Maps & Models Introduction

A map is a picture of a part of the Earth or space. Each feature is drawn in a reduced size so it can be shown on paper or on a globe. Maps are flat representations; globes are physical models. Maps help us travel from place to place and to understand the world around us. Humans have made and used maps ever since people first moved about the Earth exploring other territories, and trading. Geologists can use maps to find clues to the nature of the rocks underlying the earth's surface from the character of the topsoil and from the distribution of ridges and valleys.

A map must be drawn to scale in order to be accurate. The scale of a map shows how much of the actual Earth's surface is represented by a given measurement on a map. Scale is expressed as a ratio, such as 1:24,000. This means that 1 inch on the map equals 24,000 inches on the ground. Scale can also be written as 1/2 inch=1 mile and can be shown graphically as a bar scale marked in feet and miles or in meters and kilometers. The scale must be shown so that the map reader can use the distances and areas shown on the map in measuring or figuring out the real distances on the Earth's surface.

Models are another way of representing features on the surface of the Earth on a small scale. By making a model, it is possible to manipulate conditions and to assess the effects of changes on an environment. The information gathered from modeling situations helps us better understand interactions in a complex, dynamic situation.

According to the National Geography Standards (1994), by the end of the fourth grade, students should know and understand:

- The characteristics and purposes of geographic representations—such as maps, globes, graphs, diagrams, aerial and other photographs, and satellite-produced images.
- How to display spatial information on maps and other geographic representations.

Therefore, the student will be able to:

- Design a map that displays information selected by the student, using symbols explained in a key.

Introducción a Mapas y Modelos

Un mapa es un dibujo gráfico de una parte o de todo el globo o el espacio terrestre. Cada aspecto se dibuja en un tamaño reducido de tal manera que pueda ser expuesto en papel o en un globo. Los mapas en papel son representaciones en plano; los mapas en globo son modelos físicos. Los mapas nos ayudan a viajar de lugar a lugar y a entender el mundo que nos rodea. La humanidad siempre ha hecho y usado mapas a partir de que se empezó a trasladar de un lado para otro de la tierra explorando otros territorios y comerciando. Los geólogos pueden usar mapas para descubrir indicios de la naturaleza de las rocas y acentes bajo la superficie terrestre, de las características del mantillo y de la distribución de las cordilleras y los valles.

Un mapa debe ser dibujado a escala para que sea exacto. La escala de un mapa muestra qué cantidad de la superficie terrestre actual está representada en la medida que se dá en el mapa. La escala se expresa como una proporción, tal como 1:24,000. Esto significa que una pulgada en el mapa equivale 24,000 pulgadas en la tierra. La escala también se puede ser escrita como: 1/2" = 1 milla y se expresa gráficamente por barras de división marcadas en pies y millas o en metros y kilómetros. La escala debe expresarse de tal manera que el que lee un mapa pueda usar las distancias y áreas mostradas en el mapa y medir o figurarse la distancia real sobre la superficie de la tierra.

Los modelos son otra forma de representar en pequeña escala las características de la superficie de la tierra. Al hacer un modelo es posible manipular las condiciones y calcular los efectos de los cambios en un medio ambiente. La información recabada al representar las situaciones nos ayuda a entender mejor las interacciones en una compleja y dinámica situación.

De acuerdo a las Normas de la Geografía Nacional (1994) [National Geography Standards (1994)], al término del cuarto grado, los estudiantes saber y entender:

- Las características y propósitos de las representaciones geográficas, tales como mapas, globos, gráficas, diagramas, aerofotogrametría y otras imágenes producidas por fotografías y por vía satélite.

- Cómo exponer información espacial en mapas y otras representaciones geográficas.

Por lo tanto, el estudiante está capacitado para:

- Diseñar un mapa que exponga la información seleccionada por el estudiante, utilizando símbolos expresados en clave.

PRIMARY MAPPING

Grades		
K-2	individual	30 min.

Description: Students will develop mapping skills by arranging pattern blocks to represent classroom objects and their relative positions.

Materials for Each Individual:
an assortment of pattern blocks
paper
pencil
crayons or markers

Procedure:

1. Find or create an uncluttered area of the room with a few pieces of furniture. A dramatic play area with pretend furniture (such as a kitchen) would be suitable.

2. With the class, identify four or five things you will include on your map.

3. Choose pattern blocks to represent those items. Match general shape and size of the pattern blocks with the shape and size of the objects as much as possible. Be sure that multiples of the same object are represented by the same type of block.

4. Make a "key" for the group, which shows what each pattern block represents and display it where each student can see it.

5. Give each student a paper with physical "landmarks" written on the edges (such as windows, sink, etc.) to help students orient the paper correctly.

6. Give students a small container of pattern blocks. Working individually, but right next to someone else, have students position the blocks on their paper in the same way the furniture is positioned in the class.

7. You can help them make and check their map by using overhead pattern blocks and mapping the furniture with the students on an overhead transparency and projecting it on the wall.

8. Have students trace the outline of the positioned pattern blocks. They can then color in the spaces and label them.

9. Repeat this procedure with other arrangements of furniture.

Questions to Ask During the Activity:

1. What is a map? [A way of showing where things are or how to get from place to place.]

2. When are maps used? [Many responses possible: traveling, giving directions, etc.]

3. If we call the side nearest the window (or other appropriate reference point) north, which object is closest to north? Which is furthest from north?

Why It Happens: Maps represent the relative position of land forms or other features to scale, e.g., one inch represents 5 miles. This activity gives young students practice with representing an actual area or location on a two-dimensional drawing.

Adaptations for Participants with Disabilities:

- Students with hearing impairments will have no trouble performing this activity with appropriate modifications in communicating the instructions.
- Students with visual impairments may need a raised border on their paper and may need to walk around the furniture to determine relative location.

Extensions: As students become familiar with the process of having blocks represent real things and their relative positions, expand the number of items to be mapped.

Introduce the four directions—north, east, south, and west—and label the edge of the map paper with these directions. Have students use these directions to describe the position of objects [the desk is north of the chair, for example].

Get a map of the school and have students practice tracing their progress on the map as they move around the school. At the end of the journey, have students describe the path they took.

If you have a doll house in the classroom, ask students how the doll house compares to a real house. Is the doll house a map? How would a map of a house be different from a miniature house?

MIDDLE GRADES MAPPING

Grades		
5-8	2-3	80 min.

Description: Students will use a compass to make a map of a defined area.

Materials for Each Group:
1 clipboard and paper
1 pencil
1 compass
1 metric measuring tape

Safety: Preview the area to be mapped prior to doing the activity to be sure that it is clear of dangerous trash (broken glass, etc.) and that it is relatively secure from strangers.

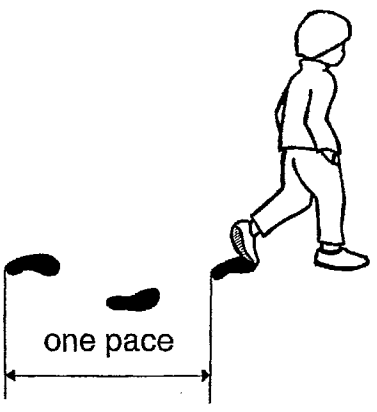
Procedure:

1. Determine an area to be mapped, such as a playground or courtyard. There should be approximately five significant objects or features which can be mapped.

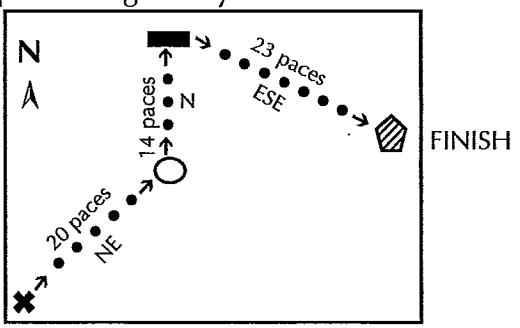
2. Based on the size of the area to be mapped, help students determine an appropriate scale for their map (such as 2 cm = 1 meter). Give students practice using the scale on possible sample measurements.

3. Have each team of students designate one member as the "pacer."

4. Have the group determine the length of the pacer's pace. A pace is defined as the distance traveled from where one foot touches the ground to where that same foot touches the ground when the pacer is walking. To determine his/her pace, the pacer walks 10 paces as evenly as possible. Then, the total distance is measured and divided by 10 to get the average pace distance. Students should record the pace distance for their pacers.



5. Demonstrate for students how to take a bearing using the compass. Choose a starting point and a destination in the area to be mapped. Holding the compass steady, face the chosen destination and read the direction indicated on the compass. Older students can determine the actual directional degree; for younger students designating the direction (NW, NNE, etc.) is sufficient. Allow each group to go through the steps of using the compass along with you.



6. Have students follow directions on Student Activity sheet to complete their maps.

Why It Happens: A compass is a device for determining directions. In its simplest form, a **magnetic compass** is a magnetized needle which turns on a pivot and points to magnetic north. Magnetic north is determined by the Earth's magnetic field and moves a few miles from year to year. True or geographical north is what we call the North Pole. The difference between magnetic north and true north varies from place to place on the Earth. This mapping activity uses magnetic north, not geographical north.

Chinese and Mediterranean navigators probably used magnetic compasses to guide their ships in about the 1000's or 1100's. The detail and quality of compasses varies; many will come with additional information on the correct use of a specific model.

Adaptations for Participants with Disabilities:

- Students with hearing impairments will have no trouble performing this activity with appropriate modifications in communicating the instructions.
- Students with physical impairments may need to use a distance measurement unit other than paces.

Extensions: Have students research the declination (degrees of difference between true and magnetic north) for their location.

Give students directions to a "buried treasure" using paced distances and compass readings. Challenge the students to discover the treasure.

References: Wiebe, Ann, ed. Finding Your Bearings. AIMS Education Foundation, 1981.

Middle Grades Mapping
Student Activity Sheet

Description: Using a compass, you will make a map of several objects within a designated area.

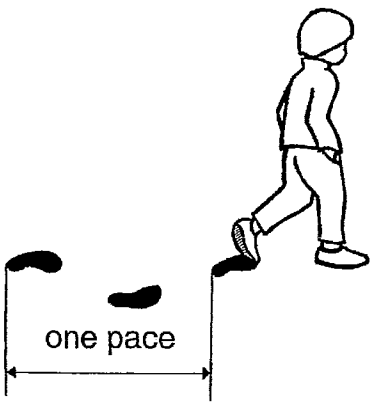
Materials for Your Group:
1 compass
1 piece of paper
1 pencil
1 metric measuring tape
1 metric ruler

Safety: Stay within the area designated by your teacher. Avoid any trash, such as broken glass, which could prove hazardous.

Procedure:

1. Mark a north arrow on the paper on which the map will be drawn.

2. Pace along the edge of the area to be mapped. Multiply the number of paces by the average pace distance to get the size of the area to be mapped.

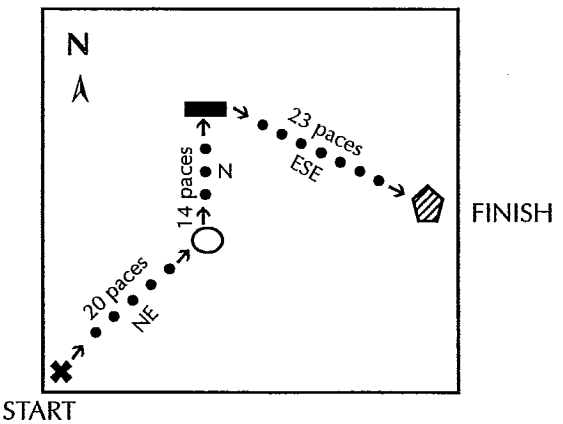


3. Start at one corner of the area to be mapped. Mark your starting point on your map.

4. Use the compass to determine the direction to one object in the map area. Record the name of the object and the compass reading on the chart below.

5. Determine the distance to the object by having the pacer pace the distance to the object. Multiply the number of paces by the pace distance to get the total distance. Record the distance on the chart below.
   Example: from a rock to a tree is 4 paces. The average pace distance is 1.1 meters. Multiplying 4 x 1.1 = 4.4 meters.

6. Use the scale chosen by the class to convert the actual distance between objects to the distance apart they will be on the map.
   Example: measured distance is 4.4 meters. Map scale: 2 cm represents 1 meter. Distance on map would be 8.8 cm.



7. Using a ruler and your compass bearing, place the object on your map.

8. Repeat these steps for five additional objects to complete your map.

Data

Keep track of your measurements and compass readings on this sheet, then use the information to complete your map.

Average pace distance: _____

Object	Starting From	Direction	#Paces	Pace Distance

Cartografía para Grados de Secundaria
Hoja de Actividades para el Estudiante

Descripción: Usando una brújula, se hará un mapa de algunos objetos que se encuentren dentro de un área designada.

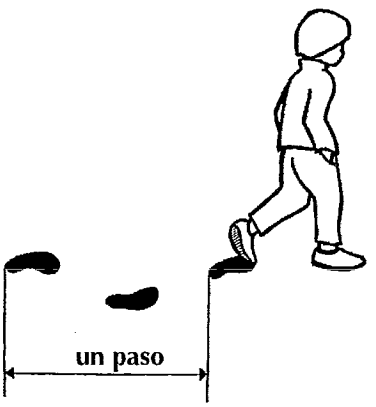
Materiales para Su Grupo:
1 brújula
1 pieza de papel
1 lápiz
1 cinta métrica
1 regla métrica

Medidas de Seguridad: Permanecer en el área designada por el maestro. Evitar cualquier basura o deshecho, tal como vidrios rotos, lo que está comprobado es peligroso.

Procedimiento:

1. En el papel en el que se va a trazar el mapa, marcar el Norte con una flecha.

2. Caminar por la orilla del área sobre la que se va a hacer el mapa. Multiplicar el número de pasos por la distancia del paso promedio para obtener el tamaño del área a cartografear.



3. Empezar en una esquina del área a cartografear. Marcar el punto de principio en su mapa.

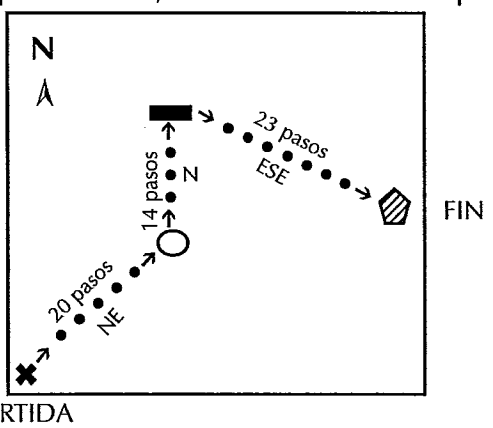
4. Usar la brújula para determinar la dirección hacia un objeto en el área del mapa. Registrar el nombre del objeto y la lectura de la brújula en la gráfica de abajo.

5. Determinar la distancia que hay hacia el objeto haciendo que quien marca el paso camine la distancia al objeto. Multiplicar el número de pasos por la distancia que se cubre en cada paso para obtener la distancia total. Registrar la distancia en la gráfica de abajo.

   Por ejemplo: La distancia de una roca a un árbol es de 4 pasos. La distancia promedio que se cubre en cada paso es de 1.1 metros. Multiplicando 4 x 1.1 = 4.4 metros.

6. Usar la escala escogida por la clase para convertir la distancia actual que existe entre los objetos, de la distancia a la que estarán separados en el mapa.

Por ejemplo: La distancia medida es de 4.4 metros. El mapa a escala: 2 cm representa 1 metro por lo tanto, la distancia en el mapa sería 8.8 cm.



7. Usar una regla y la brújula de orientación, colocar el objeto sobre el mapa.

8. Repetir estos pasos con cinco objetos adicionales para completar el mapa.

Datos

Mantener al corriente las medidas y lectura de la brújula en esta hoja, luego utilizar la información para completar el mapa.

Distancia promedio que se cubre en cada paso _____

Objeto	Empezando Desde	Dirección	No. de Pasos	Distancia Cubierta

GLOBE TOSS

Grades		
4-6	2 or whole class	40 min.

Description: Students will toss a beach ball globe to discover the ratio of water to land on the Earth's surface.

Materials for Each Group or Whole Class: beach ball globe

Safety: Review rules with students for tossing and catching the ball.

Procedure:

1. As a whole class activity, students can toss the ball from one person to another. If used as a small group activity, one student in each group can toss the ball and catch it him/herself or one group member can toss it to another.

2. After explaining the procedure, have students predict what percent of the earth is covered by land and what percent is covered by water.

3. Toss the ball up, giving it some spin, and catch it 50 times. Each time record whether the catcher's right index finger is on land or water.

4. Repeat Step 3 for two more trials.

5. For each set of 50 tosses determine the percent of times the catcher's right index finger lands on water or land. Then find the average percentage of water and land for all three trials.

Questions to Ask During the Activity:

1. What factors could have affected the outcome?
   [If the ball toss is completely random, the expected outcome is that approximately 70% of the time, the catcher's right index finger will be on water. If the ball is unevenly weighted (perhaps by the inflation opening), the results may be skewed. Giving the ball some spin when it is tossed is intended to insure a high degree of randomness.]

Why It Happens: Approximately 71% of the Earth's surface is covered by water. With enough tosses, the probability of the catcher's right index finger being on water should be close to the actual percentage of water on the Earth.

Adaptations for Participants with Disabilities:

- Students with hearing impairments will have no trouble performing this activity with appropriate modifications in communicating the instructions.
- Students with physical and visual impairments may be able to toss the ball to a partner who will then note where his/her right index finger is.

Extensions: Keep track of the ocean or continent on which the catcher's finger lands. Calculate the percent of water or land mass of each.

Do the "How Much Water Is There?" activity in the Water unit of this book.

References: Wiebe, Ann, ed., Finding Your Bearings. AIMS Education Foundation, 1981.

Globe Toss Data Sheet

For each trial, make a tally mark in either the "Land" or "Water" column to show where the catcher's right index finger was. Keep track of the total number of tosses, so you can stop at 50 each time.

Trial	Land	Water
1		
2		
3		
Average		

Calculate the percent of times the catcher's index finger was on water for each trial. To do this, divide the number of tallies in the water column by 50, then multiply the answer by 100.

Example: if there are 38 tallies for water, then
(38÷50) x 100 = 76%

Then calculate the percent of times the catcher's index finger was on land for each trial.

Trial	Percent Water	Percent Land
1		
2		
3		
Average		

Hoja de Información del Lanzamiento de la Pelota

Para cada experimento, hacer una contraseña ya sea en la columna de la "Tierra" o del "Agua" para mostrar donde estaba el dedo índice derecho del atrapador. Llevar nota del número total de lanzadas, de tal manera que se pueda parar cada 50 veces.

Experimento	Tierra	Agua
1		
2		
3		
Promedio		

Por cada experimento calcular el porcentaje de veces que el dedo índice derecho del atrapador estaba en el agua. Para hacer esto, dividir el número de contraseñas en la columna del agua por 50, luego multiplicar la respuesta por 100.

Por ejemplo, si hay 38 contraseñas para el agua, entonces:

$(38 \div 50) \times 100 = 76\%$

Luego para cada experimento calcular el porcentaje de veces que el dedo índice derecho del atrapador estaba en tierra.

Experimento	Porcentaje de Agua	Porcentaje de Tierra
1		
2		
3		
Promedio		

PLAY-DOH TOPO

Grades		
3-8	2-3	40 min.

Description: Students will use Play-Doh to make a model of a land mass and then create a simple topographic map of the Play-Doh land.

Materials for Each Group:
1 can of Play Doh
1 metric ruler
2 pieces of paper
12-14 inches of fishing line or dental floss

Procedure:

1. Older students can be encouraged to make a Play-Doh model which includes several different formations, including a stream, a hill, a lake, and a steep mountain.

2. Model for students the procedure for making a simple topographic map of a Play-Doh mountain [instructions on the Student Activity Sheet]. Emphasize the importance of making cuts parallel to the floor. Working on a flat surface, as opposed to a tilted desk, will facilitate this. Also emphasize the need to keep the pieces in the same alignment as they are transferred to the paper to be traced.

3. Have students follow the instructions on the Student Activity Sheet. As an option, you can direct students to save the slices of their mountains rather than putting them back in the can. Students can then "reconstruct" their mountain to compare it to their topographical map.

4. Have students compare their topographic map to another group's map to look for similarities and differences.

Questions to Ask During the Activity: How do the contour lines of a gently rising slope compare to those of a steep slope? [The contour lines will be closer together for a steep slope.]

If each centimeter (vertically) represented 1000 m, how tall would your mountain be?

Why It Happens: A contour, or **topographic map,** is used to show varying elevations of land features on the Earth's surface. The National Forest Service, National Park Service, city planners, landscapers, land developers and hikers use them. Large area maps are now generally now drawn using aerial photography and ground checking.

Vertical positions are defined by contours or other symbols. A **contour line** on a map connects points of equal elevation on the land surface. The **contour interval** is the difference in elevation between two adjacent contour lines.

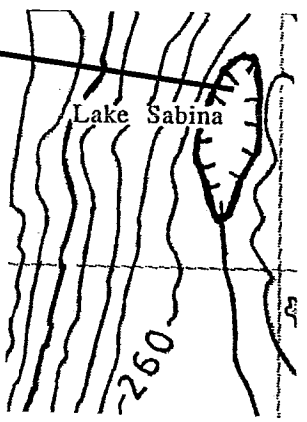
A mountain is a part of the land that rises at least 610 m (2,000 ft.) above the surrounding area. If a mountain is very steep, the contour lines will be close together, indicating a quick rise in elevation.

Adaptations for Participants with Disabilities:

- Students with hearing impairments will have no trouble performing this activity with appropriate modifications in communicating the instructions.
- Students with visual impairments can gently feel the shapes of the different slices.

Extensions: Have students exchange their Play-Doh topographic maps and try to recreate the corresponding Play-Doh mountain. They can compare their model to the original and note any differences.

For older students, have them create a more complex Play-Doh model which includes a mountain, hill, rivers and a lake. The contour map will need to include **hachures** to represent the lower elevation of the lake bottom.



Contact the New Mexico State Bureau of Mines or the State Land Office to get topographic maps of an area familiar to students. Compare the maps to the actual land features.

References: Wiebe, Ann, ed. Finding Your Bearings. AIMS Education Foundation, 1981.

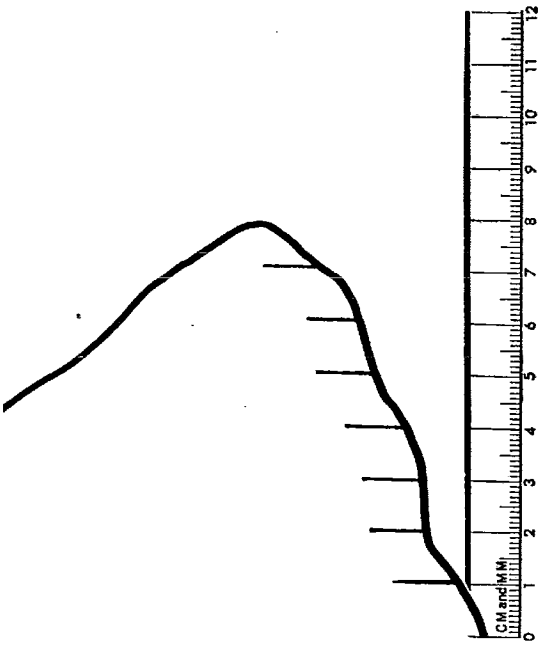
Play-Doh Topo
Student Activity Sheet

Description: You will use Play-Doh to make a model of a land mass and then create a simple topographic map of the Play-Doh land.

Materials for Your Group:
1 can of Play Doh
1 metric ruler
2 pieces of paper
12-14 inches of fishing line or dental floss
pencil

Procedure:
1. Make a mountain of your Play Doh on one piece of paper; it can be steep or gently rounded.

2. Hold your ruler upright next to the mountain. Mark the side of the mountain at each centimeter, starting from the bottom.



3. Turn the mountain so the centimeter marks are facing you. This will be the south side of the mountain. Make a slight groove vertically through the centimeter marks, to indicate the south side of the mountain. Mark South on the paper underneath the mountain and on the other sheet of paper which will be used for your map. Poke a pencil straight down through the center of the mountain.

4. Hold the fishing line tightly between your hands and use it to cut horizontally through your mountain at the highest centimeter mark. Keep the fishing line as level as possible so the cut is parallel to the table.

5. Place this top section of your mountain on the other piece of paper lining up the vertical groove with the South label. Mark where the center hole (made by the pencil) is on the paper. Trace around the edge of this Play-Doh section to make your first contour line. Label the contour line with its elevation (number of centimeters from the bottom).

6. Put the Play-Doh you just traced back into the Play-Doh can. Use the fishing line to slice off the next section of your mountain at the next centimeter mark. Move this section to your map paper, lining up the center hole with the mark you made and the vertical groove with South and place it over the previous contour line. Trace this next section and mark the elevation of the new contour line.

7. Keep slicing and tracing sections until your mountain is represented on the map.

8. Color the map appropriately: blue for water, green for vegetation, etc. Label North, add a key and a title.

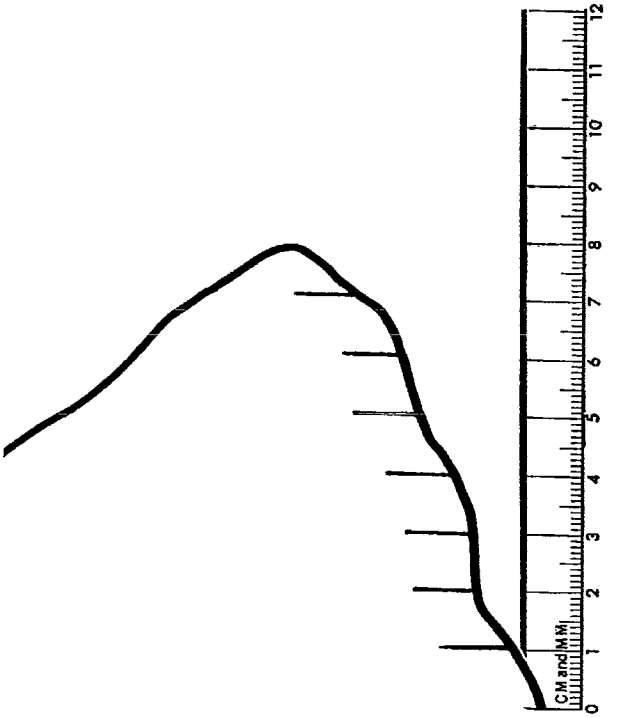
Topografía de Plastilina
Hoja de Actividades para el Estudiante

Descripción: Se usará plastilina para hacer un modelo de una masa de tierra y luego crear un mapa topográfico simple.

Materiales para el Grupo:
1 lata de plastilina
1 regla métrica
2 hojas de papel
12-14 pulgadas de filo de pesca o hilo dental
lápiz

Procedimiento:
1. Sobre un papel hacer una montaña con la plastilina; puede estar empinada o suavemente redondeada.

2 Sostener la regla verticalmente junto a la montaña. Marcar cada centímetro en el lado de la montaña, empezando desde abajo.



3. Virar la montaña de manera que la marca del centímetro quede de frente al estudiante. Este será el lado Sur de la montaña. Hacer una ranura delgada verticalmente entre las marcas de los centímetros, para indicar el lado Sur de la montaña. Marcar el Sur en el papel, abajo de la montaña, y en la otra hoja de papel el cual será usado para su mapa. Desde el tope, introducir un lápiz hacia el centro a través de la montaña.

4. Sostener el filo apretadamente en sus manos y usarlo para pasarlo horizontalmente a través de la montaña y cortarla al nivel del centímetro más alto marcado. Mantener el hilo lo mas nivelado posible para que el corte sea paralelo a la mesa.

5. Colocar esta sección del tope de la montaña en la otra pieza de papel alineando la ranura vertical con el rótulo "Sur." Marcar en el papel donde está el centro del agujero (hecho por el lápiz). Trazar el contorno de esta sección de plastilina para hacer su primera línea de nivel. Rotular la línea de nivel con su elevación (número de centímetros desde abajo).

6. Regresar a la lata la plastilina que se acaba de trazar. Usar el hilo para cortar la siguiente sección de su montaña en la siguiente marca de centímetro. Trasladar esta sección a su mapa de papel, alinear el centro del agujero con la marca que se hizo, y la ranura vertical con el "Sur," y colocarlo sobre la línea de nivel previa. Trazar esta nueva sección y marcar la elevación de la nueva línea de nivel.

7. Seguir cortando y trazando secciones hasta que la montaña esté representada en el mapa.

8. Colorear el mapa apropiadamente: Azul para el agua, verde para la vegetación, etc. Rotular el Norte, agregar una clave y un título.

STREAM MODEL

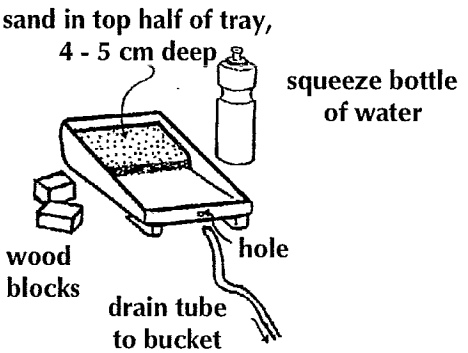
Grades		
3-8	4	40-80 min.

Description: Students will use a simple model of a stream to investigate the behavior of the moving water.

Materials for Each Group:
1 paint tray with a drain hole poked in bottom of lower end
sand
2-3 feet of plastic tubing
1 bucket
1 squeeze bottle
2 wooden blocks
water
3-4 small stones
sponges and rags for clean up

Safety: Use the stream model outdoors if possible. If used inside, caution students to wipe up spills on the floor quickly to avoid slipping on the wet floor.

Procedure:
1. Set up the stream model as pictured in Figure A. Position the bucket so water can drain from the paint tray through the tubing into the bucket. The top half of the tray should be filled to a depth of 4-5 cm (2 inches) with dampened sand.



2. Have students follow the procedure on the Student Activity Sheet for modeling different river patterns. Remind them to smooth out the sand before changing the river pattern.

3. Caution students to keep the trays as still as possible.

4. Other models students can investigate include Y-shaped curve (river with two mouths), meanders (curving loops), and damming the river. Allow students to be creative in developing other models.

5. Be sure students do not dump water with sand in it down the drains. Clean-up works best if sand in the stream tray is allowed to dry and then removed.

Questions to Ask During the Activity:

1. What makes the water in a river or stream flow? [Gravity]

2. What factors might affect the shape a river takes? [The type of rock through which the river flows, slope, erosion, soil deposition, obstacles, flow speed, and man-made alterations can all affect the shape of a river.]

3. What determines how quickly a river flows? [Elevation and water volume are two major factors.]

4. How does the sand move in each river pattern model? [Students should include this in their observations.]

Why It Happens: This stream model allows students to investigate and manipulate the flow of water to better understand how streams and rivers behave. They will observe that as water flows through a curved channel, erosion tends to happen along the outer edges and deposition on the inner edges. They should also be able to observe that the flow rate of the water increases as the elevation or steepness of the stream increases.

Adaptations for Participants with Disabilities:

- Students with visual impairments can try to feel changes in the behavior of the running water.
- Students with hearing impairments will have no trouble performing this activity with appropriate modifications in communicating the instructions.

Extensions: Have students create a river flowing into an ocean, by letting water collect in the bottom of the stream tray. They can observe the movement of sand and deposition at the mouth of the river (forming a delta).

Increase the volume of water in the stream by having students squeeze water from two bottles at the same time.

Have students create a river flowing through a steep, narrow channel and emptying into a flatland (alluvial fans).

Have students increase the flow in their river model until the water overflows the banks. After observing what happens in a flood, have them try to model different flood control measures such as levees and sandbags and compare their effectiveness.

References: Project Storyline: Science, The Changing Earth. The California Science Implementation Network, University of California, Irvine, 1993.

Gartrell, Jack E., Jane Crowder, and Jeffrey C. Callister. Earth: The Water Planet. Arlington, VA: National Science Teachers Association, 1992.

Stream Tables Erosion Kit. Delta Education, Hudson, NH.

Stream Model
Student Activity Sheet

Description: You will use a model of a stream to investigate the behavior of flowing water.

Materials for Each Group:
1 paint tray stream model
sand
bucket
water
squeeze bottle
2 blocks
sponges and rags for clean up.

Procedure:
1. Set up the paint tray stream table as shown in Figure A. Be sure the plastic tube will drain water from the bottom of the tray into the bucket. Be sure the sand is damp and smooth.

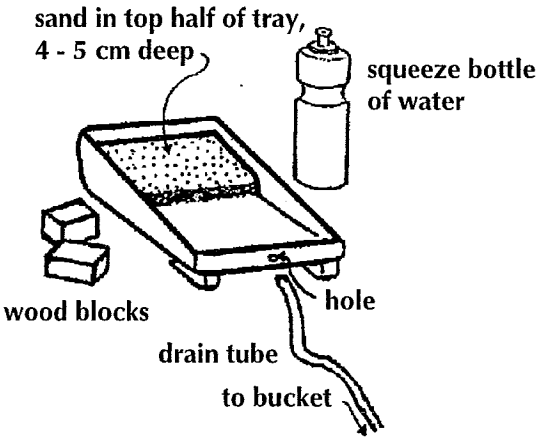


Figure A

2. Raise the end of the tray with one block of wood.

3. With your finger, make a straight, deep, narrow groove in the sand (Figure B). This represents a straight river.

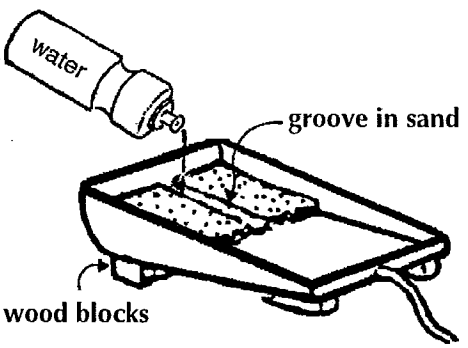


Figure B

4. Fill the squeeze bottle with water. Squeeze a stream of water into the top of the groove. Record your observations on the chart below.

5. Raise the end of the tray higher, using 2 blocks of wood. Smooth out the sand and repeat Step 3 and 4. Record your observations provided.

6. Remove one block. Smooth the sand. Make an S-shaped curved groove in the sand. Squeeze water into the groove as you did before. Record your observations.

7. Repeat Step 6 using two blocks of wood.

8. Smooth the sand. Once again make a straight groove in the sand. This time place stones or other obstacles in the groove to partially block the movement of the water. Raise the end of the tray with one block and run water down the groove. Repeat using two blocks. Record your observations in both cases.

9. Choose three more river patterns to investigate. Record the river pattern and your observations on the chart.

River Patterns Data Sheet

River Model	Record Observations	Draw the Path That The Water Flows
Straight Groove Small Angle (one block high)		
Straight Groove Large Angle (two blocks high)		
Curved Groove (S-shaped) Small Angle (one block high)		
Curved Groove (S-shaped) Large Angle (two blocks high)		

River Model	Record Observations	Draw the Path That The Water Flows
Straight Groove with Obstacles Small Angle (one block high)		
Straight Groove with Obstacles Large Angle (two blocks high)		

Choose three different models and record them in the boxes below		
1.		
2.		
3.		

Modelo de un Arroyo
Hoja de Actividades para el Estudiante

Descripción: Se utilizará el modelo de un arroyo para investigar el funcionamiento de la afluencia del agua.

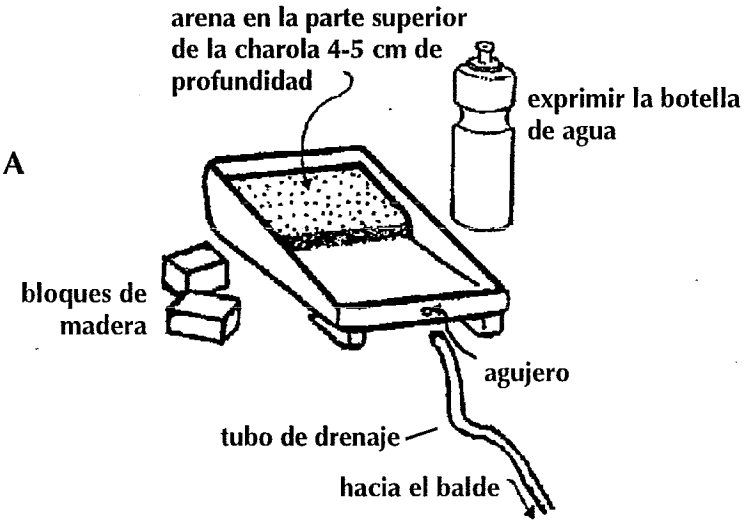
Materiales: una charola utilizada para pintar, para el modelo del arroyo
arena
un balde
agua
una botella que se pueda exprimir
dos cubos o bloques de madera
esponjas y trapos para limpiar

Procedimiento:

1. Preparar la charola como se muestra en la Figura A. Asegurarse de el agua saldrá por el agujero de la charola y a través del tubo de plástico y que caerá en el balde. Asegurarse también de que la arena esté mojada y suavé.

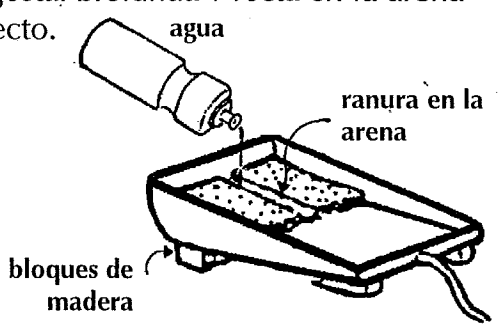
2. Levantar el extremo más hondo de la charola con un cubo de madera.

Figura A



3. Con el dedo, hacer una ranura angosta, profunda y recta en la arena (Figura B). Esto representa un río recto.

Figura B



4. Llenar la botella con agua. Exprimir la botella en la parte superior de la ranura para que figure un arroyo de agua. Registrar sus observaciones en la gráfica que aparece después.

5. Levantar más alto el extremo mas hondo de la charola utilizando dos cubos de madera. Registrar sus observaciones en la gráfica que aparece después.

6. Retirar un cubo de madera. Suavizar la arena. Hacer una ranura en forma de S, en la arena. Exprimir la botella de agua en la parte superior de la ranura como se hizo anteriormente. Registrar sus observaciones.

7. Repetir el Paso 6 usando dos cubos de madera.

8. Suavizar la arena. Una vez más, hacer una ranura recta en la arena. Esta vez colocar piedras u otros obstáculos en la ranura para parcialmente bloquear el movimiento del agua. Levantar el extremo de la charola con un cubo de madera y dejar correr agua por la ranura. Repetir esto utilizando dos cubos. En ámbos casos registrar sus observaciones.

9. Escoger tres o más modelos de río para investigar. Registrar el modelo de río y sus observaciones en la gráfica.

Modelos de Ríos

Modelo de Río	Observaciones Anotadas	Dibujar el Curso que Lleva el Agua
Ranura Recta Ángulo Pequeño (un bloque de altura)		
Ranura Recta Ángulo Grande (dos bloques de altura)		
Ranura Curva Ángulo Pequeño (un bloque de altura)		
Ranura Curva Ángulo Grande (dos bloques de altura)		

Modelo de Río	Observaciones Anotadas	Dibujar el Curso del que Lleva el Agua
Ranura Recta con Obstáculos Ángulo Pequeño		
Ranura Curva con Obstáculos Ángulo Grande		

Escoger tres diferente modelos y anotarlos en estas casillas		
1)		
2)		
3)		