



An Investigation into Learning Using the Regions of the Brain

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Introduction

Why do I need to learn this stuff? This is the question most teachers dread, although it is truly insightful. Why do my students need to learn about the brain? A promising way to maximize learning is to expose students to the way in which the brain works. Once they discover the structures of the brain and develop knowledge of the functions of these structures, they have information that will help them make a connection to their individual learning. When they can make this personal connection, a door to life-long learning will be opened for them. If students believe information is important to their lives, they will learn. We must help students see why the information we are sharing with them matters in their lives. They will be able to learn more effectively, know what challenges they may face, and develop strategies to overcome problems.

Oliver Wendell Holmes said, "Once we stretch our minds around a new idea, it never returns to its former shape." ¹ This quote helps us to recognize that learning physically changes the brain so each new experience can change the brain. By using these new experiences teachers can make connections to existing experiences and form new pathways. The key is connecting new learning to prior knowledge. Starting with what students already know and building from there is a biologically-based idea for pedagogy. ²

By learning how people learn or how the brain works, students may be able to learn more effectively. Knowing the processes involved can help students understand the problems that may arise in learning. Learning has a lot to do with repeating facts and making connections. Prior knowledge is important; all learners have prior knowledge, it is persistent, it is the beginning of new knowledge, and it is where all learners start. Teachers need to start where the learner is and scaffold in the information that should be taught; this will help to build existing neuronal networks and facilitate learning. Motivation to learn needs to be present for success. Teachers should not try to develop new ways to motivate the learner, but instead identify what already motivates them.

The brain is how information about the world is taken in and acted on. At birth, the brain is equipped with all the neurons it will ever have, but many of them are not yet connected to each other. When learning occurs, the messages travel from one neuron to another, over and over. Eventually, the brain starts to create connections (or pathways) between the neurons, so things become easier and can be done better and better.

³ Connections that are not used become inactive and are inhibited explaining the expression: "Use it or lose

it." If mental skills are not exercised, they are not just forgotten; the brain map space for those skills is turned over to the skills that are practiced instead. ⁴ The two things that change connections or synapses are: how much they are used and how important the original connection is. As students learn new information they tie it to something they already know; each time they blend the old connection with the new they create a new network and strengthen it.

Demographics

The Red Clay Consolidated School District is located in Northern New Castle County, Delaware with a combination of urban and suburban settings. Some of its elementary schools are located in the heart of the largest city in the state. The district is comprised of 30 schools with approximately 1000 teachers. It services over 15,000 students. Of those students, 27% are African American, 4% are Asian, 20% are Hispanic, and 49% are White. Students' needs vary, with almost 15% receiving Special Education Services and 10% receiving English Language support. In addition, 41% of the students come from families with low incomes.

My school, Highlands Elementary, is an urban school in the city of Wilmington, Delaware. We are a small K-5 school with an enrollment of an average of 370 students. Our minority population represents 73% of our student body with 58% of the students falling into the low socio-economic status. I am a third grade teacher with a class size varying between 24-28 students which is representational of the make-up of the school.

Rationale

I have noticed in my classroom some students believe that it is my job to teach them. While this is true on some level, I hope to lead them to the understanding that learning is personal and they have the ability—and the responsibility—to take charge. Too often the assumed role is for the teacher to be the leader, responsible for imparting all of her knowledge onto her students. Lessons are developed that begin where the teacher's understanding is and where the curriculum standards say to end. As teachers, we need to remember that our prior knowledge is much more extensive than our students'. We need to remember to begin where they are in order to make the information accessible to them. We need to create an excitement and a reason for learning. We need to provide choices that encourage all students to engage. This approach will assist us in developing a connection to the topic and then a connection to the students' learning. Once the scope of the existing knowledge has been uncovered, a starting point emerges, and then the lessons may begin.

Students know they can learn by looking at or by "seeing" things; how does this work? Visual Literacy can be defined as the ability to evaluate, apply, or create conceptual visual representations. If you can read a map, draw a diagram, or interpret a symbol then you are visually literate. How do we process these visual images and turn them into understanding? Learning about the occipital lobes and how they take in the images and make meaning out of them will help bridge the conceptual information into more concrete information.

Students know they can learn by hearing things; how does this work? Auditory discrimination targets environmental sounds, phonemic awareness, and phonological awareness. These lay the foundation for

phonics and spelling skills. Listening comprehension targets following directions and increasing depth of understanding. These lay the foundations for critical thinking skills. Auditory memory targets sequencing and working with cumulative forms. These lay the foundations for study skills and expository writing. Communication skills focus on conversation skills, grammar and syntax. These lay the foundation for social development, oral and written expression. ⁵ We will be investigating the parietal lobes and the part they play in auditory learning.

Students know they can learn by doing, touching, and moving; how does this work?

Tactile learners are active and learn by imitation and practice. By manipulating their environment and using their sense of touch, students can act out or remember information. Role playing, hands-on activities, and physical movement are strategies the tactile learner uses to input information. Discovering the motor strip in the frontal lobe and the somatosensory strip in the parietal lobe will help students better understand the area in the brain that processes information about what specific parts of their bodies are doing or feeling.

Objectives

An interdisciplinary unit will be developed focusing on linking science, math, and language arts. Students will discover the structures of the brain, complete research on the brain, and create a Power Point presentation explaining their discoveries in science class. Developing the ability to read and interpret graphs will be taught during math class with activities presented for further investigation. Also, the concept of number sense will be discussed as they try to comprehend the number one hundred billion. Reading a combination of fiction and non-fiction books will enable students to compare and contrast information. Journaling will give the students a voice to reflect on their learning and develop questions for further investigation. The unit will be developed around three major topics. The first topic is the brain structure. Through a combination of direct instruction and inquiry-based learning, my students will research the anatomy of the brain. Students will be able to distinguish between the right and left hemispheres. Students will be able to examine the location and responsibilities of the four lobes: frontal, temporal, occipital, and parietal. Students will be able to identify the parts of the mid-brain and their functions. Students will be able to recognize the brain stem and comprehend its importance.

The next topic will involve investigating how the brain works. Students will be able to recognize that a neuron is comprised of a cell body, an axon, dendrites, and synapses. Students will be able to differentiate between the axon, dendrite, and synapse. Students will be able to recognize that neurons are nerve cells that send messages back and forth to the brain. Students will distinguish between axons that carry signals away from the cell body and dendrites that carry signals toward the cell body. Students will develop an understanding that learning occurs when connections between neurons are formed.

The final topic we will include will connect learning to the regions of the brain. Students will ascertain their learning style though completing a variety of learning inventories. Students will be able to link the various regions of the brain responsible for vision, hearing and other tasks to literacy and their personal learning style. They will discover ways to capitalize on this knowledge as well as ways they can further develop the other learning styles to enhance and round out their learning. Through working with learning contracts that offer choices of activities, students will take ownership of their learning.

Brain Structure

Essential Questions: What is the brain? What are the different regions of the brain? Why do we need a brain?

The brain itself is a three pound organ that is approximately the size of a grapefruit. It is fleshy colored and is mostly water (70%), fat (10%), and protein (8%). The brain has three main sections; the cerebrum, the cerebellum, and the brain stem.

The Cortex

The cortex is the top, wrinkled layer of the brain. It covers the entire brain including the cerebrum and the cerebellum. The cerebral cortex is about the thickness of an orange peel and if unfolded would be about the size of a newspaper. ⁶ This portion of the brain is considered the thinking brain. It is also where our memories are stored. The ability to understand language and handle speech is located in the cortex.

The Cerebrum

The cerebrum is divided into two halves called hemispheres. The outer surface of each hemisphere is the cortex, as described above. The hemispheres are identical and have an interesting feature; the right hemisphere controls the left side of the body while the left hemisphere controls the right side of the body. The right hemisphere is the center of musical and artistic creation as well as the ability to understand shapes and humor. The left hemisphere controls the ability to read, speak, and solve mathematical problems. There are four lobes that make up the cerebrum; the frontal, temporal, occipital, and parietal. Each lobe serves a different set of functions within the brain. The frontal lobe is located around the forehead area. This lobe is involved in purposeful acts like judgment, creativity, problem-solving, and planning. This lobe controls the language center, which includes the ability to read, write, and speak. It also controls the voluntary movements such as lifting a book or turning the page. Memories that make each person unique are found here as well. The temporal lobes are located above the ears on the right and left side of the brain and are responsible for deciphering hearing, taste, and smell. Memories of flavors and sounds are stored in these lobes. The occipital lobe is located in the middle, back of the brain. It is primarily responsible for sight and visual information. The information that is used in this region comes from the eyes. The parietal lobe is at the top of the head, behind the frontal lobe. This lobe's responsibilities include processing information gathered from the senses and coordinating motor skills. The parietal lobe can combine the information gathered from the senses to create a complete image. For example, this lobe is involved in awareness of body location in relation to other objects, known as "spatial awareness". This keeps our bodies from tripping over things.



Figure 1

The Cerebellum

The cerebellum is located at the base of the brain just under the back of the cerebrum. It is about the size of a golf ball and is shaped like a clump of cauliflower. This area of the brain is responsible for muscle movement, posture, and coordination. This ensures that all parts of your body work together instead of every part going in its own direction. The cerebellum has more nerve cells than any other part of the brain although the cells are generally smaller than elsewhere. The cerebellum and the cerebrum work together, the thought originates in the cerebrum and sends a message to your body through the brain stem. The cerebellum monitors the messages to make sure that your body works together.

The Limbic System

The limbic system regulates temperature, blood pressure, heart rate, mood, and blood sugar. It is also essential in forming memories and is the center of emotions. The limbic system incorporates the amygdala, the hippocampus, the thalamus, and the hypothalamus. The amygdala, named for its almond shape, integrates the senses and generates emotion. It interprets sounds, smells, images, but not words. The "fight or flight" response is determined by the amygdala. This area of the brain compares incoming information with past experiences then decides what the body should do about the situation. The hippocampus and the amygdala work together to help a person understand their own feelings and other people's feelings. The hippocampus is shaped like a seahorse and actually means seahorse in Latin. This part of the brain controls storing memories and retrieving memories. There are three types of memories, (short-term, long-term, and skill or procedural) and the hippocampus decides where they get sorted. The thalamus is made up of two parts that look like tiny footballs joined at the center. The thalamus is the place that first receives messages from the body and then relays them to the cortex. Outgoing messages are also relayed from the cerebrum and sent to the spinal cord to the motor neurons. The hypothalamus is just below the thalamus and is the size of a small bean. The hypothalamus regulates body temperature, hunger, thirst, blood pressure, blood volume, waking, and sleeping. This section of the brain also controls the gland that regulates growth.

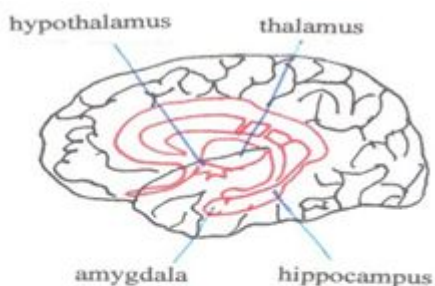


Figure 2

The Brain Stem

The midbrain, the pons, and the medulla oblongata make up the brain stem. The brain stem connects the brain to the spinal cord and controls the most basic survival functions, such as breathing and heart beat.

The Spinal Cord

The central nervous system is made up of the brain and the spinal cord. The spinal cord is the pathway that all

nerves use to connect to the brain at the brain stem. As mentioned earlier, the right side of the brain controls the left side of the body and vice versa. The nerves coming from the right side of the body cross over to the left brain at the connecting point of the spinal cord and brain stem. The brain sends messages to the spinal cord and then to the motor nerves that make the body move.

The Brain in action

Essential questions: How does our brain work? Why can we remember some things but not others? Does the brain control us or do we control our brains?

The brain cells are called neurons and there are one hundred billion of them in the brain, (100,000,000,000)! These cells form something of a branching, interconnected maze of roadways throughout the body. They branch out from the brain and spinal cord to every region of the body. Neurons carry signals from the senses to the brain and then back to various parts of the body.

Neurons are made up of axons and dendrites. The dendrites look like leafless branches on a tree and there could be hundreds of them on a single neuron. The dendrite's job is to carry electrical signals toward the neuron's cell body. There is usually one axon on a neuron. The axon carries the signal away from the neuron's cell body. Amazingly, even though there are one hundred billion neurons in the brain, neurons do not actually touch each other! There is a gap between the tip of the axon of one cell and the dendrite of the next; this gap is called a synapse. Neurons communicate through the synapse: each neuron has an electrical charge, when the neuron receives a signal from some part of the body charged particles are released, the charged particles send an electrical signal down the axon. At the end of the axon a chemical is released: the chemical floods the synapse, activating the new neuron, and the process is repeated.

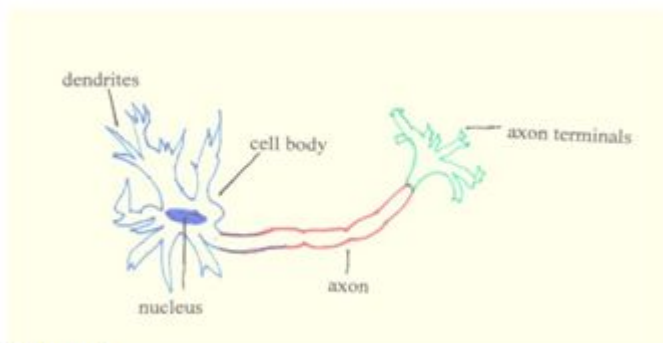


Figure 3

Neurons bring signals from different parts of the body to the brain and from the brain to different parts of the body. These signals tell the body what to do, how to feel, and where to go. Each time a signal gets passed along, a connection is made. The connections have two functions; one is to regulate the body's movement, heartbeat, and other life supporting operations. The other function is to process thoughts. This involves taking in information about the world and making decisions. The decisions made are shaped by experiences and learning. Learning has a lot to do with repeating facts and this repetition is believed to be the way the brain sorts experiences into memories.

We have three types of memory. The first is known as short-term memory. The information here has a limited span, usually only minutes. Then there is long-term memory. This is the memory that is used when remembering facts or events that happened long ago. A short-term memory can become long-term if it is used frequently. The third is known as procedural memory. Procedural memory is responsible for recalling skills developed over a long time such as riding a bike or reading a book. It is difficult to forget procedural memories since the brain works hard to create them. The brain creates memories in two phases. First, the brain looks to recognize patterns and remembers the gist of the experience, not every detail. Second, the brain organizes the new information alongside existing information and makes connections. For example, when a student learns how to multiply it is linked to the knowledge of numbers, particularly of addition. Before a memory becomes fixed, it can be changed but as it is retrieved and used over and over again it becomes fixed and then difficult to revise. Short-term memory involves temporary changes in activity in the brain. To be stored as a long-term memory, the brain must make permanent changes. This can happen in two ways: neurons can extend their axons to allow more connections or cells can increase the ability to release chemicals through synapses. As teachers, focus should be placed on what a student has done correctly in the work so the attention is centered on the proper pathway. In drawing attention to the error, emphasis is being placed on it and in fact can be strengthening it!

Connecting the regions to Literacy

Essential Questions: How do we learn? Why do people learn differently? How can we learn better?

Visual learning

We receive more information visually than by any other means. The primary visual cortex located in the occipital lobe is responsible for recognizing and processing information from the eyes. Areas of the temporal lobe are responsible for recognizing and making sense of what is seen. The parietal lobe also plays a part in visualization, areas in this lobe process information about moving through the space that is seen. ⁷

Visual literacy is the ability to interpret, negotiate, and make meaning from information presented in the form of an image. Visual literacy is based on the idea that pictures can be read and that meaning can be communicated through a process of reading. Students become visually literate by the practice of visual encoding (expressing their thoughts and ideas in visual form) and visual decoding (translating and understanding the meaning of visual imagery).

Images are pervasive in today's world. Visual literacy is used when looking at and studying photographs, symbols, graphs, and signs with students. If students can visualize as they read, their level of engagement can be increased. Students who are presented with visual images prior to the beginning of instruction have something concrete to refer to when the lesson starts. Visualization during reading enables students to place themselves in the story, link past experiences to the words and ideas in the text, and strengthens a reader's relationship to the text. ⁸

Auditory learning

Our sense of hearing starts in the middle ear, where sounds are converted into signals. The signals travel to

the brain stem, thalamus, and are sent to the auditory cortex.

Auditory learning is a learning style in which a person develops understanding through listening. They may struggle to comprehend a chapter they've read, but then experience a full understanding as they listen to the class lecture. Auditory learners may benefit by using a speech recognition tool or listening to books on tape. They can follow directions very precisely after hearing them once or twice and sometimes work well with background noise present. Collaborative learning groups suit this type of learner.

Tactile learning

The area of the brain that is responsible for motor functions and sensory functions is located in two strips that wrap across the frontal lobe like headbands. The first strip is the motor strip and controls everything that moves in your body. The second strip is next to the first and is called the somatosensory strip. This strip processes information about what specific parts of the body are feeling or doing. Furthermore, the cerebellum is integral in muscle movement; it constantly receives messages about the body's actions and position and makes adjustments so the cerebellum is critical for balance and coordination. The thalamus is responsible for relaying messages about sensations such as pain, pressure, and temperature. All of these various regions in the brain are involved in tactile learning.

Tactile learning is a teaching and learning style in which learning takes place by the student carrying out a physical activity, rather than listening to a lecture or merely watching a demonstration. Students learn by doing or movement. These students generally have high hand-eye coordination and enjoy being physically active.

Strategies

Strategies That Work

"Strategies That Work" ⁹ is a compilation of reading comprehension strategies that can transfer nicely into a brain study unit: Making Connections, Questioning, Visualization, and Inferring. Neurons need to make connections to become permanent, just as students need to make connections to the text to develop comprehension. Questioning involves problem solving, making decisions, and clarifying information for the reader. These are tasks that will activate the frontal lobe. The images created to assist comprehension can be linked to the primary visual cortex and visual literacy. Visualization allows students to create images related to their prior knowledge and the text. Students who use these strategies during reading strengthen their inferring skills and are better able to make predictions, decode unknown words, and draw conclusions.

Making Connections

Learning occurs in the brain by making connections between neurons. The way students create these connections is through connecting background knowledge to current learning. Each student comes to class with prior knowledge, this will be the starting point for new information. While reading, students will make text-to-self, text-to-text, and text-to-world connections. These connections help students to become more aware of different genres, forms, and structures within the text. When students can make a connection to a character within a story, motives, thoughts, and feelings of that character are better understood.

Questioning

"Curiosity spawns questions. Questions are the master key to understanding. Questions clarify confusion. Questions stimulate research efforts. Questions propel us forward and take us deeper into reading." ¹⁰ Teachers need to monitor their students' understanding; the questioning strategy offers teachers an opportunity to check for understanding and clear up any misconceptions. Student formulated questions are an essential component to this process and help determine where the students want to go next in learning of the topic.

Visualization

It has been said, "A picture is worth a thousand words". Learning to interpret images—also symbols, graphs, and facial expressions—involves different regions of the brain. In math class students will interpret graphs, during reading students will illustrate vocabulary words, during group work students will need to decode facial expressions of fellow students in order to help the dynamics of the group remain positive.

Differentiated Instruction

To meet the needs of all the learners in my classroom, I will use Differentiated Instruction. Differentiated Instruction is an approach to teaching content in ways that address a variety of learning styles and needs of students while maximizing the potential of all learners. This will help me to accommodate the diversity of academic needs present in my classroom. My instruction as well as the students' research can be differentiated. I will differentiate according to content, process, or product. Through differentiated content students will have access to a varied level of texts and/or websites and could be "buddied" with a partner at a different level to assist with the learning. Differentiated process will involve the students being offered choices about the way they gather information; students will be given access to books, audio tapes, and videos. When differentiating products, students are given learning contracts which present them with a variety of options to create different products, such as plays, poems, or Power Points, based on their individualized learning style and interest.

A brain research project will exemplify the definition of Differentiated Instruction. Students will be provided texts at an appropriate level and other sources to enable them to have access to all necessary information on their ability level. Students will focus on one specific region of the brain and will choose a final project to showcase and present the information they have uncovered.

Cooperative Learning

Cooperative Learning is a successful teaching strategy in which teams of learners with varied abilities and interests come together to help each other to improve their understanding of the subject matter. Cooperative Learning is used to promote student learning and retention of material, foster positive social relationships within the classroom community, and enhance student satisfaction with the learning experience. The following are examples of a variety of cooperative learning activities that I will make use of throughout this unit.

Literature Circles

Students will form interest groups of 4 to 5 members and choose the text they will read. Each group will be responsible for setting daily reading goals and strategies, partner reading, circle reading, choral reading, or independent reading. After the daily required reading is completed, students will complete a variety of

comprehension activities. Next, students will participate in a discussion of the daily reading and activities. During discussions students will have the opportunity to ask questions, share interesting passages, and formulate opinions of the text. Finally, students will complete a reflection journal to summarize the daily experiences and prepare a purpose for the following day's activities. We will complete a cycle of literature circles using non-fiction leveled text and then fiction text that involve the brain.

Think-Pair-Share

During Think-Pair-Share activities, students are given information or a question and must independently Think about how they will react to the prompt. The Think period should last a short time, no longer than 5 minutes. Next, they will Pair with a partner and conference about the prompt. During this period, they may develop new questions or clarify understanding. This period should also last a short time, no longer than 5 minutes. Then they will Share with another partner set, small group, or entire class. All information can be discussed and questions may lead to further investigations. The time frame on this portion will be dependent on the choice of sharing.

As the essential questions are posed to stimulate student thinking, we will use the Think-Pair-Share model to inspire understanding and questions about our topic. This will provide a starting point for me as it can identify what the students already know, what they are confused about, what they know little or nothing about, and also what interests them and what they want to learn.

Jigsaw

This form of cooperative learning breaks larger topics or resources into small parts. Each group is given one part of the whole. The students read the given portion, discuss, and prepare a tutorial project for the rest of the class.

Students will self-select the regions of the brain to investigate. Each group will be responsible for researching and developing a presentation for the class about the function and location of their region.

Vocabulary

Students need to acquire vocabulary directly, explicitly taught, and indirectly, when they hear and see words in context. Word sorts are a hands-on instructional tool used to teach vocabulary. Words and pictures can be categorized based on pre-determined labels. Word sorts enable students to compare and contrast items through a variety of criteria. In order to build interest in the vocabulary and to develop inferential thinking skills, students will develop their own definition based on context clues, discover synonyms and/or antonyms of the word, or draw a picture of what the word means to them. Then the students will look up the words in a dictionary or on-line search site. Students will use reasoning skills to categorize and discover patterns that they can later apply to unknown words they encounter. This activity is very easily leveled to once again meet the needs of the diverse learners in my classroom.

Technology Integration

"Recently, a growing number of researchers have published studies that provide substantial evidence that technology can play a positive role in academic achievement." ¹¹ My students will be using technology while proceeding through this unit. As students study the brain and its functions, they will be using internet search procedures to locate information on this topic. After their research is completed, students will create Power

Point presentations to highlight and share the information they have learned with students, teachers, and family members. Students will make entries into our classroom blog reflecting on their learning. An interactive white board will be used to facilitate engaging lessons.

Discovery Notebooks

Journaling allows students time to reflect, make connections, question, and synthesize the information from the day. Students can keep important vocabulary, personal thoughts, answers to questioning prompts, as well as ask clarifying questions in their journals. Students will keep a discovery notebook to chronicle their journey through the brain. This reflection piece will allow students to decipher the day's activities and make sense of the information in their own words. "The art of directing and supporting reflection is part of the art of changing a brain. It is the art of leading a student toward comprehension." ¹²

Classroom Activities

My classroom lessons will follow the Understanding By Design, UBD, model. ¹³ The backward design model centers on the idea that the design process should begin with identifying the desired results and then work backwards to develop instruction. There are three main stages: Identifying desired outcomes, determine acceptable evidence of competency (assessment), and plan instructional strategies and learning experiences that bring students to this competency level.

In stage one, Wiggins and McTighe refer to it as "enduring understanding" and includes the following elements, enduring value beyond the classroom, resides at the heart of discipline, requires uncovering abstract or often misunderstood ideas, and offers potential to engage students. Furthermore by answering key questions, "essential question" students deepen their learning about content. The enduring understanding and essential question are discussed prior to each daily lesson and are used to set-up or "open" the lesson for the day. At the end of each daily lesson, I will return to the enduring understanding and essential question. We will discuss the content of the daily lesson and this will act as the "closure" for each lesson. ¹⁴

Investigation One

Lesson Overview: Thinking Caps

Students will create a model of the brain using a swim cap and learn a mnemonic device to remember the name and location of the lobes. Students will be introduced to the worksheet, brain location and function. Students will complete this worksheet over the next few days as each lobe is introduced and discovered. The worksheet will provide note taking practice for the students as they get ready to complete independent research. After the function of each lobe has been discovered, students will create a visual image to explain the function. Students will add this image to their swim cap at the end of the week and will then have completed their very own thinking cap! This lesson will last four 25 to 30 minute class sessions.

Enduring Understanding: Each region of the brain has a different job to do.

Essential Question: What are the locations and functions of the different regions of the brain?

Materials: Hands, swim cap, permanent markers, brain location and function worksheet (Appendix A)

Procedure: Day One

At the beginning of the lesson, students will close each hand, have back of thumbs facing body, put both hands together. This is a representation of the human brain. The thumbs represent the frontal lobe, move around to the backs of the hands and this represents the temporal lobes. The pinkies will represent the area of the occipital lobe, and the tops of the folded fingers will represent the parietal lobe. This model will give students a visual representation approximately the size of their brains and showing the idea of two hemispheres. I will introduce the mnemonic device of F-TOP to remember the names and position of the lobes: start at the thumbs, (Frontal), go to backs of hands, (Temporal), around to the pinkies, (Occipital), and up to the top of the fingers, (Parietal).

Students will be presented with a variety of diagrams retrieved from an image search on-line. Students will work in pairs for this activity. Using the diagrams and the hands activity presented earlier in this lesson, students will use markers to outline the four lobes of the brain.

Day Two- Four

Through direct instruction, videos, and student led research using on-line searches and non-fiction books, (some suggested titles in resource section); students will discover the functions of each region of the brain. As students determine this information, they will add the information into the pertinent area of the worksheet. When the worksheet is completed, the students will create a visual image to explain what happens in the designated lobe. Students will add the image to their "thinking cap" and can present their caps to the class to explain their images.

Assessment: Completion of the worksheet and the "thinking cap" will serve as a summative assessment for this activity.

Investigation Two

Lesson Overview: Memory quiz

Memory is important to learning. The more efficient students can become with accessing and using their memory, the more they will be taking responsibility for their learning. There are many tricks to help memorize things; using mnemonic devices, using music or rhyming, putting items into groups, or finding patterns. These tricks work because you are engaging more than one area of your brain. Students will be in groups of four. Each group will develop a memory quiz utilizing a variety of materials. Upon completion of the quiz, students will record their memory strategy in their discovery journal. Students will share their strategies with the class and will compare/contrast each other's strategy and judge which strategy worked better. This lesson will last for one 25-30 minute class session.

Enduring Understanding: The brain looks for patterns to create connections.

Essential Question: Why can we remember some things but not others?

Materials: Playing cards, vocabulary cards, pattern blocks, picture cards, variety of small objects such a pencil erasers, coins, or stickers, blank paper, discovery journals

Procedure

A memory quiz will be modeled by the teacher. A covered tray will be presented to the class. On the tray will be 15 number cards and it will be explained that the students will be given 30 seconds to remember as many cards as possible. The tray will be uncovered and the timer will be set. At the end of 30 seconds, the tray will be recovered and the students will record on a sheet of paper as many of the numbers as the can remember in 15 seconds. Groups of four will be formed and will share strategies for remembering, this should last no more than four minutes. Each group will then be provided with a tray with a variety of materials to develop their own quiz. The group will be given ten minutes to devise a memory quiz using any combination of 15 items of the materials provided. After 5 minutes, groups A and B will administer their quiz to groups C and D. Groups C and D will view the items for 30 seconds and then will record everything they can remember. Then the groups will switch roles, groups A and B will view and then record the objects they remember. Each student will use their discovery journal to reflect about the strategy used to remember. A mixture of students who remembered many items and students who remembers few items will share out to the entire class. We will use a Venn diagram to compare/contrast strategies. This activity can be revisited a few days later to see if students adopt different strategies and are more successful in remembering.

Assessment: The assessment for this lesson will be participation in and completion of the activity.

Investigation Three

Lesson Overview

Students will be placed into literature circle based on reading level. Each student will receive a copy of the selected non-fiction book. The class will complete a T-W-L, (What do I THINK I know, What do I WANT to learn, What I LEARNED) form. Pre-reading, during reading, and post reading activities will be completed by each student. A variety of reading techniques will be used, independent, guided, choral, or circle reading. This activity is differentiated through content (varied reading level), process (varied reading techniques), and product (varied product choices). It is important to teach with nonfiction texts, extracting information is a skill every student must learn. The ability to comprehend nonfiction text is critical to success in school and after. The literature circles will be one portion of my Language Arts block, this lesson will take 7 to 8 days of 25 to 30 minute sessions.

Enduring Understanding: Students need to activate prior knowledge in order to successfully comprehend nonfiction text.

Essential Question: How does what I already know connect to what I am going to read about?

Materials: Literature circle books: How does your brain work?; The Brain: Our Nervous System at Work; Phineas Gage: A Gruesome but True story about Brain Science; T-W-L worksheet (Appendix B), vocabulary word list (Appendix C), student choice board (Appendix D), student reading journals,

Procedure: Day One

Create groups and distribute books. Have each group preview the books and discuss what they expect to learn for 5 minutes. After the discussion, the class will complete the T (THINK) section of the T-W-L worksheet. I will put all ideas on the classroom poster. After the whole class session, students will choose 5 ideas and write these on their individual worksheets. Next, the students will complete the W (WANT to learn) section of the worksheet individually. We will share out ideas and I will put suggestions on our classroom poster, the classroom poster will remain up throughout this lesson. Students will put the worksheets in their folders and keep them through the duration of this literature circle. This will set the purpose for reading.

Day Two

Each group will be given vocabulary lists, (Appendix C). Students will participate in a jigsaw activity, each student will choose a word from the list and look it up. All remaining words will be looked up tomorrow. The students will find the definition of their word using their nonfiction book and a definition, students may choose to look up word on computer as well. After students look up words, they will be responsible for teaching the group their word. The rest of the group will be responsible for writing down the remaining definitions. Each student will complete one activity from the choice board, (Appendix D).

Day Three

The remaining vocabulary words will be looked up following procedure from day 2. Students will complete a second self selected pre-reading activity from the choice board, (Appendix D).

Day Four to Day Six

Students will begin daily page assignments and will read those pages on the corresponding days. Furthermore students will choose between, independent, partner, choral, or circle reading for the daily assignments. After daily reading assignments, students will complete during reading activities from the choice board, (Appendix D).

Day Seven and Day Eight

Students will complete the L (LEARNED), section on the T-W-L form, (Appendix B). As a class we will discuss what they have filled in on the individual T-W-L forms and I will add this to the class poster. Students will then complete after reading activity from the choice board, (Appendix D). Students may choose to work independently or with a partner. Any student who finishes early may make another choice from anywhere on the board or may visit Miss Gormley's website and investigate the listed brain sites.

Assessment: Informal assessments: work completion, student participation

Formal assessment: work completion following guidelines on rubric that will be developed as a class to provide students ability to take ownership of progress and outcomes.

Appendix A

Name: _____

Brain regions and responsibility

Lobe	
Frontal lobe	Location
	Functions
Temporal lobe	Location
	Functions
Occipital lobe	Location
	Functions
Parietal lobe	Location
	Functions

Which lobe do you think is the most important and why?

Appendix B

Name:

T What do I THINK I know	W What do I WANT to learn	L What did I LEARN
1.		
2.		
3.		
4.		
5.		

Appendix C

Vocabulary lists

How Does Your Brain work?	The Brain	<u>Phineas Gage</u>
brain stem cerebellum cerebrum coordination memory neuron neuron branch spinal cord	brain stem CAT scan cerebellum cerebrum hypothalamus neuron reflexes spinal cord synapse thalamus	brain stem cerebellum frontal lobe MRI neuron occipital lobe parietal lobe spinal cord synapse temporal lobe

Appendix D

Name: _____

Color in the boxes you complete.

Pre-reading: Choose and complete two boxes	Look at pictures in the book, predict what you will learn. Write your prediction in your journal	Discuss with a partner what you expect to learn while reading this book.	In your journal, draw an empty head. Then fill the head with any pictures words or symbols that you will learn about.	Create flashcards for 5 of the vocabulary words. Include the definition and an illustration.
During reading: Each day choose and complete one box	Go on a word hunt for today's reading. How many 3, 4, 5 or more syllable words can you find? Keep a chart.	Write a summary of today's reading.	Using the whisper phone, retell what you have read today to yourself.	Draw, label, and explain a part of the brain you learned about today.
During reading: Each day choose and complete one box	Create a poem that details what you have read today.	Choose 5 new words and make flashcards for them.	Using your journals, have a silent conversation with a partner, only writing you conversation.	Write and illustrate a postcard to a friend explaining what you have read about today.
After reading: Choose and complete two boxes	With the digital camera, take and print 5 pictures that show what you have learned. In your journal, justify why you took those pictures.	Create a comic strip that shows what you have learned. You must have at least 5 frames.	In your journal, write 5 questions about the book and have a partner answer them. Go over answers with your partner.	Go to Miss Gormley's website ; visit a brain site, complete Venn diagram comparing/contrasting information from website to information from your book.

Appendix E

Standards

ELA Standard 1

Students will use written language and oral English appropriate for various purposes and audiences.

ELA Standard 2

Students will construct, examine, and extend the meaning of literary, informative, and

technical texts through listening, reading, and viewing.

ELA Standard 3

Students will access, organize, and evaluate information gained by listening, reading, and viewing.

ELA Standard 4

Students will use literary knowledge assessed through print and visual media to connect self to society and culture.

As the students complete the science research project and the literature circles in this unit, the ELA standards will be met. Students will be developing and using appropriate strategies to assist comprehension, completing research using multiple sources, making judgments about those sources, and presenting information to an audience.

Math Standard 6 Number Sense

Students will develop number sense by solving problems in which there is a need to

represent and model real numbers verbally, physically, and symbolically; to use operations with understanding; to explain the relationships between numbers; to apply the concept of a unit; to determine the relative magnitude of real numbers.

Math Standard 7 Algebra

Students will develop an understanding of algebra by solving problems in which there is

a need to progress from the concrete to the abstract using physical models, equations and

graphs; to generalize number patterns; and to describe, represent and analyze relationships among variable quantities.

In our math class, students will investigate numbers, graphs, and symbols and how they relate to visual literacy and learning.

Science Standard 6 Life Processes

The natural world is defined by organisms and life processes which conform to principles regarding conservation and transformation of matter and energy. Living organisms use matter and energy to build their structures and conduct their life processes, have mechanisms and behaviors to regulate their internal environments and to respond to changes in their surroundings. Knowledge about life processes can be applied to improving human health and well being.

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Book that investigates neuroplasticity in the human brain and interesting stories that highlight individuals overcoming obstacles.

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—. *The Secret Life of the Brain*. 1995-2008. <http://www.pbs.org/wnet/brain/3d/index.html> (accessed June 13, 2009).

Excellent website with a 3D image of the brain that can be manipulated by students detailing information about function of regions of the brain.

Simon, Seymour. *The Brain; Our Nervous System*. New York: Harper Collins Publishers, 2006.

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Notes

¹ (Zull 2002)

² (Zull 2002)

³ (Kids Health from Nemours 2007)

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⁸ (Harvey and Goudvis 2000)

⁹ (Harvey and Goudvis 2000)

¹⁰ (Harvey and Goudvis 2000)

¹¹ (Foltos 2002)

¹² (Zull 2002)

¹³ (Wiggins and McTighe 2005)

¹⁴ (Wiggins and McTighe 2005)

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