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A Multiple Intelligence Approach to the Physiology of the Brain and How Middle School Students Learn

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A multi-intelligence approach in the classroom is one surrounded in a great deal of controversy through out the scientific community. Many schools approach teaching middle school students by delivering lectures to the pupils, arranged in rows, as in a lecture hall at a large university. With so much emphasis today on test scores and comparing students, teachers sometimes feel rushed to deliver a great deal of information to students in a lecture-type venue, hoping students will grasp the material. My personal belief is that we must engage all of our students in a cooperative learning setting. From most of the recent literature and my own experience, students work better using different modalities. Each student brings their own strengths and ideas to the group and all students can learn from each other. We as teachers can also learn from our students and the many different learning styles they use to solve problems. The Multiple Intelligence Approach utilizes teaching according to each of the students' strengths, whether it is an artistic, mathematical, linguistic or other intelligence.

Howard Gardner believes that different parts of the brain function on an independent basis. This certainly supports the theory that different children learn in different ways. Each student has one or more of seven different intelligences. Every student has a different profile of strengths and weaknesses across these intelligences. As a teacher, I must learn how to teach to all of the students in different ways. By doing this, I hope to reach every student, not just a portion of the class.

If lessons addressing the different learning styles are presented to a class of students each with different intellectual strengths and weaknesses, the learners will be able to extrapolate the information and use it to forward their own learning. I believe in Howard Gardner's Theory of Multiple Intelligence in which he states that there are seven different intelligences. He believes learners can fall under these categories: Verbal/Linguistic, Logical /Mathematical, Visual/Spatial, Bodily/Kinesthetic, Musical/Rhythmic, Interpersonal, and Intrapersonal.

I believe students can discover or develop various intelligences as they traverse through different stages of their lives. My research into Howard Gardner's theory includes various resources in a multitude of genre: websites, sample documents, books in the field of physiology, support of Jepson Regional Magnet School/Yale New Haven Teacher's Institute Team, and the various team meetings of our class, "Intelligence: Theories and Developmental Origins." I plan to create a teacher's unit plan on multi-intelligence and integrate all of these important resources.

I will be using my teacher plan in the upcoming school year, and I hope to affect many students and staff members with the use of strategies that foster accessing different multiple intelligence skills. At the middle school level, we as teachers are being encouraged by our administration to have our students work in cooperative groups as well as doing hands-on experiments. I will teach my students, as well as our staff, how the physiology of the brain works and what type of learning styles work best for middle school students. My focus is to not only help students identify what styles or multiple strengths help them learn the best, but also what form of intelligence they possess and how they can accentuate their already given talents and develop other types of learning strategies. I hope to do various forms of hands-on experiments showing students directly how they learn, why they learn, and in which ways they learn best.

By teaching my students my unit plan at the beginning of the year, I hope and expect that the students will be empowered over their own futures and become independent life long learners. The push of many school systems is standardized testing. If our students learn what makes them successful learners, they will be able to perform better on any form of assessment. My hope is that my students will be able to not only learn about the different learning centers of the brain and how they work, but how we learn as well. They will have several weeks of instruction in how our external environment (for example, stress, drugs and alcohol, toxins from pollutants) and our nurturing environment affect our brain and learning process. For the conclusion of our learning about multiple intelligence, I will be asking my middle school students to create their own lesson plans for use with younger pupils in Lower Jepson School. This would directly support the cooperative learning approach and the multi-age program at Jepson. I will also document all student lessons by videotaping the students. In this way, the students will learn not only by listening and interacting, but also "by doing." This will hopefully continue to foster a strong, positive community of learners.

The unit plan that I created will additionally affect our staff in a direct manner. Though I am fortunate enough to work in an atmosphere that generally has awareness of Gardner's intelligence theory, this unit will help to accentuate the positive attributes of all our students and bring the theory of Multiple Intelligence to a more concrete level. My unit plan will be discussed at meetings and at book chats so that all staff will develop a greater awareness of Multiple Intelligence Learning.

Theory of Intelligence an Introduction

Modern psychologists have a running debate on whether there are actually multiple intelligences or if there is just one general intelligence. Most psychologists have linked their studies to "The g Factor" or "General Intelligence." They have linked their research to other psychologists before them by using variables and constants, which are linked to statistical representations. On the other side of the spectrum is a Howard Gardner who, after researching different humans with disabilities, has come to the conclusion that all people have various kinds of intelligences localized in different parts of the brain. Gardner does not dispute the fact that there is a "g" or general intelligence however; he just chooses to emphasize the fact that he believes in "s" or specific intelligence is most important. He believes different intelligences are located in different parts of the brain. Many of his fellow psychologists don't deny the fact that there are possibilities of multiple intelligence, but that there is still a general intelligence, "because these separate intelligences are highly intercorrelated such that skills in one area predict skills in other areas." This is the basis of all human intellect. Gardner disagrees. His theory states that there is general intelligence, but the brain is sectioned into several specific areas. His area of emphasis is very different from that of conventional theorists who largely restrict their inquiry to verbal and spatial reasoning. One reason why mainstream psychologists keep finding support for "g" is that they fail to develop and incorporate measures of other human abilities, such as musical and athletic ability. This point of the debate is purely semantics in that Gardner enlarges the scope of inquiry well

beyond traditional boundaries.

In the New Haven School System, students in the middle grades level do not have a curriculum that impels an extensive look into the biology of the brain and its functions. The study of how the body functions, however, is introduced during students' middle years of education. My goal is to give students an understanding of the biology of the brain and how it functions with the body. The focus would be specifically concerning how drug and alcohol inhibit healthy growth in the development of the body and brain functions. Additionally, they will learn about different physiologists and the controversy surrounding general and multiple intelligence theories.

This unit encourages students to learn about how the brain functions using different styles of learning. The use of hands-on activities will be the thrust of this classroom curriculum. The purpose of this unit is to let the students develop concrete guidelines that will help them understand how they learn best. The opportunity for the students to learn about how their brain functions will help them to understand their own shortcomings and strengths at an early age and also begin to analyze how their intelligences have changed and can modify over time. This will also help students employ the learning styles that work best for them at this point in their lives.

Gardner believes that there is not simply a general intelligence but multiple intelligences found in different parts of the brain. He believes that there are many cases of individuals with different brain inflections that can compensate in life by using another independent part of their brain to compensate for their difficulties. For instance, he believes that someone with prosopagnosia is a person who has their linguistics intact, is perceptual and has memory abilities. A person with prosopagnosia has had temporal lobe damage specifically the right side of the brain. This means a person with prosopagnosia has an inability to recognize familiar faces. Gardner also described the example of a boy with prosopagnosia, Jomo Kenyatta. His training as a boy in Kenya enabled him to identify every head of livestock in his family's herd using the cues of color, markings, and size of horns.¹ This illustrates Gardner's example of independent intelligence. Also, idiot savants and prodigies have the same respect to this ability. Children or adults afflicted with Williamson's disease are people with lower IQ's who also display a keen sense of musical ability. These are several examples that Gardner uses to show independent brain activity.

In support of Gardner's theory on multiple intelligence is additional psychometric evidence concerning individuals with IQ's lower than average. Some individuals obtain a higher sense of musical ability as well as a correlation between other types of intelligences.² Also, as support for Gardner's theory on independent brain function; Dr. Bennett Shaywitz studied the dyslexic brain. ³ In the past decade, scientists have learned a great deal about the dyslexic brain. Specifically, they noted that the neurological function of the brain could be directly linked to poor language skills. The part of the brain that is usually active during reading and sound recognition is inactive in dyslexics. However, Dr. Shaywitz states that this does not affect the person's general intelligence or "g". There are many famous people who are dyslexic and had to overcome this inability to break down phonemes in the English language. Dr. Shaywitz states that dyslexics have to overcome this problem to succeed in our society. He also adds that these people have to use other methods to compensate for the part of their brain that is not functioning properly.

Gardner indicated that the definition of intelligence involves the separation of different abilities that maybe partially distinctive. He stated, spatial intelligence entails a number of loosely related capacities: the ability to recognize instances of the same element and the like. Conceivably, these operations are independent of one another and could develop and break down separately; and yet, just as rhythm and pitch work together in the area of music, so, too, the aforementioned capacities typically occur together in a special realm. Indeed, they operate as a family, and use of each operation may well reinforce use of the others. ⁴

It is difficult to evaluate Gardner's claims because in his book he has gathered any present data to show that these separate intelligences are truly independent in a statistical sense, i.e. are uncorrelated in a representative sample. However, Ceci and Liker developed a comparison in research called the prediction equation⁵. They studied expertise in predicting racetrack odds. Ceci and Liker developed regression techniques to determine to develop a prediction equation. They found that reliance on this interactive mode of reasoning was uncorrelated with IQ. They found from their study of a mixed range of intelligence among their participants. Subjects with low IQ are able to reason in a complex way and to solve real life problems. 6

Another supporter of Gardner's Theory of Independent Multiple-Intelligence is Dr. Sue Teele, Director of Education Extension from the University of California, Riverside. She designed a survey called Teele Inventory for Multiple Intelligence's (TIMI) to help teachers to identify their students' dominant strengths. She gave this survey to over 4,000 students. She surveyed students from kindergarten through middle school on the following strengths: Picture Smart, Word Smart, Body Smart, Self Smart, People Smart, Music Smart, Number Smart. She found that middle school students were dominant in the areas of Picture Smart, Body Smart, People Smart and Music Smart. This might be true that students have strengths only in some areas, this does not mean we should only lean to their strengths; that would be taking this information to the extremes. For instance, this would mean we would not teach our first graders to read if this was not one of their strengths. Sometimes, we should emphasis areas of weakness in the class in order to strengthen those weaknesses. I believe Dr. Teele is attempting to have us use the students' strengths to accompany attending to their weak areas of study. Dr. Teele states that the way middle schoolers learn best seems to be in direct contrast to the way most school systems teach them. They will also do better working together in cooperative learning groups than alone. 7

Another advocate for Gardner is Thomas Armstrong. He believes you can follow seven steps to help all students in your classroom learn better. They include:

- How can I involve the whole body or include hands on experiences?
- How can I use the spoken or written word?
- How can I include art, color, or visual aides?
- How can I incorporate numbers, calculations, logic, classifications or critical thinking?
- How can I add music, rhythm, melody or sound?
- How can I include cooperate learning or peer sharing?
- How can I evoke students' feelings or memories?

Thomas Armstrong suggests you enlist the help of the physical education teacher as well as the music and art teacher. 8

Also, in the recent *Newsweek* article written by David Bloomberg, a group of Yale scientists are studying if

there is a link between the way the brain functions and different independent parts of the brain. They discovered that all parts of the brain shut down (except for one) when subjects pray or chant. They noticed that the temporal part of the brain would virtually go quiet, so that only one part of the back of the brain would be activated. They came to the conclusion that many religious experiences come from the back part of the brain. This would have to be the most recent neurological support that sections of the brain actually function in an independent way. 9

I also cite an article about neurotheology, written by Sharon Begley, called "Religion and the Brain" in the May 7, 2001 issue of Newsweek magazine. She researched some fascinating biological evidence for the possible basis of spirituality. Dr. James Austin in 1998 wrote an 844-page report called "Zen and the Brain," in which he stated that there has to be a biological connection between the biological brain activity and what happens when you pray or meditate. Since that time, Dr. Andrew Newberg and his associate Eugene D'Aquili from the University of Pennsylvania wrote an article in April of 2001 called "Why God Won't Go Away". They used brain imaging on Tibetan monks and Franciscan nuns as they were in deep in meditation to conclude the brain has its own spirituality circuit. This type of research was studied in the mid 1950's through 1960's and they found that brain circuits shut on and off during meditation. Dr. Newburgh and his associates have found what exactly happens in your brain when meditating. When subjects are in a state of deep meditation the partial lobe quiets down which makes the subjects feel one with the universe. In the lower temporal lobe, sacred images are present, such as candles or crosses, which facilitate prayer and meditation. Religious emotions are linked to the middle temporal lobe, which deals with aspects of religious experiences such as joy and awe. The frontal lobe lights up during meditation and deep concentration.

Dr. Newburgh states electrical stimulation of the temporal lobe, which is also responsible for language, conceptual thinking and association produces visions.¹⁰ Dr. Newburgh states temporal lobe epilepsy is abnormal bursts of electrical activity in this region of the brain. For instance, Joan of Arc would experience these religious experiences, which were actually temporal-lobe epilepsy. Dr. Newburgh does know that the brain reacts in different independent regions that give a feeling of meditation or religious experience. Dr. Newburgh states, "One Mystery that is unlikely ever to be resolved is whether our brain wiring creates god, or whether god created our brain."¹¹

Also related to Dr. Newburgh's findings of meditation and the brain is the fact that stress and emotional arousal can interfere with the brain's ability to find the source of a sound or a voice. The brain also has the ability to use its emotional brain. For instance, with intense fear, a person who hypothetically saw a poisonous snake would use their fear response to make a short cut connection between their eyes and their occipital lobe, which would tell them that danger was present and an immediate reaction was needed (see overhead 15, The Emotional Brain). Another believer that there are different parts of the brain that function independently is a man named Brodmann who created the Brodmann's Cytoarchitectonic Map of the brain. He labeled 47 different areas of the brain.¹²

On the other side of the coin is the remainder of the physiology community. These scientists link their research to what we call "g" or general intelligence. The classification of intelligence started as far back in history as 2200 B.C., the Chinese used competitive examinations to determine political office. No clear testing of intelligence happened until the 1800's. Psychologists at this time developed a specific vocabulary that would determine levels of mental ability. One of the prominent psychologists of his time was Francis Galton who published a paper called "Hereditary Genius." In his paper he argued that genetic factors were of the most importance to attain eminence. This started the era of classifications of humans. Since the 1900's there have been dozen's of tests linking IQ or General Intelligence from children to adults. One of the earliest

physiologists Lewis Terman suggested an intelligent Quotient concept or (IQ). $IQ = \frac{MA-CA}{CA} \times 100$, which would mean mental age divided by chronological age. These students would be compared to their own peer group. Lewis Terman of Stanford University who created the Stanford Binet Test created the first distinction between different levels of IQ. These tests tested students' vocabulary and mathematical abilities. Most IQ tests of their day were classified to state that 50 percent of the population falls into the normalcy range.

Among other physiologists, Wissler had an important paper published in 1901, which showed there could be a correlation between a group of measures and relationships. Today, we still use Wissler's assessment in our school systems. David Wechsler Bell View (1939,1955,1981) assessed verbal IQ; Performance IQ as well as Full Scale IQ .The Wechsler tests have a strong correlation to IQ. The standard IQ assessment is related to the Mastery Test as well as The SAT test or college entrance examine. The Wechsler, Kaufman, Stanford Binet and Wechsler Intelligence scale puts all people in a classification, IQ range. Although IQ is commonly over valued by those who don't understand their implications. The IQ assessment is a strong indicator of potential for various social, educational and occupational attainments. The range is from a high score of 140 or above which is considered genius down to below 25, which is considered an idiot. However, it is difficult as educators to motivate students to learn if we permanently stigmatize our students with labels, which tend to stick to individuals through out their education, and life.

Also, in 1908, Spearman read a paper written by Wissler. This incited Spearman to research individual differences in mental functioning. Spearman assumed that all conceivable measures of intelligence were related to a common general intellectual function. 14 This is how the theory of "g" or general intelligence was born. He developed two correlations to IQ. These were called "g" and "s", the second symbol standing for specific abilities.

Stanford IQ Score:

$IQ = \frac{\text{Mental Age}}{\text{Chronological Age}} \times 100$

Chronological Age X 100

Lewis Terman used the Gaussian Distribution, which he used to code IQ scores. This stated that any score under 70% was determined as Mental Retardation. This is an artificial cut off as everyone knows.

Another theory of the structure of intellect is the theory by R.B. Cattell (1941, 1963, 1971, 1987). He came up with the premise of Fluid and Crystallized Ability. He suggested that Spearman's theory of "g" could be divided into two separate factors called fluid and crystallized ability. He developed the symbols Gf and Gc to stand for General Intelligence Fluid and General Intelligence Crystallized. He asserts that changes in the biological state of organisms influence Gf more than Gc. Also according to his theory, intellectual ability may be influenced by brain damage, prenatal insults, and nutrition. These events influence Gf more than Gc. Cattell also believed that age-changes in the functioning of the brain lead to an inevitable age-related decline in Gf. By contrast, Gc does not decline with age. Attempts to change intelligence by better schooling or other attempts to change intelligence would affect Gc more than Gf. 11

So, a few comparisons between multi-intelligence as well as the "g" Factor Theory have been discussed. Remember, there is no right or wrong theory of intelligence.

Curriculum

A Multiple Intelligence Approach to the Physiology of the Brain and How We Learn as Middle School Students
To begin my unit starting in September with the classroom curriculum "A Multiple Intelligence Approach to the Physiology of the Brain and How We Learn as Middle School Students," I will review a bit of our human sexuality unit. This review specifically includes discussion of the sexual glands that link to the functioning of the brain as well as the different toxins that pollute our minds and bodies. This will be linked to the past year study of how drugs affect the brain and how malnutrition can affect the body during a teenager's growth and development. I will continue to teach a lesson on how the brain is also effected by any consumed drugs and in what ways these drugs can affect an unborn child or their future as a parent. Information on drugs and the affect they have on the human body can be found in the New Haven School teachers Human Sexuality guide adopted by the New Haven Board of Education for teaching middle schoolers about human sexuality.

There will be an opportunity to dissect a cow brain and learn about the different parts of the brain, the functions of it and how it manages growth and development¹⁴. This shows the dissection of the different parts of the brain and where you find them. Students will be dissecting the brain into five different areas parietal lobe, frontal lobe, temporal lobe, cerebellum and occipital lobe. The frontal lobe controls attention it is linked directly to concentration. The temporal lobe would be directly linked to joy, awe, or happiness. The cerebellum links the rest of the brain to the functioning of the human body like blinking your eyes or breathing which we do automatically. The juncture between the Parietal lobe and the temporal lobe controls the use of language. The children will then create a "brain board game" concerning the negative affects drugs have on the brain. They will then play the games with each other for one class period, rotating from one group to another. At the end of this lesson, the students will bring their brain games to the elementary school for students from grades K-4 to play. This directly affects the cooperative learning style and multi-age approach that I mentioned earlier.

Lesson One

Labeling of the different Lobes the Brain

Objective:

- Draw a poster of a lateral view of the brain in order to label the different lobes of the brain.
- Learn what causes some people to be more musically intelligent than others.

Materials: Create a Science Center for all supplies.

Five sheets of different colored paper for each group

Markers/Crayons for each group

Scissors and glue for each group

Large poster paper 3' x 4' (one for each group)

Four 8"x12" copies of overhead (Lateral view of the Brain)

Procedure: Have students vote on their own supply manager who will be in charge of retrieving and returning all supplies to the Science Center.

Students will label their own copy of the different lobes of the brain from viewing an overhead developed by the teacher.

As a group students will discuss how they will draw a lateral cut out of a human brain and take their colored paper and label those parts of the brain.

Students will pick a person to explain their project to the class.

Note: This is a good lesson to reinforce the vocabulary of the different parts of the brain. (See overhead page for Vocabulary words as well as general information about the brain.)

Lesson Two

Dissection and Labeling of a Cow's Brain

Objective:

- To dissect a cow's brain and label the different lobes.

Materials: Make sure you have plenty of flat top table space.

You should create a Science Center for all Equipment

1 cow brain per (4-5) students

(brains should be soaked in formaldehyde overnight to kill all diseases)

One Box of popsicle sticks or coffee sticks.

Five different colored pieces of construction paper approx., 4x6

Wax paper to cover all tables

Four scalpels per group

Safety goggles for all participants

Latex and Latex free gloves for all participants

One black marker for each group

Three rolls of paper towels

A powerful disinfectant for clean-up

Procedure:

Group students into cooperative groups of (4-5) students. Make sure you try to group an Artist, Music, and Kinesthetic learners together. Assign specific jobs to each student in line with the learning ability.

Have students choose a supply manager they will retrieve a return all supplies to the Science Center. All students need to wear safety goggles and latex gloves.

Set the brain in the middle of the wax paper with students surrounding the table. Choose your Kinesthetic learner to slice the brain in half from front to back down the center of the brain then lay the brain on its side.(Flat side facing up). Have Artistic students prepare the flags to place to label the different lobes of the brain.

Note:

Students will use diagramming material from previous lesson.

Notes

1 Howard Gardner. *Frames of Mind* , (New York: Basic Books, 1983) 35-38.

2 Shutter, Dyson and Gabriel. *The Structure of Intellect* , (New York: Academic Press, 1992).

3 Shutter, Dyson and Gabriel. *The Structure of Intellect* . (New York: Academic Press, 1992) 18, 19, 20.

4 Gardner, *Frames of Mind* , 1983, p. 176.

5 Ceci and Liker. *The Structure of Intellect* , (New York: Academic Press, 1988) 44.

6 *ibid*, 44.

7 *Celebrating Multiple Intelligence: Teaching for Success* . Data compiled by Dr. Sue Teele (How Kids Learn).

8 Thomas Armstrong. *Multiple Intelligence in the Classroom* , (Virginia: ASCD, 1994).

9 David Blomberg. "Is God a Brain Function?" *Newsweek* , June 2001, 20-26.

10 *The Structure of Intellect, The Theory of Crystallized and Fluid Ability* , 8.

11 Sharon Begley. "Religion and the Brain" *Newsweek* , May 7,2001 52-57

12 Overhead Brodmann's Cytoarchitectonic Map

13 *Encyclopedia of Human Intelligence* , 1994, p. 44.

14 Overhead Right Lateral view of the brain

Annotated Bibliography

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Student Resources

Brain Connections, 2001, [http:// www.brainconnection.com/topics](http://www.brainconnection.com/topics).

Project Zero, <http://www.pz.harvard.edu>

Neuroscience for Kids, <http://www.neuroscienceforkids.com>

Music and Mind, <http:// www.musicandmind.com>

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(figures available in print form)

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