# Latin American Art and Geometry

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La mejor manera de alcanzar es trabajar, trabajar y trabajar
- Alvaro Uribe Vélez, President of Colombia

## INTRODUCTION

When thinking about geometry most people think about numbers, objects, lines, planes, and angles. However, it is in the essence of nature and in our everyday lives. Geometry can be found in our surroundings. For example, the paper this is written on is a geometric shape, mini-blinds in windows are parallel lines, and even people are symmetrical. Our students usually do not notice that there are so many examples of geometry all around them. Actually, most adults do not realize it either. Even though geometry goes unnoticed, it is the essence of a balanced and attractive world.

### Becoming an Artist

I remember in third grade, I was asked to create a sculpture in art class. A sculpture? For a third grader? The teacher might as well have asked me to speak Chinese without first learning the language. I had no idea how to make a sculpture! What went into sculpting? What should I sculpt? How would I start? I went home and contemplated this project for most of the night.

It was simply not an easy task. I started to think about what I saw when my parents drove me around my hometown, Bogotá, Colombia. My parents liked to expose me to different subjects. This was a great way for me to learn about the world and my surroundings. My parents and I drove along different highways and passed by buildings in downtown. In this part of the city there was a lot of art that was influenced by many different cultures. Some of the parks and buildings displayed sculptures of different artists, usually Colombians.

My basic elementary understanding was that a sculpture was a strange object that usually had bright and attractive colors. From what I saw, sculptures were made of different shapes that made no sense, but as a whole seemed to have some kind of attraction and geometrical balance. This is what I guessed the teacher wanted.

Now that I had figured out what a sculpture was, I needed to decide what I would use to create it. My parents took me to the art supply store to buy my materials. I wanted to use something light that would not bend easily. I bought several wooden craft sticks. I took the supplies home and started thinking about my design.

I wanted to start with something simple and then build from it. The easiest shape I could think of was an equilateral triangle. However, one triangle was not enough, so I added two more equilateral triangles to the sculpture. Then, I decided my sculpture needed to look more like a pattern, so I made the triangles different sizes. There was a small triangle in back, a medium triangle in the middle, and a large triangle in the front. I glued the triangles to a flat, light wooden surface. Then, I connected the triangles by gluing a wooden stick to the top vertex of each triangle. Now the only thing my sculpture needed was color, so I painted each triangle with the colors of my country's flag: yellow, blue and red. I was so excited to finally finish my own, personal sculpture!

Without intending to, I started discovering different types of relationships. This was really interesting! I noticed that if you placed the sculpture in a diagonal position you could see more triangles, like they were growing infinitely. It was as if the sculpture had depth on its own. I also found a pattern within the colors. I realized that this hands-on activity, combined with the liberty of choosing, analyzing, and evaluating what to do gave me the opportunity to discover some geometrical skills that no math textbook would have given me.

Experiences like this one can give students an opportunity to see things in a different way. By doing this hands-on sculpture activity I was able to understand geometric concepts from a different perspective – my own. I realized that placing objects in an artistic, organized, pattern permitted me to see more. This project allowed me to analyze in depth three – dimensional objects, as well as develop an awareness of spatial reasoning. I gained first-hand knowledge of many different geometry principles from this one art project.

**Let the Students Become Artists**

Once that I decided to work on my unit, I thought it would be very interesting to combine all of these unforgettable experiences and pass them on to students. Finding a fun way to do it became my goal. This is how I decided to name my curriculum unit "Latin American Art and Geometry." This unit will start by showing students examples of geometry in nature, in Science, and in art. The unit will then show them the influence of geometry and nature in the native cultures of Latin America. Next, the unit will allow students to build models and study patterns. Once the students have had hands-on experiences and grasped the basic concepts, they will be guided into the art of shapes and how artists use them. Following this, the students will study some Latin American artists and discover the influence of native and pre-Columbian cultures in their work. Finally, the class will compare and contrast the work of these major Latin American artists.

After several days of reflecting, I concluded that a Latin American unit would bring a lot of culture into the Math concepts that are taught. There are many Latin American cultures that our bilingual students do not know about, simply because they are not exposed to them. The Math concept of spatial reasoning is used in many of the artworks

in the Latin American culture. There are terrific artists that are very deserving of study, such as Diego Rivera and Rufino Tamayo. In my elementary years I remember visiting museums and seeing some Colombian artists such as Edgar Negret and Omar Rayo and feeling astonished by the perfection of their paintings. That is the kind of impression that I want students to remember.

Omar Rayo with one of his works. This picture was taken for Diners Magazine in 1991 by Olga Jordan.

**UNIT BACKGROUND**

**Let's Remember the Basics**

As mentioned before, spatial reasoning and geometry concepts are essential to understand our surroundings. Geometry is the skeleton and framework that establishes a mathematical rationale in three dimensions. Having a strong math notion facilitates every aspect of an individual, from understanding life to understanding everyday situations. In summary, understanding math makes it easier to understand our surroundings.

Real objects enclose a full set of properties. These can be represented and described in words and through math. Using mathematical knowledge and expertise, an individual can give sense to reality. It is very interesting to logically think and understand how our surroundings work.

On the other hand, art can be understood as the representation of both reality and abstraction. Art becomes a way to connect this two. In fact, it is a perfect tool to represent express reality or abstraction. There are many types of art, but there is just one personal reaction to it, a subjective impression. Our students need to be exposed to art in a proper way to get interested in it. They love art and through it math can be explained.

Since I was a kid I have been exposed to both math and art. I see math and geometry in our everyday lives and I love it. I want to share that same feeling with my students.

**The Connection to the Students' Reality**

When thinking about the topic of my curriculum unit I realized that geometry was one of the lowest scoring topics done by Fifth Graders in the TAKS test in spring, 2003. I love Math and I really thought about how to make a connection between the pleasure and interest I find in Math and the everyday life of my bilingual students. I also thought about how to teach my students in a way that would be very interesting for them. With

this unit, I wanted to have the opportunity to teach something relevant, something they had never seen or studied before. I thought about a topic that would be meaningful and memorable for them and, at the same time, different to what they have seen before.

The result was simple. Art is unforgettable. It is special, even magical, and it lasts in time and in your mind forever. This emphasized the connection I found between art and geometry. Art requires mathematical skills that are rich in geometrical essence, and these skills are linked to the students' reality and background.

**Why Geometry?**

Geometry is a topic that can be worked on in-depth to acquire thinking and mathematical skills. It lets our students organize ideas, compare and contrast shapes, find relationships. It is rich in concepts and patterns not visible at first sight. Depending on the way these shapes and patterns are presented, they help us organize our thinking skills and give us a sense of exploration, questioning and fascination. This intriguing subject also helps us construct, establish and find relationships. Geometry takes us one step further into understanding the world around us. It lets us organize ideas and concepts and allows us to ask why are things the way they are and how can they be improved.

But it is important to present geometry in a creative way. Hands-on experiences are great. Teaching this subject should be rich in challenges for the learner. It is an opportunity to become interested and to discover, to notice, to appreciate and to enjoy our surroundings. The best link I found was to connect geometry with art.

**Constructing Relationships**

There is fascination in art and art is full of geometry. Besides, giving the chance to our students to explore and create with geometry, using instructions and examples studied in class, will make their building knowledge even better.

Once the students have gone through this unit, they will have a new vision. They will find objects, materials, construction and architectural models and in general everything that surrounds them as a potential and interesting geometrical shape. These boys and girls will be making connections. They will think and reflect about them. They will analyze, explore and enrich their initial understanding of their reality. In this sense, they will practice every day their geometrical skills. They will be always eager to explore and find relationships. They will constantly use their heads and practice, perfecting their geometrical skills.

Building up that mathematical muscle will help them exercise their brains and minds. They will exercise their perception abilities. They will get used to making connections, and to analyze beyond first impressions.

## IMPLEMENTATION STRATEGIES AND ASSIGNMENTS

### The Basics of Geometry

The unit will start with geometry in nature and science. The students will begin by finding patterns and shapes in their surroundings. There are several resources to be studied or revised to find examples of geometry in nature. Repeating patterns such as the amount of petals in flowers, the relationships between monocotyledon and dicotyledonous seeds, the different patterns within the parallel or diagonal veins in the leaves of plants are just a few examples.

The unit will also study the school and community searching for models, figures, patterns and art. Different buildings, sidewalks, tiles, ceilings are just a few examples of the variety of possibilities to encounter geometry in the surroundings. This is a first step to open the minds of the students, to focus them towards the goal for the unit.

A very good resource that will definitely attract the students' attention is the exploration of geometrical shapes through photography. The students usually show a lot of interest in technology. They are really passionate about using it by themselves. The students will have at their hands digital cameras that will be used at the introductory lesson. They will use such cameras at school and then use a projector in class to analyze the pictures taken. It is a good exercise to find patterns, relationships, colors and shapes.

The students will walk around the school premises lead by the teacher. They will take pictures of buildings, nature and science topics studied in class. Then, they will make a study based on a geometrical approach. For example, if the class is studying angles, the students can go out in the search of obtuse, acute and right angles. The students will take cameras and walk around school taking pictures of different things in an Angle Quest!

### Exploring Cultural Roots

After that introduction, the students will study some major cultures in native America including Aztecs, Mayas, Incas and Chibchas. These cultures are the roots of Mexican, Peruvian and Colombian cultures. The students will discover how these native communities understood nature through art, artifacts and tools that were used hundreds of years ago. It will also be a good experience to understand that there were more major cultures in Latin America than the ones the students usually hear about.

This part of the unit will require further power point presentations or slides to cover the native Latin American cultures from a geometrical and artistic point of view. As we know, images are worth a thousands words. Seeing pictures of the artistic expressions of these cultures will be very motivating for the students.

On the other hand, it will be very interesting to compare and contrast these cultures. The students can also study how they have influenced the world around us. Pre-Columbian art is full of geometrical figures. There are lots of triangles, rectangles, parallel and perpendicular lines in it. It is also usually full of repetitive figures that create interesting patterns to analyze. They may not be as symmetrical and perfect as the oriental or Arabic tiles, but Pre-Columbian art is definitely a source of geometrical, repetitive patterns that have influenced for many years the Hispanic roots and culture.

**Tying It Up**

The teacher will then have time to introduce hands-on activities. The students will have a chance to construct models, build shapes and work with patterns. The students will by guided with the purpose of creating connections among what was taught. The students will construct their own models and tie those with the patterns of the native cultures and their art. There will be chance for comparing, criticizing, and evaluating the native cultures' art work and its influence in our everyday lives. This would be a good opportunity for higher order thinking questions and for the students to develop higher order thinking meta-cognitive skills. This will give them the opportunity to reflect about their own learning and understanding.

Depending on time constraints, the unit may go in-depth with the art of shapes and how artists use shape. This will be an introduction to understand how an artist thinks and works. The students will reflect on how much effort, work and influence an artist goes through when he or she decides to create a painting or sculpture. It would be very interesting at this part of the unit to have a visit from an artist in the classroom. He or she could explain how geometry and art flows through his veins and how much influence from his life, experiences and surroundings could be noticed in his work.

**Time For Art to Flow**

Once all this information, hard work, influences and effort is revolving around students' minds, it will be time to introduce some very interesting Latin American artists. A lot of pictures, paintings and projector images can be used to analyze their work. Definitely one artist worth introducing is the Colombian, Omar Rayo. His geometrical art is simply astonishing. It is amazing to notice how he takes lines, basic shapes, shadows and figures to create art from geometry. There is a very neat webpage with his work. It is the site of his personal museum in Colombia. Surfing the site you can really understand the artist's background and influence. It is very interesting to notice how regular polygons, shades and shapes mix together to form lively pictures with a message to the spectator. The use of color is also very interesting to spread the artist's idea, so using a projector or visiting his site will be further more productive than analyzing his work from this black and white unit.

There are several other Latin American artists to choose from. Names such as Edgar Negret or Rufino Tamayo come up. It will be important to take the time to give the students a better understanding and knowledge of geometry in art. Showing the students different pieces of various artists can explain better how artists use geometry in their work.

Another interesting artist to analyze is Diego Rivera. He is a very talented artist with many phases during his career, but if you are thinking about using his work, I would recommend focusing in the geometrical influence of his paintings.

Once selected, the students will make the connection in class between the artists, their work and the pre-Columbian cultures. The class will study the influence of nature, culture and surroundings in their work. A good example of pre-Columbian influence in artists could be the use of Pre-Columbian imagery by Diego Rivera, the Mexican artist. Works such as *The Totonac Civilization* and *The Huastec Civilization* in the Palacio Nacional of Mexico City clearly show not only the life of these pre-Columbian cultures, but also the influence of their time in the work of contemporary artists. These paintings are full of symmetrical shapes, repeating patterns and geometrical figures that will enhance the purpose of this unit.

At the same time the students will compare how different surroundings and experiences have influenced each artist and how their work is similar and different to each other. If time allows, the students can make a field trip to the Museum of Fine Arts. The students can focus on exhibitions that show the work of Latin American artists or geometry in art. I have found it a little bit hard to get an exhibition of Latin American artists in Houston, but there is always the possibility to show online the pictures of paintings and sculptures from important Latin American museums. Never the less, there is always an opportunity of checking for exhibitions that are full of geometry so that the students can make a connection between what was taught in class and real art they can see and experience.

After this unit, expect the students to appreciate artists and their work much better. The students will feel proud of passionate and interesting Latin American artists and to have a better awareness of geometry, shapes and figures in their everyday lives.

## LESSON PLANS

### Lesson Plan 1: Geometry Quest

***Objectives***

- The students will identify critical attributes including parallel, perpendicular, and congruent parts of geometric shapes and solids. - TEKS MAT5.7A
- The students will use critical attributes to define geometric shapes or solids -TEKS 5.7B

- The students will apply Grade 5 mathematics to solve problems connected to everyday experiences and activities in and outside of school. - TEKS MAT5.14
- The students will use logical reasoning to make sense of his or her world. - TEKS MAT5.16

***Materials***
Digital cameras
Computer
Projector

***Procedure***
This is an introductory lesson to the unit. The students will have direct contact with technology with a geometrical purpose. There should be an introductory lesson on basic geometry concepts. Topics include angles, basic geometrical shapes, congruency, patterns and symmetry. Once the topics have been explained and examples have been covered and discussed, the students will go on a Geometry Quest. The idea of the lesson is to motivate the students to discover geometry in their surroundings and everyday life.

The teacher will encourage the students to look at buildings, architecture, angles, shapes, and nature. The students will be divided in groups. A good alternative would be to let some groups study nature and the rest of the groups to study man-made scenes. The fundamental idea of the geometry quest is to find geometry in the surroundings. The students would be allowed to use all the information and ideas discussed in class.

I have noticed students who are truly competitive beings, and it would be very interesting to motivate the students to find the most original or most vivid example of geometry. When you keep in students' minds the sense of competition, the students are even more motivated to do their best. Following this idea, it would be beneficial to remind the students that there is a contest to take the best geometrical picture, the one that has more geometrical content.

Once the digital pictures are taken, the students will return to class. Using a computer and a projector, the class will see the pictures and analyze geometrical relationships among them. Even though getting the necessary equipment and technology to teach this lesson might be a little bit hard or require extra time, it would be very interesting and beneficial for the students to interact with technology. They will surely be motivated and into the lesson and will really love to see their pictures on a big screen. They feel very proud to see their own work displayed and enjoy a lot to discuss their work, findings and ideas with the rest of the class. Finally, the students will have the chance to select the best geometrically rich picture.

A good variation for this activity is to let the groups rotate between natural and artificial geometrical discovering. Since at some point certain groups were instructed to focus on natural geometry, these same groups could switch and also study artificial

geometrical scenes. This would make the selection of the best pictures far more interesting and fair for the students.

Finding cameras for the activity may sometimes not be that easy. In that case a modification should be in place. There are different contacts that you as a teacher can make to find help. At Kate Bell we are very pleased to know the school has some digital cameras, but that is not always the case. You might be interested in checking the possibility of free cameras. Another valuable site to visit is the Polaroid education grant. They might have grants for classrooms or schools available depending on the time of the year. Their latest grant ran from October 1, 2003 to May 1, 2004. Please check the bibliography for further information about it.

**Lesson Plan 2: Discovering Native Cultures**

***Objectives***

- The students will understand the location and patterns of settlement and the geographic factors that influence where people live. TEKS SOC5.8
- The students will understand how people adapt to and modify their environment. - TEKS SOC5.9
- The students will understand the relationship between the arts and the times during which they were created. - TEKS SOC5.22

***Materials***

Native Latin American displays of art
Native Latin American posters
Native Latin American utensils
Native Latin American fabrics
Cloth (light colors will work best)
Paint
Brushes – class set
Scissors
Plastic containers

***Procedure***

This lesson starts with an introduction of the Native Latin American cultures. Many of the bilingual students have no background on the cultures that lived in our countries before making contact with Europe. It would be very beneficial for the students to study the origins of Hispanic cultures and customs, of their food and identity. These origins have come all the way for centuries. You can see examples of such influence in names, everyday words, food, art and even sports! An excellent source of information and links to particular aspects of the Pre-Columbian cultures in America is the webpage *Pre-Columbian Art & Culture* mentioned in the bibliography. It goes from a general perception to a lot of details and specifics.

Most of our native cultures, including the Aztecs and Mayas in Mexico, the Incas in Peru and the Chibchas in Colombia, are very rich in geometrical patterns and art. There are thousands of astonishing pieces including calendars, fabrics, clothing, utensils, jars and paintings that reflect the basic geometry and patterns that flourished within these cultures. This lesson could be extensively combined with basic definitions including geometrical relationships, lines and angles, parallel and perpendicular lines, patterns and repetitions, color and dimensions, congruency and polygons. It would be very interesting at this point to bring into the classroom a lot of pictures, and real objects that are replicas to the once used by the native cultures. The different consulates from Mexico, Colombia and Peru have good resources and interesting references that could be used in the classroom. There are also some sites listed at the end of the unit that a may provide aid about where to go to find further information.

Once the students have studied the patterns and basic geometrical art seen in Native Latin American cultures, they will have a great hands-on experience. They will create their own native culture garments. Based on the geometrical shapes of Aztecs, Mayas and Chibchas, the class will be divided into three groups. Each will be in charge of creating a piece of garment, a skirt, necklace, bracelet or blouse. Each group will have required materials including cloth, paint, brushes, plastic containers, and scissors. Besides, they will have a pattern to copy, to translate into cloth or to base their work to create a similar one. The idea with this activity is to study the concept, internalize it and reproduce, make it real. The Geometrical concepts would be recorded in the students' memory in a fun way. At the same time they will remember facts and learn about America's native cultures. While giving a sense of identity and understanding, the students will practice geometry. The next time they see Pre-Columbian artifacts, it would be easier for them to recognize the pieces, value the artistic meaning and enhance their geometrical understanding and beauty of the works.

**Lesson Plan 3: Becoming an Artist**

***Objectives***

- The students will make generalizations based on observed patterns and relationships - TEKS MAT5.5
- The students will understand the relationship between the arts and the times during which they were created - TEKS SOC5.22

***Materials***

Canvas or cloth of about 8" x 11" per student
Washable Paint
Brushes – class set
Artist's reproductions
Clay – class set

***Procedure***

The idea of this unit is to let the students work as artists. Basically, they will let their motivation and inspiration flow to create a piece of art. Before being able to do so, there are several art pieces, works and artists that need to be studied. As said before, there are several artists that have a lot of geometry in their work. It is evident. My suggestion would be to check Omar Rayo's work. Over the years his sculptures and paintings have always been expressed through patterns and geometrical figures. His museum in Colombia has an excellent website that can be used as support. They are very committed to enhance education and are very willing to help children.

For example, look carefully the following works by Omar Rayo. They are full of detail. It a sense, they give the impression to be in three dimensions. The shadows and patterns give life to these pieces. Even though being very basic and symmetrical figures, the paintings as a whole are full of life, movement and expression. All of the pictures contained in this unit have been authorized to be used by the Museo Omar Rayo since they are used for educational purposes. Let us educate our children and share with them these fantastic artists!


The author has titled these paintings as seeds facing the sun. Can you try to explain the artist's point of view to give them such a name? You can find further answers on the web page of the artist.



When remembering my art lessons at school, I found through painting and sculpture a very relaxing way to express myself. I had art classes all the way from elementary school to high school. I conceive that the most opportunities we give our students to explore their likes and talents will help them become better professionals. I understand that sometimes in the Houston school system the teachers not always have all the resources at hand, but there is always a way to bring the world into the classroom. If in your school as in mine there is not an art session, I really believe it is very important for the students to have an exposure to art. I know there are several middle and high school magnet programs that have art as a regular subject, but can we expose the students to those lessons and opportunities since the early grades? The more they are exposed to, the better opportunities they will have to reinvent themselves, to learn and find interests and talents that may have not been explore before. That is why this lesson is so important.

The students will have the opportunity to become artists. Based on the artists studied in class, the students will have the chance to copy the artists' patterns and geometrical figures. The students will be instructed to copy a picture from one of their favorites artists studied. This will allow the students to experience the geometrical processes, tools, and experiences the artists went through.

The students will choose one piece of art they liked. Then, they will proceed to paint or sculpture in clay the piece of art they chose. They will have the opportunity to create, modify or even improve the piece of art of their favorite artist.

**ANNOTATED BIBLIOGRAPHY**


Angel, Felix. *Edgar Negret*. 20 May 2004. <http://www.iadb.org/EXR/cultural/Colombia/ennegret.htm>
This web page shows interesting bibliography, connections to geometry and pictures of Edgar Negret's work. Becoming one of the most important Colombian artists of all times, Negret's work is full of geometrical influence.

Flux, Paul. *How Artists Use Shape, Seeing and Feeling Art.* Heinemann Library, 2001.
This book explains how different famous artists visualize things and the effect generated. It includes different styles and work. It is an excellent resource to understand the way of thinking if an artist and how they perceive their work.

Johnson, Art. *Building Geometry: Activities With Polydron Frameworks Grades 2-10.* Dale Seymour Publications, 1997.
This book contains 40 different hands-on activities to help students with patterns, shapes and colors. It is a very good resource for the introductory part of the unit, when further explanation of geometrical basics is required to move further in the unit.

Museo Rayo. *Museo del Dibujo y Grabado Latinoamericano*. 6 Jun 2004. <http://www.museorayo.org>
This is the official webpage of the Museo Rayo in Roldanillo, Colombia. It includes several paintings of this important Colombian artist and offers educational support. It is also a good resource for understanding Omar Rayo's life and influences.

Polaroid Education Program. *Pre-Columbian Art and Culture*. 6 Jun 2004. <thttp://www.polaroid.com/media/com/pdfs/promotions/pdf_pm009_27e3.pdf>
This webpage offers an example of possible educational grants for a classroom or school to develop photography projects that aid education for our students.

*Pre-Columbian Art and Culture*. 6 Jun 2004. <http://www-unix.oit.umass.edu/~tnm/aztlan.htm>
This webpage offers interesting links and connections to Pre-Columbian Art in America. It also has interesting information about the different native Latin American cultures. A good source of information.

Schneider, Michael S. *A Beginner's Guide to Constructing the Universe: Mathematical Archetypes of Nature, Art, and Science.* Perennial, 1995.
This book is based on what the author calls cosmic geometry. It explains and guides geometry in leafs, rings and everyday things. It is a rich resource to use at the introductory part of the lesson when the students will discover geometry in nature and their surroundings.

Steele, Margaret and Cindy Estes. *The Art of Shapes: For Children and Adults.* Fotofolio, 1997.
This book is full of modern, famous art pieces. This work introduces students to colors, shapes and the parts of the body. It is a simple explanation of famous art pieces, but at the same time an excellent reference to understand what we call art.

Urena, Fernando. *Los Laberintos Geometricos de Omar Rayo.* 14 Feb 2004. <http://www.latinartmuseum.com/rayo.htm>
This webpage give us a sample of Latin American artists' work that can be used as part of the presentation of images. There are artists of different nationalities mentioned in it. There are some good examples of work that might be used with educational purposes to instruct the students. It is also a rich source of biographies to understand influences in the work of each artist.