, while the monkey was waiting for the next experiment to begin, one of the researchers was moving about in the lab and reached for something. The electrodes on the monkey's F5 were activated. The monkey was not moving his arm but simply watching the researcher's arm move.

At first, it was considered a fluke since scientists believed that the nerve cells for action were separate from those for sensory observations. Repeated observation uncovered the existence of mirror neurons, as though the monkey's brain and the researcher's brain were somehow synchronized and overlapped, and the researcher's physical movement actually existed inside the monkey.

At that time, neuroscientists were deeply invested in the paradigm that various brain functions were separated and operated with a degree of independence within the brain. Perception was completely isolated from action, and cognition lay somewhat in between, allowing us to plan, to attend, to remember, and so on.

The Parma investigators were completely unprepared for a motor neuron that was also a perception neuron. Initially, scientists were not mentally ready to challenge the assumptions inherited from generations of researchers. Quite a few years passed before the existence of mirror neurons was accepted by the scientific community. Marco Iacoboni, a UCLA neuroscientist and investigator of mirror neurons, wrote that, *"Progress in science moves forward one funeral at a time."*

In the past two decades, research has confirmed that human brains also demonstrate a profound mirroring effect. We understand other people by performing an act of internal mimicry, by letting some of the actions and feelings of others into our own heads.

Instead of the existence of specific mirror neurons, there is a brainwide mirroring system whose tasks are shared by a number of regions and pathways. The imitating effect occurs as nerves in the frontal and prefrontal cortex begin to fire along with neurons in the somatosensory cortex (responsible for bodily sensations). Deep inside your brain, you are experiencing what you see.

Mirror neurons allow us to know what people are doing, thinking, and feeling, as the mirroring system provides input not just about sensations and actions but emotions as well. You can almost instantly pick up on the emotion of another person.

If you “catch” a smile on the face of a complete stranger or experience the tension of your own heart as your partner silently, coldly enters the room, you’ve experienced the effects of the brainwide mirroring system through emotional contagion. Your neural pathways take in another person’s feelings and replicate them inside of your nervous system.

The mirroring system activates even when another person gives only a hint that they are about to do something, an important part of the complex act of empathy. From Marco Iacoboni, *“The mirroring system helps us in understanding our existential condition and our involvement with others. It shows that we are not alone, but are biologically wired and evolutionarily designed to be deeply interconnected with one another.”*

The ability to modulate emotions is critical to maintaining healthy relationships. When someone else is sad or in great pain, it’s important to be able to empathize without feeling the exact same emotion or movement. When the mirroring system fires in empathic response, it doesn’t duplicate someone else’s feelings. It simply provides a hint of what they are feeling or doing. We are physiologically, emotionally, and neurologically in sync with them. It reminds us that, as human beings, we are never alone in the world.

Vittorio Gallese, a neurophysiologist in the Parma lab, described the role of the mirroring system in human interactions, *“The neural mechanism is involuntary, with it we don’t have to think about what other people are doing or feeling, we simply know.”*

Now imagine what it would be like not to “simply know” what other people are doing or feeling, much like a child on the autism spectrum or an adult so traumatized that they are unable to guess at the emotions of a person walking toward them. When someone is traumatized, challenged, or under near-constant stress, it is possible to view other people as adversaries, not knowing their intentions.

Neurological challenges, past experience, and the environment can actively work against the natural physiology of connection. In a competitive, violent world, a person may experience so much pain that the only way to survive and thrive is to ignore the signals of the mirroring system. Mirroring activities happen involuntarily, but it is possible to consciously reject them and, over time, develop the capacity to dissociate from your own body to feel safe. This makes it harder to decode the feelings of others as well as to identify the sensations of your own feeling states.

The mirroring system can thrive only when it’s used repeatedly. In some people on the autism spectrum or dealing with other challenges, it’s as though the mirrors might be broken or, at the very least, dormant, making it impossible for them to understand the feelings of others as well as their own. We believe that CalmConnect can help revive dormant mirror neurons, and a mechanism for this is based in audiovisual synchrony.



Audiovisual Synchrony and Socially Relevant Stimuli

When Ami Klin, Ph.D., was the director of Yale’s Child Study Center Autism Program, he and Warren Jones, a CSC neuroscientist, pioneered the use of eye-tracking technology in autism research. They developed a device that allowed them to track eye movements in infants and toddlers surreptitiously.

They discovered that children and adults with Autism Spectrum Disorder (ASD) see the world differently than typically developing subjects, often ignoring important sources of information that could help them build bridges to the social world. Their groundbreaking research demonstrated that infants and toddlers with autism are drawn to patterns, to motion that is synchronized with sound, as young children with autism look at peoples’ mouths instead of the eyes and faces of their caregivers like neurotypical children.

Using point-light animations with people in motion-capture suits (joints and other important body parts are represented by single dots) playing children’s games like peek-a-boo, researchers compared the visual responses of neurotypical toddlers to those with ASD. When two versions of these animations were presented side by side (one

upright demonstrating biological motion and the other upside down), neurotypical children looked more frequently at the conventional, upright animations, while children with ASD did not.

When the visual images were paired with sound in a synchronous beat, they found that children with ASD showed a strong preference for the conventional, upright version of that animation, in some cases improving from 23% to 92% correct.

This occurred even when most of the sound/motion correlations were very subtle, almost below the threshold of hearing, showing a strong connection between ASD and a heightened sensitivity to synchronized sounds and images.

Neurotypical children also showed an increased preference for the correct version.

Ami Klin described this preference for audiovisual synchrony (AVS), which might be used to redirect attention to socially relevant stimuli. We received an email from the lead occupational therapist at a clinic specializing in sensory processing disorders.

"We have been seeing an eight-year-old child with severe autism in our clinic for several years. His speech is scripted with significant self-stimming. In a 45-minute session, he might have four or five 'moments' of attention. I started using CalmConnect at the start of his therapy sessions. At the sixth session, he walked in and started to talk without any scripting. He stopped self-stimming and paid attention throughout the entire session. We have just started to use CalmConnect for all of our clients!"

CalmConnect utilizes audiovisual synchrony to help children on the autism spectrum. Visual patterns, rhythmicity, music, and movement draw each child in as they participate in the pattern themselves, becoming part of a larger social group. In addition to being an effective tool for self-regulation, this patented system has been shown to increase speech and language, imitation, eye contact, and socialization in children with autism spectrum disorder.



Movement: Body Language for the Mind

CalmConnect's philosophy of movement sets it apart. There are many exceptional and varied practices that incorporate movement, but as diverse as they are, they all share two things: they must be learned (by someone who will become the instructor), and they must be taught (to someone who is the student). CalmConnect's system of movement is so effective that it activates the PSNS, but so simple that a person of any age can view the movements on the screen and instinctively know what to do.

Our body affects our thoughts. Nonverbal cues, physical stance, and posture govern how other people think and feel about us and how we think and feel about ourselves. The way we hold our bodies and what we do with our bodies has an impact on our brains. Even tiny tweaks in posture and stance can lead to big changes (Petty, 2009).

Many people approach CalmConnect with very defensive postures: seated, legs tightly drawn up, head lying on the table in front of them with their shirt, hood, or arms wrapped protectively over the top. When they begin to imitate those people they see on the screen, they unconsciously move from a threat-oriented posture (drawn forward, down, and tucked inward, protecting their core) to a more confident, upright, expansive posture that "owns" more space, as well as affecting hormone levels; increasing testosterone and reducing cortisol (Carney, Cuddy & Yap, 2010).

CalmConnect purposely involves the larger muscles of the arms and shoulders in overhead movement. Occupational therapists refer to activities that engage both the large muscle groups and joints (and stimulate proprioceptive receptors) as "heavy work."

Proprioception is a form of sensory input to the muscles and joints that makes us aware of our "position in space." Our sense of body awareness tells us where we are in space, how we are moving, and where the parts of our body are in relation to one another (i.e., where we are in relation to other objects or people).

People who have difficulty interpreting proprioceptive input have trouble planning their movements and regulating their level of arousal. Heavy work activities (i.e., proprioceptive input) are often used for those with sensory processing difficulties to help with motor planning, increase attention, decrease defensiveness, and modulate arousal. The resistive input obtained through heavy work activities is generally organizing and can help to regulate the nervous system, resulting in a calm and focused state (Blanche & Schaaf, 2001).

From an occupational therapist in Iowa:

"I have been working with a third grader with autism who has a very hard time regulating his behavior and is unable to settle in one place for more than a few minutes. I began to use CalmConnect in the fall, and things changed so much that his teacher invited him to participate in the holiday concert (which his behavior had not allowed him to do previously). He was very proud and so excited. I was also very proud of what he had accomplished, but I was concerned that the excitement would be too much for him. I was shocked when I saw that his teacher had put him in the very center at the front of the auditorium. I was standing off stage, trying to figure out how to pull him off quietly, when I saw him start to shift his weight from side to side as he got more and more anxious. Suddenly, he closed his eyes, took a deep breath, raised his arms high above his head, and began to do the movements from CalmConnect. I could see his parents and grandparents in the audience, and I know we all took a big breath and began to cry tears of joy at the same time. He sang the last two songs with his eyes closed while doing CalmConnect. He was so proud that he was able to calm himself and finish the concert on stage with the rest of the class!"

"I move, therefore I am." Haruki Murakami

Movement Has Numerous Benefits:

- Improves learning and mental performance (Shoval, 2011, p. 462; Movement and Learning, 2014).
- Improves expressive language (Rocco, 2012; O'Callaghan, 2014).
- Assists with positive social interaction (Dammeyer, 2013; Ramseyer, 2013).
- Raises the levels of norepinephrine, dopamine, and serotonin, the three major neurotransmitters that affect attention, mood, cognition, behavior, and the ability to learn to manage stress levels in response to environmental and life demands (Esch, Duckstein, Welke, et al., 2007).
- Mobilizes gene expression and is a simple way to maintain brain function; both promote brain plasticity (Cotman & Berchtold, 2002).
- Strengthens the cardiovascular system, the endocrine system, the immune system, and the central nervous system. Increases levels of brain-derived neurotrophic factor (BDNF), which stimulates the growth of new cells and increases resistance to brain insult (Griffin, Mullalley, Foley, Warmington, O'Mara & Kelly, 2011).

The movements in CalmConnect are designed to initiate all these benefits and take only a few minutes to complete. However, movement alone is not as effective as when it is also synchronized with rhythmic music and comforting vocal frequencies.



The Power of Music

CalmConnect is synchronized with music to support smooth rhythmic movements that activate the parasympathetic nervous system (PNS), resulting in a calm and attentive state.

Music sets the program apart. Each piece is compelling and uniquely identified with the program. All of the music was carefully written and performed to provide a strong emotional connection while rhythmically grounding each movement.

By emphasizing the frequencies of the female voice, the music provides safe reassurance that often begins to activate a calm state on its own.

Many people listen before bed each night to quiet their minds, dispel anxious thoughts, and encourage sleep. Age provides no barrier to restless nights, as the music of CalmConnect is heard in nurseries, homes, detention centers, and cognitive care centers around the world.

“Music is the language of the Central Nervous System.” Richard Powers

Much like social contact, music is hardwired into our body and brain. In fact, researchers at MIT have discovered cortical specialization for music and neural pathways in the auditory cortex specifically designed to react exclusively to music (Norman-Haignere, Kanwisher, McDermott, & 2015).

Some researchers theorize that the neural structures that respond to music evolved earlier than the neural structures that respond to language; that speech actually evolved from music (Norton, Zipse, Marchina & Schlaug, 2009; Patel, 2010). Historically, music was an integral piece of survival and socialization. Making music with other people in a tribe was an important part of what kept the group together (Koelsch, 2013).

There is an interesting dynamic parallel between the temporal nature of auditory information and movement performance. Simply put, there is a strong connection between rhythmicity and brain function. New research continues to highlight music’s significant impact on emotional and physical well-being. For example, sound waves orchestrate patterns in the brain that facilitate learning (Kaye, 2013).

We knew that music would be a critical part of CalmConnect for several reasons:

- It is strongly associated with the brain’s reward system. The brain releases dopamine 15 seconds before the moment of “peak pleasure,” when we listen to a piece of music we know and enjoy, anticipating what comes next as the music helps to calm and engage us (Salimpoor, Benovoy, Larcher, Dagher & Zatorre, 2010).
- It provides an emotional perspective, letting us know what we should think about what we see (Cohen, 2001). The composer, Hans Zimmer, said that people always do the wrong thing in a scary movie; they cover their eyes when they should be covering their ears.
- It rewards us as it helps us to move and to learn (Leviton, 2013). Music anthropologists list “eliciting physical response” as one of the ten basic functions of music in human culture.

Music has been used for thousands of years—informally and as part of very specific and serious healing rituals in many cultures—to elicit motor response and enhance motor behavior. Neuroscientists studying the impact of music on motor processes have concluded that auditory rhythmic stimuli can enhance or promote motor responses and elicit movement, and there is clinical evidence that other components of music also have an arousing effect on the motor system (Grahn & Brett, 2007).

Music with a beat seems to help people with motor disorders such as Parkinson’s disease walk better than in the absence of music—patients actually synchronize their movements to a beat (Nombela, Hughes, Owen, & Grahn, 2013).

Studies show that when people move together to a steady beat, they’re more likely to cooperate with each other in nonmusical tasks than if they’re not in sync (Rabinowitch & Knafo, 2015).

Learning is based on pattern acquisition, which is difficult without basic rhythmic skills. Rhythm underlies patterns of breathing and movement and helps to organize incoming sensory information into coherent new patterns of learning. Steady beat is an important precursor to language acquisition, and it helps us to detect patterns in incoming sensory information (Weikart et al., 1998). It is the most fundamental concept in music. It’s the ongoing, steady, repetitive pulse that occurs in songs, chants, rhymes, and music. It’s the part that makes you want to tap your toes, clap your hands, or jump up and dance like no one is watching. It underlies our ability to first pick up patterns of language as an infant, then express the pattern as verbal language, and finally, to read that pattern.

Rhythmic movement competence can be learned and is strongly correlated with significant improvements in academic achievement and related abilities at both the elementary and high school levels (Taub & McGrew, 2004).

One study demonstrated a strong link between academic achievement and steady beat competence, particularly in math and reading achievement scores. The study of 237 second-grade children used piano keyboard training and newly designed math software to demonstrate improved math skills. The group who took the keyboard training scored 27% higher on proportional math and fraction tests than children who used only the math software. Steady beat matters and is an important part of the program (Kuhlman & Schweinhart 1999).

Music therapy is powerful in part because of its unique capacity to reorganize cerebral function where it has been damaged (Sacks, 1995; Tramo et al., 2001). Sound and music can affect dysfunction in the brain and nervous system and have been used successfully in treatment programs to reduce stress or lower blood pressure, alleviate pain, overcome various learning disabilities, improve movement and balance, and promote endurance and strength (Garza-Villarreal, Wilson, Vase, Brattico, Barrios, Jensen, Romero-Romo & Vuust, 2014; Karageorghis & Priest, 2012).

Steady beat with movement certainly helps with regulation. When this is synchronized with the movement of others, we meet the one universal need all of us share, especially children—the need to connect with others, the need for social engagement. This is also critical for helping students regulate their behavior.

We met with a teacher in Louisiana who spoke eloquently of the heartache and challenges of working with a small group of severely traumatized elementary students and the changes she's seen since using CalmConnect. One six-year-old boy had been exposed to cocaine through his mother's pregnancy and had also suffered a gunshot wound to the head. Now, he screamed all day long. One young girl was mute, largely catatonic, and with significant cognitive and developmental delays. When the class uses CalmConnect, the young boy stops screaming and quiets. The young girl hugs the small screen when a sequence ends, and she's begun to talk quietly in class.



Resilience

Research supports the idea that resilience is deeply interwoven with social connectedness and mental health. To learn new things and navigate our way socially through the world with ease, our nervous system must be calm and alert, but in order for that to happen, we need to feel safe and able to connect with other people. As human beings, we are physiologically hardwired to live in community with others.

The lifelong consequences of childhood stress, the physical pain of social isolation and the deadly consequences of loneliness, the biology of safety and danger—how our internal states interact with the faces and voices of those around us, the roots of empathy and the ability to attend to socially relevant stimuli—are all emerging as important pieces of the complex puzzle underlying human behavior and mental health.

When you have no sense of belonging to a group or community, and social connectedness is diminished, there are significant negative consequences: Physical and behavioral health, the ability to regulate your behavior, and cognitive abilities all decline. A meta-analysis of 148 studies concluded that a lack of social support had a serious negative impact, including difficulty recovering from stressful situations, the inability to stay cold-free when exposed to the cold virus, and earlier mortality (Baumeister, Tenge & Nuss, 2002; Gruenewald, 2010).

Fostering cooperation and collaboration within and between groups, CalmConnect helps create community and builds relationships, mitigating the loneliness caused by social isolation. CalmConnect connects people to the salient aspects of human connection, emotion, and positive social engagement, helping people of all ages and abilities to calm their nervous system, regulate their behavior, and connect with others.

It's how we move from *Me* to *We*.



Optimizing Learning Outcomes:

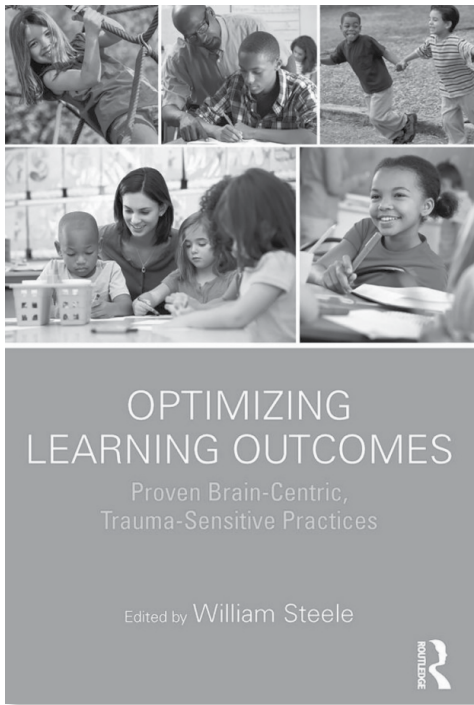
Proven Brain-Centric, Trauma-Sensitive Practices

Edited by William Steele, PhD

Chapter Three
Multi-Sensory Movement for All: Changing Our Physiology,
Behavior and Performance

by Roberta Scherf and Chris Bye

We're pleased to announce the publication of a book on trauma-informed care, edited by William Steele, PhD. The book includes a chapter on CalmConnect's (formerly MeMoves) efficacy, released in 2017 by Routledge.



Abstracts:

Book: There is no doubt that movement can help all students with regulation in ways that allow them to focus and engage those cognitive processes needed to learn. When movement patterns are integrated with rhythmic music, comforting vocal frequencies, visual patterns, and synchronized with the expressive features of emotion and the movement of others, teachers and students realize so many more benefits. This chapter describes the integrated processes of the program used in classrooms and other settings throughout the country. Teachers, parents, occupational therapists and school social workers describe their experiences with students before and after using the three to four minute segments in the classroom; how it improves focus, reduces off task behaviors, helps to regulate behavior and overall learning outcomes for all students.

Text Book: Readers will be able to identify and then discuss how the various components of specific movement patterns, rhythmic music, comforting vocal frequencies, visual patterns synchronized with the expressive features of emotion and the movement of others supports bio-physiological and neurological functions critical to learning and the regulation of reactions and behaviors associated with anxious and traumatized students, as well as those students experiencing stress and sensory processing challenges. Links to several video segments allow the reader to hear directly from teachers and parents about the various ways that the program has integrated these components into three to four minute segments for use in classrooms and other settings, and how their students and children are better able to focus, reduce off task behaviors and realize improved learning and behavioral outcomes.





Appendix

CalmConnect™ Reduced Off-Task Behavior in Wayzata MN Elementary Schools by 81%

The Wayzata School District is an award-winning district encompassing multiple communities in the western suburbs of Minneapolis. Recently named the #1 school district in MN by Niche, the district educates 5,029 elementary students in eight elementary schools and one early learning center.

Study Objective and Design

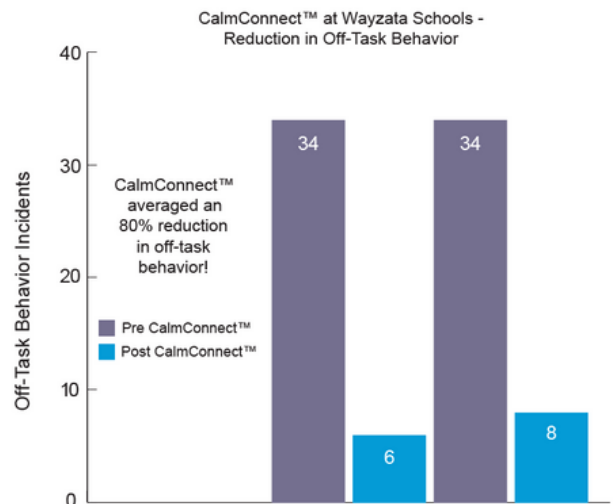
The objective was to evaluate the effectiveness of CalmConnect in reducing off-task behavior in neurotypical elementary classrooms. The study employed a “pre-post” design, measuring five metrics: not following directions, distracting behavior, talking out of turn/interrupting, moving out of seat, and being disengaged. Pre-treatment data was collected for one week (Feb 2018), with post-treatment data collected in weeks one, three, five, and thirteen.

Data was collected in four schools in grades Pre-K to Grade 4. One of the schools did not use the program, functioning as a control population.

Results

CalmConnect = **81% reduction** in off-task behaviors

CalmConnect = **78% reduction** in off-task behaviors



Data and results were presented by Dr. Stacey Lackner (Director of Research and Evaluation, Wayzata Public Schools) and Dr. Kieron Dey at the Minnesota School Psychologist Conference on January 24, 2019.



CalmConnect™ Reduced Off-Task Behavior in Saint Paul Schools by 58%

The Saint Paul School District (SPPS) measured CalmConnect’s efficacy in reducing off-task behavior in the spring of 2017. Prevention staff, school counselors, and school social workers observed students in eight classrooms, consisting of four classrooms in each of two schools. The classrooms included three Level 1 Montessori classes (Grades 1-3), as well as three classrooms with neurodiverse students: one first-grade, one-second grade and one fifth-grade classroom.

Observers catalogued each incident, which included the following behaviors: Not following instructions, distracting others, talking out of turn, inappropriately wandering out of seat or area, and disengaged behavior.

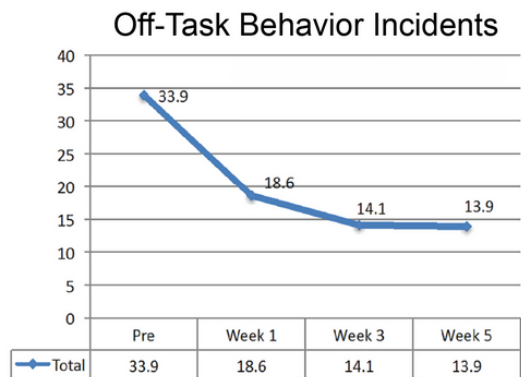
Observations were completed during the week before CalmConnect was introduced to the classrooms and after it was introduced at weeks one, three, and five. Each observation lasted 30 minutes and was done for three days a week. The eight participating teachers all reported that they used the CalmConnect program with fidelity -- using two video sequences at a time and playing the videos twice during each school day at a transition time.

Results

The results were statistically significant. **Using CalmConnect reduced off-task behavior by an average of 58%** in 8 classrooms.

Supporting Research:

Melinda Radcliff, an Early Childhood Specialist with the Alton School District in Illinois, measured a **71% reduction** in off-task behavior for her graduate thesis. She used CalmConnect 4 minutes/day in her mixed/ASD Pre-K/K classroom, collecting data over four weeks.





ACE Questionnaire: Finding your ACE Score

While you were growing up, during your first 18 years of life:

1. Did a parent or other adult in the household **often** ... Swear at you, insult you, put you down, or humiliate you? **-OR-** Act in a way that made you afraid that you might be physically hurt?

Yes No

If yes, enter 1 _____

2. Did a parent or other adult in the household **often** ... Push, grab, slap, or throw something at you? **-OR-** Ever hit you so hard that you had marks or were injured?

Yes No

If yes, enter 1 _____

3. Did an adult or person at least 5 years older than you **ever...** Touch or fondle you or have you touch their body in a sexual way? **-OR-** Try to or actually have oral, anal, or vaginal sex with you?

Yes No

If yes, enter 1 _____

4. Did you **often** feel that ... No one in your family loved you or thought you were important or special? **-OR-** Your family didn't look out for each other, feel close to each other, or support each other?

Yes No

If yes, enter 1 _____

5. Did you **often** feel that ... You didn't have enough to eat, had to wear dirty clothes, and had no one to protect you? **-OR-** Your parents were too drunk or high to take care of you or take you to the doctor if you needed it?

Yes No

If yes, enter 1 _____

6. Were your parents ever separated or divorced?

Yes No

If yes, enter 1 _____

7. Was your mother or stepmother: **Often** pushed, grabbed, slapped, or had something thrown at her? **-OR-** Sometimes or often kicked, bitten, hit with a fist, or hit with something hard? **-OR-** Ever repeatedly hit over at least a few minutes or threatened with a gun or knife?

Yes No

If yes, enter 1 _____

8. Did you live with anyone who was a problem drinker or alcoholic or who used street drugs?

Yes No

If yes, enter 1 _____

9. Was a household member depressed or mentally ill or did a household member attempt suicide?

Yes No

If yes, enter 1 _____

10. Did a household member go to prison?

Yes No

If yes, enter 1 _____

Now add up your "Yes" answers: _____

This is your ACE Score



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Roberta Scherf



References

- American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, 4th edn. Washington, DC: APA; 1994. DSM-IV.
- Armstrong, T. (2000). Multiple intelligences in the classroom. Association for Supervision and Curriculum Development, 1-11.
- Ayres, A.J. (1979) Sensory Integration and the Child. Western Psychological Services.
- Barbetta, P.M., Norona, K.L., & Bicard, D.F. (2005) Classroom Behavior Management: A Dozen Common Mistakes and What to Do Instead. Preventing School Failure: Alternative Education for Children and Youth. Volume 49, Issue 3.
- Baumeister RF, Twenge JM, Nuss CK. (2002). Effects of social exclusion on cognitive processes: anticipated aloneness reduces intelligent thought. *Journal of Personal Social Psychology*. Oct;83(4):817-27.
- Benson, H., & Stuart, E.M. (1992). *The Wellness Book*. New York: Carol Publishing Group.
- Benson, H. & Allen, R.L. (1980, September-October). How much stress is too much? *Harvard Business Review*, 58 (7&8), 86-92.
- Blackburn, E. & Epel, E. (2017). *The Telomere Effect: A Revolutionary Approach to Living Younger, Healthier, Longer*. Grand Central Publishing. New York/ London.
- Bradley, E.A., Summers, J. A., Wood, H.L., & Bryson, S. E. (2004). Comparing rates of psychiatric and behavioral disorders in adolescents and young adults with severe intellectual disability with and without autism. *Journal of Autism and Developmental Disorders*, 34, 151-161.
- Brauner, C.B., and Stephens, C.B.(2006). Estimating the Prevalence of Early Childhood Serious Emotional/ Behavioral Disorders: Challenges and Recommendations. *Public Health Rep*. May-June; 121(3): 303-310.
- Bremner, J.D. (2006). Traumatic stress effects on the brain. *Dialogues in Clinical Neuroscience*. 8(4) 445-461.
- Bringoux, L., Marin, L., Nougier, V., Barraud, P., and Raphel, C. (2000). Effects of gymnastics expertise on the perception of body orientation in the pitch dimension. *Journal of Vestibular Research: Equilibrium & Orientation*, 10(6), 251-258.
- Brown, D.W., Anda, R.F., Tiemeier, H., Felitti, F.J., Edwards, V.J., Croft, J.B., Giles, W.H. (2009). Adverse Childhood Experiences and the Risk of Premature Mortality. *American Journal of Preventive Medicine*. 37 (5).
- Brualdi, Amy (1996). Multiple Intelligences: Gardner's Theory. (ERIC/AE Digest Series EDO- TM-96-01).
- Burton, A.W., and Miller, D.E. (1998). *Movement skill assessment*. Champaign, IL: Human Kinetics.
- Carney, D.R., Cuddy, A. and Yap, A.J. (2010, October). Power posing: Brief nonverbal displays affect neuroendocrine levels and risk tolerance. *Psychological Science* 21, no. 10 : 1363–1368.
- Case-Smith, J. and Miller, H. (1999). Occupational therapy with children with pervasive developmental disorders. *American Journal of Occupational Therapy*, 53, 506-513.
- Chapman D. P., Dube S. R., Anda R. F. Adverse childhood events as risk factors for negative mental health outcomes. *Psychiatric Annals*. 2007;37 (5):359–364.
- Chang, V. Y., Palesh, O., Caldwell, R., Glasgow, N., Abramson, M., Luskin, F., Gill, M., Burke, A., Koopman, C. (2004). The effects of a mindfulness-based stress reduction program on stress, mindfulness self-efficacy, and positive states of mind. *Stress and Health* 20 (3), 141-147.
- Chakrabarti, S. and Fombonne, E. (2001). Pervasive developmental disorders in preschool children. *The Journal of the American Medical Association*, 285, 3093-3099.
- Chartrand, T. L., and van Baaran, R. (2009). Human mimicry. *Advances in Experimental Social Psychology*. 41:219-74.
- Chu, L. (2010). The benefits of meditation vis-à-vis emotional intelligence, perceived stress and negative mental health. *Stress and Health*, 26 (2), 169-180.
- Cirelli, L. K., Einarson, K.M., & Trainor, L.J. (2014, June 12). Interpersonal synchrony increases prosocial behavior in infants. *Developmental Science*.
- Clark, A., (2001). *Adaptive Music*. Gamasutra.com, May 15
- Cocke, A. (2002). Brain May Also Pump up from Workout. Society for Neuroscience Annual Meeting Web Site. <http://www.neurosurgery.medsch.ucla.edu/whastnew/societyforneuroscience.htm>
- Cohen, A.J., (2000). *Film Music: Perspectives from cognitive psychology*. Music and cinema. Middlebury VT. Wesleyan University Press.

- Connor, D.F. (2002). Preschool attention deficit hyper-activity disorder: A review of prevalence, diagnosis, neurobiology, and stimulant treatment. *Journal of Developmental and Behavioral Pediatrics*, 23 (Suppl.), S1-S9.
- Cook, S. W., Mitchell, Z., Goldin-Meadow, S. (2008). Gesturing makes learning last. *Cognition*, 106, 1047-1058.
- Cook, S. W. & Tanenhaus, M. K. (2009). Embodied understanding: Speakers' gestures affect listeners' actions. *Cognition*, 113, 98-104.
- Cook, S. W., Yip, T., & Goldin-Meadow, S. (2010). Gesture makes memories that last. *Journal of Memory and Language*, 63, 465-475.
- Cooper, D., (2003). Very Nervous System. *Wired*. i3.03. 1-4.
- Coppola, F., & Spector, D. (2009). Natural stress relief meditation as a tool for reducing anxiety and increasing self-actualization. *Social Behavior and Personality* 37 (3), 307-312.
- Cotman, C.W. and Berchtold, N.C. (2002). Exercise: A behavioral intervention to enhance brain health and plasticity. *Trends in Neurosciences*, 25, 295-301.
- Cuddy, A.J.C., Fiske, S.T, Kwan, V.S.Y, Glick, P, Demoulin, S, J. Leyens, P, & Bond, M.H. Stereotype content model across cultures: Universal similarities and some differences. *British Journal of Social Psychology*, 48 (2009).
- Czikszentmihalyi, M. (1990). *Flow: The Psychology of Optimal Experience*. New York, HarperCollins.
- Dammeyer, J., Koppe, S. (2013). The relationship between body movements and qualities of social interaction between a boy with severe developmental disabilities and his caregiver. Retrieved January 12, 2016 from <http://www.ncbi.nlm.nih.gov/pubmed/23834212>
- Drury, S., Theall, K., Gleason, M., Smyke, A., DeVivo, I., Wong, J., Fox, N., Zeanah, C., & Nelson, C. Telomere length and early severe social deprivation: linking early adversity and cellular aging. *Molecular Psychiatry* volume 17, pages 719–727 (2012)
- Duke, R.A., Geringer, J.M., and Madsden, C.K. (1991). Performance of perceived beat in relation to age and music training. *Journal of Research in Music Education*, 39(1), 35-45.
- Dwyer, T., Coonan, W., Leitch, D., Hetzel, B., and Baghurst, R. (1983). An investigation of the effects of daily physical activity on the health of primary school students in South Australia. *International Journal of Epidemiologists*, 12(3), 308-313.
- Dwyer, T., Sallis, J. F., Blizzard, L., Lazarus, R., and Dean, K. (2001). Relation of academic performance to physical activity and fitness in children. *Pediatric Exercise Science*, 13, 225-238.
- Eisenberger, N, Lieberman, M.D, and Williams, K.D. (2003). Does rejection hurt? An fMRI study of social exclusion. *Science*. Oct 10;302(5643):290-2.
- Ekman, P, Friesen, W.V.& Ancoli, S. (1980). Facial signs of emotional experience. *Journal of Personality and Social Psychology* 39(6): 1125-34.
- Ekman, P. & Rosenberg, E.L. *What the Face Reveals: Basic and Applied Studies of Spontaneous Expression Using the Facial Action Coding System (FACS)*. 2nd ed. Oxford University Press.
- Esch, T., Duckstein, J., Welke, J., Stefano, G. B., & Braun, V. (2007). Mind/body techniques for physiological and psychological stress reduction; stress management via Tai Chi training- a pilot study. *Medical science monitor international medical journal for experimental and clinical research.*, 488-497.
- Everly, G.S. Jr. (1990). *A clinical guide to the treatment of the human stress response*. New York: Plenum Press. Field, T. (2011). *Tai Chi Research Review*. *Complementary Therapies in Clinical Practice*.
- Fitzpatrick, P., Schmidt, R.C., and Lockman, J.L. (1996). Dynamical patterns in the development of clapping. *Child Development*, 67(6), 2691-2708.
- Flohr, J.W., and Meeuwse, H.J. (2001). Validity of rhythm timing software with college age adults. *Technological Directions in Music Education: Institute for Music Research, University of Texas at San Antonio*, 1-4.
- Frank, M. G., Ekman, P. & Friesen, W. (1993). Behavioral markers and recognizability of the smile of enjoyment. *Journal of Personality and Social Psychology*. 64(1):83-93.
- Fredrickson, B. (2013). *Finding Happiness and Health in Moments of Connection*. NY. Hudson Street Press.
- Gabbard, C.P. (2004). *Lifelong motor development*. San Francisco: Benjamin Cummings.
- Gage, F.H. (2002). Neurogenesis in the adult brain. *Journal of Neuroscience*, 22, 612-613.
- Garza-Villarreal, E.A., Wilson, A.D., Vase, L., Brattico, E., Barrios, F.A., Jensen, T.S., Romero- Romo, J.I., & Vuust, P. (2014). Music reduces pain and increases functional mobility in fibromyalgia. *Frontiers in Psychology*. 11 February.
- Geron, E. (1996). *Intelligence of Child and Adolescent Participants in Sports. The Child and Adolescent Athlete 6*. Oxford, England: Blackwell Science Ltd.
- Goodway, J. D., Crowe, H., and Ward, P. (2003). Effects of motor skill instruction of fundamental motor skill development. *Adapted Physical Activity Quarterly*, 20(3), 298-315.

- Goodwin, D. L., Krohn, J., and Kuhnle, A. (2004). Beyond the wheelchair: The experience of dance. *Adapted Physical Activity Quarterly*, 21, 229-247.
- Goodwin, D. L., and Thurmeier, R. (2004). Inadequate bodies or inadequate contexts: Reactions to the metaphors of disability. *Adapted Physical Activity Quarterly*, 21, 379-398.
- Gould E., Tanapat P. (1999). Stress and hippocampal neurogenesis. *Biological Psychiatry*. 46(11) 1472-9.
- Grahn, J.A. & Brett, M. (2007). Rhythm and beat perception in motor areas of the brain. *Journal of Cognitive Neuroscience*. May; 19 (5): 893-906.
- Graziano, A., Peterson, M. and Shaw, G. (1999). Enhanced learning of proportional math through music training and spatial- temporal training. *Neurological Research*, 21(2), 139- 152.
- Greenough, W.T., Black, J.E., and Wallace, C.S., (1987). Experience and brain development. *Child Development*, 58, 539- 559.
- Griffin, E.W., Mullally, S., Foley, C., Warmington, S.A., O'Mara, S.M., & Kelly, A.M. (2011). Aerobic exercise improves hippocampal function and increases BDNF in the serum of young adult males. *Physiology & Behavior*. Volume 104, Issue 5; 934-941.
- H F Harlow, H.F. Dodsworth, R.O, and Harlow, M.K. (1965). Total social isolation in monkeys. *Proc Natl Acad Sci U S A*. Jul; 54(1): 90-97.
- Haskell, L. (1993). Rehabilitation therapists tap into new rhythms for life. *Advance for Physical Therapists*, 4(5), 24-26.
- Haywood, K.M., and Getchell, N. (2001). *Life span motor development*. Champaign, IL: Human Kinetics.
- Jensen, E. (2001). *Arts with the brain in mind*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Jensen, C.G., S. Vangkilde, V. Frokjaer, S.G. Haselbalch (2012). Mindfulness training affects attention ---Or is it attentional effort? *Journal of Experimental Psychology*, 141 (1) 106-123.
- Jeong, Y.J., Hong, S.C., Lee, M.S., Park, M.C., Kim, Y.K. and Suh, C.M.. (2005). Dance movement therapy improves emotional responses and modulates neurohormones in adolescents with mild depression. *International Journal of NeuroScience*. v115 i12. 1711- 1720.
- Johnson, K. J., and Frederickson, B.L. (2005). We all look the same to me: Positive emotions eliminate the own-race bias in face recognition. *Psychological Science* 16(11) 875-82.
- Kaiser Family Foundation (2010). *Generation M2: Media in the Lives of 8 to 18*
- Karageorghis, C.I., & Priest, D.L., (2012). Music in the exercise domain: a review and synthesis. *International Review of Sports and Exercise Psychology*. Dec 7.
- Kaye, G. (2013). HOW DOES MUSIC AFFECT THE LEARNING EXPERIENCE? Retrieved January 11, 2016 from elearning.com/2013/08/how-does-music-affect-the-learning-experience/
- Kemper, K. J., & Shalout, H.A. (2011). Non-verbal communication of compassion: Measuring psychophysiological effects. *BMC Complementary and Alternative Medicine* 11:132.
- Keogh, Jr., & Sugden, D. (1985). *Movement skill development*. New York: McMillan Publishing Company.
- Klin A, Lin D J, Phillip, G. Gordon, R. & Jones W. (2009) Two year olds with autism orient to non-social contingencies rather than biological motion. *Nature*.
- Koelsch, S. (2013). Processing of hierarchical syntactic structure in music. Retrieved January 15, 2016 from <http://www.pnas.org/content/110/38/15443>.
- Kuhlman, K and Schweinhart, L.J. (1999). Timing in Child Development. High/Scope Educational Research Foundation. <http://www.highscope.org/Research/TimingPaper/timingstudy.htm>
- Larkin, H., Shields, J., Anda R.F. (2012). The Health and Social Consequences of Adverse Childhood Experiences (ACE) Across the Lifespan: An Introduction to Prevention and Intervention in the Community. *Journal of Prevention & Intervention Community*. 40(4):263-70
- Leigh, P. (2010) Interactive Visuo-Motor Therapy as a Supplementary Communication Treatment Model for Children with Autism Spectrum Disorders. Delivered at International Meeting for Autism Research. Unpublished.
- Lejeune, L. Anderson, D., Leroy, D., Thouwarecq, R., and Jouen, F. (2004). Kinesthetic perception of the vertical as a function of sport experience. *Research Quarterly for Exercise and Sport*, 75(4), 440-445.
- Levenson, R.W. (1994). "Human emotions: A functional view," in P. Ekman and R. Davidson, eds., *The Nature of Emotion: Fundamental Questions*. (New York: Oxford University Press, 123-26.)
- Levenson, R.W., P. Ekman, and W.V. Friesen (1990), "Voluntary facial action generates emotion-specific autonomic nervous system activity" *Psychophysiology*. 27: 363-84.

- Leviton, D. J. (2006). *This is Your Brain on Music: The Science of a Human Obsession*, Dutton Adult.
- Leviton, D.J. (2013). Neural Correlates of Musical Behaviors: A Brief Overview. *Music Therapy Perspectives: Volume 31*.
- Lieberman, M., Eisenberger, N. (2008). The pains and pleasures of social life: a social cognitive neuroscience approach. *Science*. 2009 Feb 13;323(5916):890-1. doi: 10.1126/science.1170008.
- Lieberman, M.D. (2013). *Social: Why Our Brains Are Wired to Connect*. Broadway Books.
- Linder, K. J. (1999). Sport Participation and Perceived Academic Performance of School Children and Youth. *Pediatric Exercise Science*, 11, 129-144.
- Linder, K. J. (2002). The Physical Activity Participation--Academic Performance Relationship Revisited: Perceived and Actual Performance and the Effect of Banding (Academic Tracking). *Pediatric Exercise Science*, 14, 155- 170.
- Locke, P., Stansberry, L. (2016). *CalmConnect in an ASD Classroom*. Unpublished.
- Maringer, M, Krumhuber, E.G, Fischer,A.H. & Niedenthal, P.M. (2011). Beyond smile dynamics: Mimicry and beliefs in judgments of smiles. *Emotion* 11(1): 181-87.
- McEwen (1999) Stress and hippocampal plasticity. *Annual Review of Neuroscience*.
- McNeill, William H. (1995). *Keeping Together in Time: Dance and Drill in Human History*. Harvard University Press.
- Melillo, Robert and Leisman, Gerry (2004). *Neurobehavioral Disorders of Childhood: An Evolutionary Perspective*. Springer Science Media, NY.
- Meeuwssen, H., Flohr, J.W., and Fink, R. (1998). Computerized assessment of the skills of sychronization and the imitation and timing of rhythm patterns. *Technological Directions in Music Education: Institute for Music Research, University of Texas at San Antonio*.
- Meyer, R.K., and Palmer, C. (2003). Temporal and motor transfer in music performance. *Music Perception*, 21, 81-104.
- Mitchell, D. L. (1994). *The relationship between rhythmic competency and academic performance in first grade children*. Doctoral Dissertation. Orlando, FL: University of Central Florida Department of Exceptional and Physical Education.
- Mittelstaedt, H. (1998). Origin and processing of postural information. *Neuroscience and Biobehavioral Reviews*, 22(4), 473-478.
- Mjaavatn, E, (1999). *Modern lifestyle: a threat to young people's life*. Norwegian University of Science and Technology.
- Mohan, A., Sharma, R., & Ramesh, R. L. (2011). Effect of meditation on stress- induced changes in cognitive functions. *The Journal of Alternative and Complementary Medicine*. National Association of Sport and Physical Education (NASPE). (2002). *Active start: A statement of physical activity guidelines for children birth to five years*. Reston, VA: National Association of Sport and Physical Education.
- Nelson, C., Zeanah, C. Fox, N., Marshall, P., Smyke, A., Guthrie, D., (2007). Cognitive recovery in socially deprived young children: The Bucharest Early Intervention Project *Science*, 318, 1937 – 1940.
- Nestler, E.J. (2012). "Stress Makes its Molecular Mark" *Nature*, Oct 11 2012, Vol 490.
- Nombela C, Hughes LE, Owen AM, Grahn JA. (2013). Into the groove: can rhythm influence Parkinson's disease?. Retrieved January 15, 2016 from <http://www.ncbi.nlm.nih.gov/pubmed/24012774>
- Norman-Haignere, S., Kanwisher N.G, McDermott, J.H. (2015) Distinct Cortical Pathways for Music and Speech Revealed by Hypothesis-Free Voxel Decomposition. *Neuron*. Dec 16: 88(6): 1281-96.
- Norton, A,, Zipse, L., Marchina, S., & Schlaug, G. (2009). Melodic Intonation Therapy: Shared Insights on How It Is Done and Why It Might Help. *The Neurosciences and Music III: Disorders and Plasticity*. NY Acad. Sci. 1169: 431-436.
- O'Callaghan, J. (2014). How a child's language development can be helped by hand movements. Retrieved January 11, 2016 from <http://www.dailymail.co.uk/sciencetech/article-2729665/How-childs-language-development-helped-hand-movements-Gesticulating-makes-words-easier-understand.html> Movement and Learning (2014).
- What The Researchers Say. Retrieved December 18, 2014 from <http://movementandlearning.wordpress.com/about/>
- Ornish D. et al, "Gene Expression Modulation by Intervention with Nutrition and Lifestyle Activity," *Proc Nat Acad Sci* 2008; 105: 8369.
- Ornish, D. (1999). *Love and Survival: The Scientific Basis for the Healing Power of Intimacy*. William Morrow.
- Palmer, C., and Meyer, R.K. (2000). Conceptual and motor learning in music performance. *Psychological Science*, 11, 63-68.
- Patel, A.D., & Iversen, J.R.. (2014). The evolutionary neuroscience of musical beat perception: The action simulation for auditory prediction (ASAP) hypothesis. *Frontiers in Systems Neuroscience*. 8:57.
- Patel, A.D., Iversen, J.R., Bregman,M.R., Schulz, I. & Schulz, C. (2008). Investigating the human-specificity to synchronization to music. *Proceedings of*

the 10th International Conference on Music Perception and Cognition.

Perret, P., and Fox, J. (2006). *A Well-Tempered Mind: Using Music To Help Children Listen and Learn*, New York, NY, Dana Press, The Dana Foundation.

Pica, R. (1999). Music and the movement program. *Teaching Elementary Physical Education*, 10, 32-33.

Porges, Stephen W., (2003). Social engagement and attachment: A phylogenetic perspective. *Annals of the New York Academy of Sciences* 1008:31-47.

Porges, Stephen W. (2011) *The Polyvagal Theory: Neurophysiological Foundations of Emotions Attachment Communication Self-Regulation*. W.W. Norton & Company.

Preston, D., and Frans B.M. de Waal (2002). Empathy: Its ultimate and proximate bases. *Behavior and Brain Sciences* 25(1):1-20.

Rabinowitch, T., Knafo, A., (2015). Synchronous Rhythmic Interaction Enhances Children's Perceived Similarity and Closeness Towards Each Other. *PLoS One* 10 (4):e0120878.

Radcliff, M. (2011). *Using CalmConnect to Reduce Off-Task Behavior in a Mixed Pre-K Classroom*. Unpublished.

Ramachandran, V.S. (2011). *The Tell-Tale Brain: A Neuroscientist's Quest for What Makes Us Human*. W.W. Norton and Company.

Ramseyer, F. (2013). Synchronized movement in social interaction. Retrieved January 12, 2016 from <http://dl.acm.org/citation>.

Ravelin, T, J Kylma, T Korhonen, (2006). Dance in mental health nursing: A hybrid concept analysis. *Issues in Mental Health Nursing*. 27(3) 307-17

Roberts, D.F., Foehr, M.A, and Rideout, V., (2005). *Generation M: Media in the Lives of 8-18 Year-olds*. A Kaiser Family Foundation Study.

Rocco, T. (2012). *Why a Long Island Speech Therapist Incorporates Movement and Sensory Activities into Speech Therapy Sessions*. Retrieved January 11, 2016 from <http://speechinmotion.com/blog/2012/10/22/long-island-speech-therapist-incorporates-movement-and-sensory-activities-into-speech-therapy-sessions>

Sacks, O. (1973). *Awakenings*, London, UK: Duckworth.

Sacks, O. (1995). *An anthropologist on Mars: Seven paradoxical tales* Vintage.

Sacks, O. (2007). *Musicophilia: Tales of Music and the Brain*, New York, NY: Knopf.

Salimpoor, V.N., Benovoy, M., Larcher, K., Dagher, A.; & Zatorre, R.J. (2011). Anatomically distinct dopamine release during anticipation and experience of peak emotion to music. *Nature Neuroscience*. 14, 257-262.

Sapolsky, R. (2004). *Why Zebras Don't Get Ulcers*. Scientific American Press.

Sapolsky, R. (2017). *Behave: The Biology of Humans at Our Best and Worst*. Penguin Press.

Scherf, R., (2012). U.S. Patent No. 823,7040. Washington DC: U.S. Patent and Trademark Office.

Scherf, R. & Bye, C. (2017). *Optimizing Learning Solutions: Proven Brain-Centric, Trauma- Sensitive Practices*. Ed. Steele, W. Routledge. New York/ London.

Schrammel, Frenziska, Sebastian Pannasch, Sven-Thomas Graupner, Andreas Mojzisch, and Boris M. Velichkovsky (2009). Virtual friend or threat? The effects of facial expression and gaze interaction on psychophysiological responses and emotional experience. *Psychophysiology* 46 (5): 922-31.

Shaffer, R.J., Jacokes, L.E., Cassily, J.F., Greenspan, S.I., Tuchman, R.F., and Stemmer, P.J. (2001). Effect of Interactive Metronome® training on children with ADHD. *The American Journal of Occupational Therapy*, 55(2), 155-161.

Shephard R.J. (1997). Curricular physical activity and academic performance. *Pediatric Exercise Science*, 9, 113-125.

Shoval, E. (2011). Using mindful movement in cooperative learning while learning about angles. *Instructional Science*, 39(4), 453-466. doi:10.1007/s11251-010-9137-2.

Sievers, C.H. (1932). The measurement of musical development: Part II. A study of rhythmical performance with special consideration of the factors involved in the formation of a scale for measuring rhythmic ability. *University of Iowa Studies in Child Welfare*, 7, 111-172.

Silberman, Steve. (2015). *Neurotribes: The Legacy of Autism and the Future of Neurodiversity*. Penguin Group.

Smoll, F.L. (1974a). Development of rhythmic ability in response to selected tempos. *Perceptual and Motor Skills*, 39, 767- 722.

Smoll, F.L. (1974b). Development of spatial and temporal elements of rhythmic ability. *Journal of Motor Behavior*, 6, 53-58.

Smoll, F.L. (1975). Variability in development of spatial and temporal elements of rhythmic ability. *Perceptual and Motor Skills*, 40, 439-442.

- Storr, A (1992). *Music and the Mind*, Random House Publishing Group.
- Taub, G., McGrew, K., and Keith, T., (2007). Improvements in Interval Time Tracking and Effects on Reading Achievement. *Psychology in the School*, 44 (8), 849-863.
- Temple, I.G., Williams, H.G., and Bateman, N.J. (1979). A test battery to assess intrasensory and intersensory development of young children. *Perceptual and Motor Skills*, 48, 643-659.
- Thaut, M.H., Kenyon, G.P., Schaeur M.L., & McIntosh, G.C. (1999). The connection between rhythmicity and brain function. *IEEE Engineering in Medicine and Biology*. Volume 18: Issue 2.
- Thomas, J., and Moon, D. (1976). *Joy in learning through music and movement improvisations*. New York: Macmillan.
- Titone, P.L. *Can Imitative Exercises Improve Social Communication Skills in Individuals with Autism Spectrum Disorders?* Unpublished.
- Townsend and Gurvitch (2002). Integrating technology into physical education: Enhancing multiple intelligences. *Teaching Elementary Physical Education*, 13, 35-40.
- Tramo, M.J. (2001). Biology and music. *Music of the hemispheres*. *Science*, 291, 54-56.
- Tramo, M.J., Shah, G.D., and Braida, L.D. (2002). Functional role of auditory cortex in frequency processing and pitch perception. *Journal of Neurophysiology*, 87, 122-139.
- Tremblay, M. S., Inman, J. W., and Williams, J. D. (2000). The Relationship Between Physical Activity, Self-Esteem, and Academic Achievement in 12-Year-Old Children. *Pediatric Exercise Science*, 12, 312-324.
- U.S. Department of Health and Human Services. (1996). *Physical activity and health: A report of the surgeon general*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion.
- U.S. Department of Health and Human Services, Administration for Children and Families. (1997). *The first progress report on head start program performance measures*. http://www.acf.hhs.gov/programs/core/ongoing_research/face/faces_pubs_reports.html
- Uvnas-Moberg, K. (2003). *The Oxytocin Factor: Tapping the Hormone of Calm, Love, and Healing*. New York: Perseus.
- Valdesolo, P. and DeSteno, D. (2011). Synchrony and the social tuning of compassion. *Emotion* 11(2):262-66.
- Valdesolo, P., Ouyang J. & DeSteno, D. (2010). The rhythm of joint action: Synchrony promotes cooperative ability. *Journal of Experimental Psychology*. 46(4):693-95.
- van der Kolk, B., "Four Concrete Steps for Working with Trauma," National Institute for the Clinical Application of Behavioral Medicine, www.nicabm.com, 2016.
- van der Kolk, B., (2014). *The Body Keeps the Score: Brain, Mind, and Body in the Healing of Trauma*. Viking.
- Volman, M.J.M., and Geuze, R.H. (1998). Temporal stability of rhythmic tapping "on" and "off the beat": A developmental study. *Psychological Research*, 63, 62-69.
- Wall, R.B. (2005). Tai Chi and mindfulness-based stress reduction in a Boston Public Middle School. *Journal of Pediatric Health Care*, 19(4), 230-237.
- Weikart, P.S. (1989). *Theory: A Sequential Approach to Rhythmic Movement*. Ypsilanti, MI: High/Scope Press.
- Weikart, P.S (1992). *Pedagogy/Theory: Movement in Steady Beat*. Ypsilanti, MN: High/Scope Press.
- Weikart, P.S (1998) *Teaching Movement and Dance: A Sequential Approach to Rhythmic Movement*. Ypsilanti, MI: High Scope Press.
- Williams, H.M. (1993). A study in the prediction of motor rhythmic performance of school children. *Journal of Genetic Psychology*, 43, 165-172.
- Williams, L.E., and Bargh, J.A. (2008) Experiencing Physical Warmth Promotes Interpersonal Warmth. *Science*. Oct 24; 322(5901): 606-607.
- Zachopoulou, E, Derri, V., Chatzopoulou, D., and Ellinoudis, T. (2003). Application of Orff and Dalcroze activities in preschool children: Do the effect levels of rhythmic ability? *Physical Educator*, 60(2), 51-58.
- Zion, L. (1996). Making sense: Kinesthesia. *ETC: A Review of General Semantics*, 53, 300-315.

