NPTT PROGRAM
EDCI 557 PORTFOLIO
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Table of Contents

Lesson 1 **June 25, 2006**

For Lesson One, my task upon reviewing Dr. Carson's article, "Direct Instruction" is to answer the following questions:

1. When do you believe direct instruction is most appropriate to use?
2. What are some examples from your own teaching where you might use direct instruction?

My approach will be to answer these questions based on my experiences so far as a math teacher and my understanding of direct instruction.

For question one, direct instruction is most appropriate when verbal communication of instruction is the best method of teaching a concept. A storytelling instructional approach allows the teacher to put feeling with expressions, body and face movement and voice tone together. This exchange of ideas captivates the audience/students into following along to learn what happens next. This is probably the best form of direct instruction and is an art to perform. Direct instruction is well suited to provide explanation of how something is done, put together or occurred. It works well when an exchange of information is required from teacher to student. While the lecture format may be considered boring and not in vogue today, it can be modified by teachers at the high school level to be effective. For example, teachers can reduce the amount of time a lecture is given and combine it with visual or hands-on learning techniques to round out a lesson plan. This approach enables the teacher to come at all angles of instruction so students may grasp the concept being taught. Direct instruction is a viable form of instruction available to teachers to use in the classroom.

For question two, as a math teacher, direct instruction is always a key part of my instructional approach to explaining new math skills to my students. I like to use it to introduce a new math concept or skill, explaining how and why this works and how it fits into the overall math schema. For example, when I teach geometry's famous Pythagorean Theorem, I would perform the following direct instructional steps. First, I would tell a verbal story about the background of the person Pythagoras and then explain how the theorem was discovered and what it is ($c^2 = a^2 + b^2$), along with how to apply it to the real world. Next, I would demonstrate an application of the theorem, such as the 3/4/5 right triangle which is used in carpentry and landscaping. I would also use visual instructions via diagrams on the board. Working out problems on the whiteboard would round out my instruction, so that students will remember this theorem and use it in their lives. Also, I use direct instruction to explain how a math problem is worked out on the board. Simply writing out a bunch of algebraic steps without a verbal explanation of what each step is would be of little use to students trying to figure out and understand how to solve the problem. For me, direct instruction is a key instructional tool that I use on a daily basis in my math classroom.

Lesson 2 **June 25, 2006**

For Lesson Two, my two tasks upon reviewing Dr. Carson's article, "The Consequences of Behaviorism," is to:

3. Write a short paragraph reflecting on my own education and how it has been influenced by behaviorism.
4. Write twenty "behavioral objective" that could be used by the teacher in planning a lesson using the phase, "As a result of this lesson the student will be able to…"

My approach will be to complete these tasks based on my experiences so far as a math teacher and my understanding of behaviorism.

Upon reflecting on my own education, I've been influenced by behaviorism in the following ways. First, during my elementary and secondary education I was strongly molded by the factory era/assembly line behavioral approach to education required by schools to produce factory workers as described in the article. Growing up in a steel mill town in western Pennsylvania, I became a product of this specific behavior approach where I learned to be a hard worker, always on time, take orders and refrain from being innovative with creative ideas. While I learned these behaviors quite well, I rebelled and did not join the work force in the factory. Instead, I earned my way through college where I developed into a very innovative thinker who was always trying to come up with solutions to problems. This was due to my training in mathematics, computers, business, science and engineering during my undergraduate and graduate studies. This educational behavioral environment focused on creating individuals who were independent thinkers with the ability to be creative in coming up with innovative solutions for problems facing society. Second, I've expanded into the educational field where I've been trained to become a teacher to meet society's need for more informational trained students who can meet the global economy challenges of today. Students will be required to be independent thinkers to come up with solutions to technological problems of the informational revolution happening now.

Listed below are my responses to the second part of this assignment, "As a result of this lesson the student will be able to…"

1. Determine how many cubic yards of concrete will be needed to pour into a new driveway.
2. Solve a quadratic equation, using the FOIL method.
3. Add fractions with different denominators.
4. Determine how many sheets of 4'x8' plywood would be required to enclose a house based on its surface area.
5. Hand draw the equation of a line and parabola on graph paper.
6. Use a graphing calculator to determine solutions of two equations.
7. Calculate the area under a curve using integrals of calculus.
8. Determine the slope of a curve using derivatives of calculus.
9. Identify the sine, cosine and tangent of an angle contained within a right triangle.
10. Input an n x n matrix of numbers and calculate its inverse matrix using a calculator.
11. Prove and use the Pythagorean theorem.
12. Recite the Pledge of Allegiance.

13. Understand the role the atomic bomb had in World War II.
14. Make 5 different kinds of rope knots.
15. Identify the various kinds of wildlife living in the Rocky Mountains of North America.
16. Name all fifty states and their capitals in the United States.
17. Write the letters of the alphabet in cursive.
18. Use a map to plot a course from point A to point B.
19. Identify all the continents and oceans of the planet Earth.
20. Name all the presidents of the United States.

Lesson 3 **July 2, 2006**

For Lesson Three, my task upon reviewing M. Hunt's Chapter Nine titled, "The Behaviorists: A New Answer to Old Questions," was to address the following:

5. How did the cultural and social trends of the early 20th century make behaviorism seem like a good direction for psychology to head?

6. What examples from my own personal experience as a student and as a teacher demonstrate how the effects of behaviorism are alive and well in education, even today?

For Question One, the cultural and social trends of the early 1900's did indeed make behaviorism look like a good direction for psychology to head towards. Three social trends occurred to allow this to develop in psychology. First, urbanism and industrialism in America changed the mindset of Americans to urge them "to master the incomprehensible and worrisome strangers all around us." (Bakan, p. 13) After World War I, America learned it could not trust the world and needed a method to accomplish this. Behaviorism promised to show how stimuli produce responses and could predict with accuracy the outcome.

Second, hostility to German psychology, namely Gestalt, occurred after World War I and prevented this branch from being accepted in America. On the other hand, behaviorism was an up-to-date and available branch of psychology ready to serve America.

Third, behaviorism fit into America's need for a pervasive move away from intellectualism. This trend justified ignorance of details of mentalist psychology, based on the belief that it was simply not worth one's time and effort. Knowing the "cause and effect" was good enough for industrial America to move forward. One of the cultural trends that allowed behaviorism to be accepted by the public was its use of scientific method, which allowed it to be ranked with other sciences such as chemistry and physics. These sciences explained our physical world via repeatable experiments, which behaviorism was able to perform in our psychological world. Also, behaviorism was practical and provided commonsense knowledge that could be put to use and fit into our culture's needs to expand.

Upon reflection, examples of behaviorism in education as a student and teacher have surfaced since my childhood years in the 1960s and 1970s, when behaviorism was mainstream in schools. For example, as a student the stimuli of the paddle steered me to not behave badly for fear of punishment. As a teacher, I've used both the "carrot and stick" approach to motivate students to perform their best in math class. While the "stick" is not a paddle in today's society, consequences of poor behavior are. As a rookie teacher, I've learned the behavior management of a class is crucial to the success of a math class. When students are allowed to demonstrate poor behavior, not much learning can occur. Setting rules and procedures are required stimuli to evoke a positive behavior response from students. This mechanism is all based on behaviorism and is simply required to maintain order in today's classroom.

Lesson 4 **July 2, 2006**

For Lesson Four, my task upon reviewing John Watson's Chapter One, titled, "What is Behaviorism" was to:

7. Summarize the main points of behaviorism described by Watson.
8. Summarize Watson's argument for why behaviorism should be the basis of the new psychology for 1924
9. Provide a reasoned analysis of Watson's argument on both accounts.

My approach was to review and reflect on the article in providing the summaries and the analysis required.

The main points of Watson's behaviorism can be summarized as follows:

- Behaviorism states the subject matter of human psychology is the behavior of the human being and not the consciousness of the mind.
- Behaviorism is a natural science that takes the whole field of human adjustments as its own and observes people as its fundamental starting point.
- Behaviorism is the business of predicting and controlling human activity via understanding stimuli and responses under scientific experimental data gathering.

Watson's argument for why behaviorism should be the basis of the new psychology is summarized as follows:

- Wundt's Laboratory proved introspective psychology was based on the wrong hypotheses of the religious mind-body problem which could not provide verifiable conclusions.
- The real field of psychology should be based on what can be observed of human beings, namely behavior, which is the doing, actions or sayings of humans.
- Behavior is the interaction of stimuli and responses which can be observed under the scientific method and allows predictions to be made. This feature moves psychology out of the introspection realm of analysis and into the scientific realm.

A reasoned analysis for behaviorism per Watson can be described as follows:

- Since introspective psychology is based on the wrong hypothesis, then any conclusions based on it must be incorrect.
- The focus of introspective psychology is the consciousness or soul and can only be analyzed by introspection or looking in on what takes place inside us.
- This does not allow for experimental solving of psychological problems or standardizing scientific methods that behaviorism allows through observation of behaviors.

A reasoned analysis against behaviorism expressed by critics can be described as follows:

- Why study human behavior when it leaves so much out, such as sensations, perceptions or conceptions and robs us of everything humans believe in since childhood? It takes away our soul and everyone knows humans have a soul.
- Introspective psychology acknowledges the soul and its analysis by introspection.

Lesson 5 **July 9, 2006**

For Lesson Five, my task upon reviewing M. Hunt's Chapter Ten, "The Gestaltists," from his book titled, ***The Story of Psychology,*** is to identify twenty or so key ideas that could potentially influence how we understand the mind's role in sensation, perception and learning. Gestalt is a set of perceptions perceived as a meaningful whole in the mind.

The twenty ideas I have identified are listed below:

1. **Proximity:** "When we see a number of similar objects, we tend to perceive them as groups or sets of those which are close to each other." *(Hunt, 1993, p. 287)*

2. **Similarity:** "When similar and dissimilar objects are mingled, we see the similar ones as groups." *(Hunt, 1993, p. 288)*

3. **Direction:** "In many patterns, we tend to see lines that have a coherent continuation or direction; this is why we are able to pick out a meaningful shape from a bewildering background." *(Hunt, 1993, p. 288)*

4. **Prägnanz:** Meaning the tendency to see the simplest Gestalten shape in complex patterns. *(Hunt, 1993, p. 289)*

5. **Closure:** "When we see a familiar or coherent pattern with some missing parts, we fill them in and perceive the simplest and best Gestalt." *(Hunt, 1993, p. 290)*

6. **Figure-ground perception:** "When we pay attention to an object, we see little or nothing of the background. " The Rubin vase is an example. *(Hunt, 1993, p. 290)*

7. **Size constancy:** "An object of known size, when far off, projects a tiny image on the retina, yet we sense its real size." *(Hunt, 1993, p. 291)*

8. **Form quality:** "When a melody is transposed, every note is changed, yet we hear the very same melody." "We recognize the sameness of relations amongst the parts of the whole." *(Hunt, 1993, p. 283)*

9. **Object to be:** "When we see a circle at different angles, it seems circular to us even though it looks ellipsoidal to a camera." "The mind interprets the sensation to mean what it knows the object to be." *(Hunt, 1993, p. 284)*

10. **Müller-Lyer illusion:** The two horizontal lines below are the same length, although they look different. However, the mind wants to include the ends and make the lengths different. *(Hunt, 1993, p. 284)*

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11. **Brightness constancy:** "When we see an object in shadow … we perceive it as having the same brightness as when we see it in the sunlight." *(Hunt, 1993, p. 284)*

12. **Color constancy:** When we see an object in shadow, we perceive it as having the same color as when we see it in the sunlight. *(Hunt, 1993, p. 284)*

13. **Power of the thinking mind:** Great discoverers have indicated that their breakthroughs often came from taking a new view of the problem that produced a sudden insight. *(Hunt, 1993, p. 293)*

14. **Out of reach bananas:** Ape experiments, where apes trying to reach bananas suddenly would see a solution at some juncture in the problem process, was called insight. This insight was defined as the appearance of a complete solution with reference to the whole layout of the problem. *(Hunt, 1993, p. 295)*

15. **Relations:** "Relations are the key to perception, learning and memory." *(Hunt, 1993, p. 300)*

16. **Instinctive behavior:** It "is not a chain of reflexive responses mechanically trigged by a stimulus; rather it is a group or pattern of reflexes… aimed at achieving a particular goal." *(Hunt, 1993, p. 301)*

17. **Learning:** "Against the behaviorist doctrine that all learning consists of chains of associations created by rewards, Koffka argued that much learning takes place through the processes of organization and reorganization in the mind in advance of reward." *(Hunt, 1993, p. 301)*

18. **Cause of organization:** "Psychophysical forces inherent in the brain—neuronal energy fields—act like the force fields elsewhere in nature that always seek the simplest or best-fitting configuration." *(Hunt, 1993, p. 301)*

19. **Force Field Theory:** "It says that in a manner analogous to the operation of force fields, we group, categorize, and reorganize our experiences, always seeking the simplest and most meaningful constructs of the contents of our mind." *(Hunt, 1993, p. 302)*

20. **Memory:** "The physiological basis of memory is the formation of "traces" in the central nervous system—permanent neural changes induced by experience." *(Hunt, 1993, p. 302)*

Lesson 6 **July 9, 2006**

For Lesson Six, my task was to analyze how constructivist practices cause me to think differently about everything that I'm doing as a teacher.

My approach was to reflect on my experiences this past school year and explore how a constructivist approach would cause me to think differently in all aspects of being a math teacher. I will examine the following five areas:

- Knowledge
- Students
- Teacher's role
- Classroom
- Textbook

I was taught mathematics using a very traditional approach, but in my first year as a teacher, I utilized more of a constructivist approach to teaching. This required me to make a transition in my thinking from a traditional approach to constructivism to meet the needs of students in today's classroom.

Knowledge

Math knowledge in the traditional approach of teaching was "spoon-fed" to students—with complicated math rules to learn and much drilling to learn the concepts. This led to very boring lesson plans for students to experience. The constructivist practice entails the "discovery" approach to learning mathematics. This is a much different concept of learning math knowledge. My students were given the chance to learn how math was developed by humankind to solve society problems. Also, math units had opportunities to discover how the math concept is put together, why it follows the previous lesson and exercises to see the math skill applied to real life problems. I created "scaffolding" to allow my students to expand their math knowledge base and grapple with new concepts to master them. The constructivist approach takes mathematical knowledge from extremely dry material to an exciting humankind tool that allows students to apply it to today's complex problems, requiring reasoning and logic plus creativity to solve.

Students

The view math teachers have towards students is critical to how the classroom will be conducted. Under the traditional approach, a teacher's view of a student would be for the student to be a "sponge" and absorb what is being spoon fed by the teacher. Students would also be expected to perform math drills over and over. On the other hand, I used a a constructivist approach, which views the students as being discovers wanting to figure out how math concepts are put together and why. With this knowledge, a student's motivation and the desire to learn are strong. This approach also gives students the opportunity to gain hands-on use learning math by putting problems on the board and working in groups to solve math problems that have real life applications. Students also learn how to use technology such as graphing calculators to assist them in understanding

mathematical concepts using discovery techniques that show relations on the graph, in addition to solving more complex problems than could be done by hand, such as matrix multiplication.

Teacher's Role

The traditional role of teachers centered on being the authoritarian with respect to the subject and control of the classroom. This approach limited the student's avenues in learning styles that would be tolerated. The student had no choice but to try to "absorb" the spoon-fed math concepts being taught. If the student fell behind in grasping and understanding the material and did not recover quickly, then he/she would become lost in the next math concepts being taught and would lose motivation in wanting to learn, struggling with math from then on. By using the constructivist practice, my role became more of a mentor that assisted, gave guidance, and built students' confidence in learning the math concepts and skills. I would bring students to the Zoped zone of learning using scaffolding that allows the students to use the discovery approach to learning and building their math content. I then expanded my role by helping students learn how to learn by using good classroom habits, studying for tests and performing math problems in a logical sequential process.

Classroom

The traditional math classroom could be described as being "sterile and rigid" with no creativity allowed and both classroom and math rules that must be followed to a "T" with penalties being enforced. When math rules are not followed correctly when solving a problem during a test, then points would be taken off. I made a high-level decision to abandon the traditional approach in favor of the constructivist approach to allow for different learning styles to occur. With the constructivist approach to a classroom, students are allowed to grow through discovery of mathematics and applications of math skills to enable them to tackle problems related to their world. Also, my students were encouraged to develop their own style of learning, while I tried different approaches to convey the material to them. Group projects were conducted in the classroom to allow teamwork to develop within the class. Students were paired up to figure out homework problems so ideas could be exchanged and minds broadened. As a constructivist teacher, I would still take points off during a test for problems not solved correctly. However, students would be given a second chance to learn from their mistakes when I reviewed a test and showed how problems are done correctly, rather than simply giving a test back with problems marked wrong and no explanation of what was wrong.

Textbook

Math textbooks used in the traditional way of teaching math consisted of supplying the material that would be spoon fed by the math teacher to the students. There were no real life examples to supplement the material, no relationship to how our mathematics was developed by humankind or any color to give the material some life. These styles of textbooks are outdated for today's math. The math textbooks I used followed the constructivist techniques, and did provide real life examples, history of math and much color, organization and excellent explanations on how to solve the problem. They also

provided supplemental information on how to use graphing calculators to solve problems, group projects for classes, discovery exercises for students to conduct, and toolboxes with math skills. Many problems at the end of each unit were related to real world problems, to allow students see the relationship of mathematics applied in their lives. In summary, these textbooks supported the discovery approach I used to allow students can get a hands-on learning experience of mathematics.

Lesson 7 **July 16, 2006**

For Lesson Seven, my task upon reading chapters 4 (The Forgotten Memory System) & 5 (The Triune Brain) of Caine & Caine's book titled ***Making Connections*** was to provide real world examples from the teaching profession that illustrate how each point listed below could find expression in practice.

Memory Principles

Chapter 4

1. Taxon memory is limited in capacity and very inefficient.
2. Locale memory is natural, comprehensive and efficient.
3. Something has "meaning" when you can relate it to something you already know.
4. Efficient, meaningful learning occurs when the parts are all related to the whole.
5. Teaching is improved by the use of conceptual or thematic maps of some sort.

Chapter 5

6. Every significant event in our lives has a "felt state" about it.
7. Our minds classify events by the way they feel (activity of limbic system), and it is through this affective dimension that memories are stored away, cataloged and later retrieved.
8. It is okay to read about an interesting historical place or event, but perception, comprehension, meaning and later our ability to remember are all enhanced by actually being there.
9. When you engage the activity of the limbic system, learning comes alive.

Real World Examples

The following sections reflect my experiences this past school year as a math teacher and provide examples to match the nine points outlined above.

1. Taxon memory is limited in capacity and very inefficient.

Students in my tenth grade Integrated Math 2 class struggled with basic algebra skills during the school year that had been covered last year during their Integrated Math 1 course. I discovered students had used their taxon short term memory to just memorize math skills and get by during tests. Thus, they could not recall the skills just a short year later in my class. I focused on teaching them the principle involved, and how to interrelate the new skill to other similar skills, in an effort to help them learn math patterns that can be more easily recalled during the next school year in their Integrated Math 3 class.

2. Locale memory is natural, comprehensive and efficient.

When freshmen enter high school for the very first time, they rely on their locale memory to help them quickly learn how to get around the school. Students create a "mental map" of how to navigate in the school. At first, they rely on routes with directions to get from the front door to their homeroom then from homeroom to their first period classroom, continuing these routes to get them through all seven periods.

But, if they make a wrong turn, they become lost and confused until they can re-orient themselves and get back on track. During this short struggle, the mind is building relationships of classrooms to one another and to the gym, principal's office, cafeteria, etc. They might also relate to where friends' classrooms are, so they can meet in between periods. In a few days, the mind has completed the map of the school and students don't even remember the room numbers of where their classes are. They just know this is the room to be in for a specific period.

3. Something has "meaning" when you can relate it to something you already know.

In teaching mathematics, this is a foundation principle of building math content for students. For example, in teaching the equation of a line: $Y = mX + b$, the simpler equation of $Y = X$ is taught first, so students can plot x, y points and see the straight line going through the origin at a 45 degree angle. Once this skill and math concept is learned, the next progression is to teach the parabola equation of $Y = X^2$. Students quickly can grasp the x, y points on the graph, making a "bowl" shape, with the vertex at the origin. Finally, the quadratic equation: $Y = aX^2 + bX + c$ can be shown to be a parabola with different parameters that can be understood. This sequence allows students to relate to previous material and climb the mathematic ladder of complexity.

4. Efficient, meaningful learning occurs when the parts are all related to the whole.

I would imagine learning the complexities of the human skeleton would be an example of this principle. An overall layout of the skeleton can be shown using a 3D skeleton model, and then each limb can be broken down showing how individual bones are connected, enabling the student to learn the specific layout or relation of bones to each other. Once the limbs are understood, then the torso bones can be broken down to areas such as the back and ribs. The student can go back and forth from the parts to the whole and learn the bones' names relative to one another so as to simply a very complex arrangement.

5. Teaching is improved by the use of conceptual or thematic maps of some sort.

Conceptual or thematic (mental) maps use the locale memory system to register "continuous" stories of life experience involving relationships. At the same time, the taxon memory system houses the "parts" out of which the story is constructed. This understanding allows for the example of math teachers taking advantage of thematic math maps to be built in students minds. Traditional math techniques focused on memorizing techniques to solve math problems, which only used the taxon memory of students. With this being a short term memory process, students quickly lose how to perform the technique. However, when teachers take advantages of thematic math maps and relate how and why the technique was created and used, it allows the student to experience a

relationship along with applications that allow the technique to become "alive" and meaningful in the student's mind. A constant build-up of these math techniques facilitates formation of the thematic math maps that can then be used by students in solving problems.

6. Every significant event in our lives has a "felt state" about it.

For students, graduation from high school or college is a significant time in their lives. It is the climax of hard work and growth as a person; various learning experiences all coming together with friends and family to celebrate the earning of an educational degree. It is the ending of one era and the passing to a new one. This major event raises many emotions such as happiness, sadness and uneasiness, which are all wrapped up to produce a "felt state" that people remember for the rest of their lives. For me personally, making the decision to become a teacher and leave the east coast for the Rocky Mountains became a singular significant event upon arriving in Missoula, Montana on Sept 15, 2005 around 5:15pm. I was at the University of Montana walking around, taking in the evening sun, the breeze and mountains and realizing that my life had changed and new challenges awaited me in becoming a teacher. I felt "alive" at that moment and will remember it for a very long time.

7. Our minds classify events by the way they feel (activity of limbic system), and it is through this affective dimension that memories are stored away, cataloged and later retrieved.

One example that math teachers deal with concerning math students and the limbic system is the pitfall many students fall into, becoming bored with mathematics. When this occurs with students, the limbic system associates this boredom with mathematics and assumes a lack of importance. This causes mathematics to get cataloged as non-important material and it quickly gets forgotten in the taxon memory. On the other hand, when math teachers are able to bring math "alive" and show various relationships and importance to students, then math knowledge is stored in the locale memory and stays for a very long period of time, where it can be quickly recalled to use in solving problems.

8. It is okay to read about an interesting historical place or event, but perception, comprehension, meaning and later our ability to remember are all enhanced by actually being there.

For me, the classic example that amplifies this principle is students' visits to our nation's capitol of Washington, D.C. Much is read about our U.S. Government and many pictures are viewed by students of our nation's monuments in the classroom. However, nothing compares to actually seeing, feeling and experiencing the city with all its national buildings and monuments. It simply must be experienced by all students to appreciate and remember for a lifetime how special the city and the United States are. One example where I personally felt the emotion in person was at the Vietnam Veterans' Memorial. This simple memorial consists of a very long wall with 50,000 names of our fellow Americans etched in who gave their lives to this very controversial cause. Whether you agreed or disagreed with the war, seeing and experiencing how many 50,000 lost lives really is

simply overwhelms you when added up mentally. An eerie feeling takes over your body and the high cost of war our country has sacrificed in lives is installed forever in you.

9. When you engage the activity of the limbic system, learning comes alive.

Another example coming from the math classroom is teaching geometry to tenth graders. For most students, learning formal proofs is very hard to get excited about. It takes a special teacher to bring passion and purpose in learning geometry to allow students to experience how logic and reasoning can be acquired through the study and application of proofs. When the teacher provides a background of the history of geometry and how the Greeks discovered/invented it to solve humankind problems at the time along with applications in the real world, then students get excited and the limbic system kicks in to store the information in the locale memory where relationships are stored and can be retrieved. This now allows the study of geometry to come alive because it has meaning, value and purpose for the student.

Lesson 8 **July 16, 2006**

For Lesson Eight, my task upon reading chapters 7 (12 Principles of Brain-Based Learning) of Caine & Caine's book titled ***Making Connections*** was to explain what each of the following statements listed below means from an educator's point of view and then provide an example or two.

1. The brain is a parallel processor.
2. Learning engages the entire physiology.
3. The search for meaning is innate.
4. The search for meaning occurs through patterning.
5. Emotions are critical to patterning.
6. The brain processes parts and wholes simultaneously.
7. Learning involves both focused attention and peripheral perception.
8. (C&C #11) Learning is enhanced by challenge and inhibited by threat.

My approach was to review the material and reflect on my experiences this past school year as a math teacher to find meaning and examples to match the eight points outlined above.

1. The brain is a parallel processor.

For teachers, realizing that multiple methods or techniques are required to reach the various workings of the brain for students is essential. Teachers must view themselves as something of an orchestra conductor, needing to select the right combination to reach their students.

An example for mathematics is when teachers use both audio and visual to convey how to solve math problems. When teachers write a solution on the whiteboard using color to highlight specific meaning, along with verbal communication of how each step is performed, it enables the student's brain to absorb both at the same time.

2. Learning engages the entire physiology.

Teachers must be aware that all physiological functions, such as stress, nutrition, exercise, sleep and relaxation, affect a student's capacity to learn. Many factors contribute to a student's rate of academic achievement, and expecting equal progress based on chronological age is inappropriate.

An example of this principle is how important it is for teachers to keep on overall profile on each student's physiology or being. This would encompass many factors, including changes in the habits of students, drug use and family environment. When a teacher notices a slip in performance in the classroom, quickly finding clues that might lead to the cause is critical in resolving the true issue at hand.

3. The search for meaning is innate.

For the classroom to function optimally in allowing for the student's brain to search for meaning, it must have routine built into it such as standard procedures and appropriate classroom behavior. Also, an environment that promotes curiosity, hunger, discovery and challenge is required to allow the mind to pursue its search for meaning in the world.

An example of this classroom is typically found in programs for gifted children that promote challenges for students to expand their horizons of knowledge. This concept should be expanded into regular classrooms to take advantage of the environment that promotes the mind in searching for meaning and knowledge.

4. The search for meaning occurs through patterning.

Patterning is a technique the brain uses to provide meaningful organizations and categorization of information. It also rejects meaningless data that is unrelated to what makes sense in understanding the patterns. Teachers can influence the direction that patterning occurs in students. For example, discouraging daydreaming in class and promoting problem solving and critical thinking through active interaction steer students in the right direction of patterning.

An example is when teachers use processes that present information that allows the student's mind to extract patterns that have meaning. This allows for information to be stored in the locale memory where relationships are stored and recalled. When students see relationships thru patterns, it allows for creation of meaningful and personal relevance that students will readily learn and use.

5. Emotions are critical to patterning.

Emotions facilitate the storage and recall of information that is crucial in forming patterns in the mind. Teachers must be aware of the importance of feelings and attitude of students and how they affect their cognitive learning experience. This requires a constant monitoring using effective communications with students. This approach ensures a positive environment is maintained by being supportive and having respect for students, which will allow acceptance on both sides within and beyond the classroom.

One example is the contrast of a positive classroom where students believe in themselves, have positive emotions, have academic goals to pursue and become a community of learners that help each other in meeting challenges laid in front of them by the teacher. Much patterning occurs and knowledge is secured. On the other hand, a negative classroom will struggle when students don't believe in themselves; have many negative emotions and shutdown on learning. This prevents patterning and learning from occurring.

6. The brain processes parts and wholes simultaneously.

Educators must understand that the brain uses two simultaneous processes in organizing patterns of information. One is reducing information into parts, and the second is when information is perceived and worked as a whole pattern. Students have difficulty in learning content when either parts or wholes processing is overlooked by the teacher. Thus, teachers must insure both processes are being exercised by their students' minds in assimilating patterns of information.

For myself, remembering to explain math formulas in relationship to how they are used in real life or in the sciences gives the student's mind the opportunity to use both processes together in putting together the whole pattern of information. This allows for math formulas to have meaning, value and purpose. Not just letters with an equal sign in the middle that must be memorized for a test and then forgotten.

7. Learning involves both focused attention and peripheral perception.

The mind will absorb direct information being presented, along with signals that lie beyond the field of attention. This ability allows for teachers to provide peripheral information that is purposeful and organized to facilitate learning. One aspect the teacher should be aware of is to follow the mantra: "Practice what you preach and believe what you preach". A teacher's actual inner state is transmitted by actions, behaviors and expressions that are picked up by learners through their peripheral perception.

An example would be for teachers to have genuine compassion for their students that will shine from the inside out. Students know the teacher really cares about them. On the other hand, when a teacher displays a lack of enthusiasm during class, students will pick this up and realize the teacher's heart is not into helping them succeed.

8. (C&C #11) Learning is enhanced by challenge and inhibited by threat.

When the brain perceives threat, it triggers survival mechanisms by downshifting to the first part of the brain, the R-complex, which reacts to the threat in order to survive. When this occurs in a student's mind, learning simply takes a second seat. However, offering students academic challenges raises the mind to the third part of the brain, the neocortex, where creativity exists and solutions are found. Teachers and administrators must create and maintain a state of "relaxed alertness" in students by eliminating threats within the school and classroom and then providing challenges.

An example of this principle is when a school district enforces a zero tolerance for weapons and drugs in a school and its surrounding area. This allows students to not worry about threats to their safety and to concentrate on challenges such as spelling bees presented by teachers. This environment will promote a learning community, where each student can thrive.

For Lesson Nine, my task upon reading Dr. Carson's paper titled, "Ourstory – A culturally-Based Curriculum Framed by History" was to analyze the key ideas that underline this approach to curriculum design. My approach was to review the paper and note five key ideas that build the foundation for Ourstory as discussed below.

1. Culture tools are for all to use.
2. Science is a global project arisen historically from a broad and ubiquitous base of traditional cultures.
3. Traditional and scientific cultures have always coexisted.
4. Ourstory is a response to "why teach the history of intellectual culture?"
5. Ourstory provides the subject/historical matrix framework needed to build purpose for learning.

1. Culture tools are for all to use.

The goal of Ourstory is to change children's view on not accepting culture tools for their use. When an a-historical approach is used in schools, many children do not believe the tools such as math and science are for them to use, but for "somebody else". Ourstory wants students to realize that all cultural tools are for everyone to use for their benefit.

2. Science is a global project arisen historically from a broad and ubiquitous base of traditional cultures.

The strategy of Ourstory in achieving the goal of changing children's view of cultural tools is centered around a main belief concerning science, which states that science is a global project arisen historically from a broad and ubiquitous base of traditional cultures. Humankind's thirst for knowledge stems from all cultures and evolves over time with the development of science. Every culture contributes to humankind's progress in seeking the truth through science.

3. Traditional and scientific cultures have always coexisted.

For humans, there is a very strong psychological need for a stable cultural framework to exist. This is the role traditional cultures perform in preventing chaos from occurring in society. While searching for the truth is the purpose of scientific culture, it drives the willingness of society to keep overturning our existing knowledge and replacing it with new profound truth. This has a significant and destabilizing impact on all other cultural systems in the world and is frowned upon by traditional cultures. Despite the struggle between the two cultures, the two must coexist in meeting humankind's unique need for balance between stability and truth.

4. Ourstory is a response to "why teach the history of intellectual culture?"

When the answer to the question: "Should we teach the history of intellectual culture to our children?" is recognized as a simple yes, then a response must be proposed. Ourstory is one response that provides a solution of integrating the history of humankind into our schools' subjects. The importance of understanding a symbol-based cultural system and knowing how powerful symbol tools are in amplifying the powers of the human mind must be well understood by students. A historical framework is needed to allow the study of school subjects by children to appreciate how traditional cultures co-exist with science culture. This will enable students to see the connectivity of both and help explain the how and why of each subject in order to provide purpose for each one.

5. Ourstory provides the subject/historical matrix framework needed to build purpose for learning.

The tool used in implementing the strategy of Ourstory is the subject/historical matrix outlined in the Ourstory Grid reference. The goal of this grid or matrix is to avoid the typical a-historical approach our schools use today, which causes a separation of culture tools from today's students. When there is no connection to how and why humankind developed tools such as mathematics to solve problems, then students don't make a connection to a school subject. They struggle with why they should learn this "stuff" and they can't make connections to their own personal life, so then they wonder how they are going to use this information. Learning mathematics with a historical approach is one example of how Ourstory provides many answers to students' inquiries about where mathematics came from and when they are going to use all of the math skills being taught.

Lesson 10 **July 23, 2006**

For Lesson Ten, my task upon reviewing the three sample lesson plans inspired by the Ourstory design was to reflect on the subject that I teach (math) and use my imagination to come up with a topic or cultural event that I would like to develop as a historical narrative, simulation or project. My approach was to write down my ideas for a mathematics project focused on geometry.

1. This will be an "explore & discovery lesson" that allows the students to experience life during 600-320 BC.

2. This lesson plan will be very informal to allow the creative juices to flow for me, based on Dr. Carson's Lesson #12 article's advice concerning when student teachers had great ideas and did not transfer them to the traditional lesson plan format.

3. Lesson will focus on the discovery and use of geometry during the classical civilization. (Egyptians and Greeks)

4. I will open the lesson with a narrative storytelling experience, to bring the students into "character" as Greek mathematicians trying to solve a problem using logic & reasoning.

5. This will probably be the first experience for high school students to incorporate history in a math class. I want to capture the excitement of trying something new and get the students involved in acting as though they are Greek mathematicians solving problems facing civilization at the time.

6. Goal is to lay a foundation for students to appreciate geometry.

7. Geared towards late spring freshman year during Algebra I in preparation for 10^{th} grade Geometry.

8. Project based on individual, buddy or 3 person teams. (leaning towards 2 person teams)

9. Have students or groups give PowerPoint presentation on findings.

10. Length 3 day lesson, 1^{st} day research, 2^{nd} day preparation, 3^{rd} day presentation. (Thursday, Friday & Monday)

11. I want students to have fun investigating geometry during the classical times.

12. This project is based on a class size of 20 students with 10 teams.

13. Presentations will be for 3 minutes, followed by 2-minute discussions.

14. Ten general topics will be divided up between the teams.

Lesson 11 **July 23, 2006**

For Lesson Eleven, my task was to design a lesson in my subject area that re-creates a historical problem space of a significant turning point in the development of the subject, explaining how I would teach it and how I would assess students for understanding.

My approach was to take my ideas form Lesson Ten and expand them into an informal lesson plan. My lesson covers the subject of mathematics and how the Greeks discovered logic and reasoning in solving the problems of how to "measure the earth".

Lesson: How to Measure the Earth: The Invention of Geometry by Greek Mathematicians.

Background:

This lesson plan will be very informal, to allow the creative juices to flow for me based on Dr. Carson's Lesson #12 article's advice concerning when student teachers had great ideas and could not transfer them to the traditional lesson plan format.

I chose this lesson based on my experience teaching geometry last year, where formal proofs are taught. This was a difficult skill for students to master. My vision is for this lesson to open the minds of students to the how and why geometry was discovered, so as to gain an appreciation for learning the skill of logic and reasoning the formal proofs provide. Also, I want students to realize they can use geometry as a cultural tool for their own benefit and use in their lives.

- This will be an "explore and discovery lesson" that allows the students to experience life during 600-320 BC.

- Lesson will focus on the discovery and use of geometry during the classical civilization of the Egyptians and Greeks.

- I want students to feel/experience why the Egyptians and Greeks pursued geometry and how they used it as a cultural tool to help civilization.

- This will probably be the students' first experience incorporating history in a high school math class. I want to capture the excitement of trying something new and get the students involved by imagining they are Greek mathematicians solving problems facing civilization at the time.

- The goal of this lesson is to lay a foundation for students to appreciate geometry. With this foundation, students will have a better feel for the purpose of geometry and appreciate why formal proofs were developed, which they are going to learn in tenth grade geometry class.

- This lesson is geared towards late spring freshman year during Algebra I, in preparation for tenth grade geometry. This lesson will be a brief break from algebra and prepare them for the next year.

- I want students to have fun investigating geometry and its discovery and use during the classical times.

- The biggest factor for students' success will be the amount of effort they apply to the project.

Approach:

- I will open the lesson with a 15 to 20 minute narrative to bring alive a story about the discovery of geometry during the classical times. I want to bring the students into "character" as Greek mathematicians trying to solve a problem using logic and reasoning.

- I will explain the details of the project with the following details:

  - Project based on two person teams conducting research, preparation and a presentation to the class on their specific findings concerning how and why the Greeks figured out how to measure the earth.

  - Teams will give a three-minute PowerPoint presentation on their findings, followed by a two-minute question and answer session with the rest of the class.

  - The length of the lesson will be for three days:
    - 1st day Thursday Research
      - Students will use the Internet to find information, take notes and organize for topic chosen.

    - 2nd day Friday Preparation
      - Students will prepare their PowerPoint presentation.

    - 3rd day Monday Presentation
      - Students will give their presentation and answer questions from the class.
  - I will be guiding and providing advice to the teams during the three day project.

  - This project is based on a class size of around twenty students, divided into ten 2-person teams.

  - Presentations will be for 3 minutes, followed by 2-minute discussions.

  - Ten general topics will be divided up between the teams to conduct their findings and presentations.

Assessment:

- The assessment will be based on students' effort, broken down into the following three categories:

    - Research effort – 33%
        - Effort researching on the Internet
        - Notes taken
        - Organization
    - Preparation effort – 33%
        - PowerPoint organization/structure
        - Content clarity
    - Presentation effort – 33%
        - Oral presentation given
        - Reply to questions asked

Lesson 14 **August 11, 2006**

For Lesson Fourteen, my task was to design a unit of study consisting of five lessons, in which I delve deeply into some transformative event in the historical development of mathematics. My goal was to re-create for my math students one of the important, transforming events in mathematics. I have chosen the development of geometry by the Greeks that occurred around 600 B.C. to 300 A.D. After teaching high school geometry this past year and experiencing the difficulty students have with formal proofs, my intent is to provide an experience for students where they come to appreciate why geometry was created and how it was used to help humankind in the quest for truth about our physical world.

My approach was to expand my knowledge on the history of mathematics by reviewing Morris Kline's book titled, ***Mathematics and the Search for Knowledge,*** and understand the role geometry had in the advancement of humankind. Groundwork for this project was completed in my Lesson Eleven, which covers the subject of mathematics and how the Greeks discovered logic and reasoning in solving the problem of "how to measure the earth". After giving much thought to how this unit should be structured in providing the most opportunity for students to experience the change in human consciousness, capabilities and understanding with regard to geometry, project-based learning modules will be used. This will allow students to be better prepared to study formal proofs in high school geometry and have a much higher desire and motivation in learning and applying geometry in their lives.

An overview of my unit titled, "Greek Development of Geometry: The Pursuit of Truth Concerning our Physical World" is discussed, along with my five lesson plans listed below.

Geometry Unit:

GREEK DEVELOPMENT OF GEOMETRY: The Pursuit of Truth Concerning our Physical World

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Lesson I: How to Measure the Earth: The invention of Geometry by Greek Mathematicians

Lesson II: Understanding Our Physical World: The Struggle for Truth

Lesson III: The Players: Pythagorean Society and Greek Philosophers and Their Role with Geometry

Lesson IV: Euclid: The Book of Elements

Lesson V: Constructs: Application of Geometry for Students

Overview: Greek Development of Geometry: The Pursuit of Truth Concerning our Physical World

The transformative event for this unit deals with the development of geometry by Greeks during the classical time period centered around 600 B.C. to 300 A.D., and will examine why they were so focused on this pursuit.

The problem space that the Greeks tackled dealt with humankind's relentless pursuit of the truth concerning our physical world. The Greeks believed there was a mathematical design to nature and needed a tool to discover this design. So, geometry was developed in finding the truth about our physical world.

Geometry is the measurement of the earth, and as a tool allowed humankind to find the mathematical design of nature by showing the physical relationships that existed.

One key shift in humankind's thinking that geometry allowed was the structured use of deductive reasoning. This framework allowed a set of axioms to be a starting point and through logic and reasoning new truths could be found concerning our physical world and nature's design or order.

This unit's purpose is to allow students to experience this transformative event in humankind. It will help them appreciate how deductive reasoning opened the minds of humans in understanding how nature's design in our physical world could be explained by showing the various relationships and order using geometry.

This geometry unit uses Project Based Learning (PBL) modules to enhance the experience for students in capturing the spirit of the Greek development of geometry. A description of each PBL and its associated lesson are listed:

Lesson #	PBL	Description
I	Oral Presentation	Group PowerPoint presentation on findings
II	Acting out Skits	Group skits acting out the struggle for truth
III	Exhibit	Group exhibit on Greek philosophers
IV	Written Report	Individual written reflection on the book: ***Elements***
V	Physical Activity	Class effort in performing geometric constructs

The general theme of this unit is to provide the opportunity for each student to explore, discover, identify and apply what they have learned about geometry during each PBL module.

Assessment will be based on each student's effort in performing the PBL of each lesson. One of the goals of this unit is for students to experience a different approach to learning and have fun!

The overall structure of this unit is described as follows:

- The unit's structure is to allow students to be immersed in the re-creation of how and why the Greeks used geometry in their pursuit of the truth concerning nature's design.

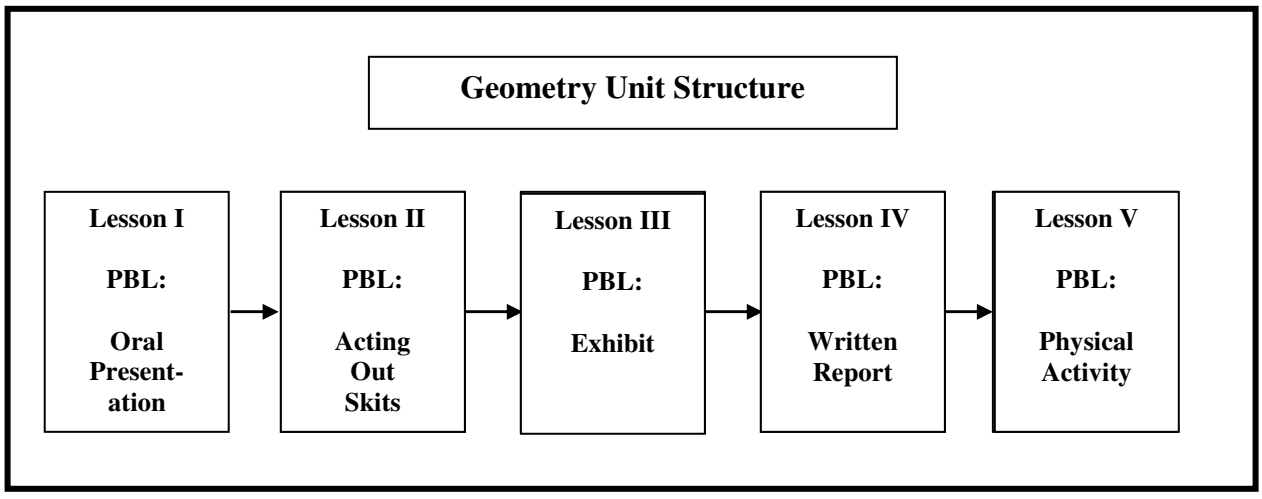
- Lesson I gives the students the chance to explore and discover in groups why the Greeks developed geometry and how they used it in their pursuit of truth. With a group oral presentation using PowerPoint, the class can share in each group's discovery.

- Lesson II will allow the students to experience what it must have been for Greek philosophers in the struggle to create geometry and apply deductive reasoning in finding nature's truths concerning the physical world. Skits will be acted out by groups that enable creative interpretations by students in presenting philosophers' discussions when developing geometry.

- Lesson III provides the opportunity for groups to display their findings on various Greek philosophers/mathematicians and their impact on geometry. Each group will create a three sided exhibit display board on their chosen subject and support the Geometry Exhibit during a lunchtime showing in the cafeteria so the entire school can be exposed to the wonders of geometry.

- Lesson IV requires students' individual efforts in reading Euclid's classic book, ***Elements,*** that opened the concept of using axioms and deductive reasoning in finding new truths or theorems about our physical world. After reflecting on the impact of this book on society and the transformative event it was in having geometry to find nature's truth, students will provide a written report on their personal findings.

- Lesson V takes the whole class as a group through various geometric constructs that can be applied to real life situations. Three methods will be used, ruler/compass, software program called Geometer's Sketchpad and outdoor constructs using rope and stakes.



Lesson I: How to Measure the Earth: The Invention of Geometry by Greek Mathematicians

Lesson I gives the students the chance to explore and discover in groups why the Greeks developed geometry and how they used it in their pursuit of truth. With a group oral presentation using PowerPoint, the class can share in each group's discovery.

Background:

This lesson is based on my experience teaching geometry last year, where formal proofs are taught. This was a difficult skill for students to master. My vision is for this lesson to open the minds of students to the how and why geometry was discovered, so as to gain an appreciation for learning the skill of logic and reasoning the formal proofs provide. Also, I want students to realize they can use geometry as a cultural tool for their own benefit and use in their lives.

- This will be an "explore and discovery lesson" that allows the students to experience what life was like during 600-320 BC.

- Lesson will focus on the discovery and use of geometry during the classical civilization of the Egyptians and Greeks.

- I want students to feel/experience why the Egyptians and Greeks pursued geometry and how they used it as a cultural tool to help civilization.

- This will probably be the students' first experience incorporating history in a high school math class. I want to capture the excitement of trying something new and get the students involved by imagining they are Greek mathematicians solving problems facing civilization at the time.

- The goal of this lesson is to lay a foundation for students to appreciate geometry. With this foundation, students will have a better feel for the purpose of geometry and appreciate why formal proofs were developed, which they are going to learn in tenth grade geometry class.

- This lesson is geared towards late spring freshman year during Algebra I, in preparation for tenth grade geometry. This lesson will be a brief break from algebra and prepare them for the next year.

- I want students to have fun investigating geometry and its discovery and use during the classical times.

- The biggest factor for students' success will be the amount of effort they apply to the project.

Approach:

- I will open the lesson with a 15 to 20 minute narrative to bring alive a story about the discovery of geometry during the classical times. I want to bring the students into "character" as Greek mathematicians trying to solve a problem using logic and reasoning.

- I will explain the details of the project with the following specifics:

    - Project based on two person teams conducting research, preparation and a presentation to the class on their specific findings concerning how and why the Greeks figured out how to measure the earth.

    - Teams will give a three-minute PowerPoint presentation on their findings, followed by a two-minute question and answer session with the rest of the class.

    - The length of the lesson will be for three days:
        - **1st day—Thursday—Research**
            - Students will use the Internet to find information, take notes and organize for topic chosen.
        - **2nd day—Friday—Preparation**
            - Students will prepare their PowerPoint presentation.
        - **3rd day—Monday—Presentation**
            - Students will give their presentation and answer questions from the class.
    - I will be guiding and providing advice to the teams during the three day project.

    - Presentations will be for 3 minutes, followed by 2-minute discussions.

    - General topics will be divided up between the teams to conduct their findings and presentations.

Assessment:

- The assessment will be based on students' effort, broken down into the following three categories:

    - Research effort – 33%
        - Effort researching on the Internet
        - Notes taken
        - Organization
    - Preparation effort – 33%
        - PowerPoint organization/structure
        - Content clarity
    - Presentation effort – 33%
        - Oral presentation given
        - Reply to questions asked

Lesson II: Understanding Our Physical World: The Struggle for Truth

Lesson II will allow the students to experience what it must have been like for Greek philosophers in the struggle to create geometry and apply deductive reasoning in finding nature's truths concerning the physical world. Skits will be acted out by groups that enable creative interpretations by students in presenting philosophers' discussions when developing geometry.

Background:

- The goal of this lesson is for students to experience what it must have been like to struggle with developing geometry so humankind could learn the truth about our physical world.

- As a starting point for this lesson, Dr. Carson's Lesson #11 collection of OurStory lessons contain several with dialogue between Greek Philosophers and will be presented to the class. Listed below are the Lesson # and Title:
    - #8: Thales in Egypt
    - #9: Pythagoras and Problem of Proof
    - #12: Why Plato Loved Geometry

Approach:

- New groups will be formed to perform the skits. Students will select one of Dr. Carson's lessons to act out with the solution provided or will research another Greek philosophers struggle to create geometry in finding the truth about natures design.

- Students will be encouraged to have fun with this lesson and use creative ways to perform their skits; costumes may be used, along with props and notes. The skits will last about five to ten minutes apiece and a question and answer session will follow.

- This lesson will take about 3 days to complete, starting on a Thursday and completing on the following Monday. Schedule is as follows:

  1st day—Thursday—Selection of Skit & Research
    - Students will chose a skit and conduct research to prepare for dialogue.

  2nd day—Friday thru Sunday—Reflection
    - During class, students will organize their dialogue and begin assembly of skit.
    - During the weekend, gtroups will practice performing their skits.

  3rd day—Monday—Presentation of Skits
    - Each group will act out their skit to demonstrate the philosophers' struggle.

Assessment:

Students will be assessed on their effort in performing the skits and how well they worked together as a team.

- **Lesson III: The Players: Pythagorean Society and Greek Philosophers and Their Role with Geometry**

Lesson III provides the opportunity for groups to display their findings on various Greek philosophers/mathematicians and their impact on geometry. Each group will create a three sided exhibit display board on their chosen subject and support the Geometry Exhibit during a lunchtime showing in the cafeteria, so the entire school can be exposed to the wonders of geometry.

Background:

- This lesson will allow students to work together in groups of three in presenting their findings on Greek philosophers and their contribution to Geometry. Starting with the research done in Lesson I, the groups will conduct further research, then organize their findings on a three sided exhibit display board. Creativity will be encouraged in the construction of the display board to capture the spirit of the philosopher's contribution.

Approach:

- A brief 10 minute discussion by the teacher will introduce the lesson and its intent. The teacher will give a passionate account of the time period when Greek philosophers were struggling with the search for truth about nature and the creation of geometry as a means to find it. The goal of each new group's exhibit is to highlight the accomplishments of the chosen philosopher.

- Each group will be given time to conduct research and make a display board to present their findings. A day will be chosen for the exhibit to be conducted, with each group standing by to answer questions during the lunchtime question & answer session. The exhibit will expose the student body to Greek philosophers and their impact on society.

- This lesson will take about 3 days to complete, starting on a Thursday and completing on the following Monday. Schedule is as follows:

  1st day—Thursday—Research
  - Students will use Internet to research chosen philosopher and take notes.

  2nd day—Friday through Sunday—Display Boards
  - During class, students will organize findings and begin assembly of display board.
  - During the weekend, Groups will complete their display boards.

  3rd day—Monday—Lunchtime Exhibit
  - During the exhibit, each group will provide answers to questions asked.

Assessment:

Assessment will be based on each student's effort and contribution to the group's display and support given during the lunchtime exhibit.

Lesson IV: Euclid: The Book of Elements

Lesson IV requires students' individual efforts in reading Euclid's classic book titled, ***Elements,*** which opened the concept of using axioms and deductive reasoning in finding new truths or theorems about our physical world. After reflecting on the impact of this book on society and the transformative event it was in having geometry to find nature's truth, the student will provide a written report on their personal findings.

Background:

- The Greek philosopher/mathematician Euclid wrote the first geometry book titled, ***Elements*** where axioms were stated as truths so self-evident that no one could doubt them. Next, Euclid used deductive reasoning that was based solely on axioms and began to create truths about the physical world called theorems that related to measuring the earth. This book is the foundation of high school geometry and shows how formal proofs were structured to allow reasoning to occur.

- The purpose of this lesson is to allow students time to explore, read and reflect on the impact this book had on mathematics with the creation of geometry.

Approach:

- The teacher will present a short PowerPoint presentation on this lesson by giving the story of Euclid and his book. The goal is to create the mood and setting back in 600 B.C. that allowed Euclid to write his book on geometry.

- Next, students will be assigned the task of going to WebQuest.com and complete investigation on Euclid and the book ***Elements***. Then, students will spend time thinking and reflecting on this book and the impact it had on society. Finally, a 2 to 3 page, well organized, written report will be submitted for assessment.

- This lesson will take about 3 days to complete, starting on a Thursday and completing on the following Monday. Schedule is as follows:

  1st day—Thursday—Presentation & Research
  - Students will use WebQuest.com to investigate ***Elements*** and take notes.

  2nd day—Friday through Sunday—Reflection
  - During class, students will reflect on their reading, ask questions and begin to organize their thoughts
  - During the weekend, students will write their paper.

  3rd day—Monday—Discussion
  - Students will turn in their papers, and a class discussion will follow.

Assessment:

Papers will be assessed on effort put forth and on organization and quality of content.

Lesson V: Constructs: Application of Geometry for Students

Lesson V takes the whole class as a group through various geometric constructs that are applied to real life situations. Three methods will be used, ruler/compass, software program called Geometer's Sketchpad and outdoor constructs using rope and stakes.

Background:

- The intent of this lesson is to allow students to make a connection between Greek geometry and applications they can use in their lives. First, the class will take classic geometry constructs, using only a straight edge, ruler and pencil, and hand draw figures on paper from a list provided by the teacher. Students will pick a construct and as a class work together to figure out what the steps are. Second, students will use PC's and a software program called Geometer's Sketchpad and complete constructs provided from a list of exercises. Third, the class will go outside and complete various constructs provided from Dr. Carson's Ourstory Lesson #10: Deeper Look at Geometry, along with a few of my own.

Approach:

- This lesson will open with a discussion between the teacher and students on how geometry created by the Greeks can be used by students today in solving problems they might encounter. Examples will be provided by the teacher such as applying the Pythagorean Theorem in making sure right angles are exactly 90° during construction of houses. (Hint: The 3/4/5 right triangle is used.)

- Teacher will provide guidance during the constructs to maximize students' experience.

- This lesson will take about 3 days to complete, and can be conducted during any time period convenient for the class. Schedule is as follows:

  1st day—Constructs by Hand
  - Students will use straight edge, compass and pencil to create constructs in class.

  2nd day—Constructs using Geometer's Sketchpad
  - Students will Geometer's Sketchpad to create constructs on computer and save them on computer files.

  3rd day—Outside Constructs
  - Students will go outside and use rope and stakes to create constructs such as making a rectangle, circle, parallelogram

Assessment:

- Students will be assessed as to their effort in performing the constructs in each category, by hand, computer and outside, along will how well they perform them.