Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
2013 Volume I: Literature and Information

The Brain Manual

Curriculum Unit 13.01.05
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THE BRAIN is wider than the sky,
For, put them side by side,
The one the other will include
With ease, and you beside.
-Emily Dickinson

Introduction

The Brain Manual unit uses a variety of fiction and nonfiction text to introduce students to their brains. Students will not only gain confidence in their ability to understand their brain and to use cognitive strategies, but also examine the emotions provoked by our minds. Hopefully students will see that they are not alone in their accomplishments and frustrations. The introduction of fiction into a seemingly science unit allows students the opportunity to investigate and synthesize the new information as well as talk about the feelings our brains create. The different genres create multiple ways to understand the complexity of this amazing mound of wrinkled grey.

We know more about our solar system than we do about our brains. New technologies and clearer imaging tools, like MRIs, EEG and CAT scans, are giving researchers, in many fields, the ability to understand far more about the brain. As teachers, I think we are living a paradigm shift, one in which we will learn precise techniques that can give our students the very best education by utilizing cognitive science. Every precious

classroom minute will be more effective, less stressful, and more enjoyable for children. Paying closer attention to brain compatible learning techniques will enable us to close some of the achievement gaps we now face. These techniques are teaching practices that have been proven effective by science's relatively new ability to monitor brain activity. [1]

This unit uses a wide variety of text and media to intrigue students, as we practice various comprehension strategies. There are many websites that provide beautiful images of our brains and those visuals will help students grappling with comprehending the brain's mechanisms. I believe the integration of fiction, in the form of the funny yet poignant novel, *Joey Pigza Swallowed a Key* , by Jack Gantos, will provide a richer experience, and weave in a common thread for a more cohesive unit. The varied text will also lend itself conducive to meeting the Common Core Standards in both fiction and nonfiction. My overriding goal is to impress upon students who have been repeatedly told they have a learning disability that, in truth, they have a learning difference. Over the course of four weeks, students will be introduced to their brains. Understanding the specific processes involved in learning will provide students with evidence on why specific strategies work to develop stronger neural pathways. [2]

The unit is designed to benefit fifth and sixth graders. As a reading intervention teacher, the students I see are struggling and in dire need of encouragement. They are all in various reading intervention programs and are there because they did not score proficiently on the Connecticut Master Test. Approximately one third are identified as being in need of special education and many are ELL. However, it is my belief that anyone can benefit from learning about his or her personal metacognitive process.

The objective of this unit is that students will be able to recognize, explain, and understand cognitive processes in the brain and also be able to express their feelings about learning. They will be able to explain and question human brain development, differentiate between the active and reactive brain, explain comprehension strategies and describe their personal learning styles. Students will be presented with short readings, video clips, websites, and other activities about on how different parts of the brain behave when they are in a certain learning environment. This substantiation will, hopefully, give students confidence in their ability to understand their metacognitive process (being aware of how they learn and their ability to manipulate and control their learning process) and impress upon them that they can *train their brains* to learn more effectively. On the negative side, students will learn about the detrimental effects of stress on a learning experience. Stress inducers include things like lack of sleep, poor nutrition, emotional difficulties, substance abuse, and also boredom.

The Brain Unit has four sections; Brain Basics, The Caveman Brain, The Modern Brain and the introduction of fiction using the junior fiction novel, *Joey Pigza Swallowed the Key* . The sections are designed to teach students how to live up to their learning potential. My hope is that students will be shown and not told, how their brain operates and after seeing this evidence become more willing to risk learning. Students will create their own personal brain user's manual.

Brain Basics

A great way to start each day would be to have one "weird" fact about our brains up on the board. For example, brains have enough electricity to run a light bulb; there are more neurons in one brain than stars in the Milky Way; and we have 600 miles of neurons in our heads. Once intrigued, students will see pictures of the various parts of the brain, paying close attention to neurons and how they operate. This will also include real images of brain scans and an explanation about how glucose and oxygen trails (hemoglobin) allow researchers to pinpoint the precise areas we use in living and learning.

The Functional Magnetic Resonance Imaging (fMRI), a machine similar to an MRI, can monitor hemoglobin levels throughout the brain. Hemoglobin transports oxygen and glucose in the brain and its presents signifies the areas of brain activity. Images that are more precise give researchers a clear idea of which regions are active during a particular cognitive task. Electroencephalography (EEG) measures the presence of voltage in a certain area of the brain. When information travels along brain cells or neurons, it moves as a tiny spark of electricity. An EEG machine can create images that give researchers amazingly precise data on the brain areas activated when a person is engaged in activities like reading. Images from these different machines can be studied to compare the brain activity of good readers to those of struggling readers. This provides insight on why one person can comprehend text and another become confused. With this insight, researchers evaluate the validity of specific teaching practices. There are many beautiful pictures on the internet that can give students a visual image of the inner workings of the brain. At this time, I will let students handle models of the brain that show basic brain features such as brainstem, cerebellum, thalamus, occipital, parietal, temporal, and frontal lobes. Students will also draw a brain cell so that they can get a better understanding of how connections between neurons are made.

The Caveman Brain

This section is devoted to how our brains have developed and how natural selection has molded how we think and feel. Topics include how brains have developed outwardly from the small reptilian region to complex grey matter. The connection to standing upright, fight or flight, and why the ability to communicate saved our species from certain extinction, in harsh environments will be covered. My hypothesis is that by explaining and showing evidence about how the human brain has developed over the past 200,000 years, and the ramifications of this development, will intrigue students and give them a sense of power. It is my experience that students find connections to our caveman ancestors fascinating and is therefore helpful in keeping them intrigued.

The brains we use today are not meant to read, drive cars through cities, take tests on geography, and play massive amounts of video games. Nor were they developed to run on chicken nuggets, chocolate, and five hours of sleep. Our brains were developed to live in extremely harsh environments where surviving the elements and predators depended on a social unit that pooled resources and outsmarted other animals. Our brains are wired to deal with stress-immediately, and this skill both helps and hurts us today. [3] This is especially true in the classroom and its ramifications can cause a struggling student to give up on learning.

When the brain confronted with something unknown, uninteresting or confusing it will take steps to avoid this negative experience. Outward symptoms of this avoidance can be acting out and daydreaming.

The human brain was so successful in keeping our species alive because it is hardwired to deal with stress, any stress, first. For example, when our ancestors came upon a field and saw a glimpse of purple, the exact purple we knew to be the color of the calorie-laden grapes from last year, and a small snatch of orange, they dealt with the orange first. The orange was the unknown and unique object in the environment. The flash of orange created stress and our ancestors investigated that first. They did not go and pick the mouthwatering fruit, they investigated the strange only to find out that it was a tiger and made the instant decision to fight or climb a tree. Homo sapiens who went for the grapes have no descendants.

Our ancestors' survival skills have consequences in our lives today and are particularly evident in classrooms, even when we do not have predators roaming the halls. Today, the confusing math problem or unknown word in a sentence is the stressor. All other clear and interesting information is thrown to the background so that the brain can process the problem. Once sentences begin to have too many problematic words, comprehension starts to break down and frustration usually results. As teachers, we must walk a careful line when we present material to our students. Material that is too stressful creates confusion and material that is not at all stressful will start to become boring.

Another way that brain development is apparent in the classroom is speech. One hundred thousand years ago, our ancestors stood up. There are many theories as to why we did this such as, to see over grass or carry food, and it changed how we communicate. By standing up, we forced our chins to lift and our throats to elongate. This change allowed us to make an incredible new variety of sounds, and languages were born. Language development meant that we could pass survival skills to the next generation instead of continually relearning. New information could be acquired and we developed more and more complex brains as a result. Language was one of the things that fueled brain development and this evolution created more complex speech patterns.

As anyone who has ever had lunch duty knows, humans have become incredibly good at speaking. It is a natural part of human development and many researchers believe is one of the reasons for our profoundly developed brains. Babies learn to talk by watching and imitating adults. Reading is a skill that cannot be learned through observation, but when we engage students in substantive conversations that promote higher order thinking, at any grade level, they can use one highly developed skill to improve and solidify the learning of another. [4]

The Modern Brain

This section is about our modern brains and what we can do to improve learning habits. Lessons and readings will be about patterning, assessing prior knowledge, how emotions help or hurt, visualizing, learning what areas in our brain are engaged when doing a specific task, and understanding how you learn. (There are many ideas for readings on a variety of different levels in the resource section of this unit. I think that the web site Neuroscience for Kids, developed by the University of Washington is particularly beneficial.) Students will see that they can take a more active part in the classroom and learn how to *train their brains* .

Millions of years in the making and our modern brains have become one of the most complex things on Earth. Information from our senses is taken in and our brain decides to route it to one of two pathways. The first is the reactive brain which operates by instinct and the other is the active brain where higher order thinking takes place. More than 80% of information is processed in or through the reactive brain. This has ensured our survival, but also has the potential to undermine classroom experiences.

The reactive brain, comprised mainly of the reticulating active and limbic systems, responds without thought. Sensory data received by the reactive brain filters the 2,000 or more bits of data that come into our brains every second, before it is deemed important enough to reach the thinking brain or the prefrontal cortex. The prefrontal cortex is the area of the brain devoted to complex thought and it is essential that information reaches this area if learning is to occur. There are two levels of filters that information must pass through to get to the prefrontal cortex.

The first filter is the Reticular Activating System (RAS). This part of the brain receives information from the outside world through seeing, hearing, tasting, and touching. As information from muscles, nerves and other organs, arrives, the RAS determines if any is necessary. Nonthreatening information is then passed to the limbic system or emotional core of the brain.

How does this affect learning?

A person who is in pain or hungry will have a difficult time learning. Incoming information about this problem takes precedence and very little, if any other data will be passed to the thinking brain. This is also one of the reasons why sound and intriguing movements are so distracting and breakfast is so important.

The limbic system is the second filter and is comprised of the amygdala and hippocampus. The amygdala routes information based on a persons' emotions. The hippocampus routes information based on related memories.

How does this affect learning?

A person who is in emotional turmoil or is reminded of an emotional experience will also have a difficult time learning. For example, if a student has gotten in to a fight at home or is being bullied, he or she will struggle and retain little new information.

Thus, the reticular activating system and the limbic system can be deterrents to learning. There is one aspect in the reactive brain that can actually help the process of learning. Dopamine is a neurotransmitter and can have a positive effect on learning. Neurons communicate with each other using chemicals and tiny sparks of electricity. They cannot be permanently attached because they need to be able to shift and make new connections as learning progresses. Because of this, there is a tiny gap, called a synapse, in the connection of between neurons. Information can travel down brain cells at a rate of 268 miles per hour. Dopamine is the chemical needed for the electricity to bridge the gap. Increased dopamine levels produce more activity between neurons. Electricity is flowing though the brain in a more efficient manner and what the person is doing becomes a pleasant experience. When a person is doing something enjoyable their brains have an increased amount of this chemical. Dopamine aided our ancestors by reminding them to do satisfying and enjoyable activities that ensured their survival. A learning experience that produces this will be repeatedly used and valued.

How does this affect learning?

When a student feels successful in a task for the first time, their brains are flooded with dopamine and they feel satisfied. The release of this chemical will make the student want to replicate that scenario and teach them how fulfilling learning can be.

Awareness is a powerful tool. Students who are aware of these influences on learning can take steps to triumph over their reactive brain and overcome these filters. In my experience, when they specifically see why skipping breakfast, staying up late, and fighting with their best friend will have an adverse effect on their school day, they are more likely to take steps to change. They learn to be more active participants in life.

The active brain is where the prefrontal cortex is. Actions such as evaluating information, abstract thought, and concentrating on a task, are performed here. This is also where short term and long term memories are stored.

The prefrontal cortex is responsible for:

- Ability to balance short-term rewards with long term goals

- Considering the future

- Focusing attention

- Foreseeing and weighing possible consequences of behavior

- Forming strategies and planning

- Impulse control and delaying gratification

- Inhibiting inappropriate behavior and initiating appropriate behavior

- Making predictions

- Modulation of intense emotions

- Organizing thoughts and problem solving

- Shifting/adjusting behavior when situations change

How does this affect learning?

Our brains have a ferocious need to find patterns and/or link new information to known information. Each new thought grows dendrites and joins brain cells together. The more connections a novel idea has to other memories, the higher the probability that it will be retained. [5] I believe that many of the comprehension strategies we use follow this principle. When we preview a book, we prepare students' brains by alerting them to possible incoming patterns. When we ask students to make connections, however tenuous, we are giving new ideas a place to anchor. For example, I may not ever have been to the Sahara Desert but I do know how hot dry sand can get from going to the beach. Reminding the brain of prior connections or patterns gives new ideas a place to reside and more connection increases comprehension. Robert Marzano's research on learning

strategies found that identifying similarities and differences was the most affective teaching practice with an average percentile gain of forty-five. [6] Comparing two or more topics is yet another way for our brains to more clearly delineate the categories where new data should be filed. Reviewing simply reinforces a pathway that has already been laid down and makes retrieval faster and more efficient. I tell my students that learning and employing patterning strategies is like putting a file cabinet in alphabetical order. I have found, over the years that sharing this explicit information and explaining to students why we use particular strategies, helps them to intrinsically motivate. They are far more willing to do things they don't like doing if they concretely understand its purpose. This is especially important for students, like Joey Pigza, the main character in the novel, who have stressful school experiences. Comprehension strategies are those practices that we have been teaching to promote the close reading of text. These strategies work because we are teaching brains to use more parts of itself. These are things that efficient lovers of reading do automatically and that we can model for our students. It is swimming in words and not just walking on top of them.

Unfortunately, for students the prefrontal cortex is the last area of the brain to mature. To compound this problem, at age 11, children's neuron production accelerates, and the task of pruning unused dendrites begins. This is a major change in the life of a brain and when added to increased hormone levels, and the inherent shift of students wanting approval from their families to that of their friends, it is easy to understand why this is such a hard time for our students. However, with new imaging techniques more scientists and researchers working with teachers, are developing best practices that make class time efficient and enjoyable.

The Introduction of Fiction

The integration of fiction into this unit provides students with an entirely different view of the same subject. Approaching material using a variety of strategies and materials not only provides a richer experience but also lays down more neuron pathways. This enables students to make complementary connections that improve comprehension. The last 10 minutes of every lesson will be a shared reading of *Joey Pigza Swallowed the Key* . This is a book about a boy with Attention Deficit Disorder (ADD) and provides a heart-wrenching look at children who learn differently. In first person the main character describes how he feels when his "meds wear off" and the thinking behind his outrageous behavior. This book has allowed many adults to sympathize with struggling children and given students courage to understand their differences. Reading his story, the question posed will be: How could the information we have just learned apply to Joey?

The fictional aspect of this unit reminds us that we are human and that this bunch of wires has created some amazing experiences. The first line in *Joey Pigza Swallowed the Key* is, "At school they say I'm wired bad, or wired mad, or wired sad, or wired glad, depending on my mood and what teacher has ended up with me. But there is no doubt about it, I'm *wired* ." Fiction will allow us to explore the emotional side of our relationship with our brain. Most of the students in my class have been told they have some sort of learning disability and that whatever cognitive skills they have is not enough. The addition of fiction, primarily Joey Pigza Swallowed a Key, will give us a chance to discuss what it is like to be frustrated with how this organ works.

Fiction will also allow us to take a lighthearted look at our brains and learn how other people have dealt with this complex thing between our ears. *Joey Pigza Swallowed a Key* starts off with main character describing how he came to be imitating a Tasmanian Devil, in the hallway, outside of his class. It allows the reader to experience the thought processes that motivate a child with hyperactivity. After being emotionally abused by

his grandmother, Joey's mother comes back to try and pull both Joey's and her own lives together. Joey goes to many more doctors and then changes schools on an emotional roller coaster, on and off different kinds of medications. We learn how painful the question, "why" is when you have little control of your thoughts. Joey says that, "Someday all that asking me 'why?' is going to wear my brain down so that it is as smooth as a boiled egg." We learn why he swallows his house key (it is attached to a string and he wants to pull up some spaghetti from lunch), stuck his finger in the pencil sharpener (his mom said he needed to file his nails and he wanted to be a vampire) and use an entire box of Band-Aids to make a dog face on his stomach (to remind his mother he wanted a Chihuahua.) After many tests, Joey is finally put on medicine that does allow him to focus just enough to learn how to deal with his problems and learn how to live with a brain that is wired differently from others. In the end, he advises the reader to make their problems the, "smallest part of who they are."

The new common core standards call for at least 70% of the text we present to our students be nonfiction. I do agree that incorporating more science and social studies text in language arts will help the two subjects that sometimes, in our zeal to improve test scores, take a backseat to English and math. The coordination would also provide students with a continuity of foci. However, a recent *New York Times* article "Your Brain on Fiction" byAnnie Murphy Paul, spoke out against this trend. Researchers using fMRI imaging are proving the validity of teaching fiction, as well as nonfiction. Reading narratives not only activates the Boca Area, a part of the brain that interprets the written word it actives areas of the brain that are needed for single words or ideas. For example, the word "pizza" or the idea of fresh baking bread also activates the primary olfactory cortex. The same is true for words and phrases that deal with physical activity. Metaphors can also provoke the brain into using more of itself. "Slippery as an eel" evokes a response in areas of the brain that deal with tactile stimulation.

Research is also finding that the brain does not distinguish between thought and reality as one might suppose. Reading provides our brains with practice in dealing with a variety of circumstances. When we read fiction, we follow how a character deals with emotions and conflict. Reading *To Kill a Mockingbird* requires the brain to spend hours examining the ideal of justice. Students' brains will have developed more connections in the areas of the brain concerned with more abstract principles. Just as we can learn about our world from nonfiction, we can learn about how to live in the world by reading fiction. In a chapter of *Cognitive Literary Studies Current Themes and New Directions* , Keith Oatley writes:

> One of the virtues of taking up this idea from cognitive science is that we can think that, just as if we were to learn to pilot an airplane we could benefit from spending time in a flight simulator, so if we were to seek to understand better ourselves and others in the social world, we could benefit from spending time with the simulations of fiction in which we can enter many kinds of social worlds, and be affected by the characters we meet there. [7]

The human brain thrives on reading both fiction and nonfiction.

Conclusion

Our modern quest for understanding the brain is not unique to our time. Sacred Sanskrit scrolls describe Buddhist understanding of brain surgery and are almost three thousand years old. Archeologists in Turkey found skulls that show evidence of trepanation and have neat rectangular holes sawed out and healed over. Galen, a doctor of gladiators was the first known physician to conclude that our brains actually control us and, therefore, control out thoughts and emotions. We have the words of Shakespeare's Macbeth who advises us to "Raze out the written troubles of the brain." And, in times that are more recent, Diane Ackerman writes:

> Imagine the brain, that shiny mound of being, that mouse-gray parliament of cells, that dream factory, that petit tyrant inside a ball of bone, that huddle of neurons calling all the plays, that little everywhere, that fickle pleasuredome, that wrinkled wardrobe of selves stuffed into the skull like too many clothes into a gym bag. [8]

My hope is that through explicit instruction on the knowledge scientists have been able to provide us about the brain, students will get a better understanding of how and why people learn. Students will be given evidence and continually asked to examine and explain how this information affects metacognition, i.e. thinking about how they think. I hope to provide proof of the efficacy of comprehension strategies and allow students to draw their own conclusions about their merit. It is my belief that this proof will empower students and allow them to gain trust in their ability to learn. Trust will encourage students to be risk-takers in the classroom. Hopefully, confidence will be fortified and students will learn that they have the power to change how their brains work. Understanding why we do things helps them to intrinsically motivate. They are far more willing to do things they don't like doing if they concretely understand the purpose. This is especially important for students, like Joey, who have stressful school experiences. They can train their brains!

Introductory lesson

The objective of this lesson is for students to understand the purpose of the unit. The introductory lesson is important because it will clearly lay out objectives, use visual images to create anchors in students' minds, and ignite their curiosity. Anchoring is a practice used by many different teachers in a wide variety of classrooms. In this practice, students are shown a short video clip on the topic they will be reading. This creates a visual "file" in students' minds that allows them to anchor new information and develop interest in the coming topic. It is like the practice of exploring prior knowledge in order to make connections and is especially useful with students who may have few life experiences to relate with the material. This is a six-minute clip that uses a model to point out where the brainstem, thalamus, occipital, parietal, temporal, frontal, and cerebellum reside. It also shows the parts of a brain cell, the soma, nucleus, dendrites, myelin sheath, axon, and axon terminals and how they work. I would have them label a blank diagram the following day. That could be done as a whole class, in pairs as a scavenger hunt on the computer, or individually depending on students' needs. The assessment would be a written paragraph answering the question: What will we study in this unit? (In this unit, we will study the brain and how it works and how it learns.) What is the

purpose for the unit and why it is important? (The purpose is for me to understand my metacognitive process and learn strategies to make my brain work more efficiently.)

Cognition Experiment

In pairs, students will make a 1 list of 20 nouns and find simple clip art pictures to match. For example; cabinet, ship, orangutan, grapefruit, pen, CD player, boxing gloves, rocking chair, sofa, TV, flag, sneakers, key board, skate board, Hippopotamus, baseball hat, dictionary, fingers, bus, watch.

Two other students will be given the list to study for one minute and then, separately given one minute to repeat as many of the objects they can remember. A second test or trial would then be performed as before, but with the addition of the test subject listening to music with headphones. A third trial would be run with picture representations in place of the word list. A fourth trial given after the student has one minute to sort objects into categories such as, items that go on your hand, or things that move. In a final trial, the pair of subjects will be given the list to study for one minute and then work together to name as many objects as possible. The data could be graphed in a math lesson. This lesson could be differentiated by adjusting the number of items or the number of trials. The following day, students would switch roles so that students could have both experiences. The assessment would be completion of the graph and answering these two open-ended questions:

Which trial did you excel in and which trial did you find the most challenging?

How could you use this information about metacognition to improve your study habits?

	1st Trial (base line)	2nd Trial with music	3rd Trial with pictures	4th Trial after sorting	5th Trial with a partner
Student 1					
Student 2					

Haikus

In order to further explore the different brain functions students and experiment with creative writing students will write their own haikus for each of these parts thalamus, occipital, parietal, temporal, frontal, and cerebellum. Writing haikus is also a great way to foster phonemic awareness and a unique way to study science. Here are some examples:

Brain cell

Electricity runs

from dendrites through myelin

synapse spark ideas

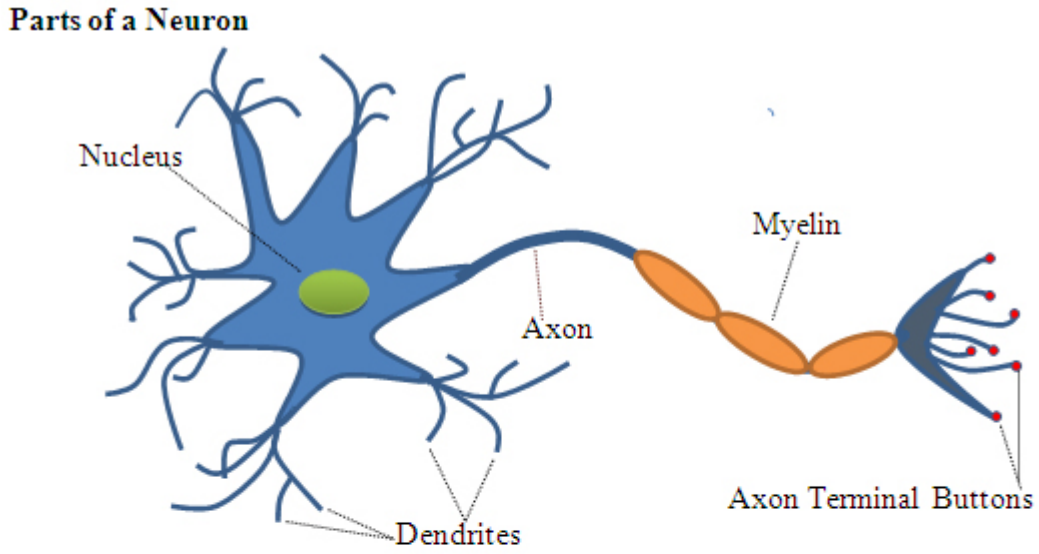
Cerebellum

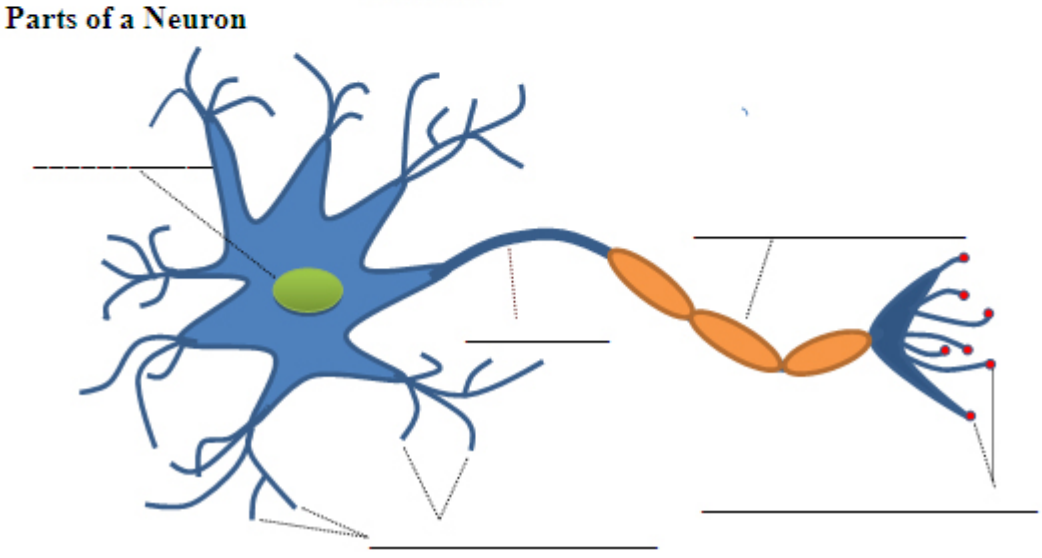
On top of the brainstem

balance, movement, muscles

coordination time

The number of syllables for each word is basically determined by the number of vowel sounds present in a given word. There are a number of websites that students can type their lines into and check to make sure their syllabication is correct. This lesson could be differentiated by the number of haikus required for each student. The assessment would be the poem.





Unit Strategies

- The comprehension strategy that I have decided to focus on is finding problems and solutions. I have found that focusing on this strategy is a good way to initiate close reading.

- The Brain Manual unit consists of a variety of text, multimedia, and tactile components. In order to maintain continuity students will keep a notebook of handouts and work they have done. It will be a portfolio.

- Each handout will have 2 small boxes at the bottom. Both the student and I will rate the paper on a score of 1, 2, or 3.

- Handouts will always have three holes punched. The handouts will include text as well as comprehension questions and at least 3 open-ended questions, per week that mirror the ones they will see on the new Common Core assessments.

- The warm up activity will be fun facts and each day students will copy down one sentence of trivia.

- To utilize the practice of anchoring and most lessons have a short video that prepares students for the lesson.

- The culminating project will be public service posters, on learning strategies that they have found the most profound or helpful. The posters will be placed around the school.

- Each day will have 2 sessions to maintain student interest.

- Higher readers will be challenged some of the higher readers by having them read the short story version of *Flowers for Algernon* .

- Review bingo will be used to reinforce learning. In this practice, students are given a list of answers to randomly place on a bingo sheet. I read the questions matching and in order to win the students has to explain their answers.

Fascinating Brain Facts

1. You cannot tickle yourself because your brain can distinguish between unexpected external touch and your own touch.

2. Your brain uses 20% of the total oxygen in your body.

3. The human brain continuallycreates neurons inresponse to mental activity.

4. Children who speak two languages before the age of five will have denser gray matter as adults

5. The human brain is the fattest organ in the body and can consist of 60% fat.

6. Your brain consists of about 100 billion neurons.

7. The brain is made up of about 75% water.

8. The weight of the human brain is about 1.5 kg (3 lbs.).

9. The total surface area of the cerebral cortex is about 2500 sq. cm (2.5 ft2)

10. There are anywhere from 1,000 to 10,000 synapses for each neuron.

11. A newborn baby's brain grows about three times its size in the first year.

12. Information from the brain to other parts of the body can travel as fast as 268 miles per hour.

13. While awake, your brain generatesenough energy to power a light bulb.

14. An area of the brain called the amygdala allows humans to ascertain another person's mood by reading facial expressions.

15. Studies show that brain waves are more active while dreaming than when you are awake.

16. Reading aloud and talking often to young children promotes brain development.

17. The brain of an adult human weighs around 1,400 grams or 3 pounds. This is an average of 2% of a person's total body weight but the brain uses 20% of its energy.

18. Other animal brain weights in grams; sperm whale 7,800, elephant 4,783, cow 450, squirrel 7.6, goldfish .097, cat 30.

19. The brain is suspended in Cerebrospinal fluid. It floats and the liquid acts as a cushion from blows to the head.

20. For the most part one side of the brain controls the other side of the body

21. There are over 100,000 miles of blood vessels in the human brain.

Common Core Standards

Reading: Informational Text

- CCSS.ELA-Literacy.RI.6.1-Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.

- CCSS.ELA-Literacy.RI.6.2-Determine a central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.

- CCSS.ELA-Literacy.RI.6.4-Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings

- CCSS.ELA-Literacy.RI.6.7-Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

- CCSS.ELA-Literacy.RI.6.8-Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not.

Reading: Literature

- CCSS.ELA-Literacy.RL.6.5-Analyze how a particular sentence, chapter, scene, or stanza fits into the overall structure of a text and contributes to the development of the theme, setting, or plot.

- CCSS.ELA-Literacy.RL.6.7-Compare and contrast the experience of reading a story, drama, or poem to listening to or viewing an audio, video, or live version of the text, including contrasting what they "see" and "hear" when reading the text to what they perceive when they listen or watch.

- CCSS.ELA-Literacy.RL.6.9-Compare and contrast texts in different forms or genres (e.g., stories and poems; historical novels and fantasy stories) in terms of their approaches to similar themes and topics.

Science

- CCSS.ELA-Literacy.RST.6-8.4-Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6–8 texts and topics* .

- CCSS.ELA-Literacy.RST.6-8.5-Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.

- CCSS.ELA-Literacy.RST.6-8.9-Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Teacher Materials

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