NORTHERN IlLINOIS UNNERSITY

Ballooning Through the Curriculum

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Department of Curriculum and Instruction

by

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ABSTRACT:

Motivation and interest are important factors in a student's ability to learn and retain information; this cross-curricular unit on hot air balloons not only motivates students to learn more, it also stimulates their interest and excitement. The hot air balloon is a fascinating topic for most people, adults and children alike; therefore it is an excellent topic to design a unit around. This unit is designed for the third or fourth grade classroom, but it can easily be adapted and used in any elementary setting. Each lesson in the unit is designed to include more than one discipline, and the unit as a whole is designed to include a wide variety of disciplines including: language arts, math, social studies, art, and physical education.

This thesis is primarily a creative work based on firsthand experience in the field of hot air ballooning and the field of education. Each discipline was considered as it related to the hot air balloon, and reasonable objectives were developed. Once the lessons were designed and written, the project was field tested in the classroom where it was very well accepted. This unit was very successful in its goal of motivating and exciting the students as well as the teachers.

Teacher's Note

This unit has been developed to be used in a wide variety of classrooms; therefore, feel free to pick and choose from the lessons to meet your needs. The unit is written for a third or fourth grade class; however, it can easily be adapted to suit any grade level. For example, I taught recently taught this unit to a first grade class by eliminating the research papers and the final project and adding some creative writing and paper mache balloon construction. The unit was a great success, the students and teachers were excited about the unit and everyone learned a great deal. When the students filled out evaluations of the unit, every student reported that they had enjoyed the unit and learned a lot. In addition, most of the students could not name their least favorite lesson from the unit as they liked all of the lessons. When I asked the other teachers I worked with what they would change, they could offer no suggestions. The field testing of this unit went better than I could have imagined, I am sure that it could be just as effective in your classroom.

One of the things that makes a balloon unit so exciting is the beauty of the balloon. An excellent way to get the students ready for the unit is to decorate the room with colorful balloons, or to let the students decorate it throughout the unit. Use your creativity in the application of the unit. Hopefully, the unit will be exciting to the teacher so that the excitement will be passed on to the students.

This unit is based on firsthand experience and a great deal of information. In an effort to make it usable, each section contains a bibliography of sources for that particular lesson as well as detailed instructions. In addition, since students always have many questions about balloons, the answers to frequently asked questions are included in the appendix. I hope that this unit will be interesting and meaningful for you and your students.

Unit Overview

Ballooning: An Introduction page: 1-5	This is a brief introductory lesson that assesses how much the students already know. (language arts, science)
Balloon Basics page: 6-9	This lesson teaches students the basic concepts behind balloon flight. (science, math)
To Hy or Not To Hy page: 10-22	A look at clouds, wind, and barometric pressure and how they can be used to forecast the weather.. (4 days) (language arts, SCience,art, math)
History of Ballooning page: 23-25	This lesson touches on the history of the balloon as well as other modes of transportation. (math, social studies, language arts, science)
Design a Hying Machine page: 26-27	Students will design their own flying machine with a defined power source. (science, art, language arts)
Poetry page: 28-30	Students write an original balloon poem. (language arts)
Aeronautical Engineering -101 page: 31-33	Students design a model gas balloon with enough lifting power to fly. (science, art, language arts)
Propane and the Balloon page: 34-37	Students study propane, where it comes from and how it is used in ballooning. (science, math)
Research Paper page: 38-41	An introduction to writing a research paper and giving a brief presentation on an aspect of hot air ballooning. (language arts)
X Marks the Spot page: 42-45	An introduction to balloon races. Students participate in a race game and invent one of their own. (physical education, math, science, language arts)
Map Skills and the Balloon page: 46-52	Students identify features of various maps, as well as their purposes. Students also practice giving and following directions. (social studies, language arts, math, art)
The Grand Finale page: 53-60	Students build tissue paper hot air balloons and plan a balloon rally to fly them. (art, language arts, science, math)

Ballooning: An Introduction

Rationale:

The opening activity of any unit should accomplish three goals: raise interest and enthusiasm about the topic, assess student's prior knowledge, and raise questions that the children want to have answered in the course of the unit.

Objectives:

-- Students will use guided imagery to imagine a hot air balloon flight. (language arts)

-- Students will brainstorm their knowledge of hot air balloons. (language arts, science)

-- Students will develop questions that they would like to have answered in the course of the unit. (language arts, science)

Materials:

-chart paper and a marker

Procedures:

Inform the students that they will be beginning a new unit about hot air balloons. have students close their eyes and imagine a balloon flight as you describe it.

You arrive at the balloon port early one summer morning, about 4:00 A.M. The weather is perfect, and you are very excited. The sun will be rising soon, and the sky is just beginning to *turn pink. The crew is already busy with the balloon, they all know exactly what* to *do, and you are fascinated by everything that is going on. There is a large wicker basket--will that really hold you up? You are*

starting to get a little nervous. The crew is dragging out a bag, it looks vel}' heavy, and as they open it up you can see that it contains the fabric of the balloon, colorful and exciting, but do you trust it to take your feet off the ground? Next they tip over the basket and attach the balloon to it with 12 steel cables. That makes you feel a little more secure, but you are still a little nervous. The balloon looks like a long, colorful snake curving along the grass. This one is mostly yellow with bits of red, orange, green, blue, and purple.

The pilot calls you over and introduces himself. Meeting him makes you feel a little bit better, and you are happy to get busy when he asks you to help. You put on the gloves he gives you and listen carefully to his instructions. The next thing you know,, you are holding open the mouth of the balloon so the balloon can be inflated by the biggest fans you have ever seen. Another crew member is standing on the other side of the balloon and you follow her actions carefully. The breeze is strong, but you hold on tight as your hair is blown about. You risk a peek into the balloon and you can see the rest of the crew at the top of the balloon. They are busy attaching the top of the balloon with Velcro tabs. The balloon is really starting to take it's familiar shape, only lying on the ground. But what are all of the cables and ropes for? The pilot is busy inside the balloon, it is so huge, he looks tiny. Finally, the pilot comes out and gives everyone a thumbs up. You have no more time to think, just to enjoy.

The pilot lights the burner and warns you not to jump as he pulls the trigger. Despite his warning, the loud noise and burst of flame make you jump, but you hold tightly onto the rim of the balloon. The flame is vel)' wann so close to your face. You look into the balloon and are amazed at how quickly it rises. Before you know it, the balloon is upright on the ground and the fans are off. The pilot is standing inside the balloon and the crew members are holding on to the

edge of the basket. The pilot tells you to hop in, so you climb over the edge of the besket--this is it!

The next thing you know, you are rising slowly off the ground, but you don't feel any movement. As the ground slips away, you are overwhelmed by the beauty around you. The other balloons are just being filled *with air, and you are fascinated to see the inflation from this perspective. Soon, the other balloons are following you into the sky. This truly is a beautiful sport. You are floating slowly along just like a cloud, seeing the ground as a bird would. The sky is a delicate shade of pink mixed with orange and purple. There is mist covering the ground, and the sun is just beginning to break through.*

You fly over a river, the boats all turn around to watch you fly over. You can see your reflection in the water as you fly over. You are flying right above the surface of the water when the bottom of the basket skims the surface of the water. The pilot hits the burner, and the balloon rises with water streaming down back into the river. You have never seen circles in the water from this angle!

As you get to the other side of the river, the balloon climbs higher over the trees and houses. The only sound you hear is the roar of the burner every once in awhile, and the dogs below you barking at the noise. There are even a few people out to watch you fly over, and you wave bello-everyone is very excited to see you. You enjoy seeing the houses and yards as you fly over them, each house, the playground equipment, even the swimming pools. Ahead, you see the ground stretching out before you as far as you can see.

The balloon climbs even higher, as you fly past the houses and out over open farmland. The ground looks like a patchwork quilt, each type of crop a different shade of yellow or green. The big red barn looms ahead in the distance, and the pilot is careful not to turn on the burner as you fly over the caws and horses so they don't get scared. You enjoy flying high, you realize how peaceful

and relaxing the flight is. You are floating like a cloud in the sky, nothing to bother you, just quiet stillness.

The pilot drops down again, as you fly over a Slv.:Ul1p.You fly just between the trees, the cattails below you are brushing up against the bottom of the balloon. It truly is beautiful, you can hear the frogs croaking. The birds fly overhead, you look up and see a deer standing right in front of you; tall, slender and beautiful. You have never been so close to a deer, and it takes your breath away. The deer looks at you for a minute, then runs away gracefully as the burner roars. You climb back out of the swamp, just over the tree ahead of you. As you pass overhead, the pilot reaches out and picks a leaf for you off the top of the tree!

It doesn't feel like it has been very long, but the pilot tells you that he plans to land in the field up ahead. He even lets you radio to the chase crew to let them know. The balloon drops slowly as you approach the open field. The pilot tells you to stand in the direction you are headed, holding on to the side of the basket, with your knees slightly bent as you hit the ground. The ground approaches you slowly, and you are not frightened at all. The pilot pulls on the red rope, opening a large hole in the top of the balloon. You hit the ground gently then bounce up into the air again for another gentle landing. The wind pushes the balloon across the field for a few feet, before the balloon fmally comes to a stop. You watch the balloon sag to the ground just as the chase crew runs up. One of the crew members grabs the rope on the top of the balloon, and pulls it down completely. You climb out of the basket as the pilot turns off the propane tanks. The crew squeezes the air out of the balloon. Now, you are called on to help pack up the balloon. It is very heavy, but with everyone helping, the balloon is soon back inside it's bag and loaded onto the van. Everyone climbs aboard, and laughing and joking, you are on your way home. It was an incredible experience, and you cannot wait to fly again!

After the story is told, brainstorm with the students what they already know about hot air balloons. Accept all answers correct or incorrect. Write answers on chart paper to refer back to later. Make a second list of things that the students would like to know about balloons, and review both charts.

Balloon Basics

Rationale:

Before students can get far in their study of balloons. they need to know how the balloon works. This will satisfy their curiosity as well as clearing up misconceptions.

Objectives:

-Students will discover that hot air rises, which allows hot air balloons to fly. (science)

-Students will learn the basic parts of a hot air balloon and their functions. (science)

-Students will determine the basic concept behind gas balloon flight. (science)

-Students will estimate the number of people who will fit in a basket. (math)

-Students will discover how gas expansion affects balloon flight. (science)

Materials:

-three thermometers

-pictures or diagrams of a hot air balloon and a gas balloon

-three balloons

-pictures of a flight if possible (see bibliography)

-masking tape

Procedures:

Ask students what they think makes hot air balloons fly. Discuss their ideas. Discuss how the first balloon flew. Tape thermometers near the ceiling, the middle of the room and the floor. Be sure that the thermometers are away from drafts and direct sunlight.

Discuss the two types of balloons, gas and hot air. Have pictures of each available. Be certain to point out that gas balloons have sandbags-not hot air balloons. Discuss that gas balloons fly because they are filled with helium, just like smaller balloons. These balloons are closed at the bottom, and are very expensive to fly.

Check the thermometers, write all three readings on the black board and compare them. Once you determine that hot air rises, discuss the fact that a balloon has a burner which shoots a flame into the balloon to heat the air inside.

This heat causes the air inside the balloon to expand, and eventually the balloon rises. This concept can be reinforced by partially blowing up three balloons. Place one of these balloons in a cold place, one in a warm place and one at room temperature. The balloon in the cold place will contract, while the one in the warm place will expand. Why is this? An easy way to explain this phenomenon is to consider ping pong balls trapped inside a bag. Each ping pong ball represents a gas molecule. When the molecules are heated, they gain energy, causing them to move faster so they hit the bag and each other more often, pushing the bag outward. When this happens, the bag expands, and eventually rises when it cannot expand any more. Exactly the opposite happens in the cold place, as the heat is removed, the molecules lose energy and slow down. Therefore, they hit the outside of the bag less often and the bag constricts without the molecules hitting it.

Next, walk through a flight with pictures explaining the various parts of a hot air balloon and their function (see attached diagram).

AERONAUT--someone who travels in a balloon

ENVELOPE--the fabric portion of the balloon that holds the hot air, there is a hole at the bottom of the envelope which is called the MOUTH, and one at the top held in by Velcro called the RIP PANEL this panel is pulled out by the RIP CORD (releasing hot air) when the pilot wants to descend

BASKET--the wicker part of the balloon the balloon that carries the passengers, fuel tanks, and burner

BURNER--the part of the balloon that burns the fuel and shoots a flame into the envelope, heating the air inside

PROPANE--the fuel that the burner bums

CROWN LINE--the line attached to the top of the balloon, used to control the speed the balloon rises during inflation and falls during deflation

CABLES--the metal 'ropes' that attach the basket to the envelope

Next, go through a flight from beginning to end-use pictures if possible. First the pilot must check the weather conditions; if the weather is not perfect, *s/he* will not fly. The pilot calls the Federal Aviation Administration for a weather report, and then releases a test helium balloon to determine wind directions. If the weather looks nice the pilot begins to prepare to fly; it takes about 15 minutes to set up a balloon. The balloon is stored in a bag, it is pulled out just before a flight and attached to the basket. Next the balloon is inflated with cold air using

fans, and the top is attached with Velcro. Then, while one crew member holds the crown line the pilot lights the burner and heats the air inside the balloon until the balloon stands upright. Passengers then climb aboard, and the balloon takes off as the pilot heats the air even more. During the flight the balloon's altitude can be controlled by adding heat with the burner or letting heat escape by opening the parachute top. The balloons can fly at any altitude during a flight from just over the treetops to over 5,000 feet. The pilot cannot control which direction the balloon flies, except for finding different air currents at different altitudes.

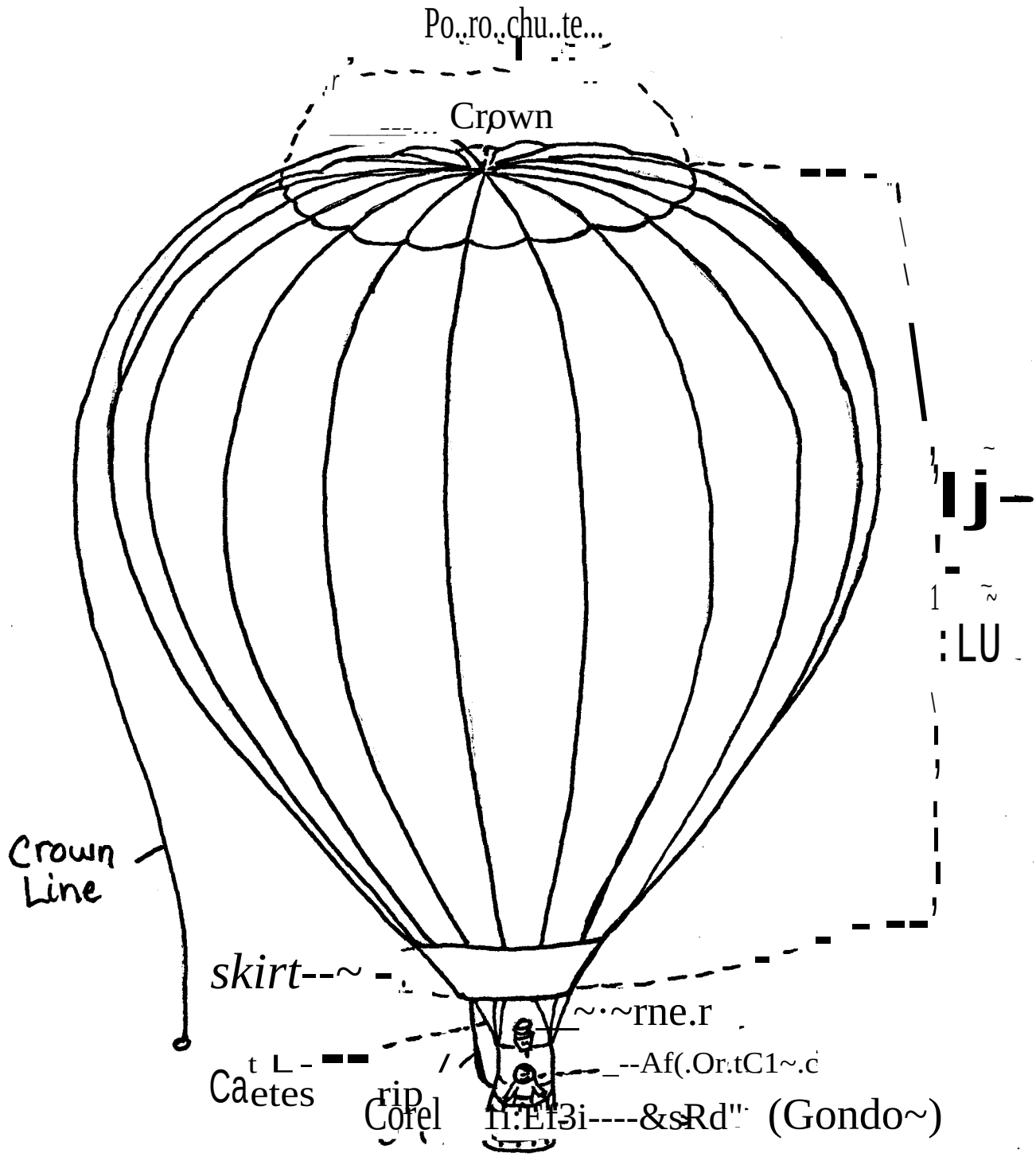
The pilot chooses an open field or backyard to land in, then he pulls out the parachute top, and the balloon descends into the field. The chase crew, who has been following the balloon in a van meets the balloon at the landing site. A crew member takes the crown line and pulls the envelope onto the ground as it deflates. The pilot then detaches the envelope from the basket and the crew packs the balloon back into the bag. The balloon, basket, crew and passengers are then loaded into the van and taken back to the launch point.

Finally, have students pretend that they will be flying. Place a 42 inch square of masking tape on the floor. Mark off a circle 10 inches in diameter in each comer for the propane tanks. Have the students write down an estimate of how many people would be able to fly with them in this basket. Test their answers by having people in the class stand in the 'basket'.

Bibliography:

Bellville, Cheryl Walsh. Flying in a Hot Air BallOOn. Carolrhoda Books Inc., Minneapolis,1993. (an excellent children'S book about how balloons work, and how it feels and looks to fly in one or chase one)

Johnson, Neil. Fire and Silk: Flying in a Hot Air Balloon. Little, Brown and Company, Boston, 1991. (A wonderful children's book explaining a flight from beginning to end, balloon history, and pictures taken from a balloon as well as special shape balloons)


Crown
Crown Line
skirt
(Gondo~)

To Fly or not to Fly?

Rationale:

One of a balloonist's greatest concerns is the weather. Much of his life is determined by whether or not it is 'flyable'. Balloonists must know a lot about weather and keep informed on the state of the weather at all times. This is a perfect opportunity make students more aware of the weather and predicting the weather.

Objectives:

-Students will play parts in a weather skit. (language arts)

-Students will observe the clouds and draw accurate pictures of them. (science, art)

-Students will build weather observation tools and use these to take weather readings. (science)

-Students will use a weather chart to predict the next day's weather, and chart their accuracy for the remainder of the unit. (science)

-Students will determine whether or not a balloonist could fly each day, and make a graph of the results. (science, math)

Materials:

See student instruction sheets.

Procedure:

Day 1: Discuss the importance of weather to balloonists. What would happen if you were flying during a thunderstorm? During fog or low clouds? If sudden winds picked up? Discuss the fact that if the wind is too fast the balloon will have a hard landing, and it will drag a long dtstance--thts could be very

dangerous. In addition, if the balloon envelope would get wet it would not last as long as it otherwise would. For balloonists, weather can make the difference between a safe, fun flight and a dangerous, terrifying flight. Balloonists determine whether or not to fly by employing many tools including commercial weather reports, Federal Aviation reports, and especially their own weather observations.

Give the students their weather observation journals (see attached sheet). Then take the students outside with crayons or pencil to observe the clouds and the weather. Students will draw what they see in a cloud journal, and then classify the clouds they observe according to a cloud chart. Students will observe the wind speed and write down an estimate. Before you go inside, consult the attached wind speed chart to determine a class estimate of the wind (Hayes). In addition, agree on a wind direction. Determine the temperature using a thermometer and record. Finally, if a barometer is available note the change in the barometric pressure over the past three hours, when you go back inside consult the weather forecasting chart and record your forecast.

Day 2: This day will be dedicated to clouds. Begin by discussing what the children already know about clouds, how they are formed, what they are made of why they are important to weather forecasting et cetera. In order to really answer these questions, create a cloud in the classroom. Using a hot plate, boil water in a covered pot, when you lift the lid a cloud of steam will form. You can make this cloud rain by holding a cold spoon in it. This cloud is formed in the same way as natural clouds form: water evaporates into the air, rises until it meets colder air, when it condenses into tiny droplets to form a cloud. The cold spoon causes the droplets to condense and get larger so they fall back into the pot. (Fox, 1987)

Next, discuss the different cloud types and the impact they have on weather. An easy way to remember the cloud names is to discuss their Latin origins. Show pictures of the cloud types and discuss their names. Cirrus or "curl of hair" clouds are wispy, feathery tufts high in the sky. Good weather likely if winds are from the West, rain if the winds are from the East. Cumulus means "heap". These clouds look like cotton balls and are usually fairly low in the sky; they are fair weather clouds unless they build into cumulonimbus or thunderheads. Stratus or "blanket" clouds are low in the sky, the entire sky is gray. These clouds indicate rain or snow. Cumulonimbus clouds or thunderheads are low clouds whose tops rise up like mountains. Cumulonimbus clouds are thunderstorm clouds. (Hayes) Once you have discussed all four cloud types, make a "Wheel of Forecast" (Predicting, 1989). On one circle, have the students title their wheel and illustrate the cover. Cut two windows out of opposite sides of the circle. On the second circle draw a picture of one of the cloud types, with the name and weather description exactly opposite it on the circle. Do the same for all four cloud types. Attach the two circles together in the center with a brass fastener. When you turn the wheel to show the cloud type in one window, the weather forecast will be showing in the other window. See the attached sample.

Finally, show some additional activities could include reading the book Dreams by Peter Spier (1986). This is a wordless book about clouds and hot air balloons, the students may enjoy writing a story to accompany the pictures. Another option is to discuss clouds as they appear in famous works of art. Artists often use clouds to depict mood in a painting, discuss how different types of clouds and weather make you feel and how they affect the moods of outdoor pictures. Students can then practice this technique by choosing a mood for a picture and using clouds to help depict this mood.

Day 3: Discuss the concept of air pressure, do a simple air pressure demonstration. Fill a glass jar completely with water. Place a cardboard square over the top of the jar. With one hand, holding the cardboard gently turn the jar over. Carefully remove the hand holding the cardboard in place. The cardboard should then stay in place due to the air pressure pressing upward on the card from the outside. (Predicting, 1989) Discuss the fact that air pressure does not remain the same all the time, so we have barometers to measure the air pressure.

Air pressure is important to weather, because winds move from areas of high pressure to an area of low pressure. Therefore, a change in barometric pressure can help to predict a change in the weather. If a barometer is available, discuss how it works and how to read one. If not, build your own barometer by cutting the neck off of a balloon and stretching the balloon tightly over the top of the jar. Hold it in place with a rubber band. Cut one end of a straw to a point and tape it on top of the jar, mark the position of the straw on a piece of cardboard. Draw a scale on the cardboard above and below the mark in millimeters. As the air pressure changes, the straw will move up and down the scale. (Predicting, 1989) Go outside to draw the clouds, and take wind speed and direction readings as well as barometric pressure readings. Were the class weather predictions accurate? Graph results. Make a new prediction and record. This procedure should become a part of your daily routine until the end of the unit.

Day 4: Wind speed and direction are also important to determining the weather, especially for balloonists, as they determine the balloon's destination. Make a wind vane according to the attached pattern. In addition, an anemometer to measure wind speed more accurately can be built by following the attached directions. (Predicting, 1989) Encourage students to do the same at home so that they can also follow the weather on the weekends. Make your daily weather

readings and predictions. In addition, wind vocabulary is important to discuss. As a class, brainstorm words that describe the winds or wind storms, such as gale, gust, tornado, hurricane, Chinook, typhoon, breeze, zephyr, and sirocco. If possible, put your list in order from the lightest breeze to the strongest wind. Choose students to illustrate each type of wind, to create a class wind chart.

Conclusion: At the end of the unit, discuss the clouds in the student's journals and the impact their impact on the weather as the students have seen it. In addition, discuss your weather graphs and the accuracy you have had in predicting the weather. How many days were flyable? What impact would this have on a ballooning business? Finally, as a conclusion to the weather unit read 'The Weather Skit' (see attached copy) and give the students each a part to play.

Assessment:

Check the instruments the students built for accuracy, as well as the student's weather charts.

Bibliography:

Hayes, Will. Balloon Digest. Order from: P.O. Box 6006, Santa Barbara, CA 93160, (805) 967-2222.

Fox, Helen. "Investigating Nature's Power, Clouds and Lightning", Learning. March, 1987.

"Predicting Weather", Creative Classroom. March 1989.

Spier, Peter. Dreams. Doubleday, 1986.

Vogel, Robert. "Weather". Taft Campus library.

"The Weather Machine Skit". Taft Campus library.

Daily Weather Chart

Current ~e€r~ture _____

Barometric Pressure..

startlVl9 .._____

enciLn3 _____

difference _ _____

Wind Sp?d ._____ desc.ripfwYL. _____

W(nd DLre~tion.. _____

CLgu.d..lg12e

_____

illustration:

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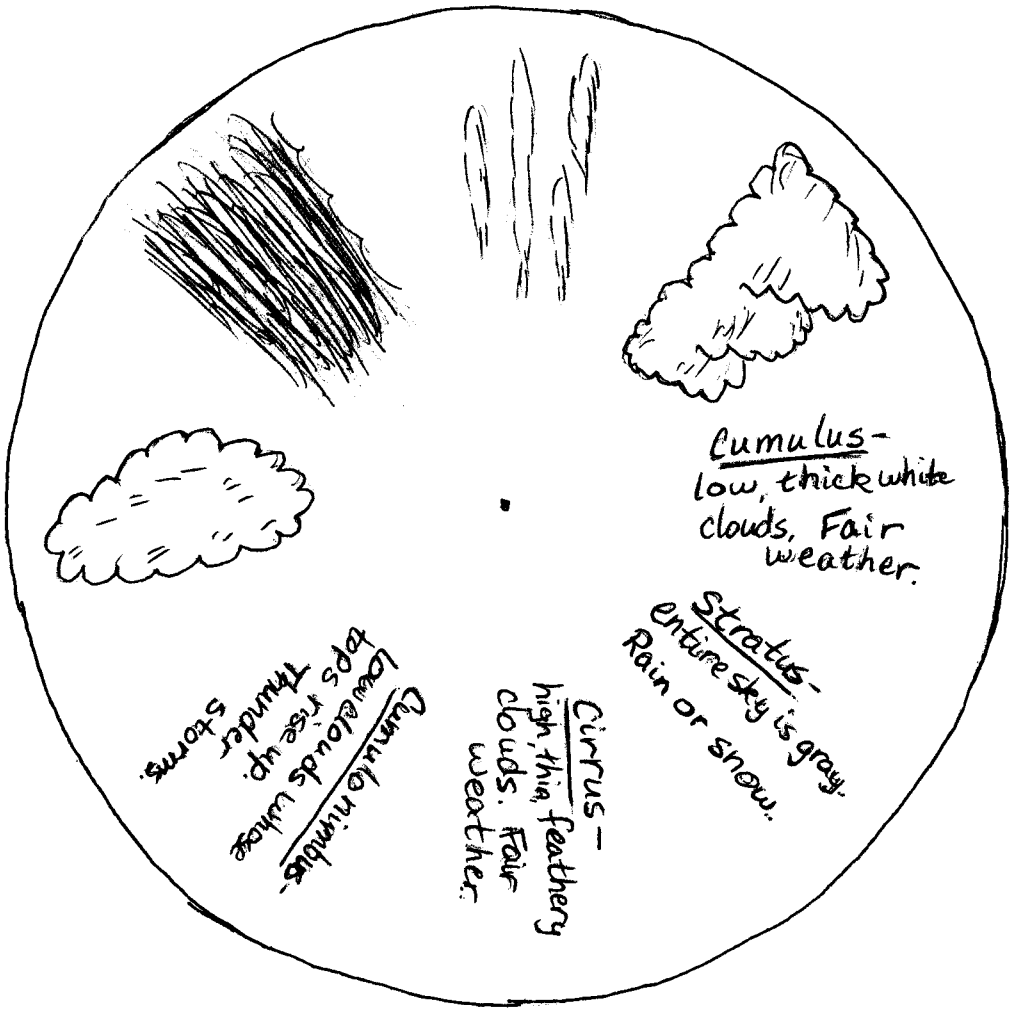
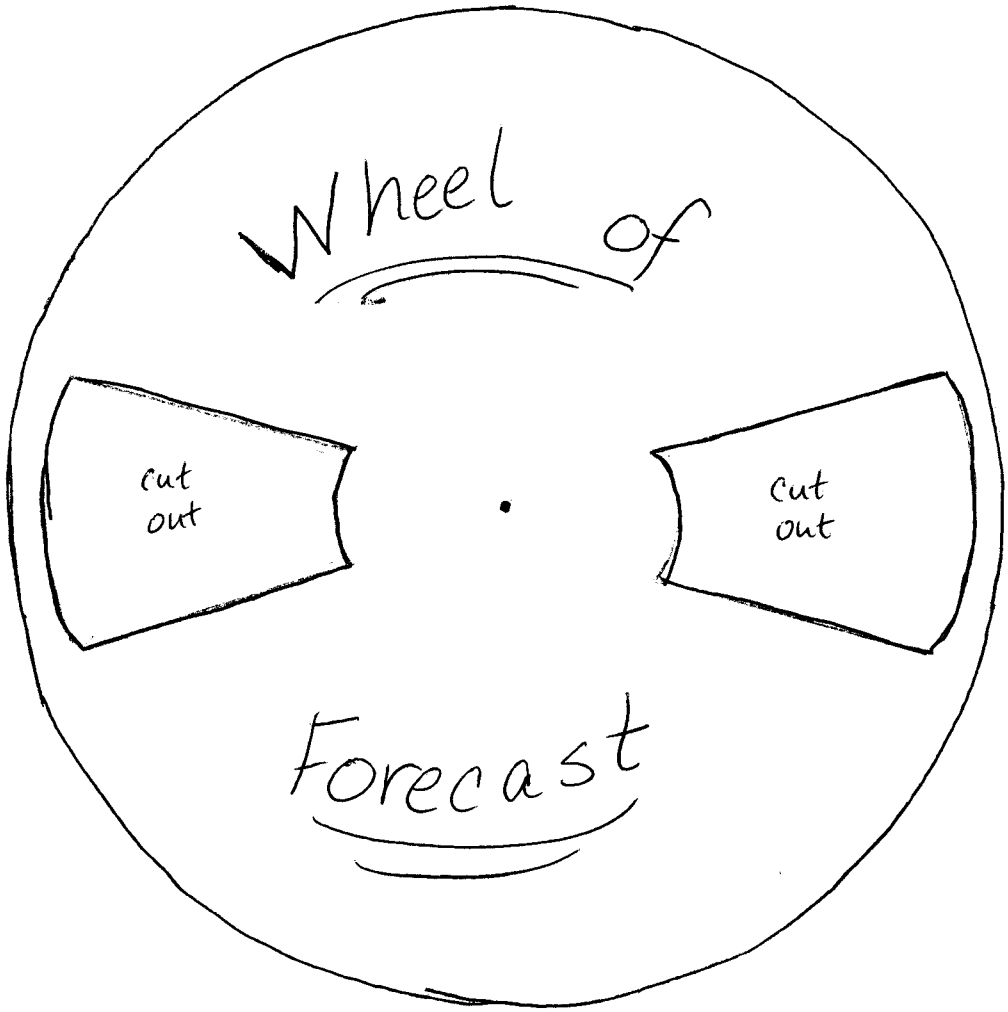
Forecast:

Was your forecast accurate?


Cumulus-
low, thick white
clouds, Fair
weather.
Stratus-
entire sky is gray.
Rain or snow.
Cirrus-
high, thin, feathery
clouds. Fair
weather.
Cumulonimbus-
Low clouds rise up
drops rise under
Thunder
Storms.


Wheel of
cut
out
cut
out
Forecast

Weather Forecasting:
Wind Direction and Barometric Pressure

WIND DIRECTION	BAROMEfRIC PRESSURE	FORECAST
SW-NW	Steady, rising rapidly or falling slowly	Fair, little temperature change
S-SW	Rising slowly	Clear within a few hours
S-SE	Falling	Precipitation within 24 hours
S-E	Falling rapidly	Severe storm
SE-NE	Falling	Precipitation within 2-18 hours
E-NE	Falling	Precipitation within 12-24 hours
E-N	Falling rapidly	Severe storm followed by cold weather
Swinging to N	Rising rapidly	End of storm - clear and colder

***Note: Rapid rise or fall in barometric pressure: 0.05-0.09 inches in 3 hours.

rt.

Beaufort Scale

DESCRIPTION	SIGNS	MILFSPERHOUR
Calm	Smoke rises vertically	less than 1
Light air	Smoke drifts, weather vane does not move	1-3
Light breeze	Wind felt on face, leaves rustle: weather vane moves	4-7
Gentle breeze	Light flags blow; leaves and small twigs move constantly	8-12
Moderate breeze	Small branches move, papers blow, dust is raised	13-18
Fresh breeze	Small trees sway	19-24
Strong breeze	Telegraph wires whistle, large branches move, umbrella used with difficulty	25-31
High wind or moderate gale	Whole trees in motion, walking difficult	32-38
Fresh gale	Twigs break off trees	39-46
Strong gale	Branches break	47-54
Whole gale	Trees snap and are blown down	55-63
Storm	Widespread damage	64-75
Hurricane	Devastation or extreme damage	above 75

Making an Anemometer

Materials:

-stapler

-four paper cups with handles

-pencil with eraser

-straight pin

-clock or watch

-red crayon or marker

-card board circle 8-9 inches in diameter

Procedures:

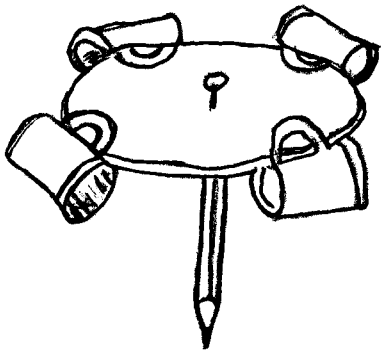
1. Color one of the cups red, outside and inside.

2. Staple the handles of the paper cups to the edge of the cardboard square, all facing the same direction and an equal distance apart.

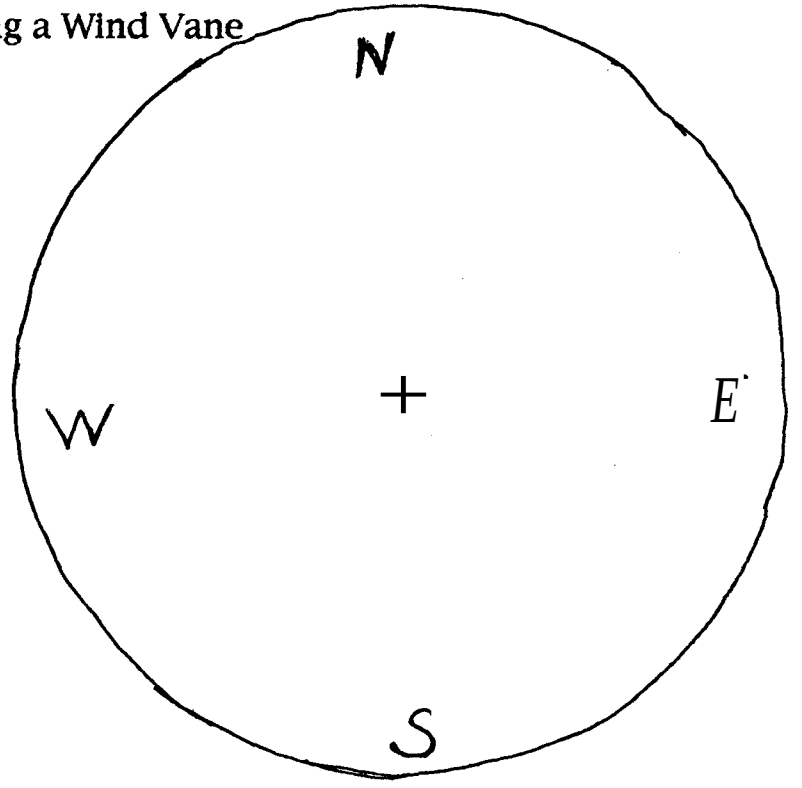
3. Poke a small hole in the middle of the cardboard circle with the pin, the hole should not be large enough for the pencil to fit through.

4. Put the pin through the hole on the cardboard circle, and push the pin into the pencil eraser, the circle should turn easily.

S. Use a clock or watch to determine how many times the red cup goes around in one minute.



Making a Wind Vane



Materials:

- -tape
- -empty thread spool
- -knitting needle
- -drinking straw
- -ruler
- -pencil
- -construction paper
- -scissors
- -glue
- -compass

Procedure:

1. Trace the arrow stencil onto cardboard, cut it out.

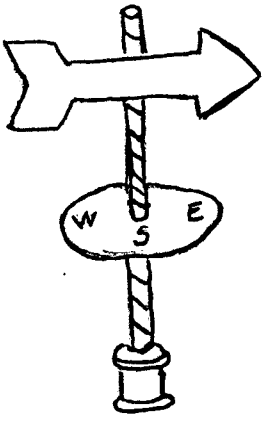
2. Draw a circle about 10cm in diameter and cut it out. Cut two small slits in the middle of the disk. Draw 2 lines on the circle at even Intervals--Iabel the circle as shown on the diagram.

3. Tape over one end of the spool. Drop the knitting needle into the other end of the spool. Slip the straw over the needle, the straw should turn easily.

4. Slip the Circle over the top of the straw.

5. Glue the arrow to one end of the straw.

6. Bring the weather vane, using the compass adjust it so the N on the Circle matches the N on the compass. The arrow will point the direction the wind is blowing.



Making a Barometer

Materials:

-a glass jar with a wide mouth
-a balloon
-scissors
-drinking straw
-strong rubber band
-tape
-piece of cardboard

Procedure:

1. Cut the neck off the balloon and stretch the rest of the balloon tightly over the top of the jar. Hold it in place with the rubber band.

2. Cut one end of the straw to a point, Secure the other end to the middle of the balloon with tape. Make sure that the straw is horizontal and exactly in the middle.

3. Put the barometer inside or outside, but keep it out of the sun.

4. Place the piece of cardboard behind the point of the straw and tape it onto the jar.

5. Mark the position of the straw pointer on the cardboard, draw a scale in centimeters above and below this mark. The pointer will move up and down the scale as the air pressure changes. The higher the air pressure, the higher the pointer.

THE WEATHER MACHINE SKIT

1. SUN: student sings, '"Iam your sunshine. your only sunshine"
2. OCEANS: student says (loudly~ "Gurgle, gurgle!"
3. CLOUDS: student says "Fluff: fluff!"-while flicking their hair.
4. RAIN: student Sings. "Splish, splash I ~as taking a bath:" ur use a spray bottle and squirt water up over the group"
5. WARM AIR MASSES: student says (loudly) ""I'm hot, I'm hot!"
6. COLD AIR MASSES: student says "I'm cold, I'm cold!"
7. HAIL: student sings. "Hail, hail the gang's all here" or says "pelt, pelt!" or can drop pebbles into a #10 can.
8. TORNADO: student makes the "tornado" music from The Wizard of Oz while spinning around.
9. LIGHTNING: student yells: "SHAZAM!"
10. THUNDER: student/group stomps feet, or can yell "Kaboom!"

Each day the SUN rises in the East. It shines upon the land and OCEANS, warming them. As OCEANS heat-up, currents begin to flow. Near the equator WARM AIR MASSES are formed and make their way toward the poles. WARM AIR MASSES can hold lots of moisture so CLOUDS are gathered up by warm winds. At the same time, COLD AIR MASSES form at the poles and move toward the equator. When wet WARM AIR MASSES collide with COLD AIR MASSES, things really begin to happen. The COLD AIR MASS pushes the CLOUDS up until they cannot hold as much mOisture, so RAIN begins to fall. If RAINdrops keep being blown upward and don't fall all the way to the ground for awhile, layers of ice may build-up to make HAIL. All this movement of air masses creates friction, causing static electrici ty which discharges as LIGHTNING flashing between.\'-"the land or OCEANS and the CLOUDS. After each LIGHTNING flash, THUNDER rumbles as the super heated crack in the air is shut by regular air. On hot summer days, collisions of air masses can create even more dangerous weather than just RAIN, HAIL, LIGHTNING AND THUNDER. The WARM and COLD AIR MASSES can mix violently, and a TORNADO may develop.

History of Ballooning

Rationale:

The story of the history of ballooning is truly a remarkable story. I believe that it will make history come alive for the children, as well as providing an excellent introduction to the history of transportation. Finally, this subject provides an excellent basis for the science behind hot air flight.

Objectives:

- Students will sequence dates and make a timeline. (math, social studies)
- Students will brainstorm modes of transportation and sequence their origins. (social studies)
- Students will research the origins of a mode of transportation using who, what, when, where, why and how questions, writing a brief research paper. (language arts, social studies)
- Students will be introduced to the concept that hot air rises. (science)
- Students will give a brief class presentation. (social studies)
- Students will work effectively in cooperative groups. (language arts)
- Students will learn how various modes of transportation work. (science)

Materials:

-butcher paper
- matches and a jar (if allowed in the school)
- index cards
-pictures of an early balloon
- map or globe showing France
-Sketches or pictures of failed flying machines

Procedures:

Have students brainstorm modes of transportation past and present, and write them on index cards. If necessary, prompt children to come up with older forms of transportation by asking how people got around before the car was invented (also be sure that the hot air balloon is included). Next, as a class try to place the cards in the order that the vehicles were invented--this is easiest if you consider only two cards at a time until all are in order.

At this point, explain that there is a story behind each mode of transportation, its history. Put the balloon in its correct spot in the order and begin to tell the history of the balloon. Begin by setting the stage based on the balloon's place in the history of transportation. The balloon was invented before the car, the train, even the bicycle. People had always dreamt of flying, if possible show pictures of attempted flying machines that failed, if not just discuss them. Tell that the Montgolfier brothers of Paris, France in 1783 dreamt of flying. Show students where France is on a map. They owned a paper company, and were sitting around the fire one day when they noticed something. Here light the match and blow it out, having the students watch to see if they notice what the Montgolfiers did. (If your school will not let you light a match, have the children imagine that they are Sitting around a campfrre. What do they notice?) The students will notice that smoke goes up, discuss why smoke goes up. Then relate that the first balloon was a large paper sack that caught the smoke (and also the hot air) causing it to fly. The first manned flight carried a rooster, a duck, and a sheep. This brings you to the first human to fly. The event was witnessed by a crowd of 400,000 people (probably the largest gathering of people up to that point in history) even the King and Queen of France were there. Also discuss the story behind the tradition of balloonists carrying champagne (to avoid being attacked

by peasants who thought that they were aliens). Here show pictures of early hot air balloons if they are available.

Every other mode of transportation also has a story. Each group of 2-4 students (depending on class size) will research a different mode of transportation so that they can be placed in the correct order, and so the class can hear the story behind each. This is designed as an introduction to research papers and presentations. Students should answer the who, what, when, where, why, and how in telling their story, as well as any interesting facts they discover. If possible, take the students to the library to begin the project. They should turn in a rough draft and then a final paper, as well as giving a brief class presentation. Also, each report should include an illustration to be placed on a class timeline of transportation. Some possible and less popular forms of transportation include airships, gas balloons, the modem hot air balloon, hang glider, glider, pogo stick, scooter, and the chariot. As each group makes their presentation, place their mode of transportation in the correct spot on the timeline. When all of the presentations have been made, place the pictures in a timeline on the butcher paper to be hung in the room.

Assessment:

Students will be evaluated based on their final paper and presentation. In addition, each individual will be given a group participation grade. You may wish to have each student fill out a questionnaire about how well his/her group worked together.

Bibliography:

Hayes, Will. Balloon Digest. Order from: P.O. Box 6006, Santa Barbara, CA 93160, (805)967-2222.

Design a Flying Machine

Rationale:

This activity gives children a chance to be creative while still teaching them about science and art.

Objectives:

-Students will identify power sources. (science)

- Students will design a flying machine with a power source. (science)

- Students will draw and color a detailed picture of their flying machine, what it would look like, and how it would work. (art)

- Students will share their designs with classmates. (language arts, science)

Materials:

-- paper and markers or crayons

Procedure:

Discuss man's desire to fly, imagine there are no balloons, planes, rockets, et cetera. Tell students that they will be inventors, inventing a new way to fly. Brainstorm things that go up. Discuss power sources of the vehicles on the timeline created in the last lesson. The challenge is to design a flying machine with a power source that can carry a person. The machine cannot be anything in existence today, the more creative the better. The picture must be labeled, as detailed as possible, and easily understandable by a viewer. When the pictures are complete, the students will share their ideas with other students in their group.

Assessment:

Students will be assessed based on their creativity, use of a power source, and effective labeling.

Bibliography:

Maurer, Richard. Airborne: The Search for the Secret of Flight. Simon and Schuster, New York, 1990. (This is an excellent children's book for any child who is interested in the origins of flight. It has many pictures of attempted and failed flying machines as well as successful ones.)

Poetry

Rationale:

Poetry is a unique form of literature that is often ignored in the classroom. An appreciation of poetry is important to engender in children, and the best way to do this is to take every opportunity to share a variety of poetry with them. Balloons make a good topic for students to begin to write poetry. Balloons are colorful and exciting, easy to picture mentally.

Objectives:

- Students will examine the descriptive aspects of a poem and brainstorm other descriptive words about balloons. (language arts)
- Students will write their own non-rhyming poems about balloons. (language arts)
- Students will draw pictures to accompany their poems. (art)

Materials:

- paper, markers, crayons or paint
- a copy of the balloonists prayer on chart paper

Procedures:

Read the balloonists prayer to students, having them make a mental picture of the poem.

TheBalloonis~'Prayer

The winds have welcomed you with softness,
The sun has blessed you with wann *hands.*
You have flown so *high and* so *well,*
That the gods have joined you in laughter,
And set you gently back again,
Into the loving arms *of Mother Earth.*

Discuss the imagery in the poem and the pictures children had in their heads. Reread the poem with the chart. Discuss the fact that the poem does not rhyme. Brainstorm balloon imagery on chart paper. Students then write their own balloon poems without a rhyme scheme. Students usually have an easy time creating a concrete poem, shaped like a hot air balloon; students only need to use individual words or phrases to create this type of poem. However, more advanced

students may want to write a more complex poem. After the first draft students read the poems in small groups to proofread and revise them. Students then write their final drafts and draw pictures to accompany them. The final drafts and pictures make a wonderful bulletin board.

Assessment:

Students final product may be assessed, as well as how well they revised their work with a partner.

Aeronautical Engineering - 101

Rationale:

This activity introduces students to the concept of 'lift' so vital to ballooning. In addition, by building their own gas balloons, students become familiar with the 'other' type of balloon. Finally, building and flying this balloon will prepare students to complete the more difficult construction of a hot-air balloon at the end of the unit.

Objectives:

-Students will build a model gas balloon or blimp and see whether it has enough lifting power to fly. (science)

-Students will decorate their flying machines to enter into an appearance contest. (art)

-Students will speculate about the reasons for the balloon's success or failure and write their ideas in a paper. (Science and language arts)

Materials:

-Balloons of various shapes and sizes (preferably latex)

-Helium (available in small tanks from party supply stores)

-String, yarn or ribbon

-Cellophane tape

-Construction materials brought by students

Procedure:

On the first day, introduce the activity, discuss balloons as well as dirigibles (blimps). Balloons have suspended baskets while blimps have attached cabins and fins for steering. The students can use a balloon of any shape or size-round

for hot air balloons and oblong for dirigibles. Discuss the reason that helium balloons, large or small fly-helium is lighter than air allowing the balloon to rise. Discuss the fact that if too much weight is hung from the balloon, it will not rise (the maximum lift of a hot air balloon can be up to 2,500 pounds). Tell the students that their task will be to build a lightweight basket or cabin for their balloon that allows it to fly. Brainstorm possible lightweight building materials for the basket or cabin, such as paper, foam cup, plastic fruit basket, small basket, ice cream cup, cardboard, et cetera. The students will also need suspension cables such as string, yarn or ribbon, and if they desire, passengers to enjoy the flight. Remind students that their baskets must be as lightweight as possible. Students then bring their construction materials from home the next day.

The following day, students choose their balloon shape and construct their basket and suspension cables or cabin and fm. In addition, students can decorate their balloons with materials such as paint, crayons, markers, ribbons, crepe paper, aluminum foil, stickers, yarn, flags, construction paper and whatever else the students think of. Students spend about one class period designing and refining their balloons, considering the effects of weather, and obstacles. On the flight-testing day, the balloons are filled with helium and students find out how well their balloon designs fly. Students tie suspension cables to the comers of the gondolas and taped to the inflated balloon. Those who chose to make a dirigible should tape the cabin right to the balloon and add a tail. Finally, in order to be able to retrieve the balloon, students tie a long string to their crafts. Then take the balloons outside to an open area for the final test.

If the students wish to, they may enter their balloons into a little competition. They name their crafts and choose a category to enter their vehicle in: distance flown, duration aloft, design originality, appearance, and construction originality. The students are then the judges for the other

categories. Ribbons can be awarded for first, second, and third place in each category.

Finally, students write a paper discussing how successful their craft was compared to others. Which design was most effective? Which was least effective? What was it about these designs that made them effective or not effective?

Assessment:

Students are given a participation grade, and student record and hand in the results of their balloon testing. Finally, students are graded on their paper.

Btbllography:

Brinks, Virgil and Robyn. "Taking the Hot Air Out of Balloons", Science Scope. April, 1994, p. 22-24.

Propane and the Balloon

Rationale:

Propane is a key to balloon flight, it is important for students to know where it comes from and how it is used. In addition, fuel is an important consideration in any flight. Many of the math skills that pilots employ involve fuel.

Objectives:

-Students will learn about the propane fuel used in hot air balloons. (science)

-Students will learn the difference between renewable and non-renewable resources and give examples of each. (science)

-Students will solve math problems involving propane and ballooning, students will use fractions, addition, subtraction, multiplication, and division. (math)

Procedure:

Have students guess the type of fuel that balloons use. Over the years, many different fuels were burned in hot air balloons. The first balloons were fueled by straw, wood, old shoes, and rotten meat. Later, kerosene was burned on balloons. Today, propane is used in most balloons. If the students do not come up with propane, have them think of their grills at home. The same type of propane used to fuel these grills is used to carry a balloon through its flight. Propane is used for many reasons; it is lightweight, it is readily available, and it burns very cleanly. Propane is an odorless, colorless gas which is very flammable, therefore, an artificial odor is added to all commercial propane. Pilots must be very careful when fueling their balloons, wearing leather gloves and long sleeves. Any type of spark, even that created when a car starts could ignite propane. All of the tanks

propane is kept in as well as the hoses that carry the propane must be inspected and replaced frequently.

Next, discuss where propane comes from, a natural gas. Is it renewable or non-renewable? How can you tell? list some examples of each type of resource. Could you think of another, renewable resource that could be used to fuel balloons?

Since propane is a gas at normal temperatures and pressures, the propane is stored under pressure as a gas. Therefore, the balloon burner has several jobs; it must vaporize the liquid propane, mix it with air to form a mixture that will bum, and then bum that mixture to heat the balloon. There is a pilot light, or flame in the center of the burner. The propane liquid is sent through coils around this flame until it turns into gas. Then, it is mixed with air and ignited by the flame to shoot a 8-10 foot flame into the balloon.

Pilots must always consider their fuel during a flight. Legally, pilots are required to land with 113 of the fuel they carry. Generally, a pilot carries four 10-gallon fuel tanks. The average balloon bums about 12.5 gallons of propane each hour. Propane generally costs about $.90 per gallon, so the average hour long flight costs about ten to fifteen dollars.

Give students a copy of the propane math problems on the attached worksheet and have the students solve them. If necessary, allow the students to work on them in pairs. Another option is to put each problem on a note card so that students may solve them when they finish their other work. Note, these problems are just samples, they should be very challenging to third or fourth grade students as they stand, but they could easily be adapted so students would have less trouble. In addition, more problems could be written by changing numbers and rearranging the problems.

Assessment:

Students can be assessed based on their responses during discussion as well as their performance on the math worksheet.

Bibliography:

Hayes, Will. Balloon Digest. Order from: P.O. Box 6006, Santa Barbara, CA 93160, (805) 967-2222. (This is a training book for pilots, but it has a lot of good material in a user-friendly format.)

Propane Math

1. Your balloon has 4 fuel tanks, each carries 10 gallons of propane. You must land with 1/3 of your fuel by law. How many gallons of propane must you land with?

2. When you land, you have 25 gallons of propane left in your tanks. You took off with 40 gallons. If propane costs $.90 per gallon, how much will it cost you to refuel the balloon?

3. If sales tax is six and one half percent of the total sale, how much will the tax be for 16 gallons of propane at $.90 per gallon.

4. You had 40 gallons of fuel in your balloon when you took off. After you land, you refuel the balloon, and it takes 16.8 gallons to refill the tanks. How much fuel was left in your tanks when you landed?

5. The wind is blowing at 5 miles per hour. You flew for an hour if you burned 10 gallons of propane during your flight, how much propane did you use each mile?

6. If you burn 12.5 gallons of fuel in an hour of flight, and you take off with 40 gallons of propane, how long can you fly before you run out of fuel?

How long can you fly and still land with 1/3 of your fuel?

Research Paper

Rationale:

Third and fourth graders are just beginning to write lengthy reports. Balloons make an excellent report topic, and there are many possible topics related to the subject. In addition, it is important for students in this age group to have many opportunities to present in front of a group of people, so that they will be less intimidated in the future. All of the students can learn a great deal about many different aspects of ballooning in this manner.

Objectives:

-Students will choose a manageable topic for a report and presentation. (language arts)

-Students will write a 3-5 page research paper (handwritten or typed) on balloons with at least three sources. (language arts)

-Students will use appropriate research paper format and will cite their sources properly. (language arts)

-Students will make a class presentation of their findings. (language arts)

Procedure:

When introducing the project, discuss how to pick a topic. Then carefully talk about the format of a report, according to the specifications you desire (see student handout). Brainstorm possible topics: history, scientific uses, gas balloons, dirigibles, blimps, the 'comeback' of balloons, types of balloons, how it works, races, historical uses. In addition, discuss the proper way to cite the sources students use (see student handout).

Next, the students should be shown how to take effective notes. One of the best ways to teach this skill is the use of note cards. Only one piece of information should be written on each card. Each source is written on a list, with the publisher, year, author and title. Each source is then lettered, , and the letter of the respective source is written on the note card along with the page number where the item was found and a general label for the information (see student handout). Then, when it comes time to write the report, the note cards can be grouped and ordered so that the information is all in one spot and nothing is forgotten. Students should be given an opportunity to find information and ask questions in the school library if it is at all possible. After a few days, the

students' note cards should be checked. At this point, set a deadline for a rough draft. On the day the rough draft is due allow students to review each other's drafts and offer suggestions. At first you may wish to allow students to choose their own partners so they feel more comfortable sharing. Remind students to respect the author's feelings and also remind them that these are only suggestions, no recommended changes absolutely have to be made.

Finally, discuss how to prepare and practice a presentation, not just reading a paper aloud. Encourage visual aids whenever they are appropriate. Always be a source of help and information to your students, especially in this regard. Set up a schedule for presentation, taking into account the topics of each report.

Assessment:

Assess papers using a holistic rubric of your choice.

Research Paper Format

I. Opening Paragraph

A. Begin your paper with an attention grabber, an interesting fact or question about your topic.

B. Write a few sentences describing, in general what your paper will be about.

II. Body Paragraphs (2-3 paragraphs)

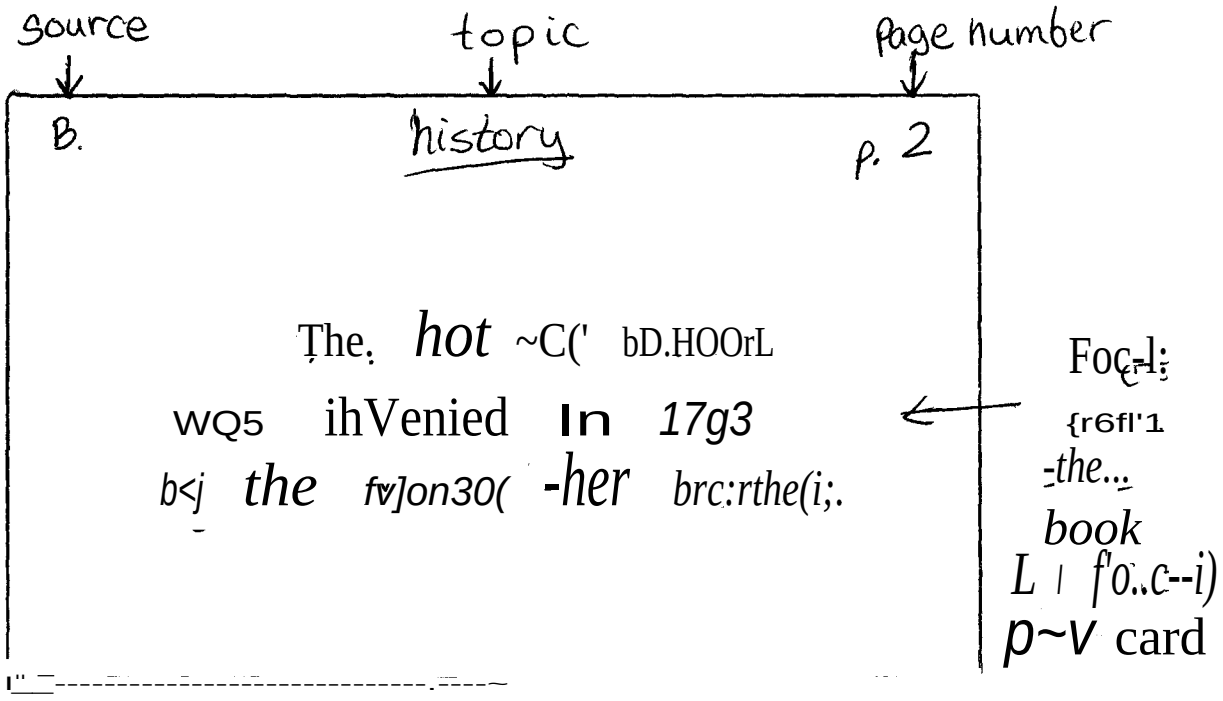
A. Each paragraph should begin with a focus sentence describing what that paragraph is about.

B. Each paragraph needs 2-3 sentences supporting your focus sentence. Be sure that each sentence is directly related to the focus sentence.

C. Each paragraph should end with a concluding sentence that reviews what was in the paragraph.

III. Concluding Paragraph--2-3 sentences reviewing the information in the report, this paragraph should wrap up the paper. remember, there should be no new information in this paragraph, only review information.

Sample Note Card



Sample Bibliographic Reference

B. Johnson, Neil. Fire and Silk: Flying in a Hot Air Balloon. Little, Brown and Company, Boston, 1991.

Sample Citation

...The Mongolfier brothers invented the hot air balloon in 1783 (johnson, 1991).

X Marks the Spot

Rationale:

Students will be introduced to the concept of a balloon race in preparation for their final race. This activity is interesting and fun, but it also teaches math skills in the scoring of the race. In addition students will use creative thinking to design their own event.

Objectives:

-Students will toss a beanbag onto a target for accuracy. (physical education)

-Students will measure their distance from the 'X' and score their toss. (math, science)

-Students will design their own balloon event and develop a way to score it. (math,, language arts)

Materials:

-Pictures of special shape balloons flown in races

-a large 'X' out of material or paper

-a bean bag with a tail for each student

Procedures:

Discuss balloon races, particularly nearby events (you can learn about races by calling the Balloon Federation of America at (515) 961-8415). Show pictures of special shape balloons that make appearances at these races. Since balloons cannot race in the traditional sense, many events have been designed to allow balloonists to test their skill in steering and accurate flying.

Hare and Hound: One balloon takes off as the 'hare', the rest of the balloons are released shortly afterward. They must follow the hare as closely as possible. When the 'hare' lands, a large 'X' is laid out. The other balloonists must try to drop a beanbag as close to the center of the 'X' as possible.

Ring/key Grab: A post is set up with a ring or set of keys hanging from it . The pilots are given a map showing where the post is. The pilot may then choose his own take-off point a certain distance from the post in order to grab the ring or keys. The first pilot to grab the ring or keys wins the car or other prize.

Judge Declared Goal Task: In this event, the judge chooses a location to lay out an 'X'. The pilots are told where the field is, and they must try to drop a marker on the 'X' after taking off from the official take-off field.

Explain the scoring system for target drop in a balloon race. Only markers found within 200 feet of a target are scored. A dead center drop is 2400 points, and one point is deducted for every inch from the center. Therefore a drop at 200 feet receives a zero distance score. In addition, pilots receive position points; the pilot with the closest marker receives 2400 points, and each pilot after him receives 50 points less (i.e. 2400, 2350, 2300...)until the 50 point position is reached. All of the pilots on the scoring field at the 50 point position and lower receive 50 points.

Students will then go outside to a preset 'X' with their numbered baggies (bean bags with tails). The students must stand a predetermined distance from the 'X' (determined by the amount of space available), and holding their baggies from the end of the tail, students will toss their baggies onto the target. Each student is then responsible for accurately measuring his/her own distance from dead center in em. Fights can be avoided by pairing students up so that one can act as an 'observer' for the other as they measure distance in order to avoid cheating. Each student should then determine his/her own position score based

on a scale of 300 cm or whatever the agreed distance is. Finally, make a classroom graph of distance so that position points may be assigned and the overall winner named. Students will then enjoy the challenge of designing their own ballooning event and establishing a scoring method appropriate for a group of 75-100 balloons. They will write up the race specifications, rules, and scoring procedures as if they were being presented to actual balloon pilots in a race.

Note: This activity can also be used as an orienteering lesson. In that case, each student would be given a numbered beanbag, a compass and directions to the target according to paces and compass directions. The students then drop the baggies in the place the directions lead them to, and scoring can proceed from that point.

Assessment:

Students can be assessed on their ability to score their bean bag toss as well as the event they invent, and how well they write the rules.

Bibliography:

Bellville, Cheryl Walsh. Flying in a Hot Air Balloon. Carolrhoda Books, Minneapolis, 1993. (This children's book has excellent pictures of special shape balloons as well as balloon races.)

X Marks the Spot
Rules and Regulations

1. Each student will have a numbered baggie with a tail.
2. The 'X' will be set up in an open area outdoors.
3. Stand in a circle 5 meters from the center of the 'X'.
4. Hold the baggie by the end of the tail when you throw it.
5. Working with a partner, measure (in cm) the distance from the center of the 'X' to the edge of your baggie (not the tail). Record your results.
6. Begin with 300 points, for every cm your baggle is away from the center of the 'X', subtract one point. A dead center drop is worth 300 points, and a throw that lands 300 em or more from the center is worth 0 points. This is your distance score.
7. Make a class graph of your distance scores.
8. The student whose baggie is closest to the 'X' receives 2000 points, the second receives 1950 points, the third 1900, and each position after receives SO points less than the one ahead of him or her. If there is a tie, both students receive the score, and the position below is awarded 100 points less than the previous score. This is your position score.
9. Add your distance score to your position score to determine your final score.

Map Skills and the Balloon

Rationale:

The hot air balloon lends an excellent introduction to the concept of a map as well as providing many opportunities for the student to practice these skills in a meaningful context. One of the greatest joys of flying in a balloon is to see the landscape from the air. One of the greatest flying experiences I ever had was the day I flew over my house, to pick out the roads, lakes, neighborhoods, houses and parks of the area. Because of the openness of a basket and the relatively low altitude, the balloon is an excellent medium for introducing the concept of a map.

Objectives:

- Students will compare and contrast a picture taken from a balloon with a street map. (social studies)
- Students will identify features normally included on a street map, a contour map, and an aviation map. (social studies)
- Each student will imagine his/her home as it would be seen from a balloon and then will map his/her yard. (social studies, art)
- Students will determine the distance flown given a map, a take-off point and a landing spot. (math)
- Students will locate north, south, east, and west on a map. (social studies)
- Students will give another student directions to a destination. (social studies, language arts)

Materials:

- street map of the area for each student or group of students
- an aerial picture of the area if possible
-large graph paper, markers or crayons, pencils, rulers, and compasses

- a variety of other types of maps

Procedures:

Have students picture what the world would look like from a balloon, particularly their house or neighborhood. Tell them that map-makers try to create a similar picture of the earth. Show students the aerial picture of the area as well as a map of the area. Compare and contrast the two in a class or small group discussion. Discuss the reasons for including or not including aspects of the landscape. Why include streets but not houses or trees? Discuss the function of the key on the map. Have students draw a map of their house and yard imagining that they are viewing the area from a balloon. A follow-up would be to map the neighborhood in order to see the relationship between the size of the area and the detail of the map.

Once they have compared the picture and the street map, children can examine a variety of types of maps in groups noting similarities and differences. Children should pay particular attention to the purpose of the map in relation to what is included on the map. For example, why would water towers appear on an aviation map but not on a street map?

Now that students have been introduced to the aspects and purposes of a map, they should be given the opportunity to use the maps. Balloonists use maps frequently in their daily routines, so this skill can be tied into the theme (see attached worksheets). For example, given a map with a take-off point and landing point marked students can determine the distance flown (and also the average speed of the flight), the direction flown, as well as any distinct landmarks seen during the flight (forest preserve, river, lake, state park, schools etc.). Given a wind direction, students can determine which town the pilot is likely to land in or near. Finally, students can practice giving directions from a map. The lost-

balloon scenario is an excellent opportunity to role-play giving directions. When a crew cannot find the balloon, the pilot and crew chief call a designated number so the pilot can give directions to his landing spot. Given a map and a landing spot a 'pilot' can give directions to his 'crew' from the location they have been given. Maps are very important to balloonists and their crew members, this is just a brief list of possible question types many more exist for the creative teacher.

One more idea is to draw a map of the school. Hide treats for your students at various places in the school. Mark the location of each treat on the student's map. Have the students follow their maps to find their treats.

Assessment:

Check the student's worksheets to see where their strengths and weaknesses lie. In addition, have students give you directions to a lost balloon as you walk around the room.

Bibliography:

Illinois Atlas and Gazetteer. Delorme Mapping, Freeport, Maine, 1991.

Map Skills

1. List three ways that a picture taken from a balloon is the same as a street map, and three ways that it is different.

2. List the 3 features normally included on a street map.

on a contour map.

on an aviation map.

Map Skills

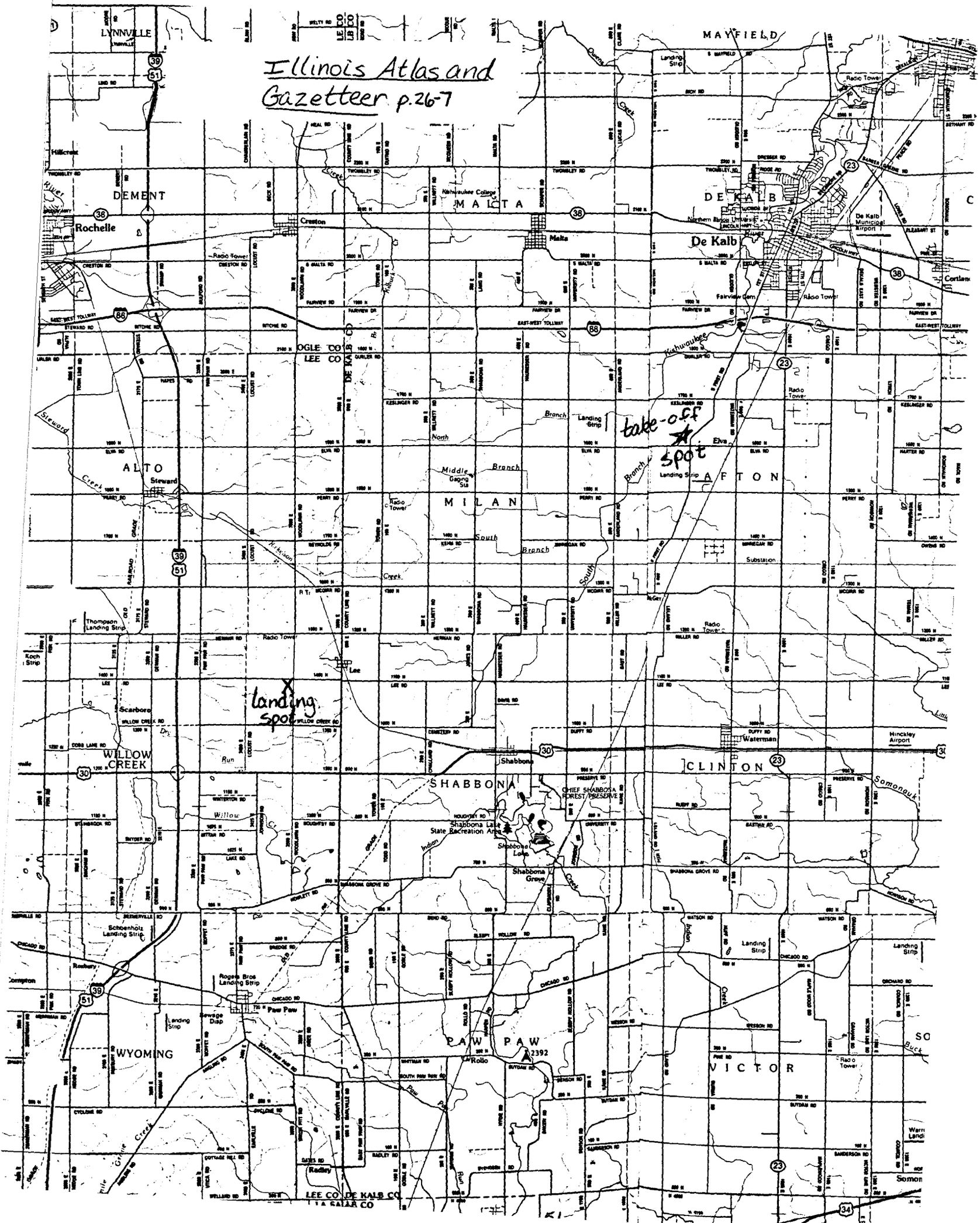
1. Mark North, South, East and West on your map.

2. Locate the take-off point and the landing point on your map.

3. Determine the distance flown from the take-off point to the landing point.

4. If you take off at the take-off point, and fly due North for 1 hour at 5 miles per hour, where will you land? Mark it on the map with a red 'X'.

S. Pretend that you are a member of a chase crew, you have lost your balloon. Choose a location to call your pilot from. Choose a partner to be the pilot. The pilot is at a landing spot of his/her choice. Sit back to back. Pretend that you are on the phone, tell the pilot where you are and have him/her give you directions to the landing spot. Take turns giving and following directions, be sure not to look at your partner's map!


Illinois Atlas and Gazetteer p.26-7
take-off spot
landing spot
LYNNVILLE
MAYFIELD
DEMENT
MALTA
DE KALB
Rochelle
Creston
Malta
De Kalb
De Kalb Municipal Airport
Northern Illinois University
Kishwaukee College
ALTO
Steward
MILAN
AFTON
Elva
Thompson Landing Strip
Koch Strip
Scarboro
WILLOW CREEK
Lee
Shabbona
SHABBONA
CLINTON
Hinckley Airport
Watermen
Chief Shabbona Forest Preserve
Shabbona Lake State Recreation Area
Shabbona Lake
Shabbona Grove
Schoenholz Landing Strip
Rogers Bros Landing Strip
Paw Paw
PAW PAW
Rollo
2392
WYOMING
VICTOR
Radley
Sewage Disp
Landing Strip
Radio Tower
Substation
Fairview Gem
OGLE CO
LEE CO
DE KALB CO
LA SALLE CO
Kishwaukee
Creek
Branch
North Branch
South Branch
Middle Gasong Sta
Willow Creek
Indian Creek
Somonauk
Big Rock Creek
Rte 23
Rte 30
Rte 38
Rte 39
Rte 51
Rte 88
Rte 86
EAST-WEST TOLLWAY

Map Key

LEGEND

- Bridge
- Tunnel
- Road Under Construction
- Locality
- Township
- Woodland
- Orchard
- Approximate Mean Lake Elevation
- Dam
- Intermittent Water
- Windmill

NOTE: Symbols below denote features or points of interest on the maps. As indicated, detailed information can be found in the Gazetteer.

Scale

1- LrlCh z: 2.5 m: fe'S

12.5 Miles
5miles

The Grand Finale

Rationale:

The end of a unit is the time to apply knowledge as well as to have some fun with what you have learned. Therefore, building and flying a balloons in cooperative groups will be an excellent culmination of all of the material the students have learned in this unit. In addition, students will gain confidence by completing a long-range project, feeling good about themselves and about school.

Objectives:

--Students will build and decorate a hot air balloon. (art)

--Students will in work in groups to publicize their balloon rally, coordinate the rules and judging, coordinate take-offs or to invite the audience. (language arts)

--Students will develop creative names for their balloons. (language arts)

--Students will fly their balloons outdoors with a propane stove. (science)

--Students will answer questions about how the balloon flies. (science)

--Students will draw a picture of what they would have seen if they had been flying in the balloon. (art)

+Students will write a newspaper article about the event. (language arts)

--Each group of students will time their balloon's flight and determine the speed it was traveling. (math)

Materials:

See student instruction sheets and take-off instructions.

Procedures:

This lesson should begin well before the end of the unit in order to allow the students ample planning time for the event. Initially, discuss balloon festivals, if possible get information about nearby events (the Balloon Federation of America is an excellent source). The students should be excited about the event, but they should also understand that it will mean a great deal of work. The students should be split into teams on the first day, teams of 3-4 should work well. In addition to building a balloon, each team should be responsible for an aspect of the race. For example, one should be in charge of publicity, another rules and

judging, a third in charge of coordination of take-offs and landings, still another group can be in charge of the design of posters, another of inviting parents and other grade levels et cetera.

This first day, students should be shown a sample balloon construction, and be informed of any materials they will be asked to supply. In addition, it is important that the students understand exactly what will be expected of them. They should be given as much freedom as possible in the planning of the event, so the event's success depends on their work.. The final product for each group will be a tissue-paper balloon about 2.7 meters high by 1.5 meters in diameter. The balloon construction should take 4-5 class periods, which should be interspersed with other activities and spread out over a few weeks.

Each group should begin their construction with a plan, if possible show the students an example of the completed project. The students should be told that they will each receive ten tissue-paper gores. They will then be able to decorate the gores with markers. In order to work well as a group, the students need to design their balloon before they begin construction. Once the students have a color scheme and a plan, they should agree on a name for their balloon. Balloons are given names similar to those of boats. Remind students to be creative but appropriate in their naming. A few balloon names that I am familiar with include 'Stormy Weather', 'Big Fun', 'Apple', 'Blueberry', 'Firedancer', 'It's Magic'. and 'Starburst' .

Now, the students are ready to begin construction on their balloons. First. you must create a gore template out of sturdy cardboard or posterboard according to the attached pattern. Students then build and decorate their balloons according to the attached student instruction sheet. Finally, on a day that is forecast to be clear and not very windy. the big launch day can be held. Be certain that each group has done its assigned job-the invitations are sent, the posters made, the launch schedule organized and a location free of obstructions chosen. Invite parents and the local newspaper to attend the big event. *The day of the launch is a very exciting one, but it could also be very, very dangerous and safety must be stressed foremost.. The launch involves a propane stove, and safety rules must be stressed indoors beforehand, and teacher supervision must be close.* The stove and stovepipe become very hot, so students must not come close. It may be worthwhile to have students and teachers wear leather gloves as they inflate the balloons, just as balloon crews do. In addition, long sleeves may also be suggested.

remind each group of students to be careful when holding their balloons over the stove.

Launch Materials:

-Hand-held hair dryer

-60cm length of lS-20cm-diameter stove pipe

-Propane camping stove

Launch Procedure:

1. Turn on the camping stove and set the stove pipe directly over the burner.

2. The initial inflation should be begun with a hair dryer (just as a fan is used in actual balloon flights).

3. Once the initial inflation has begun, two students carefully place the opening of the balloon over the stove pipe, so the bottom of the balloon is even with the top of the stove pipe. The other students in the group should extend the remainder of the balloon.

4. Once the balloon is fully inflated, which takes 3-5 minutes, count down from ten to one and release the balloon on 'lift off.

5. After the team recovers their landed balloon, the next balloon can be inflated.

After the flights, discuss what made the balloons fly, asking questions such as:

What happens to the air in the balloon when it is heated over the stove?

Why does the balloon expand and then rise?

How much weight do you think this balloon could carry?

Where do you think the balloon would have landed if they would have been able to fly farther given the wind direction?

How did the weather affect the flight?

Draw a picture of what you would have seen if you had been riding in the balloon.

Pretend you are a newspaper reporter, write an article about the balloon festival, be sure to answer the questions 'Who?', 'What?', 'Where?', 'When?', 'How?' and 'Why?'.

Assessment:

Performance assessment strategies are very effective in determining individual grades for group work. When the students have to reflect on their own work and its quality, This self-evaluation gives you valuable insight into how the children perceive themselves. See the enclosed assessment sheet. In addition, students can be graded on the quality of their balloon, as well as the other products they create, such as their newspaper articles.

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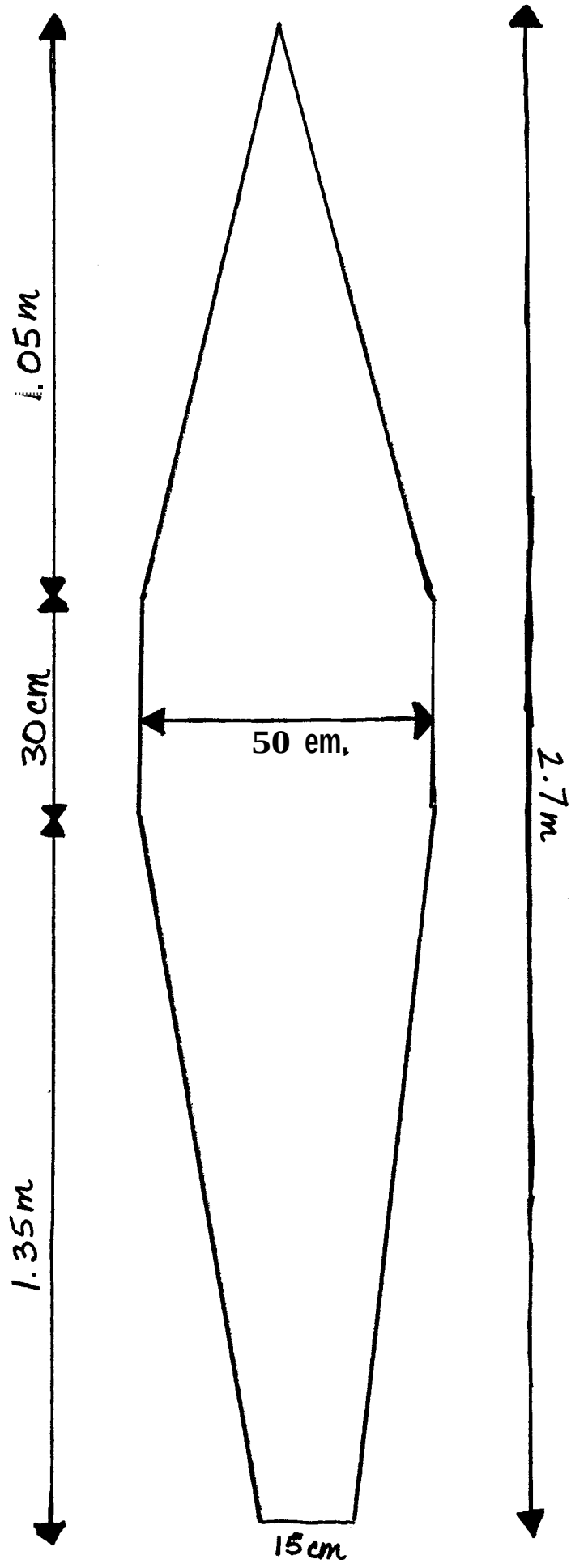
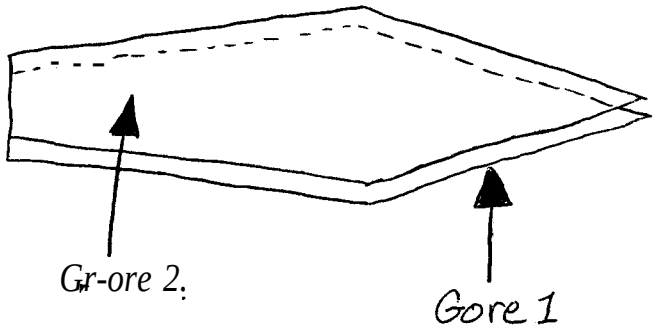


Gore Pattern

Hot-Air Balloon Construction

Materials:

-Ten 3m strips of white tissue paper
-rme-pouu marxer
-Felt-tip markers
-Sclssors
-ITIUe SUCK~
-Masking tape or duct tape
-30cm string
-Two wire coat hangers
-Pliers
-Paper dip



Procedure:

1. Stack 5 pieces of tissue paper on top of each other, get the gore pattern from the teacher and using a fine-paint marker, carefully trace the pattern and remove the pattern from the stack. Do the same with the other 5 pieces.

2. Using sharp scissors, carefully cut all the sheets in each stack without moving the paper.

3. Decorate your balloon with the markers, be sure that your whole group agrees on the design. Be very careful not to make holes in the tissue paper.

4. If you get a hole in the paper, cover a small piece of tissue paper with glue and put it over the hole.

5. Stack all ten gores into one stack.

6. Lay the top gore face down on the floor, lay the second gore face up on top of it so that the bottom one has 2 cm sticking out along one side.

7. Cover the part that sticks out with glue, and fold it over the top gore, make sure it is completely sealed.

8. Lay the next gore face down on top of the second gore, with part hanging over on the other side. Spread glue on the part that hangs over, fold and seal. Lay the fourth gore face up with the margin on the other side, fold and seal. Continue in the same way until all ten gores are attached accordion style. Then join the first and last gores together.

9. 20cm from the top of the balloon, tie the balloon closed with a piece of string.

10. Take two straightened clothes hangers and tape them together in a large circle.

11. Carefully put the ring into the bottom of the balloon about 1Scm from the bottom. Fold the tissue paper from the bottom over the ring and tape it in place.

12. Attach a paper clip to the string at the top of the balloon and have your teacher help you hang it from the ceiling. Your teacher will inflate the balloon with a hair dryer so you can check for holes or leaks. If you find any holes, repair them by covering them with tissue paper as in step 4.

Your balloon is now ready to fly.

How did you do?

1. How well did your group work together on this project?

2. What do you think of the quality of your hot-air balloon? Be specific.

3. How did the launch of your balloon go?

4. What do you think of your performance on this activity?

5. What did you learn about flying hot air balloons in this activity?

6. What grade should you receive on this activity? Why?

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Appendix

Answers to Frequently Asked Balloon Questions

Flying:

-Balloons can take off from any spot that is large enough, clear of obstructions where the pilot has landowner permission.

--Balloons can fly at any altitude, from just above the treetops to about 5,000 feet.

--Balloons can carry anywhere from 1 passenger to 12 passengers. Most balloons carry 3-4 passengers.

--Balloons cannot be flown during the middle of the day because the winds are unstable. When the sun is up, it heats the ground unevenly causing 'thermals' which are dangerous to balloons.

--If a balloon lands in the water, the fuel tanks will float keeping the basket above water. As long as the balloon is inflated, you could take off again.

--When you fly, you cannot feel the wind on your face, and the basket does not rock, as you are traveling as a part of the wind.

+Balloons can be flown at night, but they usually are not because the lights required are very expensive to purchase. However, 'glows' are held frequently where the balloon is tied to the ground by ropes and the burner lights up the balloon at night causing it to glow.

--Balloonists must carry three instruments during their flight. An altimeter to indicate altitude, a variometer to indicate rate of climb or decline, and a compass to show direction.

--A balloon can fly with a hole the size of a man in it; however, pilots do not fly if they know their balloon has a hole in it. Every flight begins with a visual

inspection of the balloon while it is still on the ground. If a hole does occur in the balloon, it must be taken to a certified balloon repair technician to be repaired.

-rr cost about $15-$20 to fly for an hour in a hot air balloon; however, it would cost about $2,500 to fill a helium balloon for one flight.

+There is only about a 3 degree Fahrenheit drop in temperature for every 1,000 feet of altitude gained.

--Balloonscan be flown year round, in fact balloons have better lift in cold weather.

--A balloon can be flown in the rain if visibility is good; however, most pilots do not fly in the rain because it is not good for the balloon fabric and for fear of thunderstorms.

--A balloon can ascend or descend at about 1,000 feet per minute if the pilot wishes to.

+Most balloon pilots do not fly in winds higher than 10 miles per hour because the landing would be too hard.

+Since balloons cannot steer easily, they have the right of way in the sky. Any airplanes or gliders must stay away from balloons.

=If a balloon were to run out of gas, the envelope would work as a parachute as long as the mouth of the balloon stayed open, allowing for a safe descent.

+Most balloon companies charge about $150 per person for a balloon flight.

Balloon Pilots:

-You have to be 16 years old to get a private balloon pilot's license.

+Balloons are federally registered aircraft, and balloon pilots must take several tests in order to earn their pilot's license. Balloons are regulated by the FAA(Federal Aviation Administration).

Construction:

-An average new balloon costs between $10,000 and $30,000. All balloons are made to order, so the buyer can choose the pattern and color.

=Balloons hold between 30,000 and 800,000 cubic feet of air, depending on the size of the balloon.

-The envelope of a hot air balloon is made of flame-resistant nylon fabric. The balloon is sewn on a large, approved sewing machine.

-After 500 flight hours, the fabric of a balloon 'wears out' and must be completely replaced.

--Only gas balloons carry sandbags, hot air balloons do not need to.

+Balloons are made allover the world, but most are made in the England and the United States.

Uses/History:

=Both hot air balloons and gas balloons were used during the Civil War by both sides to make observations.

--Skydivers can jump from a hot air balloon, and they occasionally do.

--People were fascinated by balloon flight in its early days, it even affected woman's fashion. Both the balloon sleeve and the hoop skirt originated because of the balloon.

--Balloons are flown allover the world. They are even popular in Mica where they are used to photograph the wildlife.

Any further questions can be directed to the Balloon Federation of America at (515) 961-8415.