INTEGRATING MOVEMENT INTO THE CURRICULUM FOR THE PURPOSE OF INCREASED LEARNING AND BRAIN FUNCTIONING

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PROJECT

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INTEGRATING MOVEMENT INTO THE CURRICULUM FOR THE PURPOSE OF INCREASED LEARNING AND BRAIN FUNCTIONING

A Project

by

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Abstract

of

INTEGRATING MOVEMENT INTO THE CURRICULUM FOR THE PURPOSE OF INCREASED LEARNING AND BRAIN FUNCTIONING

by

Cassandra Jean Singh

This project was created with a goal of addressing the lack of brain-enhancing movement in everyday lessons of a grade one classroom. Beyond pre-school and kindergarten, we expect children to hold still for extensive periods of time. Recent research done on the brain suggests the important connection between movement, learning and the intricate functions of the human brain. There is a scientifically proven need to integrate more movement into school days however, educators continue to require their students to hold still and think.

My research focused on presenting the basics of neuroscience followed by the support for the effects of movement on the body and mind. Information for the review chapter was obtained from books, journal articles and a collective knowledge base gained by means of elective coursework. An interdisciplinary perspective was gained by enrolling in courses outside of the department of education such as biology, psychology and child development. The lessons developed for the supplement were
written with a current language arts curriculum as a guide. They cover various topics in the language arts such as reading, writing and phonics.

While the concentration of this project is the positive effects of movement on learning, the ultimate goal would be to influence educators to consider the biology and psychology of learning when they plan and implement their lessons.

_______________________, Committee Chair
Julita Lambating, Ph. D.

_______________________
Date
DEDICATION

To my wonderful grandfather who is no longer with us…

Wayne Munsen Hunt
(1927-2001)

It saddens me that he was not here to see me graduate high school, get married, graduate college with a bachelors’ degree and now a masters. To the world he was a stern, hardworking man with a voice that boomed. To me he was the kindest, sweetest man; a tub of love I adored and called my ‘Poppie.’ I will always work hard in hopes of making him proud.

And to my grandmother who survives him…

Jean Ellen Hunt

Your interest, enthusiasm and constant support for my graduate level work keeps me going and believing I can do more. Thank you Go-go, I love you.

Lastly, to my little friend…

Josie the Pekingese

Who has brought me such comfort, joy and companionship through hours of researching, typing and editing.
ACKNOWLEDGMENTS

Family: Without them who knows where I would have ended up

To my husband who always believes I can achieve my goals. Since I met you I’ve attempted and completed more than I ever imagined I would. You are my unfaltering support system; constantly striving to provide me with everything I need.

To my parents who’ve always wanted more for me. A college degree was your dream for me and without your support I would not have made it this far.

Dad, you instilled in me that something isn’t worth doing half way. Because of you I give one hundred percent to my academic undertakings. Your ingenuity and ability to take on projects that most people could not figure out drive me to try harder too. I credit you to making me a more capable adult.

Mom, you pushed me non-stop throughout my education. In elementary school you helped me love reading, drilled me on math facts and nurtured my creativity. In middle school you put up with a moody teen and picked me up early from the dreaded gym class. In high school you read the required books in order to help me understand the stories better and edited every paper. I am a successful writer and student because of your dedication.

To my amazing ‘all A’s’ little sister, you set the bar higher and higher every day. I am continuously proud of you. I hope that my “kinesthetic-brain-stuff” inspires you to one day pursue a masters. If I can do it, you can do it - twice!
Educators: Nurturing the minds of tomorrow; inspiring the next generation of educators

I was influenced by numerous teachers during my time in school. It is because of their selfless commitment and love for learning that myself and others choose education as our passion.

Ruthann Burnell, Fourth Grade Teacher
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Hamilton High School, Chandler, AZ

Andonia Cakouros, Professor of Theatre
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Chapter 1

INTRODUCTION

Change is the law of life. And those who look only to the past or present are certain to miss the future - John F. Kennedy

The profession of education is no stranger to new theories and concepts. Wrighton (1996) notes “the educational field seems to allow more pendulum swings than any other profession” (p. 2). Over the past century, certain topics in education have been debated back and forth and new ideas are considered every day. Some are proven and implemented while others are sneered at and chased off the educational stage. History shows that scientific findings have influenced many changes that affect the way we live our lives. As doctors and scientists discovered the delicate nature of the human body; seat belts were put in cars, helmets were enforced and citizens were warned about the effects of drugs and alcohol.

Innovative educators are beginning to recognize the scientific research that will affect the way which children are approached and taught in our schools. Sylwester (2003) is one such professional who believes that the brain sciences, although in their early stages, “will change our professional lives” (p. 3). “Experts recognize that we have learned more about the brain in the last decade than in all the time preceding” (Lombardi, 2008, p. 219). Recent advances in imaging technology, such as fMRI scans, PET scans and EEGs, have provided researchers with a more expansive understanding of the brains’ structures and its’ functions (Organisation for Economic Co-Operation and Development
Today’s teachers approach their students with different teaching strategies and new instructional methods with the hopes of serving a variety of learners. The next great stride to serve students of all types is for teachers to consider and implement brain-efficient curriculum and practices within the classroom. It is important to realize that the phrase ‘brain-efficient curriculum and practices’ does not refer to newly discovered miracle methods that will change students the moment they are implemented. Therefore, it is not the curriculum that needs to be changed; the knowledge and the thought process behind the curriculum are what require an adjustment. The ultimate goal of this project is simple. Professionals in education need to have a greater awareness of the strengths and weaknesses of the brain and then use that knowledge to better serve students. In the past, students were given information in one way and expected to retain and master it. One would hope that the next generation of educators will begin to consider how the brain learns as well as how childrens’ brain-body connection affects their ability to process, retain and master new material.

**Purpose of the Project**

The purpose of this project was to address the lack of brain-enhancing movement in everyday lessons of a first grade classroom. Beyond pre-school and kindergarten, children are expected to hold still for extensive periods of time. Whether they are in their desks or on the sitting on the carpet, their little bodies are required to be sedentary. The child who moves their legs, fidgets or holds their body in a position not conforming to the expected norm is considered off-task and is usually corrected and reprimanded.
In a time where budget cuts and high stakes test scores reign supreme, activities such as dance, theatre and physical education are being cut. About 68% of American high school students do not participate in a daily physical education program and children at the primary level are expected to remain sedentary in their desks for longer periods as recess minutes are being cut back (Jensen, 2005, p. 63). An overwhelming amount of research now tells us that there is a strong relationship between learning, movement and emotions. Despite the facts, educators continue to require their students to hold still and think. Research has proven that exercise can actually grow better brains (Jensen, 2005, p. 63). Jensen (2005) sums this up well in saying that this, “suggests both a huge opportunity and the liability suffered by students who don’t get enough exercise” (p. 63). Recent research done on the brain suggests the important connection between movement, learning and the intricate functions of the human brain. There is a scientifically proven need to integrate more movement into school days.

**Significance of the Project**

Considering the way a child learns when shaping education has been practiced for centuries (Tokuhama-Espinosa, 2010, p. 11). It has only been in the past four to five decades that the brain became the focus of consideration. Early on, most of the information and theories on the brain were the result of studying cadavers or animals in laboratories. In the 1960s, studies on brain cell growth of rats brought about a scientifically confirmed need for enriched environments. This brought more attention to improving the learning environments of infants and the education of young children (Tokuhama-Espinosa, 2010, p. 9). During the years of 1990 to 1999, the ‘brain-based
learning’ movement saw a great deal of publishing and advances in medical technologies provided more research for those in the field to reapply to their theories (Tokuhama-Espinosa, 2010, p. 13). We now live in a time where learning can be observed while it happens within the brain.

The recently improved version of brain-based learning, which is the result of the intersection of psychology, neuroscience and education is called Mind, Brain and Education (MBE) science (Tokuhama-Espinosa, 2010, p. 9). MBE science is unique from other fields in that it considers learning but its focus lies in the scientifically substantiated art of teaching (Tokuhama-Espinosa, 2010, p. 11). The practices of current educators as well as upcoming teacher candidates can benefit significantly from understanding how the brain functions.

**Delimitations of the Project**

This project is written and intended for use specifically in grade one classrooms that utilize the *SRA Imagine It!* language arts curriculum. However, teachers can easily adjust certain aspects of the supplement in order to make use of it at other grade levels or in classrooms that use language arts curriculums other than SRA. I will be writing the supplement with the first three units as a guide and general outline. The curriculum itself consists of 15 units so the project will not necessarily connect directly to stories and activities of the later units. Educators can make the necessary adjustment in order to make use of it later in the curriculum.


**Definition of Terms**


*Cognitive Psychology* - Cognitive psychology is the branch of psychology that studies mental processes including how people think, perceive, remember and learn.

*Critical Period* – Concept referring to certain periods when the brain’s capacity for adjustment in response to experience is substantially greater than during other periods (OECD, 2002, p. 252).

*Decoding* – The translation of written words into verbal speech for oral reading or mental speech for silent reading (Cecil, 2007, p. 378).

*Electroencephalography (EEG)* – records the spontaneous natural rhythms of the brain by placing highly sensitive electrodes on the scalp and is highly sensitive to the timing of event related potentials (Goswami, 2004, p. 177).

*Functional Magnetic Resonance Imaging (fMRI)* – creates a functional image of the brain by measuring changes in the magnetic resonance signal generated by the protons of water molecules in neural cells (Goswami, 2004, p. 177).

*High-Frequency Words* – Words common in reading material that are often difficult to learn because they cannot be easily decoded (Cecil, 2007, p. 379).
**Limbic System** – The “emotional brain” it borders the thalamus and hypothalamus and is made up of many of the deep structures of the brain (OECD, 2002, p. 110).

**Memory** - the store of things learned and retained from an organism's activity or experience as evidenced by modification of structure or behavior or by recall and recognition.

**Movement** - the act or process of moving; especially: change of place or position or posture.

**Neurogenesis** – the birth a new cells in the brain, including neurons (OECD, 2002, p. 111).

**Neuron** – basic building block of the nervous system; specialized cell for the integration and transmission of information (OECD, 2002, p. 111).

**Neuropsychology** - a science concerned with the integration of psychological observations on behavior and the mind with neurological observations on the brain and nervous system.

**Positron Emission Tomography (PET) scanner** – An instrument that traces the metabolism of radioactively tagged sugar in brain tissue producing a color image of cell activity (Sousa, 2007, p. 210).

**Plasticity** – The phenomenon of how the brain changes and learns (OECD, 2002, p. 112).

**Sensitive Period** – Important periods in childhood development related to the acquisition of certain abilities (Tokuhama-Espinosa, 2010, p. 149).
Sight Words – Words that are recognized by the reader immediately, without having to resort to decoding (Cecil, 2007, p. 383).

Organization of the Project

The following project is a movement-based language arts curriculum supplement to be used in the first grade SRA Imagine It! classrooms. Chapter 1 demonstrates the purpose of the project, lays out some limitations as well as presents useful definitions. Chapter 2 highlights the importance of the subject by examining current research and literature. Chapter 3 discusses the conceptualization of the project and presents the authors’ methods of writing brain and movement-based lessons/activities while considering the SRA Imagine It! level one curriculum. Chapter 4 presents and analyzes its intended uses. Following Chapter 4 are the Appendices, which contain the lessons of the curriculum supplement. The final section contains references that were significant in the creation of this project.
Chapter 2
REVIEW OF LITERATURE

This review will focus on presenting information that will substantiate the need for more movement within the classroom setting. First, an overview of neuroscience will describe how the brain is studied, the structures it consists of and what scientists know about how it grows, changes and adapts. Next, the discussion of movement will be aimed at understanding how movement affects the brain on a biological level as well as how it contributes to learning and memory.

Neuroscience

The key to understanding future practices in education can be found where fields such as psychology, physiology, and neurology intersect. Frith (2005) claims that knowledge of the brain will have a substantial impact on education over the next ten years and that neuroscience can help us better understand the process of learning and teaching.

The Road to Understanding

A variety of techniques have been used to study the brain throughout the years. Wolfe (2001) points out that the oldest, most primitive method has been used since the time of Da Vinci. Autopsy studies on cadavers are still considered a viable method of observation. However, the fact that this type of observation is done on people who had died means that the specimen may not have always been a good example beyond the anatomy of its’ physical structure. Ormrod (2008) mentions that many researchers have sought to understand the brain of humans by examining and experimenting on the brains
of other mammals such as primates and rats. Scientists are able to do things with animals that for ethical reasons could never be done on humans. Whether or not evidence derived from animal studies is a viable representation of the human brain is often a hot topic of debate. Some neuroscientists find insight into the processes of the brain by studying persons who exhibit disorders of the brain, such as epilepsy or Alzheimer’s disease, or by studying individuals who had sustained damage by means of a disease or an injury. All of these methods, although of use, have a common flaw in that they do not represent a broad, healthy human population (OECD, 2002, pp. 47-48). There are other methods which have been developed and found to be of use but I chose to highlight those that I considered significant.

Recent leaps in technology have ushered in a new era of understanding. Non-invasive brain-imagining tools allow researchers to observe healthy brains in action. The images produced by x-rays and computerized axial tomography (CAT) scans are useful but unfortunately, they “do not address the issue of function” which is important when trying to uncover the process of learning (Wolfe, 2001, p. 5). The latest, more advanced imaging techniques “can be divided into two general categories, those that provide high-resolution spatial information and those that provide high-resolution temporal information about brain activity” (OECD, 2002, p. 46). These are important distinctions.

Tools that result in high-resolution spatial information are positron emission tomography (PET) scans and functional magnetic resonance imaging (fMRI). These types of scans help us understand the localization of functions within the brain but lack the ability to inform us about the second to second timing of these events. Both are also
difficult to use on children as PET scans require the injection of radioactive tracers and the fMRI “depends on inserting participants into a large cylindrical magnet” that is very noisy and tends to make people claustrophobic (Goswami, 2004, p. 177). High-resolution temporal information is acquired by the event related potentials collected by electroencephalography (EEG). This means that intricate electrical patterns of neurons can be tracked with minute detail. An EEG is better adapted to use with children since it is not sensitive to movement and only requires electrodes to be placed on the scalp. Children are often made to watch videos while wearing a cap that contains the electrodes (Goswami, 2004, p. 177). The use of EEG has brought research of education-related issues to a new level of comprehension. While the technical advances of brain imaging continue to progress, its applications expand as well. Many neurological dysfunctions, such as attention deficit hyperactivity disorder, autism and obsessive compulsive disorder, are the subjects of current research that will, without a doubt, hold important educational implications.

**Brain 101: Structure and Functioning**

To fully understand concepts surrounding any topic it is necessary start by learning the basics. The brain is a complex and exciting organ that scientists have yet to fully understand. I will highlight the basics of what we do know.

**The Smallest Level: Neurons, Synapses, Neurotransmitters and Glial Cells.**

Most of us are taught in grade school that the body is composed of cells. We were told that each and every part of our being is made up of teeny, tiny cells which are invisible to the naked eye. The brain is no exception to that rule. The cells that the brain is partially
composed of, neurons, are extraordinary in that they are different from all other cells in the body. Neurons are able to communicate with one another by means of electrical and chemical signals (Wolfe, 2001, p. 15). The structure of neurons can vary but they all maintain a few similar features. First, all neurons have a cell body, or soma, which holds the cell’s nucleus. Neurons also have numerous dendrites whose job is to receive messages from other neurons. These branchlike structures protrude from the soma like spokes on the wheel of a bicycle or legs from the body of an octopus. The other important structure that all neurons possess is the axon. It looks like a giant arm reaching out from the cell body and its purpose is to pass on information to other neurons. The end of the axon splits off like fingers of the arm and at the end of each ‘finger’ is a terminal button. The terminal buttons are the shipping docks of the cell. When they receive their orders it is their duty to dispatch the correct shipment (Ormrod, 2008, p. 13).

Messages are sent from neuron to neuron across the gaps between the terminal buttons and dendrites, known as a synapse (Ormrod, 2008, p. 14). The electrical signal that is sent within a neuron is called an action potential. Amazingly, an action potential is capable of traveling up to 220 miles per hour (Wolfe, 2001, p. 52). When the signal gets to the end of the axon, it triggers the release of specific chemicals. These chemicals, known as neurotransmitters, are produced and stored in vesicles within the cell. When they are needed, the vesicles release their neurotransmitters into the synapse. The chemicals cross the gap and find their way to receptors cites on the dendrite of next neuron. The information they carry is converted back into an electrical signal and the process begins again in the next neuron (Wolfe, 2001, p. 55).
Every form of brain activity is dependent on signals being transmitted across extensive paths of neurons. Activities such as speech, movement, perception and thought would be nonexistent without the specialty and proficiency of neurons (Groome, 2008, p. 13). While neurons are the stars of the cognitive showcase, it must be mentioned that their performance is supported by the various glial cells that outnumber them ten to one. In the opening act, glial cells aid brain development by acting as scaffolding for neurons to use during their migration to their intended site. Other glial cells act as the custodial staff of the brain by removing the remains of dead cells. There are glial cells whose purpose is to act as neural bodyguards maintaining “an appropriate chemical environment around the neurons” (Wolfe, 2001, p. 18). Another type of glial cell forms an insulating layer around the axon of neurons. This layer, known as the myelin sheath, allows for action potentials to fire with speed and precision (Sylwester, 1995, p. 29).

Without the support of glial cells, neurons would not be able to perform successfully. Sylwester (1995) perfectly sums up the importance of the basic building blocks of the brain. “From their penthouse location in our body, our brain’s tens of billions of neurons and hundreds of billions of glial support cells organize themselves at the cellular and systems levels to efficiently process the information we need to survive and to thrive” (p. 25).

**Basic Structures: Parts and Lobes.** Descriptions of the structures of the brain can get fairly wordy, complex and downright boring. Medina (2008) does a fabulous job at dodging this lackluster bullet. He discusses the structures of the brain as they developed evolutionarily and he states that we do not have one brain, we actually have
three. “We started with a ‘lizard brain’ to keep us breathing, then added a brain like a cat’s, and then topped those with the thin layer of Jell-O know as the cortex – the third, and powerful, ‘human’ brain (p. 47). I will stay in line with his method of explanation.

The hindbrain or brainstem. The “most ancient neural structure,” the hindbrain was the first to evolve and it is the first to develop in utero. It carries the nickname reptilian or lizard brain because it performs the same functions in humans as it does in reptiles; namely breathing, heart rate, body temperature, digestion and sleep. Whether the body is awake or asleep, this portion of the brain never rests (Medina, 2008, p. 40). The brainstem is composed of the pons, medulla and the cerebellum. It is the cerebellum which regulates balance, posture and directs involved motor movements such as walking, typing or riding a bicycle (Ormrod, 2008, p. 16). During the first years of life, the cerebellum grows very quickly and by the age of two, it has nearly reached its’ adult size. The learning of skilled movement is first controlled by executive systems of the brain; similar to a general giving orders to his army. Orders go through the officer, or cerebellum, down to the troops, or muscles. Once the orders have been practiced enough, they no longer require the supervision of the general and the officer takes over. In brain terms this means that executive systems no longer have to oversee a movement and are free to learn and think about other things entirely. The cerebellum plays an important role as it allows other systems to continue advancing the capabilities of the brain (Wolfe, 2001, pp. 23-25).

The limbic area. Often known as the old mammalian brain, the four components of the limbic system play roles in emotion, memories and the processing of sensory
information. The thalamus acts as a sensory switchboard that tells our brain what is happening around our bodies (Sylwester, 1995, p. 45). It receives all incoming sensory stimuli, with the exception of smell, and sends them to other areas of the brain to be processed (Sousa, 2007, p. 8). The hypothalamus keeps an eye on the internal systems of the body and signals the release of various hormones in order to maintain the body’s balanced state (Sousa, 2007, p. 9). It is because of the hypothalamus that the body sweats, shivers or feels hungry or thirsty.

However, the most important function of the hypothalamus is its’ control over the ‘fight-or-flight’ response. When the body’s senses detect stress or danger, the hypothalamus triggers the release of adrenaline. The experience of increased adrenaline in the body is not easily ignored. A racing pulse, increased respiration, perspiration and a rush of energy can only lend one idea. Your brain is saying, ‘get us out of here.’ Thus, this tiny structure has ensured the survival through evolution of humans as well as many other species (Medina, 2008, p. 174). According to Wolfe (2001) the amygdala is essentially the psychological sentinel of the brain because of the role it has in the control of emotion (p. 27). Anger, pleasure and fear are all a part of the amygdala’s emotional repertoire. “The amygdala is responsible for both the creation of emotions and the memories they generate” (Medina, 2008, p. 40). Finally, we will examine the librarian of the brain, the hippocampus. The job of the hippocampus is to sort and file information from the working memory into long-term memory (Sylwester, 1995, p. 45). It is also able to ‘create meaning’ by comparing information from working memory to previously stored occurrences. Consequently, any damage to this area, such as that sustained in
people with Alzheimer’s disease, results in the loss of memories and the inability to recall (Sousa, 2007, p. 9).

**The forebrain or cerebral cortex.** The most recent evolutionary addition to the brain is the cerebral cortex, or simply cortex. It is a gray, wrinkled, substance that is about a quarter inch thick. The wrinkles are created as the cortex increases in size. Since the skull only allows the brain to get so big, the cortex begins folding in on itself to accommodate its growth. The cortex is divided into two hemispheres that mostly mirror each other and scientists have been able to divide the cortex into four main sections based on their functions (ormrod, 2008, p. 17).

At the back of the cortex is the occipital lobe, which is also commonly called the visual cortex. After a visual stimulus is relayed through the thalamus, it is sent to the primary visual perception area of the occipital lobe for processing. Scientists have found cells within the occipital lobe that are sensitive to certain stimuli, such as color, motion and various shaped lines (Wolfe, 2001, p. 32). The temporal lobes, which are located above the ears on either side of the brain, process auditory stimuli. This area has sections that neurons that register the pitch, loudness and timbre of sound (Wolfe, 2001, p. 34). In most people, within the left temporal lobe are two, connected groupings of nerves which have been found to be vital to the production of language. The part known as Wernicke’s area converts thoughts into language and Broca’s Area takes those thoughts and produces the sounds needed for vocalization (Jensen, 2005, pp. 160-162).

Located at the top, back portion of the brain, the parietal lobes play a role in “paying attention, processing word sounds, and thinking about the spatial characteristics
of objects and events” (Ormrod, 2008, p. 18). This part of the brain is also credited with collecting and interpreting sensory information such as pressure texture and pain (Ormrod, 2008, p. 18). Moving forward from the parietal lobes, the next function oriented section is known as the somatosensory cortex. This ‘headband like’ section receives and processes touch signals from different parts of the body. Each part of the somatosensory cortex is reserved for the processing of certain body parts and the more sensitive the part is, the more area is necessary for processing (Wolfe, 2001, p. 36). As one might imagine, the fingertips and lips take up a good deal of space. Another key component of the brain is the motor cortex, which is located just in front of the somatosensory cortex. This part of the cortex is responsible for the governing of muscle movements and, similarly to the somatosensory cortex, each part of the motor cortex is delineated to a specific body part or muscle group (Wolfe, 2001, p. 40).

The final, and some might say, most significant section of the cortex are the frontal lobes. They extend from the motor cortex all the way forward behind the forehead and eyes. The prefrontal cortex is the part of our brain that sets us apart from other creatures. Symbolic thinking, decision making, problem solving, reflecting, planning, as well as the ability to regulate emotions are all possible due to our highly evolved frontal lobes. These processes and abilities are known as executive functions and our capacity to execute them is what makes us uniquely human. Medina (2010) points out that a child’s executive functions are actually a “better predictor of academic success than IQ” (p. 106). Mischel & Ayduk (2004) found that children who could delay gratification longer actually obtained much higher SAT scores than their peers who could not control their
impulses at a young age. By the time of adolescence and young adulthood some brain structures, particularly the frontal lobes, continue to mature and increase in size (Ormrod, 2008, p. 22).

The discovery of Broca’s area in 1861 and Wernicke’s area in 1874 were two of the first clear demonstrations “that brain functions can be anatomically localized” (Bear, Connors, & Paradiso, 2007, p. 620). These very intriguing connections soon gave rise to a broad theory. The idea that specific sections of the brain are responsible for processing different types of information, “one function, one location” was deemed localized functioning (Doidge, 2007, p. 16). However, it is important to note that other studies, like those performed by Karl Lashley, revealed that the destruction of specified areas did not completely impair the brain’s perceived abilities according to localized functioning (Groome, 2008, p. 1). This gives way to the idea of distributed functions. The fact that Broca’s Area, Wernicke’s area and the motor cortex are all utilized during speech suggest that many areas within the brain can be responsible for a single action (Wolfe, 2001, p. 40). Scientific findings of both localized and distributed functioning illustrate the point that the brain can be a very difficult thing to decipher, as it cannot always be placed into a generalized constraint. Medina’s (2008) third brain rule is “Every brain is wired differently” (p. 49). The next section will explore how the brain grows, changes and learns as well as how memory is added into the equation.

**How the Brain Learns**

When naturally occurring change and growth happen within the brain it is always at a cellular, microscopic level (Jensen, 2005, p. 18). When one considers that the brain
has about 100 billion neurons, one trillion glial support cells and 1,000 trillion synaptic connections, the changes which take place during learning is truly a remarkable feat (Diamond & Hopson, 1998, p. 37).

**Under Construction: Connections, Pathways and Growth.** Synaptogenesis and myelination are two of the processes dominant during post-natal brain development. Synaptogenesis can be simply explained as the growth of neural fibers, or dendrites, which connect to other neurons forming new synapses (Goswami, 2008, p. 382). Jensen (2005) mentions that a connection does not imply that the cells touch but that they are in such close proximity that a synaptic gap is formed and therefore able to be used with ease (p. 18). A synapse is typically about a millionth of an inch wide (Sousa, 2007, p. 11). Due to the massive amounts of these types of connections forming, between birth and adulthood the volume of the brain actually increases fourfold (Goswami, 2004, p. 176).

Adding to the increased volume of the maturing brain is the process by which myelin coats a neural axon, called myelination (Ormrod, 2008, p. 22). As mentioned earlier, it is the glial support cells that create the fatty myelin sheath around the axons of young neurons. Axons within the brainstem and major nerves are already myelinated before birth to ensure an infant can survive outside the womb. Areas that govern complex motor skills such as the midbrain and cerebellum are next to mature and finish by the time the child is about two years old; hence the toddler’s increased coordination and ability to walk. The neurons of the forebrain and hippocampus are the last brain structures to receive a myelin sheath. This process usually requires about ten years to complete which explains why children are not naturally able to call upon higher
functioning skills that adults depend on like memory, organization and high level thinking (Diamond & Hopson, 1998, pp. 49-50). Not only does the increase of myelin create a much larger brain, it also “enhances the brain’s capacity to respond to the world quickly and efficiently” by insulating axons and permitting electrical impulses to move faster (Ormrod, 2008, p. 22). Malnutrition, notably a lack of proteins and fatty acids, during early childhood can result in a slower rate of myelination (Byrnes, 2001, p. 39).

In her book, Diamond and Hopson (1999) liken neurons to “magic trees of the mind” and thus often refers to extensive neural networks as forests (p. 45). These dense ‘forests’ of the mind consist of a near infinite amount of neural pathways which form and strengthen to accommodate newly acquired knowledge and the retention of that knowledge. Every time a human learns something new that is worth being retained, new pathways are created or existing pathways are adjusted and strengthened (Sousa, 2007, p. 12). Sylwester (1995) explains synaptic strengthening as the growth of spines on the receiving dendrites. An increased surface area creates a greater amount of receptors and thus speeds up the processing across the given pathway (p. 90). Goswami (2004) notes that “the density of connections peaks at around 150% of adult levels between four and 12 months, and the connections are then extensively pruned” (p. 176).

The opposite of synaptic strengthening is the process by which synapses are disposed of. When particular connections are not used, and therefore weaken, the result is synaptic pruning (OECD, 2002, p. 259). Experiences are what decide the fate of a synapse. Many theorize that we start life with an overabundance of connections to be prepared for whatever our environments may demand of us (Ormrod, 2008, p. 22). A
surplus of neurons and connections might also be a way for development to continue forward when setbacks arise. Malnutrition in infancy and early childhood greatly impedes the maturation of neurons (Byrnes, 2001, p. 39). The nature/nurture aspects of neural connections will be further explored later in this section.

Ormrod (2008) refers to synaptic pruning as “Mother Nature’s way of making our brains more efficient” (p. 22). The process of over connecting and extreme pruning happens twice in a lifetime; once during the age of two or three and again during adolescence (Medina, 2008, p. 59). This truth sheds light on why we learn so easily as children but as an adult it takes more time and effort to learn and remember things. Synaptic pruning is necessary in the highly competitive world of the brain (Jensen, 2005, p. 18). It is fair to say that space is at a premium.

During infancy and childhood, energy is used at an extremely high rate. To fully comprehend the energy use of a child’s brain, it is necessary to understand the energy used within the resting brain of an adult.

Wolfe (2001) wrote:

The metabolic rates of a child’s brain begin increasing after birth, become equal to that of an adult at the age of two and continue to double the energy use of an adult’s brain by the age of three. By about ten years of age, a child’s brain begins to decrease its energy use and reaches adult levels at the age of eighteen.

(Diamond & Hopson, 1998, p. 54)

**Nature versus Nurture.** The question of whether biology or the environment is responsible for developmental factors is often a dominant debate of child development.
During the 16th century, Jean-Jacques Rousseau wrote the first book on child development in which he proposed that the ‘organization of the brain’ was affected by our experience, and that we need to ‘exercise’ our senses and mental abilities the way we exercise our muscles (Doidge, 2007, pp. 313-314). Brain development has been shown to be determined by both biological and environmental influences.

Experience-expectant synaptic connections are created with the expectation that our brains will be presented with certain stimulation. Skills such as visual perception and language seem to be pre-wired in the brain by evolution (Ormrod, 2008, p. 25). During sensitive periods, it is imperative that sensory stimuli and certain social/emotional and cognitive experiences occur (OECD, 2002, p. 260). The critical period for language development begins in infancy and closes somewhere between late childhood to early adolescence. After this time, the processing of a new language actually occurs in a different part of the brain. Doidge mentions how the realization of critical periods saves a child born with cataracts from a lifetime of blindness. “They were now sent for corrective surgery as infants, during their critical period, so their brains could get the light required to form crucial connections” (Doidge, 2007, pp. 52-53).

As human beings, we are unique for our ability to internalize the emotions and actions of those around us. Scientists deem this possible because of specialized brain cells known as mirror neurons. These neurons have been found to fire when we feel something or complete a physical action, as well as when we see someone else experience the same thing. These special neurons make complex social capabilities possible; such as understanding others and predicting their behaviors (Sousa, 2007, p. 12). Researchers
attribute the ability of an infant to mimic facial expressions of others to mirror neurons that are pre-wired in the human brain (Ormrod, 2008, p. 27). Neural structures which control visual capabilities have also been pre-formed, but will become more specialized as an infant experiences the world around them.

Experience-dependent connections are what make every brain unique. These connections are formed due to environmental factors experienced by the individual. Healy (2010) sums this concept up nicely with the statement “Genes create the outline of brain structure but environment fills it in” (p. 125). Even identical twins that are raised in the same family and home will have very dissimilar experience-dependent connections within their brains. Consequently, anything associated with education will form an experience-dependent connection (Goswami, 2008, p. 383). This lays out the groundwork for the postulation of an ominous truth: a child’s mind is infinitely capable to learn and expand but it needs to be nurtured and enriched to do so. Although Ormrod (2008) is correct in stating “eventually, the rapid proliferation of synapses comes to a halt” (p. 21) it has also now been widely acknowledged that the adult brain remains as flexible as the brain of a child (Medina, 2008, p. 271).

**Plasticity.** One of my favorite conversations is trying to persuade my 83-year-old grandmother that she can learn anything she sets her mind to. Although she is convinced that she is too old to learn new things the truth is that she can and she does it all the time. She even managed to become computer savvy. Printing, e-mailing and internet searches are just a few examples of her technological expertise. It is possible because of plasticity.
Doidge (2007) defines plastic as “changeable, malleable and modifiable” (p. xix). “At one point, neuroscientists thought that only infant brains were plastic” (OECD, 2002, p. 67). For decades, medical and science professionals maintained that the structure of the brain was permanent and the only change it went through was a slow decline after childhood. It was thought that a damaged brain could never fully recover and someone born with mental drawbacks would not be able to overcome them (Doidge, 2007, p. xvii). We now know better. Neural plasticity is the brain’s ability to constantly adapt to new conditions (Frith, 2005, p. 290).

Although the degree of capability varies, plasticity occurs throughout human cognitive processes such as language, vision and memory as well as across the age span and cultures. In a 2009 study, Kozulin found that the “cognitive modifiability of adult immigrants is as strong as that of school-age children” (p. 127). Practicing activities controlled by our visual, motor or sensory systems will produce an increase of connections in the area of the brain associated with the activity. People who learn and practice activities such as playing a musical instrument or reading Braille will show an increase in the somatosensory region of the brain, which controls the fingers (Willis, 2007, p. 310). Draganski et al. (2004) reported that people who learned how to juggle increased the grey matter within their occipital lobes (p. 311).

It has been well documented that the young brain can learn and acquire a new language with very little difficulty. “There are times in human brain development when life skills and academic skills are more easily learned than at other times” (Tokuhama-Espinosa, 2010, p. 45). Many charter schools are beginning to recognize the significance
of language exposure before adolescence and consequently are adding the study of a second language to their elementary curriculum. However, researchers are now leaning away from the term ‘critical periods’ when it comes to learning skill sets.

While an adult may need to commit more effort to learning a new language, the breakthrough and recognition of plasticity means that it is not an impossible endeavor. In a study of children, young adults and mature adults by Dobel et al., (2010) researchers concluded that even adults could learn a new vocabulary with minimal effort, further demonstrating the flexibility of the mature brain (p. 1259). Professionals within the field of mind, brain and education science now refer to “windows of opportunity when skills can be more easily learned” as sensitive periods in human brain development (Tokuhama-Espinosa, 2010, p. 46).

The idea that the brain can change and adapt beyond the first few years of life has significant educational implications. As a result, there is a recent wave in research focused on plasticity and certain cognitive disabilities. Psychologists seek to ‘re-wire’ faulty connections with behavioral therapies; ABA or applied behavior analysis is one such example that is used for children with autism spectrum disorders (Healy, 2010, p. 127). Imagine a child with a reading disability, ADHD or even autism not having so many hurdles impeding their education because of the simple understanding that their brains could change. The possibility is exciting for parents and educators alike. Doidge (2007) asserts that the concept of plasticity is the most important change in brain science since the discovery of the neuron (p. xx).
Movement

“In order for a man to succeed in life, God provided him with two means: education and physical activity. Not separately, one for the soul and the other for the body, but for the two together. With these two means, men can attain perfection.” -Plato

Jensen (2000) reminds us that the human body has not been sitting in chairs for the last 400,000 years. It has been walking, sleeping, leaning, running, doing or squatting (p. 35). Requiring children to stay deskbound as they learn is like tying someone’s feet together and expecting them to run. Sylwester (2007) argues that “school environments should be designed to enhance the development of student brains – and student brains are about movement, not motionless stagnation” (¶ 18). This section will examine how movement can affect the body and the brain. Next, the process of memory formation will be discussed as well as how movement can improve learning and memory.

The Body and Brain

Exercise and Water. “The body influences the brain and the brain controls the body” (Tokuhama-Espinosa, 2010, p. 113). There is a back and forth relationship between our brains and bodies. Spirduso, Poon, and Chodzko-Zajko (2007) suggest that exercise indirectly influences cognition by affecting other body functions such as sleep, appetite, energy physical and mental health (p. 5). A study by Potter and Keeling (2005) found that a short amount of moderate exercise produced an improved memory performance (p. 123). Tomporowski and Ellis (1986) mention that most learning theorists hold the belief that physical activity can influence processes of attention (p. 338). Exercise has been found to create short-term increases in cerebral blood flow. This
increase in blood flow would bring more essential nutrients to the brain such as oxygen and glucose. Exercise also causes an increase in certain cognition enhancing neurotransmitters like norepinephrine, serotonin, and endorphins (Etnier et al., 1997, p. 250).

The antidepressant-like results induced by the serotonin released during physical activity have long been acknowledged (van Praag, 2009, p. 287). Recent research points to brain-derived neurotrophic factor, or BDNF, as “the most important factor up regulated by physical activity.” This unassuming protein plays a central role in the plasticity of synapses as well as the birth, growth and survival of new brain cells (van Praag, 2009, p. 288). The enhancing effects on learning and memory caused by exercise are due to the role played by BDNF in hippocampal growth (Erickson et al. 2011, p. 3018). As mentioned previously, the hippocampus has a key role in the storage and retrieval of memories. For this reason, Ratey (2008) dubbed BDNF as “Miracle-Gro for the brain” (p.40).

It is fair to point out that the chemicals within the brain are just as important as the substances we put in our bodies; be it food, drinks or medications. The assumption that allowing children to drink water during class will improve their cognition has not been scientifically proven but the basis of the claim is logical. The mass of the human body is made of 60-70% water (Thornton, 2010, p. 16) while the brain boasts a water composition of about 78% (Tokuhama-Espinosa, 2010, p. 40). Tokuhama-Espinosa (2008) describes water as “brain food” (p. 277). One might imagine the effects of dehydration on the brain could be detrimental.
Thornton (2010) explains the reaction of the body to thirst satisfied by ingesting water:

…the ingested water would produce an increase in blood volume which…would induce water movement back into the intracellular compartment down a concentration gradient. The decreased levels of ADH would [also] permit the blood vessels to relax…

Thus, drinking water is a simple way to bring the body back to a natural, balanced state (Tokuhama-Espinosa, 2010, p. 40).

**Neurogenesis.** It was once thought that the amount of brain cells in the human brain only decreased with age. Adults would warn children with sayings such as ‘you’ll kill your brain cells.’ This was often a valid argument against doing things like watching too much television or experimenting with certain substances. A vision of oneself with no brain, staring at a wall, drooling is often conjured by this warning and was often enough to convince most children to avoid making the scenario a reality. Make no mistake; I am not encouraging recreational drug use or excessive television viewing but the warning that comes with this argument is no longer well-founded.

In a 1999 study, van Praag, Kempermann, and Gage reported that physical activity increased neurogenesis within the hippocampus of adult mice (p. 266). Neurogenesis is defined as the dividing and specializing of neuronal stem cells to create new neurons or glial cells (Doidge, 2007, p. 250). “After a month on the [running] wheel, the mice had doubled the number of new neurons in the hippocampus” (Doidge, 2007, p. 250). Their research suggests that exercise contributes to growth within an important
learning and memory structure of the brain. These findings greatly support the need for more physical activity within schools.

**Learning and Memory**

**Brain Breaks.** Effective teaching should begin with understanding that the brain requires breaks during learning. Medina (2008) urges that new information should be taught in 10 minute chunks with brief breaks in between (p. 89). These breaks can help refocus attention, energize learners and reaffirm an emotional interest in the topic (Jensen, 2005, p. 66) A study by Henning, Jacques, Kissel, and Sullivan (1997) found that frequent, short breaks from work actually increased productivity and well-being (p. 86). The type of break that proved most effective included some stretching or physical activity (p. 89).

Breaks from learning are vital to proper processing of newly learned information. According to Jensen (2000) after instruction occurs, “we need time for memory formation and for ‘settling’” because “the human brain cannot learn an unlimited amount of explicit content” (p. 34). The paradox of trying to fill a glass of with a jug of water comes to mind: the glass will only hold so much and then it will overflow (p. 34). Pushing through content in order to cover a greater amount of information will result in hippocampal overload. As mentioned earlier, the hippocampus is the librarian of the brain; appointed with the job of sorting and filing away information from the working memory into long-term memory. If the hippocampus is inundated with too much information at one time no new learning will occur. Imagine ten people throwing glass vases at one person and expecting him to catch all of them. Not only is it impossible, but
unfortunately a majority of the vases will fall to the floor and shatter. Why would we teach this way?

**Makes Learning Experiential/Solidifies Memory.** Movement can be thought of as an essential part of human existence. From the time of conception, we begin fidgeting in utero. By six months a mother is often alerted by the kicks of her fetus and once born an infant depends on movement to experiment with and learn about the world. Certain movement-based procedural memories that we learn as children become imbedded in us for life (Lombroso & Ogren, 2008, p. 1229). Once learned, walking, tying a shoe or riding a bicycle are actions that very few people have to work consciously on to successfully execute.

Movement is a natural, easily accessible teaching tool that all teachers can utilize. Cook, Mitchell, and Goldin-Meadow (2008) found that requiring children to connect gestures to new concepts actually improved the retention and recall of the new knowledge. The students in a gesture-based group remembered significantly more of what they learned then those in the speech only group (p. 1054). The authors suggest that gesturing can give learners an “embodied way of representing new ideas” (p. 1047). In fact, James and Gauthier (2006) reported that “letter perception automatically activates motor regions, and writing […] automatically activates letter-specific ‘perceptual’ regions” (p. 2947). The Gibsonian view of perception suggests objects afford their uses and our brains access further connections (Groome, 2008, p. 42). The evidence provided helps link the connection between learning, movement and the way our brains perceive the world.
Hannaford (1996) mentions that the body’s senses feed the brain environmental information that it uses to form its understanding of the world (p. 68). “It is optimal to teach important material through multiple learning pathways, such as through several senses (hearing, seeing, touching)…” (Willis, 2007, p. 311). Medina (2008) states that “information is remembered best when it is elaborate, meaningful and contextual (p. 114).

Adding visual representations to learning is a definite way to ensure students will recall what they have learned. Medina (2008) maintains, “vision trumps all other senses”… “If information is presented orally, people remember about ten percent, tested 72 hours after exposure. That figure goes up to 65 percent if you add a picture” (p. 221). The human brain learns more efficiently when information is presented visually rather than just in written or spoken words. In order to improve reading fluency, Peebles (2007) has her students practice the otherwise tedious task of repeated reading by doing a rhythm walk. Students follow sentence strips around the room that they read as they step (p. 579). Children transfer the natural rhythm of walking to their reading. This type of active learning is what Minton (2008) says helps children understand, remember and remain interested in what they are learning (p. 1).

As discussed previously, different sections of the brain are responsible for processing different types of information. The occipital lobe processes visual stimuli, the temporal lobes process auditory stimuli and the somatosensory cortex receives sensory stimuli (Wolfe, 2001, pp. 32-36). The motor cortex in the frontal lobe is responsible for the governing of muscle movements (p. 40). The more regions of the brain that store data
about a subject, the more overlap there will be. Thus, the more ways that the material to be learned in the classroom is introduced and reviewed, the more neural connections will be created in the brain (Willis, 2007, p. 311).

Many teachers acknowledge the various learning styles within a group of students and therefore present a lesson in different ways. Lancaster and Rikard (2002) point out that “research supports the premise that classrooms need a variety of teaching styles in order to reach every child” (p. 28). Adding movement to a lesson is an easy way to make learning visual and memorable while simultaneously benefiting a learners’ brain at a cellular level. For an organ that accounts for only three pounds of our body weight, the human brain is a complicated, yet simplistic mass of neurons. Ongoing research and experiments continue to unlock the inner workings and functions of the brain.

Considering the brain, as accomplished by the lessons within this project, could very well be key to the way we approach learning in the future. Rather than using varied instruction as a prescription for reaching individual students, teachers with an understanding of the functioning of the brain would vary instruction for the advantage of the entire group.
Chapter 3

METHODOLOGY

Discussion of My Background

In order to understand the conceptualization of this project, it is important to start this chapter with the basics of who I am, where I have been, what I have done and what my goals are. From the time I was 16, working at my first job it was with children in an educational/care setting. My jobs between then and now ranged from summer camp counselor, preschool teacher, tutoring, gymnastics and dance teacher. I started college with the intent of being a teacher and that is the path I followed. While in my final year, I began substitute teaching. As anyone who has substitute taught can tell you, sometimes it is fun but a great deal of it is learning on your feet and rolling with the punches. As I experienced different schools, grade levels and groups of children, I became more familiar with the curriculum as well as the ins and outs of classroom management.

Within a few months I had established myself as a dependable substitute and teachers would call me 2-3 weeks in advance for jobs. Being well known among teachers at several schools also meant that I was trusted to stray from lesson plans. I would often bring in my own art lessons, outdoor games and music to teach the students a dance. This was also the time when I became comfortable enough to alter the scripted curriculums to make the lessons more engaging. Some form of movement, dance or a song became my favorite way to liven up class time. In the spring of 2007, I graduated with a bachelor’s degree in Liberal Studies and went directly into the credential program.
I continued substitute teaching until I started my full time student teaching assignment in August of 2008. I was placed in the fifth grade classroom of a cooperating teacher (CT) with over 30 years of experience. I was so fortunate that it turned out to be a match made in heaven. While she made sure I learned the accepted basics of classroom teaching, she also loved letting me run free with my creativity. Her encouragement and admiration for my energy continues to push me along today. The most memorable part of my student teaching experience was the science unit that I taught on my own.

The district had recently adopted a new science curriculum and that happened to be the first year it was used in the classrooms. My CT gave me permission to teach the weather unit however I wished and to use as much or as little of the provided materials as I saw fit. I used the books, worksheets, leveled readers and even set up the students with accounts to access the online book and activities. However, the most engaging lesson was the end of the unit activity in which the students and I collaborated on creating a dance that incorporated the various weather phenomena they had learned about. To a rave inspired version of the song ‘April Showers,’ from Bambi, I had 30 ten year olds mimicking the movements of rain, hail, fog, tornados and various types of clouds.

The children loved their ‘weather dance’ so much and they begged me to squeeze it in every day. When I saw some of them dancing around at recess doing the ‘hail’ move, I knew I had really made science more than something they read about in a book. This experience defines why I am in the field of education.

By the end of November of 2008 I had finished my student teaching. At our last cohort meeting the coordinator of the program came to wish us well. He also extended an
offer to us that was too good for me to refuse. We could transfer from the credential program straight into the masters program; no application, fees or tests. I hadn’t planned on pursuing a higher degree so soon but I knew I would eventually. With that I started the masters’ program in January of 2009. As soon as I was back on the market to substitute teach I was offered a long term position for a first grade teacher who was going out on maternity leave. The stage was set.

What Led to the Project

As I started my first semester in the CSU Sacramento Masters in Education program I did not have the slightest idea what my thesis would be on. Luckily, you don’t have to know right away. By recommendation of my advisor at the time, I enrolled in an elective class, ‘The Human Brain and Its Function for Effective Teaching and Learning.’ The basis of the class was to learn about how the brain functions and to understand why or why not various teaching practices can be effective or unsuccessful. The professor who taught us was extremely passionate about the topic. I remember she said that she hoped the course would ‘wet our whistles’ for the topic. I was swiftly drawn in and started reading beyond the class’s required texts. What most surprised me is the fact that in all of my preparation to become a teacher, nearly six years, never once was I taught about the biological or psychological basis of learning. I quickly knew that brain-based learning and teaching would be the focus of my thesis project.

Meanwhile, my long-term substitute position became more than a three-month job. I ended up being with the class for six months, so as expected, they became like my very own class. With concepts from the ‘brain class’ flying through my mind, I was in a
perfect position to experiment with brain-based learning and teaching. Many of the
lessons included in the supplement of this project are activities I piloted with my first
graders and used nearly every day. As mentioned earlier, the great part about substitute
teaching is the freedom it affords. When you do not have a contract and are not held to
the same standards and scrutiny as most teachers you are less afraid to try things that
might be seen as ‘out of the box’ or nontraditional.

My students were all allowed to have a water bottle on their desks for which they
could drink whenever necessary. If they wanted to, they were allowed to sit on their
knees or stand at their desks to work. My wiggliest students could chose to use a mini
seesaw called a balance board during deskwork. As they sat at their desk they could
teeter-tootier their feet back and forth on the little board, effectively focusing their excess
energy on something that did not distract anyone else. Along with the addition of
movement to lessons, I made sure movement breaks were used at least every 5-10
minutes.

**Context of the Project**

This project was developed with two very different groups in mind. First, as an
educator myself I tried consider my fellow teacher. While lesson plans are
straightforward and can be followed by any educator, I wrote Chapter 2 with my
colleagues in mind. My goal was to break down the most important basics about the brain
and learning and to present them in a way that is more attention-grabbing rather than
overwhelming or boring. A teacher who reads this project should be able to walk away
with a sort of ‘drive-thru’ understanding of the little brains they are responsible for and
why movement is essential to a better learning experience. I would be flattered if just one teacher read this and started adding movement breaks into their daily routine.

Naturally, the other group this project was developed for is students. Every child needs to move but some need it more than others. Adding movement to a curriculum is for the benefit of all student brains but it can be the key to setting free the busy minds of children with certain learning disabilities. Students plagued by autism spectrum disorders, attention deficit hyperactivity disorder and even those considered gifted can benefit from instruction that gets children out of the stagnant, traditional slump that so many schools see as good classroom management. It is funny to consider the major difference between kindergarten and grade one: desks. In kindergarten, most children do not have an assigned desk that they required to return to throughout the day. They often spend their days moving between the floor and small group tables. In grade one children are given a desk and are expected to sit in it as quietly and stagnantly as an adult.

A very brief, seemingly insignificant moment that happened during my long-term substitute position is the event that turned me from a believer to an advocate for including movement in the classroom. A little girl in my class named Maria was a great student, very smart and well behaved but she could never sit on her bottom. She was one of those who always took the option to sit on her knees or lean on the desk while standing to do deskwork. I simply made sure her desk was a bit off to the side in the seating arrangement so she would not block another child’s view. One day the principal came through the classroom as he often did and Maria was sitting on her knees. I continued instruction but I could not help but notice that he went over to Maria, asked her to sit in
the chair on her bottom and then proceeded to push her in. I know he meant well and probably figured he was doing me a favor but it still bothers me to this day. She was doing nothing wrong, not distracting anyone or endangering herself or her classmates. Maria was simply positioning herself in a way that she could best pay attention and therefore learn.

This project is for Maria and every student like her who just needs a little bit of ‘wiggle room’ in their daily routine. Hopefully with time, education and understanding educators and administrators will adopt a more progressive view of what good learning looks like.

**Description of the Project**

I set out researching with the focus of my review being to present the basics of neuroscience followed by the support for the effects of movement on the body and mind. I soon found that with the right keywords a database search could yield more journal articles than I might ever hope to finish reading. Also great deal of useful information was lying in the books I had read during my brain elective class. I’ve read many of the books cover-to-cover a few times and have even tracked down their authors at conferences. I was lucky enough to be able to thank John Medina, Jane Healy, Pat Wolfe and John Ratey for the contribution their works have made to my passion for this project. Dr. Ratey, author of *Spark*, enthusiastically approved of this project; with a high five.

Since learning is based in more places than just education, I found it that researching my topic lead me into other areas of expertise. I set out to fill my remaining elective credits with classes from other departments. It was not always easy squeezing my
way into waitlisted, upper division classes, for which I had no prerequisites, in
departments where no one knew who I was. I ended up taking cognitive development
from the Child Development Department, cognitive psychology from the Psychology
Department and neurophysiology from the Biology Department. The interdisciplinary
perspective I gained by taking these courses gave me a much stronger foothold in my
literature review chapter.

The lessons developed during my substitute teaching position were based off of
the curriculum I was using called *SRA Open Court*. Published in 2004, the district I was
working in had been using it since 2005. I wanted to use a more current curriculum as a
basis for my project so it would not be rendered ancient in a few years. Although three
major school districts in the greater Sacramento area use *SRA Open Court*, the state
recently adopted new programs in 2008. Among the new programs is *SRA Imagine It!*
which is very similar to *Open Court*. Using *Imagine It!* as an anchor, I compiled my ideas
as well as concepts, activities and suggestions from current books and articles so they
pair well with the lessons and units of the curriculum. This way if you were to sit and
read my lessons with one of the *SRA Imagine It!* teachers guides next to you it should be
easy to make the connection to the references in my lessons. When it came to deciding
which lessons to include I wanted to make sure they were all different and covered
various topics in the language arts: writing, reading and phonics.

I wanted to use a current curriculum to guide my writing. Although three major
school districts in the greater Sacramento area use *SRA Open Court*, the state recently
adopted new programs in 2008. One of the new programs is *SRA Imagine It!* which is
nearly identical to SRA Open Court. Using Imagine It! as a guide, I compiled my ideas and lesson as well as concepts, activities and suggestions from current books and articles so they went well with the lessons and units of the curriculum. On the other hand, I also tried to make the lessons broad enough that they could be easily used and understood by a teacher who did not use the Imagine It! or Open Court curriculums.

**SRA Imagine It! First Grade Language Arts**

The following is a basic outline and explanation of a typical level one unit from the SRA Imagine It! curriculum. Each unit contains 15 lessons; the first is an introductory level and the last is the unit wrap-up lesson. Each lesson is broken into three color-coded sections. The first section, which is color-coded green, is called preparing to read. Here you will find lessons that focus on building the skills a student needs to develop literacy. The lessons and activities introduce new sounds, build phonemic awareness, reinforce phonetic concepts and help increase fluency. A majority of the lessons provided in this supplement are meant to enhance this section of the curriculum. In the grand span of a school day where many lessons need to be taught, this section seems to be the easiest to rush through. The lessons provided are simple and easy to follow, which eventually makes them commonplace if a teacher does not add his or her own twist to them.

The red section called reading and responding follows. Its primary focus is to introduce literature to students and help them comprehend what they have read. This section is rarely overlooked since the unit tests are heavy on comprehension questions about the given story. In fact, the story is often read twice a day for a week. By the end of the week students sometimes beg their teacher to not make them read it again! Adding
movement, group reading in centers and readers theatre to this section is a much-needed relief for children weary from reading the same story repeatedly while sitting in their desks.

The last section, simply titled language arts, is one that even I admittedly could only get to once or twice a week. The topics that need to be covered often do not fit into a single school day. Most teachers find a way to integrate the concepts highlighted in this blue section with other subject areas. Grammar, usage and mechanics can usually be addressed during the blending activity of the preparing to read section. The 15-20 words provided in the text are followed by two or three sentences that contain words with phonetic combinations practiced during blending. Penmanship, while performed throughout the day, can typically be practiced and evaluated through supplemental worksheets or packets. The writing activities provided in this section can be very engaging but most grade one students have difficulty with them during the first few months of the school year.

As with most curriculums, SRA Imagine It! has way more lessons and activities than a teacher has time for. The formatting is very user friendly and the consistency of the lessons provides teachers with an easy to follow curriculum that can be supplemented or altered to fit the needs of any group of students.
Chapter 4

CONCLUSION

Summary of the Project

The lessons included in the project range from 20 minute activities that stand alone to five minute concepts that can be added to an existing piece from scripted curriculums. Each one addresses on the California English-Language Arts content standards and the majority of them also touch on either the Visual and Performing Arts or Physical Education content standards. A few of the lessons, such as the Read-Walk Paths, Reader’s Theatre and Reading with a Change of Scenery, are pulled from my reading and research. The other lessons are the result of working with the SRA curriculum on a daily basis and modifying it to make it more engaging for students. I am sure that many teachers create very similar modifications to what I have presented here. I could not go a day in my first grade classroom without using Read-Erase, Phonics Gestures or the Parts of Speech and Punctuation Game. These lessons can be great fun for students and teachers alike.

Recommendations

An underlying ideal within this work is that physical education teachers are not the only educators responsible for getting our children to move. When I took kinesiology classes to earn a minor in physical education, I felt that many of the P. E. majors seemed threatened by the idea of general education teachers adding movement to classroom lessons. I am a strong proponent of keeping physical education in the hands of those who know it best. This project is not meant to replace physical education time but to carry
physical activity throughout the school day. Every educator needs to take an active role in encouraging a love and understanding for physical activity in their students. In light of the alarming way that obesity plagues our children; all adults can and should attempt to get children moving.

At the very least, I would hope teachers could try out one of the lessons included in the supplement. Teachers could easily incorporate most of the lessons into their daily routines. I would recommend using a movement-based lesson or stopping for movement breaks every 10 to 15 minutes for lower elementary grade students (kindergarten to grade three) and every 20 to 30 minutes for upper elementary through middle school-aged students (grades four to eight). The best-case scenario would be a teacher that could take the concepts from the review and insert them into the entire school day. Movement and other brain-friendly teaching strategies can be applied to any subject area. Mathematics happens to be an extremely sedentary subject. Applying movement to math curriculum would be a challenging but interesting way to extend this project. Even if a lesson is not easily modified to include movement teachers could simply ask children to stand and stretch every 5-10 minutes. Having the children do a set of 10-20 jumping jacks or body crossovers (i.e. touching elbows to the opposite knee) is a great way to quickly get their blood flowing.

Although none of the lessons call for allowing students to drink plenty of water, this is an addition to the project that I would strongly encourage. Any increase in physical activity, whether it is slight or extremely aerobic, lends itself to the consumption of more water. To avoid the formation of long lines at the water fountain, teachers can send a
letter home encouraging parents to send a water bottle to school with their child. As mentioned in the review, there is no solid connection between drinking more water and academic achievement. However, a child with their needs met, i.e. well rested, fed and hydrated; is more likely to pay attention and benefit from instruction.

I would have also liked to include outdoor activities that use reading, writing and phonics concepts in this project. The focus was more centered on modifying and enriching the classroom activities that typically become commonplace and sedentary. An exciting extension to the supplement would be outdoor games that connect to language arts content.

**Conclusions**

While the concentration of this project is the positive effects of movement on learning, my ultimate goal would be to influence educators to consider the biology and psychology of learning when they plan and implement their lessons. I strongly believe professionals in education need to have a greater awareness of the strengths and weaknesses of the brain so they can use that knowledge to better serve students. One would hope that the next generation of teacher education will include how the brain learns as well as how a child’s brain-body connection affects their ability to understand, remember and master new information. The future of mind, brain and education science has exciting implications for learning and teaching.
# APPENDIX

Lesson Plans

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Lesson 1: Read-Erase

Overview: This lesson can be utilized every day during the blending lesson of the green ‘Preparing to Read’ section of SRA. The curriculum has a daily list of words (about 15-20) that can be sounded out by using the sound spelling that is currently being taught or introduced.

CA Content Standard(s) Addressed: English-Language Arts: Reading 1.1

Purpose: Decoding games can motivate students to recall what they have learned. The option of walking to the whiteboard and erasing a word is engaging, movement-based and something special as most young students are not given the opportunity to use the teacher’s board.

Time Required: 5-10 minutes

Materials: A whiteboard, dry-erase markers and about twenty decodable words

Preferred Organization: Students can be sitting at their desks or, more preferably, sitting on the carpet in front of the whiteboard.

Teacher Function: Lead the activity by choosing words and calling on students; either randomly or by choice.

Procedure: Most teachers write the words on the whiteboard, point to the words for the whole class to read aloud and then erase the words themselves. Alternatively, the teacher can ask the students as an entire class to look silently for a word. After a moment, the teacher should call on a student to come up and point to the word. If the student correctly identifies the word they can then erase it. If the child is not correct the teacher can either
give them a hint or let the child ask a classmate for help. It is usually a good idea to have a stool or small ladder for the students who are shorter or need to reach one of the top rows.

V**ariations:** The way in which students are chosen can be by random, as with names on sticks, or on purpose. In my room students had name tags that were magnetic. We used them as a visual way to take attendance, lunch count and appoint children to stations. For this game I would put all of the name tags on a tray or table above the students sight so they couldn’t see who I was about to pick. Once I had called a word I would select a name and hand the student their name tag along with the eraser. After erasing the word, the child could stick their magnet on the board where the word had been. Although this variation does not add anything educational or movement based, the students really bought into it. An addition which may appear to be of no consequence to adults can give children ownership and make an activity exciting.

Another fun variation is to use different colors when writing the words on the whiteboards. Each line can be written in a different color or words that have similar sound spellings can be similar colors. Having the words written in different colors makes giving hints much easier. If a child is having trouble the teacher can say, “The word is in the red row.”

**Assessment:** Having the students identify words and then erase them is a great way to check for understanding. If a student has difficulty finding the correct word it will be clear to the teacher that the student needs help reviewing the concept.
Lesson 2: Phonics Gestures

**Overview:** This lesson provides students with an embodied way of representing new phonetic sounds. The green ‘preparing to read’ section often has a lesson titled ‘Introduce the Sound/Spelling.’ There is usually a short story which repeats the sound/spelling several times. Adding this activity can strengthen the lesson and provide an easy way to reinforce the sound/spelling later.

**CA Content Standard(s) Addressed:** English-Language Arts: Reading 1.10, Visual and Performing Arts - Theatre: Creative Expression 2.1

**Purpose:** Using hand gestures and other body movements to help learn and recall phonetic sounds.

**Time Required:** 5-10 minutes

**Materials:** Whiteboard, dry-erase markers, letter cards

**Preferred Organization:** While following the provided language arts curriculum, this lesson can be used when any new letter sound is introduced.

**Teacher Function:** Lead discussion/brainstorm of what gesture to use for the given letter sound.

**Procedure:** Creating a gesture to accompany a newly introduced sound can easily be inserted into the basic scripted lessons. The teacher can ask students what things (objects, animals, etc.) they think of when they hear the sound. As students make suggestions, the teacher can write the ideas on the white board. After four to five ideas are written down the teacher can suggest one or select the one that makes the most sense to pair with the
sound. (Note: This gesture will be recalled and used throughout the school year by students so it is important to choose a gesture that best elicits a memory of the sound.)

For the letter sound /aw/ students may suggest ‘aw’ sounds like the sound we make when we see something cute or the sound we make when we open our mouth for the doctor.

The SRA Imagine It! curriculum has stories to introduce new letter sounds. For the /aw/ sound the story is about a bird; so it makes sense to use a gesture like imagining your hand as a claw and holding it up while saying, “aw, aw.” Once the teacher and students have decided on a gesture for the sound it is important to encourage the children to use the gesture every time the sound is seen or mentioned.

**Assessment:** Understanding of the concept can be checked at anytime and can also be used as a filler when a few extra minutes present during the school day. The teacher can show the class the gesture and ask them to respond with the sound or a quieter alternative is for the teacher to say the sound and ask the students to respond with the gesture. This is a great, silent way to entertain, focus and manage a classes’ behavior during times when they might have to wait in line quietly. Individual assessment could occur in the same manner but one student at a time, perhaps when they are transitioning from one activity to another. An example would be as students are released to go out to recess or as the teacher calls on students to go from the carpet back to their desks.

**Source:**

Lesson 3: Sight Word Games

**Overview:** The ‘fluency/reading a decodable’ segment of the green section often requires students to learn and recognize sight words and/or high-frequency words. This lesson can either be used with words from the decodable texts or with the sight word flash cards.

**CA Content Standard(s) Addressed:** English-Language Arts: Reading 1.11, Physical Education: Fitness Concepts 3.1

**Purpose:** Entire class, large and small group games that get students out of their chairs can motivate students to learn and recall words that cannot be sounded out phonetically.

**Time Required:** 5-10 minutes

**Materials:** Sight word flash cards provided in the SRA Curriculum (or make your own)

**Preferred Organization:** As a whole class divided into teams

**Teacher Function:** Lead the games

**Procedure:** Break the class into 2-4 groups and have the groups sit on the floor in rows facing the teacher. Place the cards, word-side down, on your lap. The first student in each row is ‘on deck’ and the other children must stay quite (i.e. not scream out the answer). When the teacher flips the top card into view, the first child to stand up and correctly read the word on the card earns a point for their group. Those who were ‘on deck’ move to the back of the rows and the other students scoot forward for the next round. This game could be a used as a filler between activities or it could be used daily and the points could be tallied and kept track of on the board.
**Variations:** Rather than having students stand up to answer, they could begin by standing and execute a certain movement to ‘ring in’ their answer.

**Assessment:** The teacher can observe whether or not students can identify the sight words.
Lesson 4: Up & Down Vowels

**Overview:** This lesson could be used during several of the activities in the green ‘preparing to read’ section. The lesson may be utilized as a warm-up or to reinforce the ‘introduce sound/spelling’ activities. This lesson was specifically designed to accompany the phonemic awareness activities that focus on long and short vowels. All of these activities occur in the preparing to read section throughout the school year.

**CA Content Standard(s) Addressed:** English-Language Arts: Reading 1.5, Physical Education: Fitness Concepts 3.1, 3.4

**Purpose:** The action of making the body long or short can be a fun way for students to identify long and short vowels.

**Time Required:** 5 minutes

**Preferred Organization:** As a whole class

**Teacher Function:** Name off words with short and long vowels

**Procedure:** The SRA curriculum provides numerous ways to teach the long and short sound distinctions of vowels. This activity is a fun, quick and easy way to check for understanding. It can be used just about anywhere or anytime. Students can be gathered on the carpet, standing near their desks or waiting in line. When the teacher calls out a word the students will either squat down for a short vowels sound or stand straight with hands over their heads for a long vowel sound.
Examples:

Short vowel words: pip, rip, at, set, met, tub, sop, mop, tap, sit, got, whip

Long vowels words: pipe, ripe, ate, seat, meet, tube, soap, mope, tape, sight, goat, wipe

Assessment: Observation of the students during the activity will tell the teacher whether or not students comprehend the difference between long and short vowel sounds.
Lesson 5: Read-Walk Paths

**Overview:** This lesson is intended to be used with the fluency activities of the ‘preparing to read’ section. It is easiest to apply to the decodable books which are provided with the SRA curriculum. However, this lesson can be used with any story that is of the appropriate length. If the Unit story provided in the ‘reading and responding’ section is short enough, it could be used for the lesson.

**CA Content Standard(s) Addressed:** English-Language Arts: Reading 1.16, Physical Education: Fitness Concepts 3.1

**Purpose:** Short stories are broken down into phrases that can be written on sentence strips then walked upon in a path around the classroom by students thereby increasing fluency and exposure to the fluent reading of peers.

**Time Required:** 15-20 minutes

**Materials:** Sentence strips, markers, short stories (SRA decodables)

**Preferred Organization:** Familiarize students with the story, introduce the read-walk concept then supervise the activity.

**Teacher Function:** Prepare sentence strips ahead of time, lead read-walk activity and manage behavior.

**Procedure:** The decodable books provided within the SRA curriculum are perfect for this activity. In preparation for the lesson, the teacher should write the story out on sentence strips. The words should be about the size of the students’ feet. This will measure out to about three to four words per strip. Depending on the story, the number of
strips may be between ten and twenty. Laminating them will ensure they can be used more than once. After the children have sufficiently practiced read the story (either by themselves, in small groups or as a class) the teacher can place the strips around the classroom in a sequential path. The students line up and one-at-a-time walk the path around the room reading the words aloud as they step. The even rhythmic pattern of walking will help the students read more fluently. The students waiting their turn should be listening to the reading of their peers.

**Variations:** English language learners could walk with a buddy walks for assistance reading and more direct exposure to fluent reading. The activity could also be done in smaller groups with more than one story to give students more chances to read-walk and reduce the wait time.

**Assessment:** Assessing students ability to read words smoothly as they step could be done while the entire class is participating in the activity. Using the lesson during station time would provide a smaller group for the teacher to observe.

**Source:**

Lesson 6: Reader’s Theater

**Overview:** Reader’s Theater is easiest to use when the story is already in script format. Unit eight in SRA Imagine It! and SRA Open Court is called Games and the unit story is presented in script format. ‘The Big Team Relay Race’ is an excellent story for introducing reader’s theater.

**CA Content Standard(s) Addressed:** English-Language Arts: Reading 1.16, Visual and Performing Arts - Theatre: Artistic Perception 1.2, Creative Expression 2.1, 1.2

**Purpose:** Acting is an excellent way for students to capitalize on the effects of episodic encoding, internalizing stories thereby increasing fluency and improving upon their ability to read aloud.

**Time Required:** 30 minutes

**Materials:** A story in script format

**Preferred Organization:** As a whole class or in small groups

**Teacher Function:** Lead reading to ensure understanding and to supervise when students break into groups.

**Procedure:** Introduce students to the story and characters. After the first reading, an overview of the characters would be beneficial to help the students understand the type of intonation to use and how their character they are reading might move. Depending on the number of parts, either assign each child a part or group 3-4 students to a part. The story should be read aloud a few times as a class so that students are familiar with it. Students can then break up into their groups and act out their parts.
**Variations:** Jigsaw – One reader from each group can be reassigned to a new group where the new group is composed of one student to a part rather than the whole group reading one part. This will create several small groups that can read the story independently; giving the students more individual accountability. They can read and act out the story in different areas of the classroom or outdoors in a courtyard, on a blacktop or on the field.

**Assessment:** Assessing students’ ability to read and act out the story from the viewpoint of their character could be done while the entire class is participating in the activity. However, having students work smaller groups would provide more convenient observation for the teacher.
Lesson 7: Reading with a Change of Scenery

Overview: This activity can be utilized at any grade level. This lesson is meant to be used any time students are required to read in their desks. Thus, the red ‘reading and responding’ section could be enhanced by this activity any day of the week.

CA Content Standard(s) Addressed: English-Language Arts: Reading 1.16, Physical Education: Movement Concepts 2.1

Purpose: Reading in different positions, not just sitting at a desk, and in various locations throughout the classroom assists episodic encoding and gives learners a new spatial reference.

Time Required: 15-20 minutes (3-5 minutes per station)

Materials: A story, book or textbook

Preferred Organization: As a whole class or in small groups

Teacher Function: Supervise student behavior and rotate groups if necessary.

Procedure: Students should be encouraged to find a position that they find comfortable within the designated four to five areas in the room the groups can rotate between. Students can either read silently or aloud in a quiet voice. Time spent in one spot can be as long or as short as the teacher deems necessary. Students reading a lengthy story might stay in their spot for 15-20 minutes. However, younger students that read shorter books might switch to a new spot after 3-5 minutes. As a means of reinforcing directional concepts, the teacher can ask groups to rotate to their right or left.
**Variations:** Episodic encoding could be especially useful for students reading from a textbook. Each chapter or section could be attributed to a spot in the room or a certain position. Students could then recall, “I was lying on my stomach by the teacher’s desk when I read about the lifecycle of butterflies.”

**Assessment:** The teacher can assess students’ ability to read aloud with fluency by walking around listening to their reading. Whether or not students can identify the right and left sides of the body and then move in the correct direction can be observed by the teacher during the rotations.

**Source:**
Lesson 8: Writing in the Large

**Overview:** This lesson can be used anytime students are practicing handwriting, such as during the penmanship lessons in the blue language arts section. This lesson can be applied when students need to do writing that does not have to be turned in, as with the dictation activities that appear in the phonics lessons of the green ‘preparing to read’ section. As an added plus, the use of mini whiteboards also eliminates the use and waste of paper.

**CA Content Standard(s) Addressed:** English-Language Arts: Writing 1.3, Physical Education: Fitness Concepts 3.1

**Purpose:** The use of mini whiteboards for dictation and other writing activities allows students to write larger than usual and in doing so they must use their gross motor skills.

**Time Required:** 10-15 minutes

**Materials:** Miniature whiteboards, dry-erase markers and something to wipe the boards clean with like a sock, a small rag or a glove.

**Preferred Organization:** As a whole class; students can do this at their desks, sitting or standing or from anywhere in the classroom.

**Teacher Function:** Monitor for appropriate use and/or announce dictation words aloud for students to write.

**Procedure:** Students use dry-erase markers to write words or practice handwriting on mini whiteboards. This can be adapted and used in almost any lesson. The teacher can
ask for a yes or no answer to a given question or request students to work out math problems.

Assessment: Students can hold their whiteboards up so that the teacher can quickly check for understanding.
Lesson 9: Parts of Speech and Punctuation Game

Overview: Grammar, usage and mechanics, which appears in the blue ‘language arts’ section, can be introduced during the blending activity of the green ‘preparing to read’ section. The fifteen to twenty words provided in the text are often followed by two or three sentences that contain words with phonetic combinations practiced during blending. The sentences can also be slightly modified to make them more appropriate for this activity.

CA Content Standard(s) Addressed: English-Language Arts: Written and Oral English Language Conventions 1.2, 1.4, 1.5, Physical Education: Fitness Concepts 3.1

Purpose: Using hand gestures and other body movements can be a fun way for students to learn and identify simple parts of speech and punctuation.

Time Required: 5-10 minutes

Materials: A whiteboard and dry-erase markers

Preferred Organization: Students can be sitting at their desks or, more preferably, sitting on the carpet in front of the whiteboard.

Teacher Function: Lead the activity by asking questions and calling on students; either randomly or by choice.

Procedure: The teacher should write one sentence on the board at a time and then point to each word while the entire class reads aloud. The class should read the sentence aloud 2-3 times. Next, the teacher can pick a specific word for students to identify as either a noun, adjective or verb depending on which part of speech the students are learning. The
class should have already agreed on a gesture to represent each part of speech. For instance, for a noun students might hold both hands out in front of them with palms flat and fingers spread, like they are being told to freeze. For adjectives, students could hold their hands out in the same way and wiggle their fingers. Since verbs are action words the movement could involve the entire arm wiggling. These ideas only involve movement of the arms but teachers could opt to have students stand and engage in full body movements or poses.

**Variations:** This lesson can also be adapted for basic punctuation. The movements could represent periods, question marks and exclamation points. Students could be presented, visually or verbally, with a sentence and the teacher could ask them to execute the movement that signifies the correct ending punctuation.

**Assessment:** Observation of the students during the activity will tell the teacher whether students are able to identify simple parts of speech and punctuation.
REFERENCES


