Classroom Adventures

TEACHER ENRICHMENT RESOURCE PACKET

Light and Sound

A *Classroom Adventure* for 1st and 4th Grades

Experiment with the wave nature of light and sound. Use patterns of light and sound to send coded messages. Use light, heat, sound and electricity as forms of energy.

what's inside

Think it.
Try it.
Explorit.

Welcome

Thank you for choosing Explorit Science Center's Classroom Adventures to supplement your ongoing science curriculum. Whether you use the program to kick off a new unit, wrap up a nearly completed unit, or purely to excite and interest your students in the wonderful world of science, advance preparation and follow up with your students are critical to achieve the greatest educational benefit from this unique science experience.

Explorit provides two resources to help prepare you and your students for Classroom Adventures. First, simple logistics of the program are detailed in the confirmation letter. Second, this Teacher Enrichment Resource Packet outlines appropriate science content and processes to help you:

- successfully prepare your students prior to Explorit's visit;
- participate fully in the *Classroom Adventure* yourself; and
- follow-up with your students after Explorit leaves.

Learning Objectives

Learning objectives provide a broad overall guide to what students will begin to experience and understand through participation in Explorit's Light and Sound Classroom Adventure designed for Grades 1 and 4. During this program, students will:

- experiment with the properties of light including light's ability to travel through transparent and translucent objects;
- experiment with the properties of sound including its wave nature;
- understand how coded patterns of light and sound can be used to transmit information; and
- use heat, electricity, light, and sound to make motion.

Science Standards

Explorit Science Center's Classroom Adventures programs address concepts teachers need to teach under the Next Generation Science Standards. The alignment of Classroom Adventures with the science standards allows you, the teacher, to bring exciting fun-filled science experiences to your students while at the same time fulfilling your requirement to teach particular science content and processes. For specific science standard concepts covered by Light and Sound, refer to Science Standard Alignment, page 8.

Our Mission:

To ignite and foster curiostiy about science and nature through inquiry and discovery.

Background Information

Vision and hearing are two of the primary tools young scientists use to explore their world. The properties of light and sound, how they travel, how they transmit energy, and how we use them for communication are the discoveries that await your students in Explorit's Light and Sound Classroom Adventure program. Light and sound are some of the most basic, but also most baffling, aspects of our world. The study of light and sound provides an opportunity for students to practice the processes used by scientists. As part of this program, students will use some or all of the following science skills: observing, communicating, comparing, testing, quantifying, and asking questions.

Ridin' the Wave

Light, like sound, travels as a wave. But light can also act like a particle. This dual nature of light is called the "wave-particle duality" and is a wonder of physics. As a particle, light can bounce off of a mirror and be reflected back in a different direction. Blocking the movement of light particles creates a shadow. As a wave, light can bend into a rainbow. Particles and waves are two ways of explaining light's behavior.

Fabulous Physics Fact:

"Ultrasonic" refers to any sound that with a frequency above the range of human hearing (above 20,000 hertz)!

Sound also travels in waves. Sound waves are vibrations that travel through a medium such as air or water. A vibrating object makes a sound, and sound makes objects vibrate. Sound waves can be measured in terms of frequency and wavelength. Frequency refers to how many waves pass a given point in a second. Frequency is measured in hertz. Wavelength refers to the distance between a given point on a sound wave (for example, the crest) and the corresponding point on the next wave.

What do light and sound have to do with energy?

Anything that moves uses energy, and light and sound are no exception. When a ray of light shines through a window or a sound wave strikes your eardrum, energy is being used. But energy can never be lost or destroyed; it can only be transferred to another object or changed into another form. Stretch out a rubber band, then pluck it with your finger. You'll hear its sound, but you'll also see and feel the vibrations created by the energy of that sound.

Light energy travels in particles called "photons", which scientists describe as tiny energy packets. When a beam of light shines on an object, the photons that make up that light transfer their energy to the object. That's how our skin gets sunburned.

Plants also use the energy of light to make their own food through photosynthesis. Radiation, microwaves, and solar power all capitalize on the energy of light.

Background Information
continued

What about communication?

As they travel, light and sound can communicate information over long distances; the key is in their pattern.

An excellent example of using patterns to communicate is Morse code. Relying on a series of short and long signals that correspond to the letters of the alphabet and Arabic numerals, Morse code messages can be sent with audio tones, light flashes, or pulses of electricity.

Amazing Animals Trivia:
Insects range in length from less than 1/100th of an inch to over 14 inches.

Named for Samuel F.B. Morse, the creator of the telegraph, the first version of Morse code made its debut in 1836. The code has been refined and modified in the years since. International Morse Code, the current standard, was adopted in 1865, and played a critical role in military communications throughout the twentieth century.

Another great example of coded communication is binary code. Binary code reduces text or computer instructions into a series of 1s and 0s, and is the basis of modern computer coding. Binary coding using two single-digit numbers was first developed in the seventeenth century, but other forms of binary code using light and dark or long and short sounds have existed from the ancient world. Morse code is one form of a binary code. Braille is another.

Most communication codes rely on either auditory or visual transmission, making use of the wave nature of light and sound to transfer not only energy, but also information.

Amazing Animals Trivia:
Almost one million species of insects have been discovered, about 3 times the number of all other animal species combined!

Animals must be able to take in oxygen in order to survive. Depending where they live, animals have vastly differing breathing adaptations. Animals that always live in water must be able to breathe in water. Fish have gills which allow them to absorb oxygen from the water. Whales, on the other hand, have lungs. Whales must be able to hold their breath for long periods of time so they can obtain food, but still must come up to the surface to breathe. Frogs present an interesting example of an animal that breathes in water with gills in its early stages, but later loses the gills and as an adult develops lungs to breathe outside of the water.

CONCLUSION

Through Explorit's **Amazing Animals** program, students will explore a wide array of animals with their vastly differing features and unique adaptations to various habitats. Students naturally seem to enjoy investigating animal life. Let's all help build upon this existing interest in the animal world.

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Vocabulary

This list includes words that may be used during *Classroom Adventures*. Specific vocabulary used depends on students' grade level and prior knowledge.

Adaptation - modification of a species' characteristics over time in a way that increases its chances of survival in a particular habitat.
Animal - an organism that can usually move freely and obtains food from other organisms or their byproducts.
Aquatic - living in water.
Backbone - the column of vertebrae encasing the spinal cord. Also called spine.
Camouflage - coloration, shape, or behavior that allows an animal to be hidden against its surroundings.
Carnivore - animal that eats other animals.
Domesticated - raised or used by humans.
Ecologist - a scientist who studies the interrelationships of living things to one another and their environment.
Ecosystem - an interacting system of living organisms and nonliving parts of the environment; the place where these interactions take place.
Ectothermic - an animal that cannot internally maintain a constant body temperature and thus must move between warm and cold places to regulate their body temperature. Also called cold-blooded.
Endothermic - an animal that can maintain a constant body temperature independent of the outside temperature. Also called warm-blooded.
Extinct - no longer exists.
Food chain - the transfer of food energy from one organism to another.
Food web - a network of interconnected food chains.
Habitat - an animal's immediate natural surroundings or environment, containing an arrangement of food, water, shelter or cover, and space that meets the animal's needs.
Herbivore - animal that eats plants.
Invertebrate - animal that does not have a backbone.
Omnivore - animal that eats both plants and animals.
Predator - an animal that kills and eats other animals.
Prey - animals that are killed and eaten by other animals.
Species - a distinct kind of animal that is able to breed and produce fertile offspring under natural conditions.
Terrestrial - living on land.
Vertebrate - animal with a spinal column (backbone) and a cranium (brain case). Fish, amphibians, reptiles, birds and mammals are all vertebrates.
Wild - not raised by humans.

Amazing Animals Trivia:
A snake's flexible spine contains 200-400 vertebrae, each attached to a pair of ribs; the human body has only 24 movable vertebrae.

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Classroom Activities

For your convenience, the following activities can be used as you deem most appropriate to integrate Explorit's **Amazing Animals** into your ongoing curriculum. The activities are grade-level appropriate, but please note that this program is designed for a broad grade range (K-4) and thus all activities may not be appropriate for every group of children. Choose those activities that will work well for your students.

ACTIVITY #1: "SO MANY ANIMALS, SO MANY PLACES"

Materials:
- old magazines
- scissors

Science Standards:
- Life Science
- K: 4 a, c
- First: 2 a, c
- Second: 2 c
- Third: 3 a, b
- Investigation & Experimentation
- K: 4 a
- Second: 4 g

Objective: To compare and classify various animals in different environments; to discuss how animals adapt to their environment for survival.

Procedure:

1. Have students cut out as many pictures of animals as possible from magazines or the internet. Try to be sure the animals come from all over the world and from as many habitats/environments as possible.
2. Once you have a large collection of animal pictures, talk about how the animals are the same or different. Depending on your students' grade level, classify (group) the animals according to whether they are: 1) wild or domestic; 2) terrestrial or aquatic; 3) mammals, birds, fish, amphibians, reptiles or invertebrates (older students can further classify the invertebrates, too); or 4) cold-blooded or warm-blooded. Consider finding a place in your classroom to display your animal groups throughout your entire unit.
3. These same animal pictures may be used to discuss the various habitats/environments in which the animals live, the adaptations each animal has to survive, etc. Once you talk about habitats and adaptations you may wish to combine animals together according to their habitat and/or adaptation. For example with respect to habitats, you may wish to create separate groups for oceans, deserts, tundra, forests, grasslands and wetlands. For adaptations, you might make groups for camouflage, breathing with gills, etc.

ACTIVITY #2: "AMAZING ANIMAL ADAPTATIONS"

Materials:
- clock
- tape measure
- scales

Science Standards:
- Life Science
- First: 2 a
- Second: 2 c, d
- Third: 3 a, b
- Investigation & Experimentation
- First: 4 b
- Second: 4 g

Objective: To understand animal adaptation and discuss the variety in animal life.

Procedure:

1. Talk with your students about the variety of animal life. Animals come in all shapes and sizes, with all kinds of adaptations to help them survive. Don't forget to remind the students that humans are animals, too.
2. Have a "contest" to see how your students stack up against some other animals. Here are some events to have in your "contest." Feel free to add other events as you learn about many other animals.
   a. *Wing Workou*t: Have the students hold out their arms to the sides as if they were birds' wings. Make sure the students have plenty of room so that they do not bump into each other. Have the students flap their arms as fast as they can. How fast can they flap? Time them to see how many flaps they can make in ten seconds. Talk with your students about how a crow flaps its

Classroom Activities
continued

wings about 20 times every 10 seconds, a pigeon 30 times in 10 seconds and a chickadee 270 times in 10 seconds. Try flapping again. Can your students flap as fast as these birds? Now let your students know that a hummingbird flaps 700 times every 10 seconds. Can you imagine?

b. *Flea Jump*: Have your students try a standing broad jump (i.e., jump as far as they can from a standstill). Measure how far each student jumps. Compare the ratio of the jump length to the student's height. You may even want to take an average of all the students' jump lengths and compare it to their average height. Now let your students know that a tiny flea can jump about 200 times the length of its body. How do your students' jumps compare to a flea's jump?

c. *Weight-a-Minute*: Talk with your students about which animals they think might be some of the heaviest animals in the world. Let them know that the largest land mammal is the African elephant, which weighs up to 6.5 tons (13,000 lbs). Weigh each student in your class. Have the students add all their weights together. Does the whole class weigh as much as an African elephant? Do all the students in their grade level weigh as much as the elephant? All the students in the school? What are the advantages of being so large? Disadvantages?

3. This activity helps students understand some amazing animal adaptations. Clearly, humans cannot hold their breath as long as a whale, flap their arms as fast as birds can flap their wings, jump comparatively as far as a flea, or weigh remotely as much as an elephant. Talk with your students about whether humans need to be able to do these things. What human adaptations allow us to survive in our habitat/environment?

ACTIVITY #3: "INVENT AN ANIMAL"

Objective: To invent an animal, considering its adaptation, behavior, and environment.

Procedure:

1. Have your students write or draw about: 1) an imaginary animal; 2) the habitat in which it lives; and 3) adaptations that allow it to live in that habitat. Encourage creativity in your students. Even though they create an imaginary animal, they must justify why their animal has the particular adaptations it has and what in its habitat makes it necessary to have these adaptations.
2. For younger students, working with just one adaptation will be enough. For older students, you may encourage them to describe more than one adaptation. You may wish to focus your students on a particular aspect of animal survival; you could have your students focus on an adaptation that will allow the animal to find food, or an adaptation that will allow the animal to move about.
3. After the drawings/writings are complete, have your students choose a name for their animal that relates to the animal's unique adaptation.
4. As an extension, you may wish to have your students create a "sculpture" of their animal.

Materials:
paper or journal
pencils
crayons
sculpting materials: clay, paper, glue, pipe cleaners (optional)

Science Standards:
Life Science
First: 2 a, b
Third: 3 a
Investigation & Experimentation
K - Fourth 1.

Supplemental Resources

BOOKS

Burnie, David. **How Nature Works: 100 Ways Parents and Kids Can Share the Secrets of Nature**. The Reader's Digest Association, 1991. *Contains easy to follow instructions along with clear illustrations of activities.*

GEMS Series. **Terrarium Habitats**. Lawrence Hall of Science, 2000. *Excellent unit for grades K-6; www.lhs.berkeley.edu/GEMS. See also Aquatic Habitats for grades 2-6. Spanish version available for some units.*

Kneidel, Sally. **Creepy Crawlies and the Scientific Method: Over 100 Hands-on Science Experiments for Children**. Fulcrum Publishing, 1993. *Great resource to teach children ages 5-12 about the scientific method.*

National Wildlife Federation. **Ranger Rick's NatureScope**. Learning Triangle Press, 1998. *Contains many ready-to-use activities.*

Project WILD K-12 Curriculum & Activity Guide, 2000. *Creative activities to teach about animals/habitats. Only available through workshops contacting Department of Fish and Game, Project WILD Coordinator. See below.*

Taylor, Barbara. **Animal Hide and Seek**. Dorling Kindersley, 1998. *Depicts differing habitats and the animals that live in them.*

VanCleave, Janice. **Ecology for Every Kid: Easy Activities That Make Learning Science Fun**. John Wiley & Sons, 1996. *Easy-to-do activities.*

Visual Dictionary of Animals. Dorling Kindersley, 1991. *Excellent photos.*

WEB SITES

Kid's Planet ESPECIES Web Site

http://www.kidsplanet.org/factsheets/map.html

Factsheets on over 50 different animal species in the world. Information regarding the Endangered Species Act.

Project Wild Web Site

http://www.projectwild.org

Excellent K-12 curriculum on wildlife and their habitats. Includes, aquatic life.

World Almanac For Kids Web Site

http://www.worldalmanacforkids.com/explore/animals.html

Includes a directory on various animals; good background information regarding animals and their habitats.

National Zoo Web Site

http://nationalzoo.si.edu

Includes information on all of the zoo's animals, and some live animal webcams!

Science Standards Alignment

Below is the exact language of California's science standards that Explorit's **Amazing Animals** program addresses either during our visit to your classroom or through materials in this Teacher's Packet that you may use.

CALIFORNIA SCIENCE CONTENT STANDARDS

Life Sciences

Grade K: 2. Different types of...animals inhabit the Earth. As a basis for understanding this concept, students know: a. how to observe and describe similarities and differences in the appearnance and behavior of...animals (e.g., birds, fish, insects). c. how to identify major structures of common...animals (e.g., arms, wings, legs)."

Grade 1: 2. [A]nimals meet their needs in different ways. As a basis for understanding this concept, students know: a. different...animals inhabit different kinds of environments and have external features that help them thrive in different kinds of places. b. animals...need water; animals need food.... c. animals eat plants or other animals for food and may also use plants or even other animals for shelter and nesting. d. how to infer what animals eat from the shapes of their teeth (e.g., sharp teeth: eats meat; flat teeth: eats plants).

Grade 2: 2. [A]nimals have predictable life cycles. As a basis for understanding this concept, students know: c. ...Some characteristics are caused by, or influenced by, the environment. d. there is variation among individuals of one kind within a population.

Grade 3: 3. Adaptations in physical structure or behavior may improve an organism's chance for survival. As a basis for understanding this concept, students know: a. animals have structures that serve different functions in growth, survival, and reproduction. b. examples of diverse life forms in different environments, such as oceans, deserts, tundra, forests, grasslands, and wetlands. c. living things cause changes in the environment where they live; some of these changes are detrimental to the organism or other organisms, whereas others are beneficial. d. when the environment changes, some...animals survive and reproduce, and others die or move to new locations. e. some kinds of organisms that once lived on Earth have completely disappeared; some of these resembled others that are alive today.

Investigation and Experimentation

Grades K-2, Concept 4 / Grade 3, Concept 5 / Grade 4, Concept 6:
Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept, and to address the content in the other three strands, students should develop their own questions and perform investigations.

Explorit's Classroom Adventures *involve students' use of many science process skills. For grade level specific skills, see California Science Content Standards at www.cde.ca.gov/board.*

Explorit Programs for Schools and Groups

At Explorit's Site

Discovery Lessons & Labs Visit one or more of the Changing Exhibitions throughout the year
Nature Safaris & Labs Visit Explorit's outdoor spaces at Mace Park Branch

Explorit in Your Classroom

Classroom Adventures Explorit educators visit your classroom for hour-long presentations
Young Scientist Series Science investigations through multiple visits

For the Whole School

Health in Your World Learn about keeping your body and the world healthy and safe
Science in Your World The ultimate family science night
Science Assembly A multimedia presentation for the whole school

Reservations required.
For information please call
530.756.0191

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