The Discovery of the Mesoamerican Culture with Math

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INTRODUCTION

Throughout history we learn how the European and Eastern world has contributed to math and science. Without belittling the achievements of the Old World, it may be said that earlier American achievements in science and mathematics go largely unrecognized in our curriculum, even though Ancient American culture influences a significant part of our classrooms. It is fascinating to think that the western and eastern parts of the world were far apart and yet their thinking patterns for doing math and science was very similar. Just as in the West, math and science in the New World forms an important part of ancient American history, and yet it is little discussed. This is due mainly to the recent discovery and decipherment of ancient American books and because of the 500 years between the fall of the Mayan civilization and the discovery of their ancient history, the Mayan people's history is rarely talked about.

My unit will combine math, science, and social studies as part of the integration process. Integration is the process of combining or accumulating subjects in the classroom. Motivating the students to understand the historical aspect of Mesoamerica as well as mathematics of the same culture will be invigorating. Mesoamerica is an area of high civilization in the Americas with a history spanning several thousand years. It is these people who domesticated corn and chocolate. The people of this culture came from Asia, and they developed a number system that dealt with the relationship between the number and numerals. According to Otto Neugebauer, a science historian, the Maya numeration system with positionality and place value was "one of the most fertile inventions of humanity, comparable in a way with the invention of the alphabet" (Lara-Alecio, Irby, Morales-Aldana 154). The Mayan civilization created the zero, which allowed many people to configure large numbers.

They used concrete representational items as numerical symbols in their base-20 system, such as the cacao bean and rocks. Math was central to the Maya culture. The Maya were able to connect astronomy, geometry, and mathematical calculation to create a society that could predict the future, plant corn, and trade with other parts of the Americas. This was a cosmopolitan, complex culture with many of the same challenges faced by complex cultures around the globe, including our own. Cultures and languages were constantly interchanging ideas and goods. The Maya alone spoke more than 25 Mayan languages, as different from each other as our modern Latin-derived languages. This is a much different situation than I was accustomed to growing up.

Growing up in a small town that wasn't as diverse as Houston, I realized once I moved here how important understanding other cultures is for teaching in the classroom. When I first moved to Houston, I was thirsty for knowledge about other cultures, wanting to understand where they came from, what their religious beliefs were, and especially what types of food they ate. I believe that the students will benefit from the knowledge and the experience I have gained from this seminar, and will be able to grasp and learn about other cultures. My school, T.H. Rogers, was designed to house different programs that would work well together. Each program at T.H. Rogers is unique in the way it is set up. There are three programs: the RDSPD School for the Deaf, the Vanguard Program for the gifted and talented, and the program for Multiply Impaired

students. The students are diverse is their own special way, and to see the Vanguard, the RDSPD, and the Multiply Impaired students working together is touching. Most gifted and talented students are very in touch with their emotions toward others in general, but when they see students who are less fortunate, they are extremely empathetic toward them. The diversity of the group is important to understand. The majority of the group is Caucasian and Asian. We have two Black and two Hispanic students in fourth grade this year. The student population doesn't diversify itself until middle school. However, the students on our campus get to experience ways of helping others that are not like them with the RDSPD and the Multiply Impaired, so, therefore, they understand how to empathize with other individuals regardless of the cultural status. I want the students to be aware of the other cultures and be able to relate to them at school. We are advanced academically, so, therefore, the students that enter the school will be at least a grade level ahead. It is great to teach students that have prior knowledge of so many different things. They have a passion for growing and are very competitive in their education. This unit will be created for fourth grade math and science Vanguard students. My students are hungry for knowledge and are constantly looking for challenges; for example, I make games for them to play when they are finished completing their work. One of the centers is a folder that contains challenge sheets. The students will complete the folder on their own, create a lesson for that chapter, and teach a lesson to the students over the concepts that they have learned from the challenge folder I made for them. Teaching them is exciting, fulfilling, and challenging as well. My classroom is like most in that you have a mix of students who are able to motivate themselves and some that need a little encouragement to push themselves.

OBJECTIVES

Since the Pre-Columbian math unit is based on studying non-base-10 number systems, it allows us to see the underlying structures of math in a particularly clear light because it allows us to take a step back from math processes and tools that may have become too familiar. Exploring the nature of a non-base-10 mathematical system will directly enrich and enliven a number of HISD math objectives. Below are the objectives that I will use to teach this unit.

These are the Texas Essential Knowledge and Skills

(5.1) - The student uses place value to represent whole numbers and decimals. This TEKS is important in teaching the students with Mayan math because it gives them a whole new concept to learn place value in a new light. We are so accustomed to learning the Arabic number system that the thought of learning how the indigenous people figured out how to use a whole new number system is mesmerizing. The Mayan people counted corn and cacao beans in their daily life and used these concrete items to count and complete an equation.

(5.3) - The student adds, subtracts, multiplies, and divides to solve meaningful problems. The students will be able to use the vigesimal number system to answer word problems created by the teacher, while being taught how to add and subtract using the vigesimal number system.

(5.5) - The student makes generalizations based on observed patterns and relationships. I believe this skill is important because in Mayan math the students will learn how to use the vigesimal number system. They have to understand the patterns of Mesoamerican people's number pattern. The students will be able to think about patterns other than what they have been taught in class.

(5.7) - The student generates geometric definitions using critical attributes. The student is expected to identify essential attributes including parallel, perpendicular, and congruent parts of two- and three-dimensional geometric figures. The students will understand the

building of the three-dimensional figures of Mesoamerica. They will draw the pyramids of Teotihuacán, as well as other symmetrical objects created back then.

(5.16) - The student uses logical reasoning. The student will have to think outside the box and discover a new strategy to discovering that math can be done in different ways. When doing a lesson on the Aztec calendar the students will have to understand how the Mayan people used their surroundings, which were logical to them to be able to come up with a calendar that followed the patterns of the life.

RATIONALE

I believe that my students will gain knowledge through this unit by understanding that the influence of today's math had to do with the contributions of people from all over the world. Much of our history of the ancient world has come from the Eastern and European countries. The history of the Americas needs to be known and embraced, and math is an excellent entry to the subject. The students in my class will learn and gain knowledge about a genius people who had one of the greatest civilizations known to man. The history of the culture is also a great way to humanize math systems – students like to know the stories behind math functions and logic. Math is a chief way into the history of any cultural study.

The integration of several subjects in a more holistic learning environment for the student has been something talked about for years in education. It is really hard to learn how to integrate subjects. In my experience as a teacher, integration has been exciting to do not only because you see how the students make the connection, but it takes less time to plan. The National Council of Teachers of Mathematics leaves no doubt that integration is a fundamental goal of the math curriculum

> According to Reeder and Moseley, Integration provides an opportunity for students to make natural and meaningful connections between and among multiple content areas. Both National Council of Teachers of Mathematics (National Council of Teachers of Mathematics 2000) and the National Science Teachers Association (National Research Council 1996) have long supported the integration of mathematics and science with other content areas for students to make meaningful connections and develop significant understandings of important concepts. Additionally, activities and lessons involving mathematics and science should involve students in constructing appropriate graphs and charts to represent their data, making predictions and conclusions based on that data, and testing their predictions and conclusions (National Council of Teachers of Mathematics 2000). (9)

Integrating the study of ancient math is not limited to the study of a single culture's history together with its math and science. One can also make comparisons between the major ancient cultures. In my unit, the students will learn that the people in the Mayan civilization and the other cultures around the world were thinking the same thing at about the same time. They will learn how people are equipped with the ability to come up with their own systems to do things such as math, and that these systems are deeply embedded in the history of the people. I will guide my students to an understanding of how the vigesimal number system compares and contrasts with the Arabic number system. The students will use critical thinking skills to develop their own ideas about ways they could create their own civilization. We will compare the calendar of the Mayans to the solar calendar that we use today. The solar calendar is divided into thirty or thirty-one day cycles for months, whereas the Mayan calendar has 13 days in each of their 20 months. I want the students to walk away having a better understanding of how to use problem solving strategies. The communication between the students will improve by using the symbols of the Mayan people. Geometry was used by the Mesoamerican people to form statues, pyramids, and

buildings. They are going to build structures to help reinforce the geometry. My students are going to develop a folder for all the material that we are using in the class.

UNIT BACKGROUND

Chronological History of the Mesoamerican People

If we are to integrate indigenous American math with its history, then a brief synopsis of the history is necessary. As found in the Oxford Encyclopedia, the editors have been faced, in cases, with the thorny problem of finding the appropriate "name" for indigenous peoples. Scholarship has not always been kind, thoughtful, or accurate in using the names that identify a groups or a people-such as the "Aztec," for example, and the result is that some peoples have not been called what they call themselves. Aztec was a name made popular by William Prescott's famous writings on Mexico and is not a term used by the Mexicas or Chichimecas or Tenochcas to designate themselves. In a number of cases, such as the "Olmecs" or the people the people of Teotihuacán, we do not know what these people called themselves and have resorted to using names designated by scholarly consensus (Carrasco xi).

In the ancient Americas, there were classes in their society. The history shows that the royal families controlled much of the territory, including the people who were poor. The people had a strong belief in gods and would sacrifice themselves for the gods, married within their own family, and were warriors. Researchers have discovered that the pottery, art, and architecture of the ancient American people tell that each culture was different. They are differentiated by the way the faces on the monuments are formed or some types didn't use faces, the colors they used, the types of food they ate, their written language or the lack thereof, and the area were they lived. Many of the cities that they lived in were divided into "subdivisions" like the way we live in cities today. These cities did not appear suddenly fully developed, but were the product of millennia of cultural, social, and scientific developments on the part of the indigenous people of Mexico and the surrounding areas. To fully integrate their math and science with their history, it is important for the teacher and the student to have the basic historical developments in mind.

The best source on ancient American culture history is the recent *Oxford Encyclopedia of Mesoamerican Cultures* (Carrasco et al. 2001), which has used information from ethnohistoric accounts, culture history and its interpretation, and archaeological methods and finds to craft a complete historical narrative of the region and its complex civilizations. Much of my synthesis of ancient American history comes from several Oxford articles that are cited individually below

> Much information about these people was from the four books called the codices such *Codex Zuche-Nuttall* (Mixtec), the *Historia Tolteca-Chichimeca* (Toltec), the *Chilam Balam de Chumayel* (Quiche Maya), and *Florentine Codex* (Mexic-Aztec). Other archaeological methods were used to find out inform, such as stratigraphy; which is researching the natural and cultural deposits, ceramic typology, radiocarbon dating, obsidian-hydration analysis and thermolumin-escence. The Mesoamerican Chronology is important to understand Periodization, Early Development and the Archaic Period (before 2600 BCE), Formative (Pre-Classic) Period (200 BCE-250 CE), Classic Period (250-900), Post-Classic Period (900-1521), Colonial Period (1521-1821), and Postcolonial Period (1821-present) (Mendoza 222-223).

The Archaic period falls after Paleoamerica period at the end of Pleistocene (radiocarbon dated @ 8650 BCE) and before the Formative Period starting about 2600 (Mendoza 222). The Archaic period was characterized by a basic foraging subsistence system that included a series of hunting, trapping, and plant-collecting activities, seasonally and ecologically scheduled. "During this time Archaic Period Incipient Agriculture stage, the Mesoamerican people created their own tools such as rock, bone tip, nets, chipped stone tools, and mortars and pestles. Throughout this

period experimentation with plants may have resulted in genetic changes that made some plants different from their wild ancestors and led to the cultivation and/or domestication of those plants" (Mendoza 226).

As you can se, the scientists and other scholars who have worked on the information about the Mesoamerican people were thorough and intensive. After discovering the Codices and other artwork, they were able to come up with the time periods. In the Pre-Classic Period scientists decided to study the architecture and ceramic styles of the culture area. This study led to the realization that the decline in art, architecture, and ceramics was identified with the Post-Classic period. "Epigraphers determined that the heights of the Maya civilization occurred during the six-hundred-year period from 300-900 CE. During this same period a great deal of information came out the Olmec people" (Mendoza 224). John Stephens and Fredrich Catherwood in 1839 were lost in the jungle in Mesoamerica. They discovered stone statues and temples covered in overgrown vines and branches (Discovery Education). These men discovered the Olmec statues and a pure jade mask, which led scientists to believe this was an era of elitism in Mesoamerica around the western part of Mexico and in Guatemala's Montagua River Valley (Grove 240). A century had passed and because of the discovery of the Olmecs, people started understanding more about the Mesoamerican people.

During the Formative Period (2000 BCE-250 CE), a society that built their rulership in the tropical Gulf Coast of southern Mexico was the Olmecs. They are known for their great symmetrical stone monuments. Most of the statues were made from basalt from the Tuxtla Mountains, which was a great distance north of San Lorenzo and La Venta where the Olmecs civilizations were located. The scientist also found an irrigation system in the The Red Palace in San Lorenza's early public architecture. Basalt was carved into a U-shaped form to carry spring water to domestic or ritual areas (Grove 239).

During the Olmec period, the Mayans started forming small urban areas. They started developing their own civilizations by growing their little villages. This was classified as the Formative Period. The Formative (Pre-Classic) Period, 2000 BCE-250 CE, encompasses a timespan of approximately two thousand years, during which Mesoamerica underwent a gradual, but momentous, social and technological evolution from simple horticultural villages to near-urban settlements and state-level political systems supported by intensive agricultural practices (Grove 236). The Mayas started settling down in the cities of Palenque, Uaxactun, Bonampak, and Copan. There was a famous city in the middle of all these cities called Tikal. Tikal was designed with temples, palaces, and plazas. These historic buildings were used for rituals of the noble-priest, the highest being called True Man. The city started to grow. The people started building houses like apartments, and like today, they were built for different classes of people, the rich and the poor. The temples of the rainforest were covered in plaster that had been painted red. The temples stood out because they were important to the Gods. When the temples were being discovered by the scientists, the red paint was still visible on the temple walls. There were also buildings that had courtyards, and it is thought that these buildings were residential areas. About 200 BCE, Teotihuacán started quickly evolving into one of the major cities. A century had passed and the building of the most famous pyramids in the Americas started. The largest of those was the Pyramid of the Sun. Teotihuacán continued to grow during the Classic period of 250-900, which led to the development of the Avenue of the Dead. It was approximately two kilometers. It ran from the Pyramid of the Moon at the northern part to the southern part which housed the Pyramid of the Sun and the Cuidadela. The Cuidadela is a large open plaza that contained the platform shrines. The famous Feathered-Serpent shrine has conch shells believed to represent the mythical origin of Quetzalcoatl in the watery underworld (McCafferty and Carrasco 245-246)).

> The term Classic has a long and checkered history in Mesoamerica archeology and was initially introduced by Willy and Phillips (1955) to describe the city of Teotihuacán and

> the theocratic city states of the Maya, with explicit reference to the "Classic" Greeks. The comparison based on the mid-twentieth century notion that those cultures were ruled by "philosopher-priests" who were more concerned with religion and astronomy than such mundane subjects as politics and economics. This "classic" conceptualization was in stark contrast to the later Aztec culture which seemed to be consumed with warfare and brutal religious practices, and thus was conceived as "Roman-esque." (McCafferty and Carrasco 243)

According to the *Oxford Encyclopedia*, The Classic period was an important era in Mesoamerica. The people started to develop their trading skills and understand how to maintain a society. It included sculptural masterpieces as the Temple I at Tikal, the Temple at Palenque, and the Hieroglyphic Stairway at Copan. The time period that followed was the Post Classic Period (900 and 1521) and includes the fall of the Classic period cultures and the Spanish conquest – a time of dramatic and widespread sociocultural change that engulfed all of Mesoamerica (McCafferty and Carrasco 243).

The Toltecs were another type of people that lived in an area to the north of present-day Mexico City. The Toltecs lived in an area called Chichimeca, which means "The sons of the dog." This city and area of Mexico was dry and desolate. The Toltec's capital was Tula. They were very territorial people, causing people to give up food and their land. Because Mesoamerican people worshipped gods of all types, though mostly idols, Chac Moal was a statue that these people would place the human heart on during a sacrifice. The next upcoming people were the Aztecs which took the place of the Toltecs. The Aztecs adopted human sacrifice from the Toltec people. The Aztecs were from northern Mexico, and they traveled a far distance in search for their capital Tenochtitlan. They were ordered to search for this city by their god, Huitzilopochtli. Once the Aztecs got to Lake Texcoco, the island that housed Tenochtitlan and the sister city, Tlatelolco, they had to build draw bridges that were 50 miles long to connect to what is now Mexico City, to protect them from their enemies. The Aztecs continued making sacrifices of their captive enemies to the rain god Tlaloc for new life and to Tonatiuh, the sun god who is in the center of the Aztec calendar. The Aztec empire started to fall when Hernan Cortez from Spain entered the country. The great king Montezuma and others thought he was a god. Soon the Spanish took over their gold and wanted to convert them to Christianity. Despite their warrior-like attitude, the Aztecs were defeated by the Spanish because of the Spanish armor, guns, and horses. Spain also brought diseases like smallpox that these people had never been exposed to (Discovery Education).

MATHEMATICAL SYSTEMS

Math has been around since time began. Math is all around us and in everything we do. In ancient times the people would count years, days, and time. These practices were considered abstract math. Over time, people started discovering how math could help build structures, plant crops, study the alignment of the stars, and create trade. Because ancient people discovered the mathematical process in different ways around the world, they were all using the same rigor, which are the uniform principles that should be applied. Ancient people had their own equations for math, which included concrete representation – for example: the Chinese abacus, the quipu made by the Incas, hieroglyphics by the Egyptians, Cuneiform by the Babylonians, Roman numerals, and Milesian or Alexandrian numerals from the Greeks. These types of number systems were being developed around the world at about the same time. Each one of these groups grew their own civilizations. They all were using the number system for the same purposes as I mentioned above. They all used numerals, which is a written form that represents a number. These civilizations, like the ancient Americans, came up with a number system that represents numerals in a consistent way.

The Maya were brilliant in math and science. They made accurate observations of the eclipse of the moon and created the vigesimal number system. In the center of their society, they developed courts where they could play a ball game that was similar to soccer. They weren't able to use their hands – only their feet, hips and knees. The Mayan people were interesting. They developed the number system by using the zero. These indigenous people were far away from other people of the world. They developed one of the most flourishing countries in the world. Even though the Arabic people created a base-ten number system, the Maya had a base-20 number system. These people had to create something to be able to count corn and cacao pods.

According to the Maya, a dot represented 1 unit and the bar, 5 units. Numbers from 1 to 19 could be obtained by the appropriate accumulation of dots and bars—dots lined up horizontally, bars vertically. This arrangement of dots over bars may have been adopted for the sake of convenience or for reasons of religious significance (Nicholas as quoted in Lambert, Ownbey-McLaughlin, and McLaughlin 249).

The Arabic number system, what we use today, uses decimals which are part of a base-10 system. The Arabic used the 1s, 10s, 100s, and so on, to represent numbers, whereas the Maya used a base-20 system that was based on how many fingers and toes they had. The Maya used this number system for calendrical calculations as well. For calendrics, the Mayan people who lived in the lowlands used the same number system but with 18 rather than 20 for the third digit, so that the 1s digit (kin) corresponds to a day, the 20s (uinal) roughly, to a month, the 360s (tun) to the computing year, the 7200s (katun) for years, the 144,000s (baktun) to 400 years, and the pattern continued (Lambert, Ownby-McLaughlin, and McLaughlin 249).

This was incredible! What made them think of a system like this? How did they create a successful number system and develop societies that thrived on other societies in the areas to trade and build an economic society? Because of the geographical areas of Central America, they were able to trade for goods. The elegance and simplicity of Mayan arithmetic derives from its use of only two symbols. The binary interaction of these symbols becomes almost mechanical. Essentially no memorization of multiplication tables is required, since two symbols can interact only three ways (Lambert, Ownby-McLaughlin, and McLaughlin 255).

Although the Mayan mathematical system was not allowed to evolve to a state of complete development, it is not unreasonable for us to admire the system and try to imagine where that evolution might have led (Lambert, Ownby-McLaughlin, and McLaughlin 255). For us, it leads to a realization of their great achievements, the heirs of which are in our classrooms. The integration of these new math skills with closely integrated history of their culture and science will give the students a window into another world of human thought that seems so distant from our own only because we have been so unfamiliar with it until recently.

LESSON PLANS

Lesson One: Base Twenty Number System

Objective

(5.3) - The student adds, subtracts, multiplies, and divides to solve meaningful problems.

Introduction

The history of mathematics is unique in the Mesoamerican civilization. We are taught how to use the Arabic base-10 number system. At the same time across the world the Egyptians were using a similar approach to math. The Mesoamericans used a vigesimal number system. Does anyone know what a vigesimal number system is? A vigesimal number system uses a 20 number base system. Why do you think that the Mesoamericans would use a 20 base number system? They used all of their fingers and toes to count items. They had a special way counting. They used

manipulatives like rocks, beans, and sticks. They also started using the zero before anyone else. Can you imagine what our number system would be like if we didn't have a zero? We are going to be able to compare the Arabic number system, the number system we use, and the number system of the Mesoamericans. How do we read our numbers, from right to left, left to right, bottom to top, or top to bottom? We read them from left to right. The Mesoamerican people read them from bottom to top.

I always try to associate new material to their prior knowledge, what the students already know. The numbers for the Maya were written up and down. There are 19 numbers and one zero to represent the number system. The zero looks like a shell and the other numbers are either represented by a dot being one and a bar being five. The place value for the number to represent the next place value is twenty. Addition is carried out by summing the bars and dots in parallel registers. Only three rules are necessary: (1) a dot represents 1 unit; (2) an accumulation of 5 dots is transcribed as a bar; and (3) an accumulation of 4 bars in one register becomes a dot in the next higher register. Promoting 4 bars in one register becomes a dot in the next higher register. Promoting 4 bars to a dot in the next register is analogous to carrying in the addition of Arabic numerals. Thus Maya addition is far simpler then Arabic addition, which requires then symbols and the memorization of a host of rules, such as 2+3 = 5 and 4+5=9 (Lambert, Ownby-McLaughlin, and McLaughlin 249). You will use Appendix A for Numbers and Bars, Appendix B How to add (explanation), and Appendix C Vigesimal Place Value to teach this lesson.

Concept Development

The students will be able to place the manipulatives in the correct spot on the place mat. They will be able to compare and contrast the different number systems.

Student Practice

The students will practice showing the place value of the Arabic number system. They will go to the board and fill in the place value for the numbers that I call out to them (1, 238, 3342; 567, 439, 998; 34, 876; 109, 377; 43, 555). I will leave the numbers on the board, but then write a number in Mayan form. I will explain how to read the number. I will then hand out a sheet with all the symbols for the number system. I will give them time to look over it and then we will talk about it. Are there similarities or differences that they notice? I will model how to calculate the beans and sticks into numerical form using the numbers 26, 13, 49, and 61. I will pass out all of the manipulatives to them and allow them to form the numbers 57, 12, 88 on their own.

Assessment

The students will keep the manipulatives to use in the assessment. I will put Mayan numbers on the board and they will work in groups of two to answer.

Closure

The students will compare on a Venn diagram the differences and similarities between the Arabic and Mayan number systems.

Resources

beans, sticks, place mats to help them read the numbers from top to bottom

Lesson Two: Ancient Maya Mapping

Objective: The learner will understand the geographic location of Mesoamerica.

Introduction: The students will receive their maps in class. We will cover map skills, using the compass rose, the map key, and how to find miles between the cities. We will learn about the different types of maps as well as the different types of land. They will be able to envision how

Mesoamerica survived for so long. Taking them through the Mayan ruins in Central Mexico will allow them to see how this side of the world worked 2,000 years ago. I will have them explain how the human mind works even though long time ago there was no schooling for them to go to on a daily basis.

Concept Development: I want the students to be able to locate where the areas are that we are talking about in class. Map skills are usually taught in a Social Studies class, but the students need to be able to read maps if they are going to talk about the Ancient times. However, graphing, reading a scale, and interpreting charts are part of the Math TEKS (see above).

Student Practice: I will guide the students through the lesson to show them how to find things on a map. The students are going to receive a copy of the map of Mesoamerica in Appendix D to draw on the areas that we discover during the lesson. They will use the compass rose, and we will briefly discuss how the Mayans used their own ways to determine the direction at which they were going on land. We will talk about how the Mayans were very scientific with the stars and the moon. We will then go to the computer lab and search the maps on the website, http://www.ancientmexico.com. The students will be able to interact with the computer by locating all of the large ancient cities of Mesoamerica. Once the students view all the places on the map and take notes on the historical figures in each city, then they will draw it out themselves on a piece of art paper. They will have to measure each city by the scale and longitude and latitude. After they have completed the map, then they will be able to produce a topographical map of the area about which they learned.

Assessment: Once the students have completed the activity, we will play the game Jeopardy. They will be quizzed over the cities and the historical figures.

Closure: We will display our maps in the hallway. The students will then present their lesson to the fifth grade classroom.

Resources: maps for the students, computers, clay, student's object to place on the map to be brought from home.

Lesson Three: Geometry with the Tallest Structure

Objective: The student will create a geometrical figure of their choice.

Introduction: Temples were created from plaster, paint, and stone. Usually the large temple would be combined with smaller temple in side. Their stone monuments were symmetrical as well as their plazas. I will introduce them to the geometric patterns that you see from the design picture. I will teach them the about the area of the triangle.

Concept Development: I want the students to understand the geometry that was used by the Mesoamerican people.

Student Practice: They will sketch out the pyramid they want to build and we will create our own Tenochtitlan with sketches of the pyramids. They will discuss some of the reasons why they built other structures that they did during their time period, for example the "Olmec" head. We will then go out in nature and view the things that surround us. I want the students to be able to draw an item symmetrically and geometrically correct to create our own view of our society like the Mesoamerican people did back then.

Assessment: See if the students understand finding the area of a pyramid, and the area and perimeter of a rectangle

Closure: display our pictures for others to view

Resources*:* graph paper.

Lesson Four: Aztec Calendar

Objective: The students will understand how to use the calendar from the Aztecs.

Introduction

> Like the Mayan, the Aztecs had two calendars. The ritual calendar, or "counting of the days," had a 260-day cycle. This was used by priests to forecast future events and had great religious significance. The solar calendar, or "counting of the years," had 365 days and was used to determine regular seasonal festivals. The two calendars came together once every 52 years, when there were special ceremonies (Morris 27).

In the center of the calendar is the Sun god. The calendars were monstrous in size and weighed tons. They were colorful with pictures of the 20 day signs. The days were used to name their children according to the year that the children were born. At the end of a 52 year period, the Aztec would bundle up reed to represent the 52 year period that just passed. This celebration was because the tzol'in calendar (260 days) and the haab (365 days) came together every 52 years, which is called the calendar round. For this lesson you will refer back to Appendices E, F, and G in the back of the book. You will count 13 dates of the 20 day names and then count the next 13 dates of the 20 day names. What is the pattern you see? How does 260 days in a year relate to 13 dates and 20 day names? (The students will see that if you start counting on Lizard 4 you would end up on Vulture 3.) After you understand counting the day names, we will try the calendar round.

Concept Development: I want the students to calculate the dates on the Aztec calendar.

Student Practice: I will start the lesson off by asking them when their birthdays are. I will write each one of them on the board. "What is so important about your birthday? What type of calendar do we use? On the Aztec calendar there are 13 dates and 20 day names or 13 days in each 20 month cycle and 52 year cycles, which combines 365 days and 260 days. We are going to learn how to read the Maya calendar. You will be able to tell your birthday in Aztec." I will give them a sheet that has all of the dates for the calendar. We will begin counting the dates together. They will start with the first day name and count 13 days then start over to continue counting thirteen more names. Once the students have gotten the dates down, then I will start writing down the dates for them to try to master them. We will then start analyzing the calendar round.

Assessment: Create a tree with their families' birthdays.

Closure: We will present our lesson to the other classes.

Resources: copies of the Appendices E, F, and G

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