The Effect of Directed Sensory Motor Activity on Attention and Independent Work Skills of Second Graders

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THE EFFECT OF DIRECTED SENSORY MOTOR ACTIVITY ON ATTENTION AND INDEPENDENT WORK SKILLS OF SECOND GRADERS

by

Janene R. Johnson

A capstone submitted in partial fulfillment of the requirements for the degree of Master of Arts in Education.

Hamline University
Saint Paul, Minnesota
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Dedicated to my parents Gerald and Martha Peterson, in honor of the enduring life lessons you have taught me. Your faith taught me that we all have a purpose and everyone has value. Your unconditional love, constant prayers, encouragement and support let me know that I can do anything I set my mind to. Your interest in every single thing I did, or was learning, or cared about, taught me that details matter. Your positive attitude and humble spirits taught me that you can learn something from everyone you meet, and every situation you face.

For all that, and so much more, I am forever grateful.
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I love my job. I am an occupational therapist in the educational setting and have been doing this for over 25 years. I work with students of varying abilities, challenges and unique needs. Every day is different! Currently my students cover the age span of 3 through 21 across two school districts and the staff that makes up their teams are an honor to work with.

I often describe my job as that of a detective. I am called into situations to try and help figure out why something is or isn’t happening, why a behavior has suddenly started or another has stopped. I am brought in when a student’s ability to participate or access their classroom program is impaired. I have to be an excellent observer and look at the environment, the student, the staff, the peers, the task and the demands. I formulate theories and use my training in medical conditions, cognitive impairments and sensory processing. I work with a team to establish interventions, train staff, assess and then revise if needed. This is when I get to utilize my “McGyver” skills to create adaptations or equipment. (McGyver was a former TV character who always saved the day creating gadgets or devices from ordinary items within reach). Throughout this process we are always looking for progress, no matter how small, as a victory for our students. While it can be very challenging, my job is highly rewarding.

The Evolution of My Question
My current question may seem a bit out of place considering my explanation of my previous experience. I am asking, “how does consistent sensory motor activity impact student attention and independent work skills?”

As an occupational therapist working in the school setting I have come to see an increasing mismatch in our classrooms that I cannot ignore. I began my career as an occupational therapist in geriatrics and rehabilitation in 1987. A year later I added the role as therapist in the school setting working primarily with students categorized as “severe and profound”. These students were faced with multiple physical and cognitive delays. They were often separated from their same age “typically developing” peers. The next largest portion of my caseload was comprised of individuals with mild to moderate developmental disabilities. My role was primarily supporting their access to education and providing for physical needs while the teachers accommodated for cognitive delays. While some students with milder learning disabilities were also part of my caseload, they were relatively few and I never was approached regarding students in the regular education classroom.

Over the years a gradual increase began in my service to students on the autism spectrum. These individuals often struggle with more sensory processing issues. I have welcomed this new challenge and sought to increase my knowledge and understanding of how the brain processes sensory information. This is also information that applies to all students regardless of their diagnoses or lack of. And now, in the last five years or more, there has been a drastic increase in requests from teachers to consult on regular education students struggling with attention, focus and the ability to complete work independently. The majority of these students demonstrate a frequent need for redirection and repeated
instructions as they struggle to sit and focus (“They just can’t sit still”, “Can you come see why this student is wiggling?!” “He won’t stop rocking”. “They keep falling out of their chair”, “I have to repeat the directions four times”, “They keep dropping their pencil” etc…). Over this same time frame I have noted there has been an increase in the standards based curriculum resulting in advanced academic demands being placed on students at younger ages than ever before. There is more academic rigor at younger ages that our students are not ready for. In fact, I believe they are less developed from a neuromotor standpoint than in years past. This is where I see that the mismatch is an issue.

There is a natural progression to a child’s neuromotor development. To begin with, they must conquer the physical demands of the physical world. They must conquer gravity, develop and refine control of their body through repeated experiences and adapted responses. Only then they can control their body and movements to sit still, attend, receive verbal and visual information, store it and respond to it in word, action or written language. This “higher level” cognition depends on a strong foundation of motor development.

My theory is that we have an increasingly sedentary, sensory deprived society. Our increase in visual “stimulation” and the drastic decrease in active whole body sensory motor experiences have left many children’s brains hungry for more input.

In the general public, our society has taken away typical movement experiences and physical demands. It begins at birth. Babies are transported everywhere in plastic carriers, set down in carriers, rocked in plastic swings (in the same position as their
carriers) and often deprived of floor time experiences and significant “handling and holding” physical contact from caregivers. As they grow, doors open with a push of the button or by merely standing in front of them. Chores are done by machines and due to overbooked schedule and safety concerns, children are driven to and from activities rather than walking or riding their bikes. Birthday gifts are no longer chinese jump ropes, jacks, hula hoops, coloring books or hippity hops. Instead they get video games, cell phones, tablets, DVDs, gift cards or trading cards. When was the last time you saw a child receive a sit and spin for Christmas? Their job for the first few years of life is to establish the boundaries of their body, conquer gravity, integrate all the sensory input they receive and develop a “body map” that is clear and automatic. This is what will allow them the ability to focus on academic information rather than worry about being able to sit in their chair without falling over. It is also what enables them to hold the pencil and print the letters of the alphabet or their name focusing more on the order of the letters than on the way to form them correctly. Rich sensory experiences satisfy the brain’s “hunger” and enable development of finer visual motor skills such as reading and writing. I cannot tell you how many referrals I get these days for terrible handwriting. It is becoming an epidemic.

Even when children arrive at school we have reduced the typical daily opportunities for movement and sensory experiences. Many schools are taking away daily recess time, tearing down merry go rounds, monkey bars and teeter totters (lawsuit risks). They are cutting music and art, and reducing physical education classes or adding classroom instruction, worksheets and papers to the physical education program which also cuts down on the actual movement experiences within their day. More desk time is
expected of students than ever before and at younger ages in order to keep up with the new standards based curriculum and benchmark testing that is required. These expectations have been placed on the teachers and students despite the lack of “developmental evolution” that it would require to achieve them. This is a dangerous combination and I believe our students, (and teachers), are paying the price.

Through my training as an occupational therapist I know that sensory stimulation is food for the brain. There is a body-brain connection. There is a need for input and movement that connects both sides of the brain and make learning possible. Some input stimulates, alerts and promotes action. Other input relaxes, calms and promotes focus. Basically, I believe that attention and learning are supported when the body moves and sensory motor experiences occur. More children are seeking this movement on their own, right in the classroom in ways that the teachers find disruptive or concerning and at times even ends up hindering their ability to learn. That is when I am called. I am more and more convinced that providing directed movement experiences PRIOR to academic tasks will increase the student’s ability to sit, initiate tasks as directed, and stay engaged with the task without need for repeated directions or teacher assistance.

In the past few years I have met with teachers and principals, as well as curriculum directors. I have consulted on multi- sensory approaches to learning, handwriting and classroom management. I have obtained grant monies to provide training and equipment for school wide sensory motor programming and helped teachers find ways to get movement into their student’s days. Most of this has been directed at specific students and individual needs. While that has been beneficial, I would like to see the impact of consistent structured movement on an entire classroom.
Summary

In summary I propose that two trends have collided. First, a general decrease in natural movement and sensory experiences our students are exposed to in their early years and second, an increase in academic demands at younger ages. These trends have led me to ask this question: How does consistent sensory motor activity impact student attention and independent work skills? For many of our students the foundation that needs to be established before children can sit in a desk, hold a pencil, follow words on a page with their eyes and take in, store and organize new information in order to formulate a verbal or motoric response is lacking. They are arriving at our doors less “ready to learn” than ever before and most of the teachers I work with are at a loss of what to do. Those who might actually have an idea of what to do, feel they have no time in their day to get it done. Suddenly there are multiple students with “behavior” issues and attention struggles in multiple classrooms instead of just one.

I am excited to have the opportunity to work with a 2nd grade classroom and their teacher to provide consistent structured sensory movement experiences prior to independent work time. These will be activities that are designed to increase alertness and focus and promote learning. We hope to see a benefit to all students regardless of cognitive ability and developmental level. Specifically we will be tracking the need for redirection, the need for movement, the frequency of requests for assistance and the ability to finish the work within the allotted time.

In this first chapter I have laid out the reason for my question. In Chapter Two, I will review the literature on the body and brain connection, developmental progression
and the effects of sensory motor input on attention and learning. Chapter Three will delineate my research methods and tools used. Chapter Four will report my results and Chapter Five will conclude the capstone with a summary related to my question and possible plan for continued action.

I am passionate about this issue and I am excited to educate staff about uncovering the need behind the behavior and what they can do about it. I believe that we can address student behavior as well as student’s ability to learn. My question and subsequent action is one I personally believe in and I hope to see it positively impact the schools that I am part of.
CHAPTER 2

Literature Review

In this chapter I will take you through the development of my research question which looks at the impact of movement on children’s attention and independent work skills. The foundation that is needed to be “ready to learn” is the number one job of children prior to arriving at our classroom doors. I will give a basic introduction to the typical progression of neuromotor development and how a child moves from simple registration and response to higher level learning. Next, I will review the brain and its amazing ability to receive, process, sort, store and develop a response to sensory input. I will review the eight senses a child must process on a daily basis and also explain the correlation between this processing and how it prepares a child to learn. Finally, I will list the relatively recent changes in our culture that are depriving our children of the opportunities they need to have these rich sensory motor experiences and develop this foundation.

As the focus on academic achievement has increased in our country, the opportunity for physical activity has decreased. In the past 50 years multiple studies have been done to determine the effects of physical activity on academic achievement and cognition in children. The majority of them have been undertaken in the last five years. While the results have been inconsistent, the vast majority of conclusions have shown a positive effect of physical activity on constructs related to academic achievement (Howie & Pate 2012). This is what sets the stage for my proposal to integrate movement and
sensory motor activities directly into the classroom. Recent developments will be shared and current programs being used will be chosen to highlight and implement in this action plan.

This topic is very important to me as an occupational therapist working in the school setting. I am called on more and more to consult on students who are “off task”, who are “all over the place”, who “can’t sit still” and “have to touch everything”, as well as those who are propping their head on the desk, can’t focus, don’t start or don’t finish their work and just “don’t tune in”. I see students and staff becoming frustrated and know that this is an issue I can do something about. Research suggests that the brain, and with that cognitive functioning, is strengthened by kinesthetic programs (Everhart et al., 2012, Hillman, Erickson, & Kramer, 2008;). With that premise I see potential to create a positive change in our classrooms. I want to help students succeed and free teachers up to teach. The question I seek to answer is, ”how does consistent sensory-motor activity impact student attention and independent work skills?”

Typical development

All children are born to move. They are programmed to explore the world around them. They are driven to challenge gravity, reach out and touch, turn and look and move from place to place. Most of the activity in the first seven years of life is part of one process, the process of organizing the sensations in the nervous system. Within every child is a great inner drive to gain information, process it, store it and use it over and over until it is mastered. We do not have to tell a child what to do at a playground, they are wired to explore. The benches are for the adults! When the children dash out of the car
and head for the monkey bars and the parents stroll over to the bench it’s as if the adult brain is saying “been there, done that” while the child’s brain is saying “WOW, let’s try this out!” Until about the age of seven the brain is primarily a sensory processing machine. The brain senses things and gets meaning directly from these sensations. Therefore these first years are referred to as the years of sensory-motor development. As the child grows older, mental and social responses replace some of this sensory-motor activity. Therefore, the brain’s mental and social responses are based upon a foundation of sensory-motor processes (Ayres 1989, Connell & McCarty 2012, Oden 2006).

All learning begins with the body. It’s our only true point of reference. The human brain is capable of doing only one conscious, thinking task at a time. When we hear of multitasking we actually are referring to the process of layering a thinking task on top of one or more automated processes (Connell & McCarty, 2014). It is only when a child has settled into their own body that their mind will be free to think about other things like ABCs and 123s. “The body is the brain’s first teacher and the lesson plan is movement” (Connell & McCarty, p.8).

While it is not a new concept that the brain-body connection is strong, the actual links between sensory motor experiences and an individual’s attention, learning and memory are currently being acknowledged and clarified in both the medical and educational communities. In providing students with consistent movement activities that stimulate both sides of the brain and utilize rhythm, deep breathing and music, the intended outcome of increasing their self-regulation is more likely to occur. Theoretically this regulated state would then enable them to attend, follow directions, initiate and complete tasks with less need for support (Ayres, 1989).
The Brain

Before we go any further, some background on the brain and how it does its job is needed. The brain is the director of all activity in the body and mind. Over 80% of the nervous system is involved in processing and organizing sensory input. The brain is primarily a sensory processing machine (Ayres 1989, Kranowitz 1998). There are approximately 200 billion neurons (nerve cells) in the brain but only a small number are connected at birth. Just enough are connected to survive, the rest must be wired and that happens through interaction with the world and extensive repetition. Experts believe that given the right opportunities and experiences, 90% of the brain’s neural connections can be in place by the age of five (Connell & McCarty, 2014). Ideally, even if these connections are in place when a child begins their classroom experience, they will still need repeated exposure and use to feed the brain and promote development and continued learning.

The basic structures of the nervous system include two large cerebral hemispheres, a smaller cerebellum, a brain stem, a limbic system, a spinal cord and a number of nerves that spread out to each part of the body. These structures use the sensory input to produce body posture, movements, and the planning and coordination of motor responses.

The brain stem is at the base of the brain and is in charge of survival. The brain stem is on constant alert, managing breathing, heart rate and digestion. When danger or stress arises, energy goes here for immediate action. This state can all but shut down other parts of the brain until the situation is resolved. If the brain perceives something as
a threat, no learning can occur (Ayres 1989, Connell & McCarty 2012). It is worth noting here that this perception of what is a threat varies from individual to individual. For instance, while a fire drill may cause moderate stress for most of our students, some will find the announcement of a drill extremely frightening and be unable to get out of the survival mode to listen or learn until that drill is over.

The limbic system manages our emotional lives. It determines our behavior. Sounds, words, settings and especially smells are fast triggers for response. Sensory triggers often are not known for young school aged children. It will take some good observational skills for the teacher to see a pattern to sudden melt downs or emotional outbursts. Once the trigger is identified, modifications can help the child be more successful.

The cerebellum is the primary processor for physical movement and muscle control. It also plays a role in some cognitive functions. The cerebellum learns how to move every muscle and stores that information as muscle memory for future use. Learning to move muscles automatically is one of the brain’s biggest priorities in the early years (Ayres, 1989, Connell & McCarty 2012). It is what allows for layering of tasks within the classroom. For instance, an established muscle memory of how to hold a pencil allows a child to focus on how to form the letter they are learning that week. Once that letter formation becomes stored as a muscle memory, they can then focus on how to put a string of letters together in order to spell a word.

The cerebral cortex is the most complex part of the brain. It directs what we think of as higher-level human thought such as imagination, creation, prediction, and
interpretation of symbols (Connell & McCarty, 2014). This is the part of the brain that is most active when developing the ability to understand and use symbols such as letters and numbers for formal learning like reading, math and science.

Finally, the spinal cord carries the sensory information to the brain and the motor commands from the brain. When the functions of the brain are whole and balanced the body's movements are highly adaptive, learning is easy and good behavior is a natural outcome (Ayres, 1989).

Our Senses

What do we mean when we refer to sensory input? When we think of our senses we quickly list vision, hearing, smell, taste and touch. The three “hidden” senses we also need to include are the sense of movement (vestibular), the sense of body position (proprioception/kinesthesia) and the sense of how our internal organs are doing (interoception). Hunger and thirst are examples of this. The next section will provide a quick overview of the best known five senses with mention of how they impact learning.

The auditory system

The auditory system processes and interprets information that is heard. It is composed of the external ear, the middle ear (containing the three tiny bones) and the inner ear. Each hemisphere of the brain has a different role in decoding and processing different types of auditory input from language and music. The inner ear also contains the cochlea, which is the apparatus that serves a dual purpose in hearing as well as processing vestibular input and helping with our equilibrium (balance). Because of the
interconnections of the vestibular and auditory systems, sound has a great impact on our nervous system (Oden, 2006).

Auditory processing is what allows a student to filter out the teacher’s voice from background classroom noise. While auditory information can be difficult for the brain to organize, we often use it as the primary means to introduce or reinforce what we are teaching in the classroom. If students don’t understand what we have said, we often just repeat it perhaps louder, or in a slightly different way. This added volume or change in words could actually increase their confusion. Some children have trouble comprehending information even though they can hear. Every individual has different preferences for the amount and type of auditory input they can handle. Some children are bothered by the hum of fluorescent lights, clicking computer keys, the classroom fan, whispered conversations or the sound of their pencil on the paper. Others may find the volume of large groups, the lunch room or assemblies to be extremely stressful (Ayres 1998, Oden 2006, Connell & McCarty 2012). As stated earlier, stress impedes the ability to learn. Some accommodations to address this include use of carpeting, ear plugs, headphones, or a metronome.

The visual system

The visual system involves the eyes bringing detailed information to the brain about the surrounding environment. It is the most important way we determine our orientation in space. Dancers get their bearings when spinning by visually “spotting” a place in the distance. When we are in a car and the one next to us moves we press harder on the brake as we perceive we are rolling backward. In order for visual processing of
information such as reading writing, spelling or calculations, the basic visual system must be functioning well.

Vision requires the muscle coordination of both eyes focusing and tracking. A child may pass their school screening with 20/20 vision but not be able to track across the page to read or to find their place on a worksheet to fill in all the blanks. This motor control takes time to develop. Saw et al suggested (as cited by Oden, 2006) that near work is contributing to near-sightedness in 2nd graders. The muscles and tissues of the eye change dependent on the demands placed on them at such an early age. We are now asking children to do more and more close work at earlier and earlier ages wanting them to learn their numbers and letters at the ages of four and five. Placing this demand on a developing visual system may result in them coping by covering one eye with their arm or resting their head on the desk at a significant angle as they write or read. Headaches, double vision, fatigue and decreased concentration can result. Forcing the child to go between near and far work (copying from the board) at young ages is visually demanding. Combining this with the increased use of computers leads to fatigued and weakened eye muscles (Oden, 2006).

Finally, the trend to replace good old chalkboards with white boards also has consequences on the visual system. There is significant glare involved with white boards, especially with red orange and yellow markers. Some students will have greater difficulty processing the same information presented in this way. Some ways to decrease the visual strain in a classroom include cutting down on copying from the board, providing copies at their desk, reducing screen time, continuing with recess, physical education and as much “far” input as possible. If near work is unavoidable, add frequent
eye breaks; this allows students to look away from the page or screen every so often and let their eyes relax.

**The olfactory system**

The olfactory system is one of the first to develop. Typically it is developed at birth and plays a role in our survival (Ayres, 1989). It has a direct pathway to our limbic system; therefore, information from what you smell can quickly affect emotions. It is important for enjoying what you eat as well as to help you be aware of danger. Aromatherapy is based on the strong connection between smell and emotion, using certain scents to calm and others to energize or alert.

**The gustatory system**

The gustatory system provides us with information regarding the quality of foods and liquids (Bialer & Miller, 2011). It determines preferences and is an early source of tactile information with the most nerve endings actively providing details about objects and the environment during the young “mouthing” stage of development. Receptors in the mouth continue to be refined in young school aged children and many will use oral input to calm and help them focus by chewing on pencils, fingers, clothing etc. When this occurs, use it as a signal that the child in under stress and doing what they can to be successful (Ayres, 1989; Oden, 2006).

**The tactile system**

The tactile system gives us two types of information. The first is discriminative and tells us small changes in temperature, vibration, pressure and touch. The second is
protective and tells us of danger with information related to extreme degrees of
temperature and pain. This information involves powerful automatic responses related to
behaviors. The ability to process tactile information effectively allows us to feel safe and
to bond with those around us as well as to understand our contact with the world around
us (Oden, 2006). An immature tactile system might result in a child chewing on their
shirt, hair or pencil; a need to touch everything in sight; a negative reaction to touch or
tactile activities can often affect handwriting skills as well. Incidental contact may be
perceived as forceful and even painful and result in a fight, flight or fright response. The
tactile system triggers this response and involves the whole mind and body of the child
(Murray-Slutsky & Paris, 2005). This is not an uncommon cause of scuffles while
students wait in line and bump into each other. Activities to promote regulation and
development of this system include deep pressure input, oral stimulation and tactile tasks.
The focus for now will be on the two senses that are primarily addressed by my question
related to movement and learning. They are often referred to as “hidden” senses.

The vestibular system

The first of these “hidden” senses is the vestibular sense. The vestibular system
provides information for our balance, our sense of movement and our understanding of
gravity. It also influences the position of our body and our eyes. This system controls
five aspects of daily living; posture, balance, alertness, concentration and stillness
(Connell & McCarty, 2014). This is the system that is essential in creating a calm and
alert state of being (Oden, 2006). In their book, A moving child is a learning child,
Connell & McCarty state that “the highest form of balance is sitting still “ (2014, p86).
An immature vestibular system may result in a child needing to bounce, move
continuously, rock, tip upside down or spin. They will make up excuses to get out of their chair and move around the room. Conversely, they may be afraid to move at all for fear of falling. In this case they will limit the amount of turning to look side to side or up and down using their eyes more than their head to scan. Ways to promote regulation and development of this system include specific movement activities that incorporate linear and rhythmic movements of the head in space. As vestibular input has a direct impact on our arousal level; movement can be incorporated for classroom management. Fast irregular movement will alert us and wake us up. Slow, linear, back and forth or up and down movements will be organizing and calming while spinning is typically disorganizing to the system (Murray-Slutsy & Paris, 2005).

The proprioceptive system

The proprioceptive system is the second “hidden” sense and gives us information about the position and stability of our body. Its receptors are in our muscles and joints. It allows us to go on autopilot so we can concentrate on other things. It tells us what space we occupy in order to maintain just enough muscle contraction to not fall out of our chair (Oden, 2006). Having good proximal stability and trunk control supports emergence of fine motor skills, including handwriting, which are important aids to a child’s ability to learn (Losquadro-Liddle & Yorke, 2004).

This same spatial awareness is needed for a child to write letters that are proportionate to each other and the space on the page as well as to allow appropriate space between them to create words and sentences (Connell & McCarty, 2014). It tells us how much pressure to apply with our pencil when writing or our eraser when erasing
so we don’t rip our paper. An immature proprioceptive system might result in a child needing to use furniture to prop himself up, hang off the edge of their chair, wrap their legs around the chair legs, lean forward on their desk, tap their feet or sit on their knees. They may need to do these to keep themselves alert or to keep from falling out of their chair. They will rely on external support to hold them up so they can think. Activities to promote regulation and development of this system may include heavy resistive work and movements, such as pulling, pushing, carrying, stretching and isometrics. Proprioceptive input from heavy work or massage are helpful in calming and organizing a child (Murray-Slutsky & Paris, 2005).

**Sensory Integration as a Basis for Learning**

Sensory stimulation is constant and comes in all different forms and intensities. Sensation is food for the brain; it provides the energy and knowledge to direct the brain. Sensory integration is the organization of sensation for use (Ayres, 1998). Without our sensory system, (our eyes, ears, skin and nerves), we could not function. Our ability to utilize our senses to absorb information, sort it out and then respond to it is what we call sensory integration. Although every child is born with the capacity for sensory integration, they must develop it by interacting with many things in the world and adapting their body and brain to many physical challenges during childhood (Ayres, 1989). Each of the foundational sensory systems plays a role in a child’s ability to focus and learn (refer to Appendix D: Sensory Integration as the Foundation for Learning and Classroom Performance). While the processing of this information is critical, current research is beginning to show that each system mutually supports the other (Oden, D
2006 citing VanSant, 2005; Montgomery, 2005; Bundy 2002). These individual systems are in a dynamic state, each contributing in an organized way.

As we mature, an efficient sensory system allows us to concentrate on and complete an activity without being distracted by extraneous noises or activities (Losquadro- Liddle & Yorke 2004). The brain-behavior connection is very strong. The child who lacks efficient sensory integration has a disorganized brain and therefore many aspects of his behavior will be disorganized. Overall development can be disorderly, performing ordinary tasks and responding to everyday events can be challenging. This inability to function smoothly is not because the child won’t, but because he can’t (Kranowitz, 1998). This is where our challenge lies. Each student in a classroom is in a different state of organization dependent on their internal processing and experiences. They may have an unusually high activity level, or unusually low. They may be impulsive or distractible and it can change from day to day and moment to moment. How do we get them in the best place to be ready to learn? In her book, *The Out-of-Sync Child*, Carol Kranowitz delineates four levels of sensory integration. A summary of each follows.

Level One: Primary Sensory Systems. Typically this level is established in the first two months of life. The sense of touch (tactile system), the sense of balance and movement (vestibular system), the sense of body position (proprioceptive sense) and the visual and auditory systems are actively registering, sorting and storing information about their own bodies and the world within their reach. Touch feels good and is a source of comfort and information. Attachment begins. Visual information leads to learning a
mother’s face, imitating expressions and registering movement and activity of those around them. Movement affects posture and gives the infant security in space.

Level Two: Perceptual-Motor Foundations. Typically this stage of development is established in the first year of life. Concepts of body awareness (body percept), teemed use of both sides of the body (bilateral coordination), hand preference (lateralization) and motor planning (praxis) are taking up most of their time and require huge amounts of movement, experiences and exploration. The child begins to use both sides of the body, they crawl, creep and are constantly figuring out how to do things they could not do before. Their activity level is becoming more regulated, their attention span is increasing, they can look where they are going and go where they are looking and certain motor tasks are becoming automatic.

Level Three: Perceptual-Motor Skills. With enough opportunity this stage is complete around the age of three. Hearing becomes more refined, sight becomes more precise and eye-hand coordination develops. By now they can hold a crayon, draw a simple picture, catch a ball and pour a little juice. They can do a simple puzzle, manipulate small objects and arrange them in place.

Level Four: Academic Readiness. By the age of six or seven the child’s brain is mature enough to specialize (Kranowitz, 1989). Different parts of the brain become more efficient and specialized. Their eyes and ears are ready to become primary teachers. Another important development during this time is bilateral integration. Bilateral integration refers to the coordinated use of the two sides of the body. Information from the two sides of the brain is integrated, enabling each side of the body
to be aware of and cooperate with the other side resulting in efficient and coordinated movement (Losquadro- Liddle & Yorke, 2004). This is when they are considered “ready to learn” in our traditional classroom setting. With the proper experiences and solid foundation of sensory processing in place, the child feels good about himself and is ready for school. Notice that according to current research this isn’t expected until the age of six or seven and it is dependent on years of rich sensory motor experiences. Reference that fact with what we are now expecting preschool and kindergarten children to do and you see the problem that exists (Oden, 2006).

A rich “pre-school” environment (at home or in a program) enhanced by different sensory experiences will promote physical movement and development. These functions will in turn facilitate new learning experiences. The net result is that your child will have a greater sense of confidence in the world. Effective play will actually set the foundation for more challenging activities to come preparing your child for school (Losquadro- Liddle & Yorke, 2004).

Brief mention of primitive reflexes must be made here. These reflexes are innate movement patterns that serve a vital purpose in teaching children to roll and crawl and are pre-cursors to eye-hand coordination. They act as a catalyst to motor learning and sensory integration. If these reflexes are not fully integrated at school age they can interfere with foundations necessary for function in the academic setting (Oden, 2006). For example, if the asymmetrical tonic neck reflex is still mildly present a child’s head movement will have a direct effect on his arm movement. If the student is writing at their desk and turns their head to see the board or respond to the teacher, their writing arm will bend or straighten slightly. This will either cause them to lose their place on the page or
they will compensate by pressing firmly on their paper to anchor their arm in place. Residual reflexive patterns can also interfere with a child’s ability to cross midline, a necessary skill when reading, writing and performing many academic tasks.

How this relates to the classroom

When children arrive at school they all display different stages or patterns of physiological and neurological development. Some are still wiggling, chewing and bouncing while others are like noodles in their chairs, slouching and propping their heads. How can we supply what they need when it seems they should have all of this figured out and be ready to sit, hold a pencil, read and write? Why isn’t everyone ready?

As the cited literature has shown, academic abilities, behavior and emotional growth rest upon a child’s sensory-motor foundation. Piaget suggested that the human brain is not designed to process "abstractions" until it has “concrete” knowledge of the body, the world and its physical forces. Seven or eight years of moving and play are required to give the child a sensory-motor intelligence that can serve as the foundation for intellectual, social and personal development (Ayres, 1989). Sensory modulation is a term used to define this organizational process. Sensory modulation is the ability to adjust, regulate, limit, or enhance incoming sensory input. It occurs automatically to create appropriate states of arousal required for attention, social relationships, memory, learning and other key aspects of life (Bialer & Miller, 2011).

Each time a child engages in fine or gross motor movements the following skills are used: equilibrium, kinesthesia, motor planning and bilateral motor coordination. Equilibrium refers to body movements or shifts to maintain or regain balance. The
movement can be small, such as maintaining a sitting position in a chair or large such as protecting the body from a fall by using one’s arms and hands. Kinesthesia is the internal awareness about our body parts that allows us to perform tasks with coordination. Co-contraction is a type of joint stability and is very important for coordinated movement. Motor planning refers to a person’s ability to organize, plan and then execute new or unpracticed motor tasks. The sensory systems, especially tactile, are of prime importance for motor planning. Bilateral motor coordination is the ability to coordinate both sides of one’s body. Bilateral motor coordination can be achieved when tactile and kinesthetic information is processed (Abraham, 2002).

For most children, sensory integration develops naturally and unremarkably in early play activities. Adapting to new sensations becomes ordinary as play progresses and skills are gained. When children enter a classroom, they are bombarded by sensory stimulation they need to process. There is sensory stimulation all around us. Most of us experience external sensory input every day without thinking about it. We walk into a room that may be cluttered with things on the wall, even things hanging from the ceiling. There may be music playing or announcements over the loud speaker. There may be a buzz from fluorescent lights and the smell of perfume, cleaners or the school lunch in the air. All of this can influence a child’s behavior (Murray-Slutsky & Paris, 2005). The ongoing flow of classroom activities, various teacher styles, curriculum and peer activity provide a complicated mix of information that children must regulate through their central nervous system (Abraham, 2002). Often perceptual problems do not become identified until the demands of second grade. Reading skills, including writing and cutting which require the child to understand right and left sides of the body are usually
attained by the second grade level. (Abraham, 2002). They need to be able to stabilize the paper with one hand while the other hand writes or cuts with skill. Yet we are facing standards that require this in kindergarten.

If development is on track, the ability to process this sensory information is automatic and nearly effortless. If it is not on track, decoding and regulating this information can be challenging and overwhelming. Adaptation may not take place naturally and the child will have a hard time knowing which information is important and which information is irrelevant (Abraham, 2002). These students are inconsistent from day to day in their ability to focus and learn. Three general categories may be used to describe students with sensory processing issues in our classrooms.

The first is those with sensory over-responsivity. These students are very reactive to small amounts of external and internal stimuli. They often experience a sense of overload and find sensory information painful and scary. It often triggers a flight or fight reaction. They may actually avoid interaction with people and things.

A second category is the student with sensory under-responsivity. These students seem unaware of the noise and activity in the room. They may not respond the first time their name is called. They need extra time to process needing increased frequency and intensity of sensory input before they notice and respond. The students seem to lack an inner drive and are slow to initiate tasks.

The third category is the sensory craving child. These students are “space invaders”. They can’t seem to get enough information. Yet the more they get, the more disorganized they can become. Sensory input needs to be provided in a very specific
manner and for a certain parameter of time to help them attain an optimal state for learning. They lack awareness of personal boundaries and often begin things impulsively before directions are complete (Bieler & Miller, 2011).

According to Abraham, signs of sensory integrative dysfunction include:

- Delays in academic achievement
- Delays in speech, language or motor skills
- Difficulties making transitions for one situation to another
- High degree of distractibility
- Impulsivity
- Inability to unwind or calm self
- Over- or under-sensitivity to touch, movement, sights or sounds
- Physical clumsiness
- Poor self-concept or self-esteem
- Social and/or emotional problems
- Unusually high or unusually low activity level (2002, p.6)

Brain - Body Connection

Recent evidence suggests regular physical activity can positively influence academic performance. In recent years, conclusive evidence has indicated that physical activity in school-aged children can not only have a positive impact on health-related areas of need (Centers for Disease Control and Prevention (CDCP), 2010; Howie & Pate, 2012; Pate, Davis, Robinson, Stone, McKenzie, & Young, 2006), but also in the improvement of academic achievement of PK-12 students (CDCP, 2010; Castelli,
Hillman, Buck, & Erwin, 2007; Everhart et al 2012; Howie & Pate; 2012; Jensen, 2008).

Clearly, children need regular activity periods in addition to physical education class and recess so that the brain can function optimally. For their brains to function optimally and to do their best academically, children generally need regular opportunities for activity in addition to physical education class and recess. Movement increases the heart rate and stimulates brain function, which facilitates a child's ability to take in information and learn. Physiologically, when students are inactive for periods longer than twenty minutes, they experience a drop in glucose and oxygen to the brain, resulting in diminished ability to focus, comprehend, and remember (Reilly, Buskist & Gross, 2012).

Incorporating physical activity into the classroom throughout the day also can improve student behavior, an important element in student achievement (Dwyer et al., 2001). They go on to explain that exercise increases the levels of neurotransmitters in certain areas of the brain; higher levels help maintain balance, affecting the ability to focus attention and control impulses. Direct measurement of attention-to-task is intensive and demanding on observers. In a study reviewing research on the impact of short bouts of physical exercise on attention of elementary school students by Matthew Mahar a correlation was found. He concluded that

Attention-to-task is a variable that directly relates to concerns of classroom teachers. The limited available research has demonstrated moderate to good evidence that physical activity during the school day improves attention-to-task in elementary school students. Because of the positive effects of physical activity on attention-to-task, it is recommended that elementary school teachers consider
implementing physical activity sessions throughout the school day in the form of recess and classroom-based physical activities (2011, p 60).

Further studies found that students in kindergarten through fourth grade who are more active during the day, taking ten minute breaks for energizing activities, stay on task in the classroom better than students who are not given that opportunity. Results of their study showed an eight percent improvement in on-task behavior for students overall and a twenty percent improvement for those children who had the most off-task behaviors. To improve learning and curb obesity, schools should incorporate physical movement with academic tasks which should be appropriate for the classroom and the age and abilities of students (Reilly, Buskist & Gross, 2012). Children need play and movement to lay the foundation for developing habits that affect their ability to read, write and think. Children also learn from concrete to abstract. Their bodies provide the most concrete experience available for planning and organizational skills. They must first experience controlling their bodies in space before they can organize pictures and letters on a page (Abraham, 2002).

Montessori believed that the key to obtaining a child’s attention was through interest and movement. Because of this, children in Montessori schools actively engage with a variety of hands-on activities requiring them to concentrate as well as hone their fine motor skills. He believed that perception and action are closely related and interest and concentration are secured through movement (Standing, 1984; Travers, 1985). In short, according to Montessori theory, the hand leads the mind, or the body leads the brain. It would follow then, that each time a child engages in a task and fully focuses their attention on the required motions, the ability to concentrate increases (Stuart, Rule
& Giordano, 2007). In their study, kindergarten students were required to participate in a variety of fine motor tasks for fifteen minutes prior to academic work time. The theory tested here was the impact of required directed attention to a fine motor task carrying over to directed attention on an academic task. A trend was noted in the kindergarten population for increased attention.

In a study conducted in Tartu, Estonia by Oja & Jurimae they looked at the relationship between physical ability, motor activity and school readiness in six year old children. The physical activity of children was reported by parents and teachers using the questionnaire of Harro (a self-reporting questionnaire). The motor ability of children was evaluated using various tests from the Eurofit test battery as well as the three minute endurance shuttle run test. The Eurofit Physical Fitness Test Battery is a set of nine physical fitness tests covering flexibility, speed, endurance and strength. The standardized test battery was devised by the Council of Europe for children of school age and has been used in many European schools since 1988. The Controlled Drawing Observation test was used as a predictor of school readiness and development of mental abilities. This tool has been used in Denmark, Finland and Estonia for assessing a child’s readiness for school. It is a group test that gives information about a child’s functioning in an educational setting. Oja and Jurimae obtained results that indicated that indoor physical activities on weekdays are more closely related to the school readiness scores of six year old boys and girls than outdoor activities on weekdays. Indoor physical activities predicted 19% to 25% of the variance in scores on the Control Drawing Observation for these preschool children (Oja & Jurimae, 2002). These results suggest that motor tests,
which demand children's total attention and concentration, appear to be closely related to school readiness.

Finally, there needs to be made mention of yoga as an established practice. In the book *Yoga Calm for Children: educating heart, mind and body*, a 2007 study conducted by Purdue University and Indiana University concluded that *YogaKids Tools for Schools* had a significant positive effect on the academic achievement, general health, personal attributes and relationships of students (Gillem & Gillem, 2008; retrieved July 12th, 2015 from [www.yogakids.com](http://www.yogakids.com)). As noted earlier, the state of being relaxed and alert is the optimal state for learning. Yoga brings increased awareness to our breathing, linking the mind and the body. The typical pattern of shallow rapid breathing is associated with stress and anxiety. Deeper slower breathing is associated with being calm and relaxed. It also gets more oxygen into our blood stream and helps us feel more alert and focused.

These findings and reports have established that the use of activities to incorporate movement into the school day can keep students' minds and bodies functioning optimally. The 2nd grade class that will be the subject group for this project falls short of the recommended daily minimum minutes of physical activity. Their schedule allows a daily recess break of 35 minutes (minus time needed to dress and undress for the weather in Minnesota) and 50 minutes of physical education two times every six days. That means four out of six days they are not getting the recommended daily amount of physical activity. The CDCP recommends 60 minutes of moderate level physical activity per day for children (CDCP, 2015). The World Health Organization (WHO) also states that children ages five through seventeen need physical activity daily. For children and young people, physical activity includes play, games, sports,
transportation, chores, recreation, physical education, or planned exercise, in the context of family, school, and community activities (WHO, 2015). So how do we address this issue within the confines of school?

The SECRET Approach

In their book *No Longer A Secret*, Doreit Bialer and Lucy Jane Miller have developed this acronym to attempt to address the complexities of the challenging situations children find themselves in, including situations in the classroom. They have identified six factors to consider. They are: A (attention), S (sensation), E (emotional regulation), C (culture/context/current conditions), R (relationship), E (environment) and T (task). Each of these individual areas may contain a challenge for our students on any particular day.

-A- Attention refers to how focused a student is. Are they distracted by something in the environment or even within themselves?

-S- Sensation makes note of what sensory input they are being exposed to at that moment. Is there something that is alarming or irritating to them, or is there something that could be used to help them regulate and focus?

-C- Culture/context/current condition takes into consideration what habits or conditions are established or need to be established to help promote order and focus.

-R- Relationships look at what the mood and emotional tone is that is being projected by the teacher and those who are significant to the student.
-Environment refers to anything that might be distracting in the environment, and considers what could be done to create a more calming atmosphere.

-Task describes what is being expected of the student. It evaluates whether it is a reasonable challenge or is there a need for more support to be successful (Bialer & Miller 2011).

Clearly there are many factors involved, and each influences the other. Many of them are not aspects that I have the ability to control or impact significantly. Therefore this study will focus on sensation. This is the area in which I have the most experience and understanding. This is also the area where there are many resources which can provide specific strategies for change. The remaining factors are those that fall under the realm of the teacher’s reflective and responsive instruction. The goal is to increase teacher awareness of the role that movement and sensation plays in today’s classroom. The next section will highlight a prime factor influencing all of our student’s readiness to learn, our increasingly sedentary society.

Societal Changes/Sedentary Society

There is an environmental factor today that affects our students’ physiological readiness to learn. Compared to past generations, children today are living far more sedentary lives. Our culture is depriving our children of vital sensory motor experiences from the day we bring them home from the hospital to the day they head out to school. As Connell and McCarty state in their book *A Moving Child Is a Learning Child*:

“At home, at school and in the communities our children are being denied vital opportunities to move their bodies, exercise their imaginations, and interact with
other kids. Children can spend an average of eight hours a day in front of a screen. Almost half of all low-income students do not get a recess. Only one in five children lives within walking distance of a park or playground. This directly affects these children’s physical development and, more importantly, their social, emotional and cognitive development.” (p xi, 2014)

Based on a nationally representative sample of schools, it is estimated that only 57% of school districts required regularly scheduled recess for elementary school students. In addition, few schools (4% of elementary schools, 8% of middle schools, and 2% of high schools) in the United States provided daily physical education (Maher, 2011).

There is a new term being used and it is “containerized kids.” Products that have been designed to keep our little ones safe and more portable are actually being seen as harmful if overused. Car seats, strollers, front packs, backpacks, slings, cribs, bassinets, baby carriers, portable baby chairs, pack and plays, bouncy seats, high chairs, exercise saucers, baby jumpers and baby walkers are all products that are intended to contain or even restrain children’s movement. If a family owns two or three of these chances are their child is spending many of their waking hours “confined” (Connell & McCarty, 2012).

Children deserve a right to move and to be given room to move. Babies need to be put down on the ground, in the grass or on a blanket on the floor and be free to move and explore, not always set down in a car seat or bouncy seat or some other device that is easy for the caregiver to carry around and separates the child from their surroundings. Because of this trend to place infants in equipment that holds them in a semi reclined position, “tummy time” is a popular buzz word these days. There are even official
campaigns to encourage it. Parents often limit this time due to schedules, location (not a good place to put them down) or because the baby seems to get fussy or bored when they do. Belly play is a lot of work! It is like us doing a whole lot of push-ups over and over a few times a day but it is crucial for their core (trunk strength) development, reflex integration and more. The work of lifting their head, pushing up on their fists and arms, shifting their weight all begins the development of head control, shoulder stability, supination and pronation of their arms. As their hands open up they receive tactile input from the surface to the palm of their hands and fingertips. This helps prepare for experiencing new sensations and is a precursor to grasp development. Even wrist and finger extension and strengthening begin with tummy time. These are all crucial to a child’s future development of fine motor skills (Losquadro- Liddle & Yorke, 2004).

Combine this trend of passive positioning with the campaign to put your baby “back to sleep” and you have removed most of the opportunity for crucial sensory input and motor development that occurs when baby is on their tummy. This can then set the child up for subtle foundational struggles in the near future. Development of the core/trunk strength is limited, shoulder strength and stretch to the hands and fingers are diminished and key information about gravity, textures and their body in space is restricted.

Other trends continue the decrease in necessary movement experiences. Many children are indoors most of the day more than ever before. Modern playgrounds often have high levels of safety but low levels of challenge. Electronic screens demand (and easily gain) children’s attention with mesmerizing but two dimensional, tactile free effects, and they contribute to a child’s expectation for immediate gratification (Connell
& McCarty, 2014). Children now tend to be driven or accompanied everywhere instead of walking or biking. By the time children are reaching four or five years of age “heavy work” is no longer the cultural norm. Doors open with a push of a button or simply by standing in front of them, Chores are done by machines, activities are organized and directed by adults or coaches, children are driven here and there instead of walking and exploring along the way. Definitely, one of the greatest changes is that opportunities for continued dynamic motor learning experiences are limited with the increased time spent in front of a television, computer or electronic game (Oden 2006; Connell & McCarty, 2014).

When children finally arrive at school they find that a recess “recession” is happening across our country with schools shortening or eliminating recess in favor of more classroom work and test preparation. Even our playgrounds have changed. There is a list of top ten things a playground should have to truly provide a rich and challenging experience for a child. The majority of playgrounds fail. A hill, trees, monkey bars, swings, merry go rounds, planks, beams, tunnels, see saws, slide and modular elements are considered vital (Connell & McCarty, 2012). And finally, more and more focus on school readiness and academic skills at younger and younger ages is placing unrealistic demands on unprepared students. Many schools have sacrificed physical education and recess to allow more time for academic study. While little evidence exists to show that this extra time spent working on academics each day is beneficial to student achievement, an abundance of evidence supports the importance of exercise to children's ability to learn (Reilly Buskist & Gross 2012). Recently, with the intention of raising student achievement, The CDCP (2010) has recommended that all students in grades P-12
participate in high-quality physical education classes every day. Many schools fail to meet this minimum.

**Academic Changes/Increased Demands**

Since the introduction of *No Child Left Behind* legislation in 2001, academic outcomes have become more important than ever. This is always on every administrator’s and teacher’s mind as they strain to meet the ever increasing standards. In order to return physical activity to the schools, a correlation must be proven between activity and academic achievement. In her manual *Ready Bodies Learning Minds*, Athena Oden states: “Our young children are now straining under the academic load intended for a more mature child. The philosophy of ‘if they don’t get it, teach it earlier’ has only been harmful. At the same time, fear of safety, the necessity of working mothers and technological recreation has eliminated the freedom of unrestricted play. How can our children learn to perform difficult academic tasks with bodies that have had little practice? The danger lies in forcing our young developing children to sit up straight in a chair too large for them, with their feet dangling, while they learn a new task” (2006, p1-2). There are so many influences on how children learn. There is great variety in the amount and types of sensory motor experiences that children are exposed to prior to arriving at school. Our educational systems are constantly changing. In order to meet the needs of children they must repeatedly modify the pace, classroom size, curricula, teaching style, physical set up and more (Abraham, 2002).

**Kinetic classrooms: What is being done?**
The issue of increasing student demands while decreasing student movement is becoming well known. In studies cited by Howie and Pate in both 2003 and 2011, a review of physical activity and cognition combined with literature review concluded that there is a significant positive relationship between the two. One study by Best & Miller (2011) found that both acute (short term) and chronic (consistent, long term) exercise may produce improvements in executive functions of children. This executive function is the higher level thinking skills I referred to in the introduction chapter of this capstone. Many teachers and schools are trying to address this but it can be very hit and miss as teachers try to implement little “exercise breaks” on their own. Helping kids get their “wiggles out” can become a constant battle. It is not uncommon to walk past a room and see students sitting on large physio-balls instead of chairs. Teachers have students stand and stretch, push on their desks or the wall and return to their seat. It is typically in response to heightened activity level or student’s struggling to pay attention.

By providing classroom teachers with instructional techniques that target sensory motor skills educators can effectively enhance sensory challenged (as well as non-sensory challenged) learners to take in and regulate sensory information. Through consistent repetition and continuity of experience children can learn to regulate their vestibular, tactile, visual auditory and proprioceptive (kinesthetic) awareness (Abraham, 2002). Incorporating movement into the classroom can be as easy as having students stand up in between subjects and do a few jumping jacks or isometrics. Movement and learning can be simultaneous as well. Students can complete an activity as they perform an academic task--for example, running in place while reciting a poem, counting by twos while touching their toes or doing sit-ups, or quizzes one another on an upcoming test as
they hold a push-up position or clap. To encourage engagement, students can come up with their own movements or activities. Many programs have been developed and organized in a ready to use format for teachers. I will now introduce a few that I have found to be especially useful.

Programs Reviewed

**Ready Bodies, Learning Minds**

This is a program developed by Athena Oden, a physical therapist. She provides background information, theory, and research based activities focusing on developmental skills. Beginning with reflexive patterns of movement and progressing through the various sensory systems, she supplies specific structured activities with step by step instructions, visuals and specific equipment in order to promote consistent practice and development of skills to help students be ready to learn.

**MeMoves**

This resource combines specific music, images and movements that are targeted to fully engage the mind and body. It was created by Roberta Scherf, a mother of a child with special needs. She discovered that there was a way to help children of all ages calm their minds and remove stress that may be hindering their development. The program consists of a DVD compilation of categorized and progressively challenging movements that aim to integrate the brain and body by creating new connections and strengthening ones that already exist. Simple, ready to use, brief videos are easy to implement with consistency.
YogaKids

This program was developed in 1986 by Marsha Wenig. It aims to get kids ready to learn by facilitating movement and kinesthetic learning in order to decrease stress and increase student academic success. Easy to use visual aids, cards and scripted instructions will again provide consistency for daily use and promotion of a clam and organized state.

Brain Gym

Dr Paul Dennison and Gail Dennison coined the term “educational kinesiology”, and founded the educational kinesiology foundation. From that process the book and program entitled Brain Gym was developed. This program was developed in order to use specific movements, especially crossing midline, to support communication between both sides of the brain and promote a more organized state for processing and problem solving tasks. It claims to help prime the brain for reading, writing and spelling activities. They describe it as a self-help program that will complement, support and enhance current educational programs.

Energizing Brain Breaks

This is a compilation of 50 one – two minute activities which are designed to help refocus and energize. Developed by David Sladkey, a high school math teacher from Naperville, Illinois, these various individual, partner and group activities will give plenty of options for directed movement experiences. Photos are provided in a flip-book format with simple directions easy to follow by students or staff.
Summary

While I am not able to change the dynamics of our society nor can I change the ever increasing expectations of the academic system our children are in, I hope to be able to support the children and staff who find themselves in the daily challenge of increased expectation and inconsistent sensory-motor development. In their article, Howie and Pate conclude that the majority of published research shows positive associations between physical activity and academic achievement, but inconsistencies exist in the type, doses and relevant outcomes reported (Howie & Pate, 2012). My training and experience, as well as the literature reviewed, promotes the theory that sensory motor input is fuel for the brain. Telling students to “sit still and pay attention” is actually contradictory for many of the students in our classrooms today. In many cases we have a situation of children missing out on basic movement experiences, being placed in sensory “deprived” situations, and then being asked to perform and learn skills that are beyond their developmental level.

When a student is struggling to sit, or to focus, or to practice a new skill, teachers often resort to use of verbal reasoning or listing possible consequences (often missing recess) in attempt to redirect or motivate the student. From the information I have reviewed it is clear that these methods will not be successful. The problem that has brought me to ask this question is the increasing need for redirection and support during independent work time among students. The potential for improving student focus and achievement is what motivates me to implement this research project. If it is clear that providing consistent sensory motor activities within the daily classroom routine increases student's ability to focus and work independently, a powerful tool has been
uncovered. Teachers will be able to proactively take a few moments directing movement with their students, and hopefully avoid a day long struggle trying to control their movement!

Ideally this doesn’t mean that the teacher has to radically change lesson plans, but rather to begin to teach to the movement needs of the students. We need to change our expectations because “learning never sits still” (Connell & McCarthy, 2014, p7). I have knowledge of many user friendly programs and activities that teachers can choose from to fit their personality, classroom environment, schedule and student needs. I get excited at the prospect of teachers realizing the role that the body plays in the brain's ability to learn. In the next chapter I will explain my plan for intervention to affect a change in this challenging situation.
CHAPTER 3

Methods

In the previous chapters I have described the concerning trend in our society of decreased motor experiences combined with increased academic demands. I have given a simple overview of neuromotor development and sensory integration as a foundation for getting children ready to learn. I have also noted the increasing issue of student struggles with focus and independent work skills. This has led to the development of my question: “how does consistent sensory motor activity impact student attention and independent work skills?” The literature review shows an increasing interest in this topic as well as the need for more research with specific strategies and consistent measures (Mahar, 2011). In this chapter I will introduce the methods I will use in order to answer this question.

Paradigm

In considering my question I chose to use a quantitative research design. In quantitative research the question is presented at the beginning. The objective is to test or verify the theory rather than develop it. The researcher proposes the theory, collects data to test it and reflects on the confirmation or disconfirmation by the results (Creswell, 2009). In planning my research with the classroom teacher we identified the behaviors that we wished to change. Specifically, we decided to focus our research on students struggling to focus, (needing frequent redirection), getting up out of their seats, seeking lots of movement at their desks and not completing their work independently. Frequent
need for redirection, repetition of directions, and difficulty getting work completed is a daily occurrence and interferes with progress on daily learning tasks. These behaviors are measurable and a change in frequency could indicate the effectiveness or ineffectiveness of our interventions. From my training as an occupational therapist and my continued work in the school system I have resources and knowledge to formulate the theory and develop the interventions. The unique opportunity afforded by this teacher looping with this class means that they would be able to hit the ground running in the fall. They would start the year with relationships, classroom expectations and teaching style already established.

Setting

The school is located in a rural/suburban setting just one hour outside of a large Midwestern city. It has a population of roughly 13,500. There are two elementary schools in this city. The school involved in this research serves K through 5th grade with approximately 1,000 students. There are five second grade classes. The socioeconomic makeup of this town is middle and lower middle class. Many students are on free or reduced lunch. The ethnicity is primarily Caucasian with only 2% of the student population being minority. Parent participation is good with a nearly 97% attendance at parent teacher conferences. There are quarterly family and staff events that are also very well attended. This elementary school is staffed with two principals dividing the population into kindergarten through 2nd grade and 3rd through 5th grade. Administration is supportive and actively engaged in building relationships with students stopping into classrooms regularly and taking part in assemblies, celebrations and other positive relationship building opportunities. All staff are encouraged to learn and find new
avenues that would increase student participation and success in their education. I had full support from administration for this research.

**Participants**

The choice of subjects for my study actually came from conversation and consultation with a teacher/colleague. For the past nine years I have worked as an occupational therapist serving two school districts working with students aged 3 through 21. I am part of a variety of teams and consult regularly with regular education and special education staff. For the past eight years one of the first grade teachers I have worked with has been asking for assistance with the issue of students’ ability to attend, to control their bodies, and complete work on their own. This coming school year she will be “looping” with her class, moving to teach second grade. As we spoke in the spring we saw the opportunity to take action and implement a change for this group of students. This teacher has a relationship with these students, is motivated to be part of this action research and willing to consistently follow through with activities and strategies. This group of second graders would be non-random with a convenience sampling as it is a naturally formed group. This particular class has 22 students, eleven female and eleven male.

**Methods**

I have established that this study involved a non-random group, conveniently selected as an entire 2nd grade class. This was a pre-experimental procedure as it involved a single group with an intervention added during the experiment. There was no control group therefore pre and post intervention data will be compared. The data
collection techniques consisted of observation of four variables completed by myself. This enabled the teacher to focus on consistent instruction and implementation of the activities while I observed and took data. As my goal is to determine the impact of consistent sensory motor activity on student attention and independent work skills I was able to establish a baseline of off task behavior and need for staff support prior to implementing the interventions.

**Variables**

**Independent variables**

Consistency was of primary importance. The ages of the subjects are similar. The physical environment remained unchanged for the duration of the study. No rearrangement of the classroom furniture or student groupings occurred. The style of instruction for independent work tasks remained the same in format and length. The number of minutes of directed sensory motor activities was similar each day. We had determined that this would take place daily, as a preparation for their instruction and enrichment time (I & E). There would be zero minutes of directed motor activity during the pre-test data collection and six to ten minutes immediately prior to teacher instruction and independent work time during the study.

After initial observation and trial of the data collection process our plan was revised. We adjusted the schedule to provide the movement activities prior to their math lesson when the greatest demand for attention and remaining seated is required. The original I & E time was actually structured to allow for students to choose their place and position in the classroom, they could sit in a variety of positions, chairs, lie down or prop
up in a corner. Extra sensory input was already available to them to help meet their needs. This was working great for the students so we met to discuss another more challenging time of the day and we adjusted our schedules for the afternoon academic time. The teacher was trained by me in the strategies to be used prior to the start of the study. The strategies were implemented exactly as directed with the scripts and visuals provided. These included: *Ready Bodies Learning Minds* activity sheets, *MeMoves* DVD selections, *Yogakids* cards, *Brain Gym* activity sheets and finally, Hand Prep isometric activities (developed by me). Examples of each may be found in the appendices E-H.

**Dependent variables**

The variables we measured to determine the effect of the independent variables are also the target behaviors we were hoping to reduce. These included:

- Number of times students get out of their seat

- Number of times individual redirection is given

- Number of times teacher repeats directions to the class

- Incidence of student movement/sensory seeking behaviors at their desk

**Threats to validity**

I am aware that a significant factor of the impact of our interventions may be the number of minutes of physical activity the students will experience prior to their afternoon I & E time. Currently the second graders at this school get recess for 35 minutes per day which follows lunch and involves any changing into and out of outer clothing that is needed. Physical education lasts for 50 minutes and is on a rotation cycle
of two days out of every six. Record was made of recess whether it was indoor or outdoor each day to see if there were any corresponding variation in off task behaviors. Note was also made of which special they attended prior to arriving at math. The specials change on a six day rotation and include physical education, art, music, media (library) and technology.

We began the fall with three weeks of no intervention, allowing students and the teacher to settle in and establish a rhythm and rapport. During this time a description of the project and a letter of consent was sent home for parent signature and permission. Samples of these may be found in appendices A and B. All 22 forms were returned promptly allowing for full participation and maximum data collection. It was during the last couple days of this waiting period as I tested the data form and target activities I discovered that this I & E time was not ideal for the purpose of this study. During portions of this work time the teacher already had provided opportunities for students to seek out other positions and places to work which they preferred. These findings did, however, actually support my original theory that students need certain sensory motor input for optimal focus and learning. It also suggests that students will seek out that input instinctively. This will be discussed in the results section of this capstone. Baseline data for two weeks was taken recording the four indicators listed above and noting attendance, specials and opportunities for outdoor recess. Next, the teacher introduced and began implementing the daily activities for six to ten minutes immediately preceding their math time. I was present in the room for observation and data collection of the directed sensory motor activities as well as the four indicators during the first 20 minutes of math on a daily basis.
Instruments used

Prior to initiating my study I met with my capstone committee for review of my plan, obtained a letter of permission from my school’s K-2 principal, completed the Human Research Subject Protocol (exempt short form) and sent home the consent forms for parent permission receiving all 22 back prior to the baseline start date. The tools used for intervention strategies have already been listed. Data collection took place using a tally sheet developed by the teacher and myself. I observed the implementation of the sensory motor activities for participation and duration and then began tallying the target behaviors for the first 20 minutes of instruction and work time. I recorded each incidence of the four target behaviors as well as the special attended, recess and attendance. Scores were totaled at the end of the day. The sample data collection chart may be viewed in the appendix C of this capstone.

Summary

In this chapter I have laid out the format for my research, the intended participants, variables to be tracked, and methods of implementation and data collection. In the next chapter I will present the results and note any possible issues with validity and their impact on interpretation of the data.
CHAPTER 4

Results

In this chapter I will report the data obtained from two weeks of baseline observations and two weeks of specific motor activity intervention. It was within this four week time frame that I sought to answer my research question and determine the effect of directed sensory motor activity on attention and independent work skills of second graders. For review I want to define the setting and interventions used. All observations took place within a regular education 2nd grade classroom. The class of 22 students is made up of eleven females and eleven males. The classroom teacher instructed all academics and led all motor activities using consistent verbal cues, visual demonstration and DVD recordings. On one baseline day the teacher was absent and a substitute teacher was present. On that day no interventions were led and no data was taken resulting in nine days of baseline data over two weeks instead of ten. For collection of the intervention data a total of nine days over two weeks were also used due to a teacher workshop day with no students in attendance. Throughout the study there was no rearrangement of the desks and only one switch of seating assignment due to attention issues (moving one student away from the classroom door). Also consistent was the classroom lighting as the teacher’s choice is to leave half of the fluorescent lights on and half off. (There have been findings that fluorescent lights emit a buzz and that some find the flickering light patterns irritating and fatiguing.)

Daily observation of behaviors and collection of data began immediately following the movement activities and continued for 20 minutes each day. Academic activities during this time included teacher led instruction in math, small group reading
instruction and independent read to self/write to self and word work. Word work involves a variety of fine motor tools and manipulatives to practice their target words for that week (alphabet beads, letter tiles, putty writing). With the exception of the small group reading, all academic tasks were individual and were to take place in quiet. The fact that this teacher looped with her students this year also provided the benefit of familiarity. The students already knew the routine, her expectations, and the activities as they incorporated new information. When she gave an instruction they knew exactly what they were to do.

Behaviors tallied for data purposes during both baseline and intervention phases included the following: 1. Number of times students got out of their seats; 2. Number of times individual redirection was needed; 3. Number of times directions were repeated; 4. Incidents of student movement/physical activity (also referred to as sensory seeking behaviors) at desk. Note was also made of scheduled physical activity for each day. Opportunity for outside recess and specials (art, music, media, technology and physical education) was tracked.

In the planning stage of this research we had hoped to report the percentage of work completed. However, at this early transition of a new school year, this teacher chose to structure her tasks to ensure student success and build confidence. She only gave independent tasks that she knew could be completed. It was noted that some students completed work beyond the minimum required. For example, when they were expected to write at least three sentences during “write to self”, all students completed that easily within the time frame, yet many continued to write and produced far beyond the three sentence minimum. Also, when some had completed their minimum number or
word work repetitions, they continued with more until the time was up. This shows they had sufficient focus, interest and knowledge to continue with the task.

The specific structured movement activities were provided and chosen with the teacher and occupational therapist together. The goal was to include a combination of whole body movement, including counting with rhythm, heavy work, balance, midline crossing and gentle, calming patterns. All students took part in two to three different movement activities immediately prior to the instruction and work time. Activities used included “cross crawl” from Brain Gym, “popcorn and superman” from Ready Bodies Learning Minds, “stork” from Yoga for Kids, “chair lift and desk press” from my own Hand Prep program and video led routines from the “focus” and “calm” portions of MeMoves. The classroom teacher was trained in the activities during the last baseline week and had everything ready for the first day of intervention. Directions, cues and duration were consistent to promote reliability of results. The students had been prepped and followed the directions each day for 100% compliance. Visual supports and samples of these may be found in the appendices E-H.

Baseline and intervention data

Record of the incidence of specific behavior may be found in the appendices I and J for both baseline and intervention data. Please note that the description of “movement/sensory seeking behaviors” included rocking, bouncing or swinging legs, tapping feet, sitting on feet or knees, leaning arms/head on desk, standing up, chewing on pencils/fingers/hair and fidgeting with pencils or rulers.
Looking at specific behaviors during the baseline week, the greatest frequency was seen in the number of times students got out of their seats. A dramatic decrease took place from an average 12.67 incidents dropping down to 2.64 incidents during the 20 minute time period immediately following interventions. This particular behavior is a real problem for teachers as they report students making up excuses to get up and move around, dropping pencils, repeatedly sharpening pencils, going to throw something away, going to choose a different pencil from the bin or get a drink (they are all allowed and encouraged to have water bottles at their desks). This particular behavior of getting out of their seat leads to the need for redirection and interrupts their focus on their work. It was also not uncommon for students to stop and distract their peers along the way as they returned to their desks.

Consideration was given to the opportunities for movement that had naturally occurred during their day. On all but one day during the baseline and intervention period they had been outside for recess prior to their work time. This provided at least 20 minutes of physical activity and sensory input to fuel their bodies and brains for classroom tasks. On the one day they had indoor recess they partook in table games and various activities in their classroom. That same day they did have physical education for their special and were given a little extra “work out” (running laps around the gym) by their teacher to make up for the more sedentary recess time. Some differences were noted in classroom movements/sensory seeking behaviors tallied on days where the special was technology (computer lab) or music with the count at 26, 11 and 35 behaviors observed. On days where the special was physical education, media (library), or art the number behaviors were somewhat lower where the count was at 10, 9, 11, 5, 19 and 14
behaviors observed. It should be noted that all three of the days with high counts of movement behaviors also happened to be the first day of the week returning from a weekend break.

According to the data it appears that providing short amounts of directed sensory motor activities prior to classroom instruction and independent work had an impact on student attention and independent work skills. Summarizing the data on the four target behaviors shows a dramatic 82% decrease (going from 12.67 to 2.34 times per 20 minute observation) in number of times that students got out of their seats. There was another significant 45% decrease in the incidence of student movement/sensory seeking behaviors (going from 28.1 to 15.56 behaviors per 20 minute observation) at their desks. There was a 15% decrease in the need for individual redirection as well as a 17% decrease in the need for repetition of the task specific direction to the class. Overall, target behaviors decreased in frequency on the days directed sensory motor activities were implemented.

While data was recorded with student anonymity it was clear to me as I observed that there was a great variety of behaviors among the class of 22 students. Some students were movers and shakers from the get go and gave me many tallies over the four weeks while others were very “quiet” in terms of sensory behaviors and seemed solid, organized and ready to learn from the start. This leads me to another potential research question addressing the benefit of directed movement on students without overt sensory seeking behaviors. The intended outcome would be to determine if these movement activities promoted specific academic gains.
Summary

In this chapter I shared the results of the data taken and the change in behaviors displayed by this particular group of second grade students. I have explained my methods and the reason behind the data collected. I have taken this process of action research and applied it to a group of second grade students to attempt to answer the question, “what is the effect of directed sensory motor activity on attention and independent work skills?” I will now conclude my capstone by discussing the findings, limitations, implications for future research and final thoughts in the next summary chapter.
Chapter 5

Conclusion

Throughout this capstone process I have built upon the premise that children develop from the inside out. They are driven to learn about the concrete, physical world and the boundaries and capabilities of their own body before they can sit that body down, focus on higher level thinking and take part in academic learning as we have constructed it in our society. A visual representation of this developmental progression may be found in appendix D. A multitude of rich sensory experiences must occur to lay the foundation that is needed and movement is at the forefront of all childhood development. Automaticity (movement without having to think about it) creates efficiencies in the brain and frees up processing power for more complex thinking, reasoning, imagining, inventing and learning (Connell & McCarthy, 2014). Developing that automaticity requires extensive repetition and opportunity for refinement and practice. If a child is still learning about their body, their boundaries, their own true “point of reference”, they will not be free to focus on academic instruction or higher level thinking. If a child doesn’t have a strong foundation of fundamental skills they will struggle to transmit information needed by the brain in academic endeavors (Oden, 2006). Unfortunately, our society has changed over the years, limiting these necessary experiences and removing opportunities for input, exploration and refinement. We are seeing the impact of this in the children that show up at our classroom doors each year. Young students are struggling to sit in their seats, to regulate their bodies, to hold a pencil with control and to initiate and complete multiple step tasks.
At the same time this sensory motor “deficit” is occurring, administrative decisions have been made that have increased the academic expectations placed on children. Teachers must require more and more of their students at earlier ages than ever before. Free play, recess, physical education, and time to explore various manipulatives are drastically reduced and sometimes removed. Time spent sitting at desks doing worksheets is increasing. Combine these trends referred to by Connell and McCarty as “academic creep and recess recession” (2014, p.14), and we find ourselves frustrated on all sides. This combination has led to a very challenging situation in classrooms across our country.

Many teachers are bravely trying to forge ahead with instruction while others are looking for ways to meet the children’s developmental needs with very little time or resources. There is suddenly an abundance of videos, resources and workshops on meeting students need for movement, but the research and the specifics of what is the best practice for the best result is vague. Teachers may actually be increasing a child’s distraction and disorganization with some of the suggestions and ideas they come across. For instance, I pass some classrooms where every chair has been replaced with a large ball. While this may be helpful for some students, for a portion of the day, it is not a good fit for all, and hardly ever is it a good idea for an entire day. Another common occurrence is teachers pulling out an activity hoping to help students get their “wiggles” out only to find them more disorganized and distracted when they are done. With my training as an occupational therapist, I have knowledge and resources that I believe can be helpful in addressing this issue when used consistently throughout the day. This is the reason behind my research and I believe the data shows that we are on the right track.
Findings

Looking at the data the greatest change occurred in relation to actual physical movement by the students. The number of times students got out of their seats as well as the number of movement/sensory seeking behaviors occurring at their desks showed significant change from the baseline weeks to the intervention weeks. When the directed movement activities were completed immediately prior to academic instruction and independent work time there was an 82% decrease in the number of times students got out of their seats and a 45% decrease in the number of movement/sensory seeking behaviors while still seated at their desks. To me, this significant change implies that their bodies were more regulated and able to remain balanced and seated allowing their brains to focus on the academic task. They did not need to stand, wiggle, press, twist, fidget or get up and move in order to supply that “food” for the brain. It was well fed, more organized and ready to learn.

The smaller decrease noted in the incidence of individual redirection and whole class repeated direction was significant as well. While there was a decrease, it was much less, 15% and 17% respectively. It is important to note that the initial tallies were small to start with. Individual redirection was needed an average of 2.1 times per 20 minute observation and repetition of directions to the whole class occurred an average of 1.2 times per 20 minute observation during the baseline weeks. There wasn’t a lot to reduce! The fact that any reduction was seen could be attributed to a couple things. My initial interpretation is that the relatively small number of times that any redirection or repetition of directions was given is probably due to the fact that this class had looped with this teacher. They already knew her routine, her behavioral expectations, even her methods.
of giving instructions, cues and structuring academic tasks. The second factor I believe played a role was the implementation of the motor activities. Due to the decrease in physical, sensory seeking behaviors, I propose that their ability to attend to the initial direction, initiate and complete academic tasks increased needing less redirection or instruction.

The impact of outdoor recess was not conclusive as they had opportunity to be outside and move as much as they desired all nine days of the baseline weeks as well as eight days of the intervention weeks. The fact that some of the highest rates of behaviors occurred on the first day back to school after the weekend suggests that either they were too sedentary at home (a likely occurrence with the trend for significant amounts of screen time for today’s children), or they have spent a few days moving and getting needed sensory input and the classroom demands to “sit still and pay attention” are a bit too much to handle the first day back. Again, a possible opportunity for more research related to activity levels on weekends and the impact on learning the first day back at school.

Implications

For me this action research process was a lot of fun. As I formulated my question I grew excited to be able to address a need that is relevant to my current job and the day to day issues of the staff I work with. The mechanics of the literature review were very tedious for me and probably where I struggled the most. I am not the least bit savvy with technology and the use of electronic resources. Give me a real book, journal or article any day! However, when I did manage to successfully search, locate references, articles
and resources related to this issue I found that the theory is strong and yet the specific data is spotty. It was clear that the greatest need right now is specific research on which kinds of activities and movement have the greatest impact on student learning. How often do they need to be done? For how long? At what time of the day? I would envision this research design involving a control group which received no sensory motor intervention activities and the variables including specific academic measures in addition to behavioral observations. This data could really get the attention of administrators and curriculum directors! Ultimately what matters in the educational system is developing successful learners. If we could find a link between certain physical activities and the decrease of inattention along with promotion of certain academic skills everyone would benefit.

Future opportunities for research based on this study could be varied. Younger learners would theoretically require even greater amounts of activity, movement and sensory experiences as part of building their foundation for beginning academic tasks. Older learners would also benefit from sensory motor activities to help refocus, and facilitate connections of old and new learning with left brain - right brain activities such as the Brain Gym exercises or reduction of stress with Yoga for Kids or MeMoves.

My personal experience from years as an occupational therapist in the school setting, combined with this research, has lead me to certain conclusions. Whole body movement, crossing midline, steady pace and rhythm and a calm quiet environment work well together to produce a more organized, “sensory-fed” foundation to support attention and independent work skills. The impact seems to be quick acting with activities done just prior to instruction. The duration does not need to be long and I would suggest that
brief spurts of directed movement and “heavy work” can be interspersed easily within extended desk work tasks to avoid the need for redirection or student sought input such as getting up to get a drink or a pencil or throw something away.

Looking forward

As I completed my observations and reviewed my data I came up with some specific suggestions for this teacher and her second grade classroom. I asked her for her feedback and she shared with me which activities she felt were more challenging or difficult for the students and which ones she felt truly seemed to calm and settle them so they were ready to work. It was affirming to have her report that all the activities were very easy to plan and to use. This is vital for teachers with their impossibly busy schedule and curriculum requirements. We will be setting up a plan to try for the most challenging parts of their day and try not only the brief activities at transition times but choose specific 30 to 60 second strategies that she can have ready to use depending on their energy level and sensory behaviors. Our belief in supporting a student’s need to move has been reinforced by this action research and the results. In my opinion, the results of this study showed a positive effect of directed sensory motor activities on the attention and independent work skills of this second grade class.
Dear Parent or Guardian,

Hello, my name is Janene Johnson. I am an Occupational Therapist and I have been employed in the XXXX School district for the past 9 years working with Mrs. B. for 8 of those years. I am currently pursuing my Masters Degree in Education through Hamline University and part of this program involves conducting research. The purpose of this letter is to get your permission for your child to participate in my project. The focus of my research is to determine the effect of structured sensory motor activity on student’s ability to focus and complete independent work tasks.

Your child’s part in this study would consist of participation in approximately 6 minutes of movement activities prior to the start of their instruction and work time. These would be led by Mrs. B and conducted with the entire group together in the classroom. The activities are non-strenuous, designed for children, and developed specifically to promote a calm and focused state to enhance learning. All of the activities are commonly used by teachers across the country, but we are attempting to structure their use consistently prior to independent work time. Participation in this study is voluntary. While all children will be part of the class movement activities, permission will be needed from a parent or guardian for me to collect data. The data taken will include number of students in attendance, observation by me with tallies of number of times students get out of their seats, the number of times that the teacher needs to redirect students, the number of times the teacher has to repeat the direction and the percentage of work students complete in the allotted time. No names will be used, the students will remain anonymous. Permission to include your child’s data can be withdrawn at any time.

Baseline data will be taken for two weeks starting approximately three weeks into school. The activities will be added for the next two weeks. Students will be observed for the first 20 minutes of their instruction and work time with data being taken by tally marks representing the entire class, not individual students. Current research shows no adverse or detrimental effect of students engaging in movement activities during the school day, but rather the majority of the studies show a positive impact on attention and learning. I have received approval for my study from the Graduate School of Education at Hamline University, and from Mr.O, school principal. The results of my study will be included in my completed capstone which will be catalogued at Hamline University’s Bush Library Digital Commons, a searchable electronic repository and may be published or used in other ways.

If you have questions please contact me. If not, please complete the attached permission form and return to school with your student by September 15th.

Thank you!
Janene Johnson OTR/L
XXX-XXX-XXXX  janene.johnson@xxxxxxxx.x.x.x.x

Appendix A
Sample Parent Letter
Appendix B

Sample Permission to Participate in Research Study Form

I have received and read the letter about the research study that is to be conducted this fall in my child’s classroom by Janene Johnson, occupational therapist, as part of her graduate program through Hamline University. I understand that this will take place in the first 2 months of school this fall of 2015. This research is intended to determine the effects of teacher led sensory motor activities on student attention and independent work skills. I understand that the class will be observed by Janene Johnson with group data recorded for the number of times students require redirection, get out of their seats and need the instructions repeated. The percentage of work completed independently will also be recorded.

I understand that my child’s identity will remain anonymous and I may withdraw my permission to have data collected on my child at any time.

I understand that this study will be printed, bound and shelved in the Bush Memorial Library at Hamline University as well as catalogued at Hamline University’s Bush Library Digital Commons, a searchable electronic repository and may be published or used in other ways. This work could be published, cited or used in other scholarly endeavors.

By signing this form I give permission for my child to participate in this study and for data to be collected regarding their participation.

Parent/Guardian signature

_________________________________________  Date ________________
## Data Sheet

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<th>Minutes of directed movement activities completed</th>
<th>Individual redirection given</th>
<th>Student out of seat</th>
<th>Directions repeated</th>
<th>Movement/ Sensory seeking behaviors</th>
<th>Attendance #/22 students # M/#F</th>
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Appendix D

Sensory Integration as the Foundation
For Learning and Classroom Performance

- ability to concentrate
- ability to organize
- academic learning
- abstract thoughts and reason
- specialization of sides of the brain and body
- creativity
- problem solving

- speech & language
- eye hand coordination
- visual perception
- purposeful activity

- motor planning
- activity level
- attention span
- bilateral coordination
- emotional stability
- kinesthesia

- eye movements
- balance
- muscle tone
- eating
- posture
- body scheme
- gravitational security
- bonding
- balance between protective and discriminative sensory systems

THE SENSES

-AUDITORY
-PROPRIORECEPTIVE
(muscles and joints)
-VISUAL
-TASTE

-VESTIBULAR
(movement and gravity)
-TACTILE
-OLFACTORY

Adapted from V. Scardina 1978, A Jean Ayres 1979
Hand Prep

1. wall push
   hands shoulder width and height on wall. PUSH!
   Count of 4, two times

2. desk press
   stand with hands down on desk, shoulder width apart,
   press down with body weight for count of 8

3. chair lift
   seated in chair grasp under sides of seat and pull up for count of 8

4. hand press/pull
   press palms together at midline count of 4,
   pull apart with cupped fingers count of 4

5. “gloves on”
   press FIRMLY down both sides of each finger, through the palm,
   down to the wrist, as if smoothing on an imaginary glove

created by Janene Johnson, OTR/L

# 3,4 &5 may be helpful to repeat midway through desk work
Stork

With patience and practice, you will stand as steady and strong as this graceful bird.

YOGAKIDS
Appendix G

CROSS CRAWL
In this contralateral exercise, similar to walking in place, the student alternately moves one arm and its opposite leg, and the other arm and its opposite leg. Because Cross Crawl accesses both brain hemispheres simultaneously, this is the ideal warm-up for all skills which require crossing the body's lateral midline.

TEACHING TIPS
• Water and Brain Buttons help prepare the body and brain to respond to Cross Crawl.
• To activate the kinesthetic sense, alternately touch each hand to the opposite knee.

VARIATIONS
• Cross Crawl as you sit, moving opposite arm and leg together.
• Reach with opposite arm and leg in varied directions.
• Reach behind the body to touch the opposite foot. (See Switching On for more variations.)
• Do a slow-motion Cross Crawl, reaching opposite arm and leg to their full extension (Cross Crawl for focus).
• Skip (or bounce lightly) between each Cross Crawl. (Skip-Across is especially helpful for centering; it also alleviates visual stress.)
• To improve balance, Cross Crawl with your eyes closed, or pretend to swim while Cross Crawling.
• Use color-coded stickers or ribbons on opposite hands and feet for children who may need this cue.
• Do Cross Crawl to a variety of music and rhythms.

ACTIVATES THE BRAIN FOR
• crossing the visual/auditory/kinesthetic/tactile midline
• left-to-right eye movements
• improved binocular (both eyes together) vision

ACADEMIC SKILLS
• spelling
• writing
• listening
• reading and comprehension

BEHAVIORAL/POSTURAL CORRELATES
• improved left/right coordination
• enhanced breathing and stamina
• greater coordination and spatial awareness
• enhanced hearing and vision

RELATED MOVEMENTS
Lazy 8s, p. 5
Brain Buttons, p. 25
The Thinking Cap, p. 30

HISTORY OF THE MOVEMENT
As the body grows, interweaving of the opposite sides through movement naturally occurs during such activities as crawling, walking, and running. Over the last century, crawling has been used in neurological re-patterning to maximize learning potential. Experts theorize that contralateral movements worked by activating the speech and language centers of the brain. However, Dr. Denure discovered that Cross Crawl activity is effective because it stimulates the receptive as well as expressive hemispheres of the brain, facilitating integrated learning. This preference for whole-brain movement over one-side-at-a-time processing can be established through Denurion Laterality Repatterning (see Edu-K for Kids).
Appendix H

Ready Bodies Learning Minds activity pages

**SUPERMAN**

1. Starting Position

2. Superman!

*Task*
- The child will:
  - Lying on his stomach, have the child make his chin off of the floor, bring his extended arms overhead close to his ears, and lift his straightened legs off the floor.
  - His body should be bent, only touching the floor at the shoulders. Arms and legs should be fully extended. Thighs should not be touching the floor.
  - Ask the child to hold this position for 20 seconds. Repeat 3 times.

**Performance Objectives**
- Inhibition of Labyrinthine Reflexes.
- Motor planning.
- Postural control.

**Further Suggestions**
- Please see Ready Bodies, Learning Minds Book, Chapter Two.
- Use an auditory stimulus such as clapping, to initiate the movement from supine to prone. (and the reverse movement) as an automatic response.
- The child should maintain this position in a calm, relaxed manner without struggling.

**POPCORN**

1. Starting Position

2. Eyes close to knees

3. Pop Out!

*Task*
- The child will:
  - With the child lying flat on his back, ask him to bring his knees to his chest, wrapping his arms around his legs.
  - He should then lift his head, trying to keep his arms close to his knees.
  - Ask the child to hold this position for 20 seconds. Repeat 3 times.

**Performance Objectives**
- Inhibition of Labyrinthine Reflexes.
- Motor planning and postural control.

**Further Suggestions**
- Please see Ready Bodies, Learning Minds Book, Chapter Two.
- Use auditory stimuli such as clapping, to initiate the movement from supine to prone (and the reverse movement) as an automatic response.
- The child should maintain this position in a calm, relaxed manner without struggling.
Appendix I

Baseline Data

<table>
<thead>
<tr>
<th>Activity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minutes of directed movement activities</td>
<td>0 minutes/day</td>
</tr>
<tr>
<td>completed:</td>
<td></td>
</tr>
<tr>
<td>Minutes of data collection</td>
<td>20/day</td>
</tr>
<tr>
<td>Number of students present out of 22</td>
<td>22 on 7 days</td>
</tr>
<tr>
<td></td>
<td>21 on 2 days</td>
</tr>
<tr>
<td>Opportunity for AM outside recess</td>
<td>9/9 days</td>
</tr>
<tr>
<td>Behaviors tallied:</td>
<td></td>
</tr>
<tr>
<td>Students out of seat (average)</td>
<td>12.67/day</td>
</tr>
<tr>
<td>Individual redirection given (average)</td>
<td>2.1/day</td>
</tr>
<tr>
<td>Directions repeated (average)</td>
<td>1.2/day</td>
</tr>
<tr>
<td>Student movement at desk* (average)</td>
<td>28.1/day</td>
</tr>
</tbody>
</table>

*movement/sensory seeking behaviors include rocking, bouncing or swinging legs, tapping feet, sitting on feet or knees, leaning arms/head on desk, standing up, chewing on pencils/fingers/hair, fidgeting with pencils or rulers.
Appendix J

Intervention Data

Minutes of directed movement activities completed (average) 6.56/day

Minutes of data collection 20/day

Number of students present out of 22
- 22 on 4 days
- 21 on 4 days
- 19 on 1 day

Opportunity for AM outside recess 8/9 days

Behaviors tallied:

Students out of seat (average) 2.34/day

Individual redirection given (average) 1.78/day

Directions repeated (average) 1/day

Student movement at desk* (average) 15.56/day

*movements/sensory seeking behaviors include rocking, bouncing or swinging legs, tapping feet, sitting on feet or knees, leaning arms/head on desk, standing up, chewing on pencils/fingers/hair, fidgeting with pencils or rulers.


