

Applied Science Our Technological World



FIFTH GRADE SCIENCE AND MATH



3 WEEKS LESSON PLANS AND ACTIVITIES

APPLIED SCIENCE OVERVIEW OF FIFTH GRADE

SCIENCE AND MATH

WEEK 1.

PRE: Interpreting data from a graph.
LAB: Estimating data and comparing results on a graph.
POST: Exploring different types of graphs.
WEEK 2.
PRE: Measuring objects.
LAB: Obtaining and interpreting medical data.
POST: Researching a problem.

WEEK 3.

PRE: *Researching background information for an experiment.* LAB: *Experimenting, recording, and interpreting data.* POST: *Analyzing data on sound.*

PHYSICS

WEEK 4.

PRE: Distinguishing between electromagnetic and physical waves.
LAB: Comparing diffraction, refraction, and reflection.
POST: Interpreting the electromagnetic wave spectrum.
WEEK 5.
PRE: Discovering the components of light.
LAB: Exploring properties of light.

POST: Comparing reflection and refraction.

TECHNOLOGY

WEEK 6.

PRE: Distinguishing between incoherent and coherent light.
LAB: Analyzing laser beams.
POST: Exploring the uses of lasers.
WEEK 7.
PRE: Comparing and contrasting the different parts of the microscope.
LAB: Analyzing the focal distances in microscopes.
POST: Comparing the optics of the microscope with that of an eye.

WEEK 8.

BUILT ENVIRONMENT

PRE: Exploring how physical and electromagnetic waves are used. LAB: Comparing different light bulbs. POST: Investigating how knowledge of light and sound changes society.



PRE LAB

Students plot data on a graph.

OBJECTIVES:

- 1. Interpreting data from a graph.
- 2. Plotting data on a graph.

VOCABULARY:

data estimation interpret graph prediction

MATERIALS:

worksheet measuring tape

BACKGROUND:

Introduced students to how scientists look logically at the world. Scientists attempt to simplify and understand how the world works and use different techniques to gain this knowledge. Emphasize that before beginning a project, whether it is in the science field or not, a working plan is needed. Scientists normally predict an outcome to test an idea. In this lab, students will gain practice in prediction and estimation and learn how to present information or data. Data can either be "real" (actually derived information from an experiment or observation) or "estimated" (a general idea based on an educated guess.)

A graph is a tool that shows easily read information. To be helpful, graphs must be designed correctly. Graphs can show how things are related and how they can be compared. Go over simple graphs, and emphasize bar graphs. Have students list where they have seen graphs and charts. The list may include areas such as the stock market, newspapers, television, math books, and advertisements. Give the students a homework assignment to cut out graphs and charts from a local newspaper. They will be amazed at how many they will find.

PROCEDURE:

1. Review with students the basic philosophy of the I.Science MaTe curriculum. The Life Cycle is present on Planet Earth, because of the Water Cycle. The movement of the outer portion of the Earth created water and three different rocks (Rock Cycle) as



a result of the Plate Tectonic Cycle. This planet we call Earth has life, water, and rocks because of how we were formed LAB the Universe Cycle. Understanding the Earth and how we were formed gives scientists an insight into controlling the forces that made us.

2. See how much students remember from their last year of science. Ask them which were their favorite labs from Applied Science, Universe Cycle, Plate Tectonic Cycle, Rock Cycle, Water Cycle and Life Cycle. This helps identify students who are not familiar with the program.

3. Discuss students' perception of science by having them give their opinions on what they think science is all about. Have students list the different parts of science, like biology, geology, chemistry, or physics.

4. Using the worksheet, have students provide data so they can interpret a bar graph. Pose the following question to the class, "How many students are between 3-4 feet tall, 4-5 feet tall, and 5-6 feet tall?"

5. Then discuss how to graph this information. Students should collect data using the worksheet, plot their graphs, and then interpret the results as a class.

PRE

How tall are you? (If you don't know, use a meter stick to determine your height in centimeters.)

How many females in the class are between 100-120 cm?
How many males in the class are between 100-120 cm?
How many females in the class are between 121-150 cm?
How many males in the class are between 121-150 cm?
How many females in the class are between 151-180 cm?
How many males in the class are between 151-180 cm?
How many females in the class are over 180 cm?
How many males in the class are over 180 cm?
Using this data, make a bar graph below.

Make sure to label the horizontal (x) axis and the vertical (y) axis so the data chart makes sense.

Interpret the graph.

LAB

OBJECTIVES:

1. Estimating data and comparing results on graphs.

2. Interpreting the margin of error.

VOCABULARY:

bar graph estimation guess margin of error prediction



Students predict number of items in

a container.

MATERIALS:

2 sizes of marbles, beans, beads (you can substitute any of these items) containers or beakers (optional)

BACKGROUND:

When scientists tell others about their work, they frequently display their data using charts and graphs. Graphs and charts can be easily read and interpreted. This makes them an effective means of communication. Graphs and charts have been used since written record was developed, and graphing techniques are still used today. There are even computer graphing programs that help scientists, economists, statisticians, and many other people interpret data easily.

In this lab, students make a bar graph to record estimated quantities of items and then compare the actual amounts. Place different items in different containers or beakers. If using the module, store the materials in the plastic bags. Items can be marbles, beans, beads, or other objects.

PROCEDURE:

1. Review how to make an "educated guess." Next, have students estimate how many items they think are in only one of the containers. Record the prediction. Then have them count the items and record the information. Do one container at a time. After students complete this first part, make a bar graph of their findings. See the example below to help guide your students.

2. The margin of error reflects the difference between the actual answer and the

projected answer. Discuss how to determine the margin of error. Now have students predict and count the other containers. See if the students' margin of error is reduced. If so, students are learning that with practice they can estimate with a smaller margin of error.

PROBLEM: Can you learn how to estimate?

PREDICTION: _____

MATERIALS: 3 containers filled with items given to you by your instructor

PROCEDURE:

For each container: (1) estimate the number of items that are in the container and record, and (2) count the actual number of items it took to fill the container and record. Complete one container at a time. Record the results below.

ITEM	1	2	3
ESTIMATION			
ACTUAL NUMBER			

Plot the above data as a bar graph on the chart below as accurately as possible. The difference between the actual number and the number estimated is the margin of error (how far off the estimation was). Color the margin of error a separate color. Make the x axis estimation/actual number, and y axis the number of items.

CONCLUSIONS: Summarize your findings. Discuss your margin of error for each container. Were you close?

POST

OBJECTIVE:

- 1. Exploring different types of graphs.
- 2. Interpreting line graphs.

VOCABULARY:

extrapolate interpretation line graph

MATERIALS:

worksheet

BACKGROUND:

A graph is a pictorial presentation of a relationship among 2 or more items. Graphs can be used to easily visualize a mathematical relationship. Define the axis of a graph. Point out the vertical (y axis) and horizontal (x axis) components. In graphing, the x is considered the independent variable, whereas the y is the dependant variable (y is dependent on x). In a common example, y represents the number of people and x represents the year in which the number was counted.

Students usually see graphs that are part of a rectangular Cartesian coordinate system. This system is two dimensional. The term "Cartesian" is derived from the French mathematician and philosopher Descartes

(1596-1650) who was noted for his logical analysis and mechanical interpretation of the physical world. Cartesian coordinates help locate a point by using a reading from the x axis and one from the y axis. For instance, in the graph to the right, point A is located by finding its x and y axis.



PROCEDURE:

1. The student constructed a bar graph in lab. In this activity, students look at a line graph and ask themselves questions about the graph to extrapolate an answer. Extrapolate means that students will predict or extend how the graph will continue. The points on the graph can be read from the x and y axis.

Students interpret data on California population.



2. The worksheet revolves around the population of California. If located in another state, make this graph more representative of your area. California is now the most populous state in the United States, with about 28 million people. New York was the most populous state up until 1989. According to this graph, it looks as if California will be the leader for a long time to come.

3. Students are learning to extrapolate the future by using past data. This is a common practice in determining future trends.

4. ANSWERS: 2. increased, 3. 19 million, 4. double, 5. run out of space to live, shortage of housing, not enough food, increased use of natural resources (timber, water, oil, etc) and (5) pollution increase

CALIFORNIA'S POPULATION, 1900 - 2000



1. Connect the dots to make a LINE GRAPH.

2. From 1900 to the year 2000, has California's population increased or decreased?

3. During the year 1970, what was California's population?

4. Assuming the extrapolation the data from 1990 to 2000 is accurate, from 1960 to the year 2000, will California's population double or triple?

5. What will be the population in California in the year 2040, if its population growth continues at the rate shown in the graph above? How did you figure out the answer?

PRE LAB

OBJECTIVES:

- 1. Measuring objects.
- 2. Comparing body measurements.

VOCABULARY:

girth linear metric

MATERIALS:

ruler tape measure

BACKGROUND:

Scientists measure many things and analyze and record the data. In this exercise, students and their partners will make linear measurements on their bodies and graph the results. Measurement can be in the English system and the metric system, depending on the type of rulers and tape measurers available.

PROCEDURE:

1. Have students measure the parts of the body listed below and record the measurements. Measuring their body parts helps students learn linear measurement. Note that some of the items are more easily measured by a tape measure (ie. head size). See if the students can figure out how to measure before giving them additional instructions. After they obtain this data, have students predict which person has the largest and smallest before they look at the answer. Determine who in the class has the largest and smallest of the items measured.

2. Data obtained from the height measurement will be graphed along with the measurements of all the other students in class. By analyzing the graphed data, students will quickly be able to determine the tallest and shortest heights. Use different colors, one for girls' and one for boys' to more easily compare which group is the tallest or shortest. Have student make a legend.

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Students measure their body parts.



3. Construct a bar graph comparing boys and girls.



MEASUREMENT OF YOUR BODY

Use a ruler or tape measure and record your measurement in centimeters.

	cm
hand span	
right foot	
left foot	
right ear	
smile width	
between eyes	
right arm	
left arm	
arm span	
head size (girth)	
height	
wrist	

Measure other parts you might want to know.

LAB

OBJECTIVES:

- 1. Obtaining and interpreting medical data.
- 2. Graphing the data on a bar graph.

VOCABULARY:

astigmatism farsighted nearsighted

MATERIALS:

Snellen eye charts a piece of paper

BACKGROUND:

Physicians measure the human body to check the status of its health. They test hormone levels, size of the fetus (for pregnant women), weight, and many other parts to see if anything is going wrong with the body.

An optometrist and ophthalmologist are two types of people who determine the health of your eyes. Optometry is the measurement and science of vision care. Optometrists do not treat diseases of the eye, practice medicine, or perform surgery. Ophthalmology is the study of the diseases of the eye. An ophthalmologist or oculist is a physician who can detect and correct eye problems. Detecting problems of the eye can start with a simple test to see if a person's eyesight is normal. The test requires an understanding and interpretation of measurement.

This lab gathers data on the eyesight of your students. It may also help alert parents to their child's need for glasses. In this activity, students will measure their vision by using a simple Snellen Chart which quickly tells if a person's eyesight is normal. The chart uses letters like P, S, E, Z, and L that help determine if your eyes are impaired. The eye chart was developed by a Dutch physician, Herman Snellen, in 1863. It is designed to be viewed at 6 meters or 20 feet and the patient is asked to read off letters and numbers that get successively smaller with each line read. In the United States, we use the English system to read the chart. However, it was originally invented and is still used in most countries in the metric system. Perfect eyesight in a metric country is 6/6 and in the English system, 20/20. The vision score is expressed as a fraction determined by the last line read successfully. A score of 20/30 for example, means that from 20 feet away, you can read a line that people with normal vision can make out at 30 feet. When the second





number is larger, it means your vision is not as sharp as the norm. A score of 20/10 on the other hand, means that at 20 feet you can read letters that a person with normal vision will have to move up to 10 feet to see clearly. However, when an optometrist or ophthalmologist prescribes new glasses, it is written in the metric system related to the diameter of the lenses.

Variations of the Snellen eye chart are used to test distance vision, first without glasses and later with an assembly of lenses made to correspond to the new prescription.

Astigmatism causes a blurred vision where lines seem to merge. Without astigmatism, it is difficult to see the same thing a person with an astigmatism does.

PROCEDURE:

1. Hang several eye charts around the room (in module) and have groups of students test each other. They should record their right eye, left eye, and both eyes. Use a piece of paper to cover one eye. Students should record the information on their lab sheet. If students find they have trouble reading the chart, assure them that having glasses are only a means to see better. Mention all the great people in history who have worn glasses from Marie Curie, Einstein, and Ben Franklin to most of our presidents.

2. Use the chart for astigmatism. There are several examples of these charts on the enclosed sheet. Instruct students to look at the chart at their normal reading distance. Look at the illustrations first with one eye closed then the other. If some sections of the image look blacker or sharper than others, the student may have an irregularity in the curvature of the lens called astigmatism.







PROBLEM: How many students in the class have better than 20/20 (6/6) eyesight?

PREDICTION: _____

MATERIALS: Snellen eye chart, astigmatism chart

Measure 20 feet (6 meters) away from the eye chart. Have your partner stand on that line. Point to several of the lines on the chart and record which lines they can see and which ones they cannot. Tabulate what eyesight you think the student has. Have your instructor check your conclusion. Use your partner's lab sheet to record the information.

Partner who is recording _____

EYE	LINES THAT CAN BE READ	LINES THAT CANNOT BE READ
left		
right		
both		

Figure out your eyesight for "both" eyes. _____

Look at the astigmatism chart. Describe what you see. Do you have astigmatism?

After the class is finished with testing, the teacher should find out the following by a hand count. Record the class results.

	GIRLS	BOYS
less than 20/20		
20/20		
more than 20/20		

CONCLUSION:_____

POST LAB

OBJECTIVES:

- 1. Researching a problem.
- 2. Exploring how to get more information.

VOCABULARY:

cataracts glaucoma lens research

MATERIALS:

Internet library research worksheet

BACKGROUND:

The eye is an organ that reacts to light by sending signals to the brain. Use the enclosed sheet as an overhead, or make copies for your students.

The eye captures light and images through the lens, which then is picked up by the retina and transferred to the brain through the nerves. If this system functions correctly, a person will have normal eyesight. However, nature is not always perfect all the time, so many humans have eyes that are not perfect. Emphasize that the eye is an organ directly exposed to human mistreatment. There are many susceptible areas around the eye, including the eyelids, eyelashes, and the eye itself. Ask students how many times something gets into their eyes per week. If organisms, especially bacteria, get into the roots of the eyelashes, a local infection takes place known as a stye. Organisms are also responsible for "pink eye," which is highly contagious.

The lens of the eye is actually like a glass or plastic lens, but the material is organic and is produced by our body. The lens is not really "alive" because it doesn't require blood or other nourishment after it is made. As a crystalline lens grows, the younger layers are deposited around and on top of the older, more condensed portions of the lens. The older the person gets, the more a lens may change. A new born baby's lens is not formed completely, so a baby doesn't really see as we see LAB the first weeks of its life.

Cataracts are an overgrowth of tissue over the lens of the eye. Many cataracts are caused by the normal aging process.

Glaucoma means that there is an increased pressure within the eye. If untreated

Students research how to find information on eye diseases.



it can cause blindness. The gradual loss of nerve function causes loss of peripheral, or side, vision painlessly and without notice.

Retinitis pigmentosa (RP) refers to a group of diseases which tend to run in families and cause slow, but progressive loss of vision. The retina is the tissue which lines the inside of the eye and sends visual images to the brain.

Conjunctivitis, better known as "Pink Eye," is the medical term that describes an inflammation of the conjunctiva, the thin membrane that covers the white of your eyes. This membrane produces mucus to coat and lubricate the surface of the eye.

PROCEDURE:

1. Discuss with students what is an eye disease versus what is an variation of the condition of the eye. Be careful on discussing myopia(far sightedness - common in any given population) and hyperopia (near sightedness - common in older people), which is common reason why children have glasses. Some students may think that they have a real disease when they have glasses. A disease is something that effects the eye, either by contracting a virus or bacterial infection (i.e., pink eye) or which may be hereditary (i.e., retinitis pigmentosa). If untreated a person could go blind in some eye diseases.



2. Ask students if anyone had problems with their eyes in the LAB Lab. Discuss with them what might be the problem. Remind students that our eyes are a guide to see the world and we must take care of them. Students are sometimes unaware that their eyesight is changing, or if they may see one color for another, until an adult notices that the child may not be seeing what the normal child sees.

3. Students can research more about eye diseases using the Internet or your school library. Below are just two sites that may be helpful. Remember have students use a search engine like www. yahoo.com, to help them find out more about eye disorders. Use the worksheet to write down information.

http://www.eyesite.ca/info/02f-pub.html

This site is from the Canadian Ophthalmology Society.

http://www.eyenet.org

This site is maintained by the American Academy of Ophthalmology.

1. Below are pictures of the eye. Label each part of the eye from information derived from your research.



Write down the websites or books that helped you discover more about diseases of the eye.

PRE LAB

OBJECTIVES:

1. Researching background information for an experiment.

2. Designing an experiment.

VOCABULARY:

research sound

MATERIALS:

Internet library worksheet

Students learn to research on a

topic.

BACKGROUND:

Children always seem to have questions that many adults cannot answer. Therefore, it is important to teach children the skills to learn more about a subject. This activity uses "sound" as the vehicle to spark students' interest in this research. Many students take the gift of hearing for granted. Have students imagine a world without music, a voice, or what a bird sounds like. Violins, flutes, and other instruments were designed to capture the beautiful sounds of nature. Without sound, we cannot imitate sound. Deaf people have trouble talking because they haven't heard the sounds.

Sound is a physical wave. It actually vibrates through the air and then literally



"knocks" on our ear drum. We translate these signals into words that mean something. Sound cannot be heard in a vacuum. Living on a planet without air would mean a silent world.

PROCEDURE:

1. This activity inspires students to learn about sound and its components by conducting research at home or at the school library. Have students spend time doing "research" as a group if your school is equipped with a library or internet access.

2. This is an opportunity to introduce students to research books such as reference books and science books. For instance, "sound" can be located in several sections including physics, music, instruments, or senses.

3. In the library, internet, or as a homework assignment, have students research what sound is. Use the enclosed worksheet to help students find out about sound. After the research, discuss what students learned about sound. You will be amazed at what they can find out from books or even an encyclopedia.

4. Students should write a paragraph similar to the example below.

Blowing a flute, playing a drum, strumming a guitar, and hitting a gong will produce different types of sound. Playing an instrument makes part of it vibrate rapidly back and forth. The vibration of the instrument causes different types of waves to be transmitted to our ears. The sound wave from each instrument makes its own kind of pressure changes in the air. These vibrations are "translated" by the brain so that we can recognize which instrument is being played.

SOMETHING INTERESTING ABOUT SOUND

Sound is everywhere. We know when someone opens the door or when you are on the beach. The sounds are different. Can you explain sound. Use any book, encyclopedia or ask a knowledgeable person.



LAB

OBJECTIVE:

- 1. Distinguishing different types of sound.
- 2. Experimenting, recording and interpreting data.

VOCABULARY:

experiment frequency interpret pitch sound vibrations

MATERIALS:

tuning forks	
6 jars at each station which are the same	size
nail	
pencil	
pen	
rubber bands	

BACKGROUND:

There are two major types of waves, physical waves and electromagnetic waves. Sound waves are physical because they actually have a physical motion in the surrounding area. Light is an electromagnetic wave which will be discussed in detail in the 5th grade physics lesson. Waves represent a mechanism whereby energy is transmitted.

Sound is heard because of vibrations. Vibrations are a disturbance of the air space that mechanically moves the air. Sound cannot travel in a vacuum because there is no medium. Sound travels in a push-pull or compressional type of manner. Introduce the word "pitch." A pitch is the "highness" or "lowness" of a tone, governed by frequency. High frequency equals a high pitch sound, while low frequency equals a low pitch sound.

When a rubber band is stretched a little and strummed, it will cause little vibrations and a low pitch. If you stretch the rubber band further and strum it, they will have created a higher pitch.

PROCEDURE:

1. In this experiment, students will establish that sound needs a medium to be transferred. Students are asked to see if the sound produced by a tuning fork can be felt or heard by hitting the tuning fork and touching it to the nose, hand, nail, paper, pencil, pen and cup of water.

2. Students should feel a "tingling" feeling when the tuning fork's tines touch their bodies. The nose is the most sensitive. The nail, pencil, and pen will just vibrate. The papers should give a humming sound. The vibrating tuning fork sets up vibrations in the water. The spot where the tuning fork hits the water is similar to the focus of an earthquake or the point where a pebble enters the water.

3. In the next activity, students are asked to look at 6 similar jars and fill them with different amounts of water. Different amounts of water in a jar will produce different sounds. Students should only use a stick or pencil to tap the jars, and then record their findings. The more liquid in the jar, the lower the pitch. Have students arrange the jars from lowest to highest pitch.

4. Students have learned that sound is a physical wave and is transmitted through substances in different ways.

PROBLEM: How can you determine if sound is a physical wave? **PREDICTION:**

PROCEDURE:

MATERIALS: 6 jars (same size); water, stick, tuning forks

EXERCISE I. Stretch a rubber band to different lengths and describe what happens to

the pitch of the sound _____

EXERCISE II. Hit the tines of the tuning fork on a hard surface and touch the tines to the items listed below. Record what happens and see if you can hear the tuning fork.

ITEM	WHAT HAPPENS	CAN YOU HEAR
nose		
hand		
nail		
paper		
pencil		
pen		
surface of water		
other:		

EXERCISE III. Using 6 jars, fill each with the appropriate amount of fluid in the chart below. Record the type of sound produced when you tap it with a drumming stick. Describe the quality of the pitch.

JAR CONTENTS	DESCRIPTION OF SOUND
A. empty	
B. 1/4 full	
C. 1/3 full	
D. 1/2 full	
E. 2/3 full	
F. 3/4 full	

CONCLUSIONS: Do the above experiments illustrate that sound is a physical wave? What else did you learn?

POST LAB

OBJECTIVE:

- 1. Applying knowledge learned from experiment.
- 2. Analyzing data on sound.

VOCABULARY:

analyze application results

MATERIALS:

worksheet

BACKGROUND:

What we hear from all musical instruments is produced by sound waves. A sound wave is a form of a physical wave. A wave is a disturbance caused by the movement of energy from one place to another. The ability to sense sound is not only essential for survival, but is also a source of pleasure.

Instruments which produce sound have been around since the dawn of mankind. The earliest instruments were various kinds of percussion producing instruments in the form of drums, which were struck by the hand or sticks. String instruments and woodwinds came later.

When a person listens to music he or she hears many different sound waves. Waves that occur together may change each other by the process of interference.

The difference between pleasant musical sounds and noise results from interference. You are able to hear a radio or "boom box" playing in the next room because waves are able to move around a barrier such as a wall or door because of diffraction.

The pitch or tone of an instrument results from the frequency at which the instrument vibrates. Higher pitched instruments such as violins and flutes vibrate at higher frequencies. Lower pitched instruments such as tubas or bass violins vibrate at lower frequencies.

Students have completed some research on sound and have conducted some experiments. Now try to use their knowledge of sound to create descriptive terms. In literature, sound cannot be heard in the pages of a book. Authors must depend on the power of descriptive language to convert the correct sound. In the English language, many of these terms help readers understand sound. Different languages sometimes use other terms because the sound of their letters are different than those in English.



Students use a worksheet to

describe sounds.

PROCEDURE:

1. Depending on your student's writing skills, have them write a sentence or paragraph using as many "sounds" as they can.

2. Use the worksheet to write the sentence or poem. The different instruments can help students think about the many different sounds that can be produced. You may want to see how many instruments the students can identify.

3. Listed below are examples of sounds. Continue the list if students want to add more examples.

WHISPERING OF TREES
WHISTLING OF WIND
PATTER OF RAIN
GURGLING OF RUNNING WATER
BARKING OF DOGS
HUMMING OF WIRE
ROARING OF LIONS
HISSING OF SNAKES
CRACKLING FIRE
SCREAMING OF GULLS
BLATTING OF GOATS
RUMBLING OF EARTHQUAKES

