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10 Environmental Science Activities for Under Resourced Classrooms

Introduction

Integrating environmental education in classrooms need not be difficult. Nature herself is the greatest teacher. It is after all in nature that humans discovered patterns and rules that then built human society as we know it. All we did was observe.

Thus, here is a collection of ten engaging and exciting science activities that can easily be completed in under resourced classrooms. From creating bio gas to tadpole transformation and finding invertebrates, these activities will introduce students to the wonders of the natural world and encourage them to explore their environments.

Each activity is accompanied by

- A guide
- Materials needed
- Other resources
- A list of possible subjects to integrate each activity with
- Possible extensions, and;
- A brief explanation of the underlying science

Who is this activity guide for?

This activity guide is for teachers of early years and lower primary across all subjects. Each activity is perfectly suited for ages five and up. Older children too can benefit from these activities.

The "Science Behind the Activity" section is a quick teacher resource in order to teach the material effectively in line with their subject. One need only be creative on how to merge each module with learning outcomes.

Acknowledgments

The shape of this document and some ideas and information were inspired by Liz Lee Heinecke's book *"Outdoor Science Lab for Kids - 52 Family Friendly Experiments For the Yard, Garden, Playground and Park"*.



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1. Biogas from a Banana

What better way to learn about biogas than by creating it yourself from a banana! With just a few simple materials, students can create their own mini biogas generator and investigate the science behind it. In addition to learning about the important role of biogas in energy production, students will also learn about decomposition, chemical reactions, and the importance of conservation.

Integration: This activity can be used for science, social studies and environmental studies

Materials Need

1. One small plastic bottle
2. One balloon
3. A banana peel
4. Water



Activity Guide

1. Place the banana peel in the water bottle
2. Fill the bottle with water all the way to the brim
3. Put the balloon over the opening of the bottle, making sure it's secure
4. Wait several days until the balloon inflates. Ask students to make observations on a daily basis in a journal
5. When the balloon is full, carefully remove it from the bottle, tie it off and touch it to your nose to smell the biogas

Possible Extensions

1. Set up multiple bottles with different variables to test how they affect biogas production, such as temperature, light exposure.
2. Explore the impact of biogas on energy production and conservation
3. Explore the impacts of landfills as anaerobic environments that contribute to greenhouse gases that causes global warming

Science Behind The Activity

During the banana peel activity, a chemical reaction takes place between the acids in the banana peel. This reaction produces carbon dioxide gas, which gets trapped inside the balloon, causing it to inflate. This hands-on activity not only engages students in a fun experiment but also introduces them to the concepts of anaerobic digestion, gas production, and the potential applications of biogas in sustainable energy practices.

Here's a breakdown of the science behind this experiment:

Anaerobic Digestion

The banana peel contains organic matter, primarily carbohydrates. When submerged in water and sealed inside the bottle, it creates an anaerobic (without oxygen) environment. Microbial Activity:

Naturally occurring bacteria on the banana peel start to break down the organic material through a process called anaerobic respiration. These microorganisms consume the carbohydrates and produce byproducts such as carbon dioxide and methane gas.

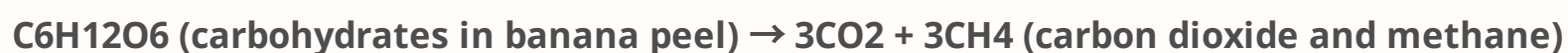
Gas Production

Methane gas is a byproduct of anaerobic digestion. As the bacteria break down the organic matter, they release methane, which is lighter than air. This gas begins to accumulate in the sealed environment of the water bottle.

Balloon Inflation

The balloon is placed over the opening of the bottle to capture the gases produced during anaerobic digestion. As methane gas is released, it inflates the balloon, demonstrating the production of biogas. Chemical Reactions:

The overall chemical reaction during anaerobic digestion can be summarized as the breakdown of complex organic compounds (carbohydrates in the banana peel) into simpler compounds, such as methane and carbon dioxide.



Smelling Biogas

Methane is odorless, but the balloon may contain traces of other gases produced during the process. When you touch the balloon to your nose, you may detect a faint smell. This smell could be a result of other compounds produced during the microbial breakdown of the banana peel. Application to Real-world

Biogas Production

This simple experiment can be extended to discuss the real-world applications of anaerobic digestion. Biogas, primarily composed of methane, can be harnessed and used as a renewable energy source for cooking or heating in some settings. This can also be used to talk about the effects of landfills on the atmosphere as more methane is produced globally.

2. Finding Macro-invertebrates in a Garden

Looking for macro-invertebrates in a garden is a fun and engaging activity that introduces students to the wonderful world of mini-beasts. Not only will students learn about different types of invertebrates, but they'll also learn about the important role they play in our ecosystems, and the interconnectedness of all living things.

Integration: This activity can be integrated with science, geography and languages

Materials Needed	Activity Guide	Possible Extensions
<ol style="list-style-type: none">1. One garden bed/outdoor space2. A plastic pot or tray3. A trowel or small spade or plastic spoons or just your hands!4. Gloves (if required)5. A magnifying glass or hand lens (not required if not available)6. (Optional) 1/3 cup ground mustard & 4 Litre water (pour over the ground to cause earth worms to come to the surface)	<ol style="list-style-type: none">1. Introduce the idea of the mini-beasts and their place in the garden ecosystem2. Give each student a pot or tray and a small spade, and ask them to dig for invertebrates in the garden bed or look for hm in water3. Encourage students to observe, identify and compare different types of invertebrates using their magnifying glass (if available)4. Draw and record observations and findings, including unusual features. Generate individual fact sheets about each	<ol style="list-style-type: none">1. Research and analyze the different roles of invertebrates in an ecosystem with a identification key2. Create a macroinvertebrate poster to share with the local community and draw attention to the importance of mini-beasts, their habitat preservation and restoration3. Ask students to sit in a circle and talk about how to be gentle with animals that usually are considered 'icky'. Emphasize the importance of respecting and appreciating all forms of life, regardless of their appearance.



Science Behind The Activity

Invertebrates are a diverse group of animals that lack a backbone. They play crucial roles in garden ecosystems, contributing to soil health, nutrient cycling, and pollination. This activity aims to introduce students to the fascinating world of invertebrates, emphasizing their importance in maintaining a balanced and healthy environment.

Invertebrates include a vast array of organisms such as insects, spiders, worms, and snails. These creatures are essential for the following reasons:

Pollination

Insects like bees and butterflies play a crucial role in pollinating flowers, enabling the reproduction of many plants.

Decomposition

Invertebrates such as earthworms and beetles contribute to the breakdown of organic matter, enriching the soil with nutrients.

Food Source

Many birds, reptiles, and mammals rely on invertebrates as a primary food source, contributing to the overall biodiversity of ecosystems.

Ecosystem Balance

Macroinvertebrates help maintain the balance of ecosystems by controlling populations of other organisms, preventing overgrowth or infestations. Scientists do regular macroinvertebrate surveys because the number and diversity tells us about the health of ecosystems.

By exploring and understanding invertebrates, students gain valuable insights into the intricate web of life in the garden and the broader natural world. This activity fosters a sense of curiosity, respect for biodiversity, and the importance of conservation.



3. Tadpole Transformation

Watching tadpoles grow and develop into frogs is a great way for students to learn about the concept of metamorphosis, life cycles and the importance of adaptation. Students will be able to observe the changes that occur as the tadpole transforms and learn how environmental factors, such as water quality and temperature, can affect the survival and development of aquatic organisms.

Integrations: This activity can be used as part of science, languages, art and wellbeing

1 Materials Needed

1. Glass box or clear jar
2. Tadpole eggs or live tadpoles
3. Water with suitable oxygenation and sunlight
4. Green lettuce boiled for 5 minutes and finely chopped (tadpole food)

Other Resources

1. [How to take care of tadpoles](#)
2. [Frog lifecycle poster](#)

2 Activity Guide

1. Set up an aquarium or clear jar with water and live tadpoles or tadpole eggs. You can collect these from a nearby pond
2. Over time, observe and document the changes that occur as the tadpoles go through the stages of metamorphosis into frogs.
3. Discuss the environmental factors that may impact their growth and development and compare the changes in different growth rates or species.
4. Create and label diagrams/create a story of the growth stages of a tadpole

3 Possible Extensions

1. Compare and contrast life cycles of different organisms, noting similarities and differences with the frog's life cycle
2. Explore the adaptations that occur in different stages of the frog's life cycle, and how these adaptations help them survive in their environment
3. Discuss how different events/experiences in people's lives can also cause them 'metamorphosize'. Discuss how people can change positively

Science Behind the Activity

Metamorphosis is a biological process wherein an organism undergoes a profound and often dramatic transformation in its physical form and structure during its life cycle. This phenomenon is particularly notable in insects, amphibians, and some other organisms, involving distinct stages such as larval and adult phases, each adapted to different ecological roles and environments. Metamorphosis allows for adaptations to changing conditions and is crucial for the survival and reproduction of various species.

Metamorphosis is crucial for the survival of frogs, allowing them to exploit both aquatic and terrestrial habitats during different stages of their life cycle. This adaptation enhances their ecological flexibility and reproductive success. In summary, tadpole metamorphosis is a complex biological process driven by a combination of genetic, hormonal, and environmental factors. It represents a remarkable transformation from an aquatic larval form to a terrestrial adult, enabling frogs to thrive in diverse ecosystems.

The metamorphosis of tadpoles into frogs is a fascinating biological process that involves significant structural and physiological changes. Here's a brief explanation of the science behind tadpole metamorphosis:

Life Cycle of Frogs

Frogs undergo a unique life cycle known as metamorphosis, which consists of distinct stages: egg, tadpole, metamorphosing tadpole, and adult frog.

Egg Stage

The life cycle begins with the laying of eggs by adult frogs in water. The eggs hatch into aquatic larvae known as tadpoles.

Tadpole Stage

Tadpoles are adapted for an aquatic lifestyle. They have gills for breathing underwater, a tail for swimming, and a mouth adapted for herbivorous feeding. During this stage, tadpoles primarily consume algae and plant matter.

Initiation of Metamorphosis

Metamorphosis is triggered by both internal and external factors. External factors include environmental cues like water temperature and the availability of food. Internally, hormonal changes play a crucial role in initiating metamorphosis.

Growth of Limbs

One of the early signs of metamorphosis is the development of hind limbs, followed by the growth of forelimbs. The limbs gradually replace the tail, marking the shift from an aquatic to a terrestrial lifestyle. Changes in Respiration

As the frog develops lungs, it undergoes a transition from gill respiration to lung respiration. This adaptation allows the frog to breathe air in its adult form.

Digestive System Changes

The digestive system undergoes modifications to accommodate a change in diet. Tadpoles are primarily herbivores, while adult frogs are typically carnivorous.

Tail Resorption

The tail, which was crucial for swimming in tadpoles, is gradually absorbed or resorbed as the frog develops limbs and transitions to a land-based lifestyle.

Skin Changes

The skin of the tadpole is thin and permeable, suited for an aquatic environment. In the adult frog, the skin becomes thicker and more protective, featuring glands that secrete mucus to keep the skin moist.

Completion of Metamorphosis

The entire process of metamorphosis, from the initiation of limb growth to the resorption of the tail, culminates in the emergence of a fully formed, terrestrial adult frog. The length of this process can vary among species.

Other organisms that go through metamorphosis are butterflies, spiders, salamanders and cockroaches.

4. Creating Mandalas from Natural Sources

A great way to combine art and science is by creating mandalas using natural materials found outside. Not only do students get to flex their artistic muscles, but they'll also learn about patterns, geometry, and the importance of the natural world.

"Mandalas are where art, math, and science meet."



Materials Needed

1. Various natural materials such as leaves, twigs, flowers, rocks, and berries.
2. A designated space for students to work
3. Glue or adhesive (optional)

Activity Guide

1. Show examples of mandalas and talk about the concept and symbolism behind them.
2. Give each student a designated space to work and have them collect natural materials from outside, encouraging them to observe and appreciate the natural forms and shapes of each object.
3. Students can then create their own mandalas using the materials they have collected.
4. Ask them to present how they thought of their piece and what led them to create their design. Did they notice patterns in nature while they were searching for materials? (look closely at materials to see if there are any patterns on each)

Possible Extensions

1. Research and analyze the different cultures and religious traditions that incorporate mandalas
2. Explore the patterns and geometry found in the natural world and how they are used by different organisms for survival
3. Create a class display or publication of the finished mandalas and their corresponding scientific explanations.



The Science Behind this Activity

Mandalas are geometric designs that typically form a circular pattern, originating from spiritual and cultural traditions. Creating mandalas from natural materials provides students with a meaningful and meditative artistic activity. The process of collecting and arranging elements like leaves, stones, or flowers into a harmonious design fosters a connection with nature, encourages mindfulness, and allows for creative expression. It can also promote ecological awareness by highlighting the beauty and diversity of natural materials, fostering a sense of respect for the environment.

Mandalas hold spiritual significance in various cultures and belief systems, often representing a symbolic expression of the universe, unity, and the self. Several reasons contribute to the spiritual importance of mandalas:

Symbolism of Wholeness

Mandalas are often circular, representing the cyclical nature of life, eternity, and the universe. The symmetry and balance in mandala designs symbolize a sense of wholeness and completeness.

Spiritual Connection

Creating or meditating on mandalas is considered a spiritual practice in many traditions. The process of constructing a mandala can be a form of meditation, leading individuals to a deeper connection with their inner selves and the spiritual realm.

Sacred Geometry

Mandalas often incorporate sacred geometry, such as circles and triangles, which are believed to have inherent spiritual significance. These geometric patterns are thought to tap into universal principles and cosmic order.

Overall, symmetry in nature is a result of inherent physical and biological processes that optimize form and function. It reflects the inherent order and organization present in the natural world, from the microscopic to the macroscopic scale.

Meditative Focus

Engaging in the creation or contemplation of mandalas is a meditative practice. The repetitive and intricate nature of designing a mandala helps individuals focus their minds, quiet mental chatter, and achieve a state of mindfulness or spiritual awareness.

Expressing the Divine

Mandalas are sometimes viewed as a representation of the divine, reflecting cosmic order and the interconnectedness of all life. In this context, creating or contemplating mandalas becomes a way to express spirituality and divine harmony.

Healing and Transformation

Mandalas are believed to have therapeutic effects on the mind and spirit. The act of creating or experiencing a mandala can be a transformative process, providing a sense of inner peace, healing, and spiritual growth.

Cultural and Religious Significance

Mandalas are integral to various religious and cultural practices, such as Hinduism, Buddhism, and Native American traditions. In these contexts, mandalas may serve as sacred art, ritual tools, or representations of cosmological and spiritual concepts.

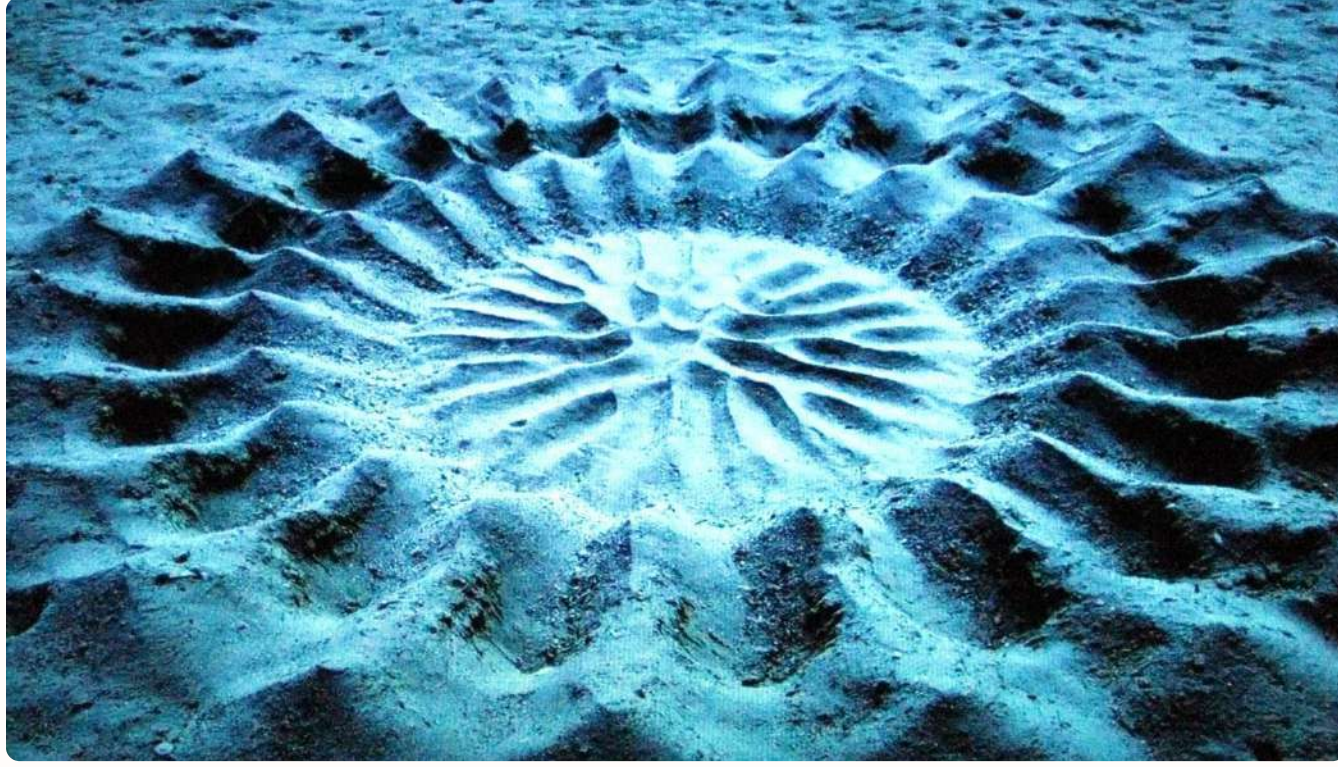
Personal Journey

Mandalas can be seen as a reflection of one's personal journey or spiritual path. Through the creation of a mandala, individuals may explore and express their inner thoughts, emotions, and connections to the divine.

In summary, the spiritual importance of mandalas lies in their symbolic representation of unity, wholeness, and the connection between the individual and the cosmos. Whether used in religious rituals, meditation practices, or personal expression, mandalas offer a powerful means of exploring and cultivating spirituality.

Mandalas continued..

Symmetry is a fundamental and prevalent aspect of nature, observable across various scales and in diverse living and non-living systems. Here are several ways in which symmetry manifests in nature:



Bilateral Symmetry

Many animals exhibit bilateral symmetry, meaning their bodies can be divided into two mirror-image halves. Examples include butterflies, humans, and fish. This symmetry often relates to the efficient organization of body structures for movement and function.

Radial Symmetry

Some organisms, particularly invertebrates like starfish and jellyfish, display radial symmetry. Their body parts are arranged around a central point, like the spokes of a wheel. This symmetry is advantageous for organisms that need to access their environment from multiple directions.

Fractal Symmetry

Fractals, intricate geometric patterns repeating at different scales, are found in natural structures like coastlines, mountains, and clouds. Examples include the branching patterns of trees and the self-similar designs of snowflakes.

Spherical Symmetry

Certain organisms, such as some single-celled organisms and pollen grains, exhibit spherical symmetry. Their features remain the same, regardless of the orientation from which they are viewed.

Reflective Symmetry in Plants

Many plants display reflective symmetry in their leaves and flowers. This type of symmetry ensures optimal exposure to sunlight and efficient nutrient distribution within the plant. Crystalline Symmetry:

Crystals, both mineral and biological (such as in snowflakes), often exhibit highly ordered and symmetrical arrangements of atoms or molecules. The repeating patterns contribute to the characteristic shapes of crystals.

Symmetry in Snowflakes

Each snowflake is unique, but they often exhibit hexagonal symmetry due to the molecular structure of water molecules as they freeze. The intricate branching patterns result in a hexagonal shape with six-fold symmetry.

Symmetry in Molecules

Molecular structures, including DNA, proteins, and other biomolecules, often display symmetry. The precise arrangement of atoms contributes to the functionality and stability of these molecules.

Symmetry in Landscapes

Geological formations, such as mountain ranges, river deltas, and coastlines, often exhibit symmetrical patterns when viewed from a broader perspective. This can be attributed to natural processes like erosion and tectonic activity.

Symmetry in Shells

Many seashells exhibit intricate symmetrical patterns, often based on mathematical principles. The spiral or radial symmetry of shells provides structural strength and efficient use of space for the organism inside.

5. Butterfly Garden Project

Understand the importance of pollinators in ecosystems by creating a small butterfly garden.

Integrations: Science, art, social studies, environmental studies



Materials Needed

1. Locally available flowering plants (native to the region)
2. Soil Gardening tools (shovel, gloves)
3. Cup or jar partially filled with water
4. Plastic or foil wrap

Other Resources

1. [Gardening Guide for Schools](#) (see pages 38 to 40 for regional plants that support butterflies in Pakistan)
2. [Video: Monarch Time Lapse](#) (2 minutes)
3. [Growing a Pollinator Garden teaching Resource](#)

Activity Guide

1. Introduce the concept of a butterfly garden as a way to attract and provide habitat for these essential pollinators.
2. Discuss the types of locally available plants that attract butterflies and support their life cycle. Emphasize the importance of using native plants, as they are well-adapted to the local ecosystem.
3. Assign areas for planting and discuss the layout of the butterfly garden. Consider factors like sunlight, soil type, and plant spacing. Divide students into small groups and let them plan their section of the garden. They should label each plant as well for educational purposes
4. Ask students to look underneath leaves for butterfly eggs or caterpillars. If they find it they should take the whole stalk of plant and put it in a vase. Line it with plastic or foil wrap to ensure no caterpillars fall in and drown.
5. Place the jar, plant and caterpillar in a container with a cover and watch the caterpillar grow. Add more of the same plant once it is eaten.
6. Once the butterfly is born, let it sit for a day as it needs time to pump energy into its wings. Then release it into the wild

Possible Extensions

1. Incorporate art by having students create butterfly-themed artwork, such as paintings, drawings, or sculptures, inspired by the garden
2. Extend the project beyond the classroom by involving the local community. Organize a small event to showcase the butterfly garden, educating others about the importance of pollinators. Invite parents so students can showcase their work to friends and family.



Science Behind the Activity

The transformation of a butterfly, known as metamorphosis, is a remarkable process that holds great importance in ecological and scientific contexts, and it captivates the human imagination with its wonder.

Only one to two butterfly eggs out of 100 live to become adults in the wild. Thus when you provide a safe haven for them in your garden or raise them yourself in a container, you increase their survival rate. This is even more crucial in a changing climate and with habitat loss. As ecosystems are changing and causing disruption, many species of animals are going extinct.

Butterflies play a crucial role in pollination, transferring pollen from one flower to another as they feed on nectar. This process is essential for the reproduction of flowering plants and the production of fruits and seeds, contributing to the biodiversity of ecosystems.

In various life stages, butterflies serve as a vital food source for other organisms in the food web, including birds, mammals, and insects. Their presence contributes to the balance and health of ecosystems.

Caterpillars have the most incredible growth spurt. It is like growing from a 3.6 kg baby to the size of a cement truck in two weeks! That too, by eating only plants.

The diversity of butterfly species reflects the richness of ecosystems. Different species have unique adaptations, behaviors, and ecological roles, contributing to the overall biodiversity of a region.

6. Birding for Citizen Science



Take your students on a nature walk to not only observe birds but contribute to the scientific community.

Integration: This activity can be integrated with science, geography, social studies and languages

Materials Needed	Activity Guide	Possible Extensions
<ol style="list-style-type: none">1. Downloaded Merlin and Ebird apps to your smartphones2. Binoculars (if available)3. Journals for student observations4. Park, garden or trail site5. Map of your trail (optional) <p>Other Resources</p> <ol style="list-style-type: none">1) Winged Sentinels2) Video: The Joy of Bird Watching (1 minute 50 seconds)3) Birding with Children (2 minutes 20 seconds)	<ol style="list-style-type: none">1. Discuss how scientists contribute to research but cannot be at so many places at once. Introduce the importance of citizen science2. Tell students they will collectively act as citizen scientists for this activity.3. Take them out in the field with rules of silence and keen observation. Ask them to sit in silence and listen to bird sounds. Discuss why it is important to identify birds by their sounds4. Use the Merlin app to identify birds5. Log your bird species and number of birds (count) on the Ebird app.	<ol style="list-style-type: none">1. Take a screenshot of your trail from the Ebird app at the end of your trip2. Ask students to replicate the map and trail in their journals, along with drawings and labels of each bird species they identified and their reflections from the day3. Ask students to create a story or theatrical performance of the importance of birds for their community and have them conduct it



Science Behind the Activity

Our feathered friends are usually the first to experience changes in the environment and have for centuries been made use of as indicators for these changes. In old tradition, observing birds and knowing them was prestigious. They are used as important indicators. In many cultures, eagles, hawks and owls were considered an omen.

Today, modern science continues this tradition of bird observations. What are some of the things that these birds might be able to tell us? For one, they make habitat quality known. An ecosystem can support a number of species and their presence can tell us how the habitat is doing. A specialised species will be the first to get affected by degradation to their ecosystem. Their presence or lack thereof could be a clear-cut sign of change. Birds are finely attuned to the weather as well; wind patterns, precipitation. All of it determines their own breeding, migrating and summering seasons.

This is how citizen science helps us! The more citizens contribute to the research, the more data points there are. This helps scientists analyze any changes in behavior by birds or perhaps even find new species all together!

Engaging citizens in scientific endeavors fosters a sense of ownership and responsibility for the natural world. It promotes a deeper connection between the public and scientific research, breaking down traditional barriers between scientists and the community.

Why are birds important?

- **Environmental indicators:** Birds serve as important indicators of environmental health, reflecting changes in ecosystems and helping scientists monitor the impacts of climate change, pollution, and habitat degradation.
- **Pollinators and seed dispersal:** Many birds play a vital role in pollination and seed dispersal, contributing to the reproduction and diversity of plant species, which, in turn, sustains healthy ecosystems.
- **Ecosystem services:** Birds provide essential ecosystem services, including pest control by consuming insects, regulating populations, and maintaining ecological balance.
- **Provide sanitation:** Certain bird species, such as vultures, play a critical role in sanitation by scavenging and disposing of carrion, preventing the spread of diseases and maintaining a clean environment.
- **Opportunities for eco tourism:** Birds attract eco-tourism, offering economic opportunities for local communities. Birdwatching and bird-related tourism contribute to conservation efforts and the sustainable use of natural resources.

7. Seed Ball



Teach students about the importance of reforestation and biodiversity by creating classroom seed balls. This an excellent way to discuss how different plants spread their seeds and pollinate. What is habitat loss and how to easily recover forests through spreading these balls.

Integration: This activity can be integrated with science, geography, environmental studies and social studies

Materials Needed	Activity Guide	Possible Extensions
<ol style="list-style-type: none">1. Air-dry clay2. Soil3. Seeds of local plants (native to the region)4. Bowls or containers for mixing5. Water6. Large open space like a vacant lot or schoolyard <p>Other Resources</p> <ol style="list-style-type: none">1. <u>Plant Growth Journal</u>	<ol style="list-style-type: none">1. Distribute air-dry clay, soil, and seeds to each student or group. Provide bowls or containers for mixing. Explain that they will be making seed bombs to promote reforestation.2. Instruct students to combine equal parts clay and soil in their bowls. Add a small amount of water to create a workable consistency. The mixture should be moldable without being too wet.3. Have students incorporate a handful of seeds into their clay-soil mixture. Ensure they evenly distribute the seeds for optimal growth. Discuss the importance of using local plant seeds to support biodiversity.4. Demonstrate how to form small, round seed bombs using the clay-soil mixture. Encourage creativity and emphasize the importance of making them sturdy enough to withstand tossing but soft enough for the seeds to germinate.5. Take students to a nearby vacant lot or schoolyard. Instruct them to toss their seed bombs into areas where they believe native plants could thrive. Discuss the potential impact of their actions on reforestation and the overall biodiversity of the area.	<ol style="list-style-type: none">1. Return to the site after a few weeks or months for a follow-up observation. Discuss any signs of seed germination or plant growth.2. Organize a community event to involve parents and local residents in seed bombing.3. Discuss 'solastalgia' and how changing environments have an emotional and mental effect on individuals. How can we make ourselves feel better? How do we manage the anxiety with this loss? Meditate in a natural environment with students to teach managing wellness in nature. <ul style="list-style-type: none">• <u>Video: Tree Guided Meditation for Kids (2 minutes)</u>



Science Behind the Activity

Seed germination is the process by which a dormant seed transforms into a new plant. This intricate process involves several key stages:

Imbibition

Water is absorbed by the seed through its outer coat, initiating metabolic processes and triggering the seed to swell. This uptake of water, known as imbibition, rehydrates the dormant tissues within the seed.

Activation of Enzymes

As the seed imbibes water, enzymes within the seed become activated. These enzymes, previously in a dormant state, start breaking down stored nutrients and complex molecules in the endosperm or cotyledons, providing the energy and building blocks necessary for growth.

Respiration and Energy Production

The germinating seed undergoes respiration, converting stored carbohydrates into energy. This energy fuels the metabolic processes required for growth. Oxygen is also crucial in this phase for the breakdown of nutrients.

Radicle Emergence

The first visible sign of germination is the emergence of the radicle, which is the embryonic root. The radicle grows downward, anchoring the seedling into the soil, and starts absorbing water and nutrients.

Shoot Development

Once the radicle is established, the shoot system begins to develop. The shoot emerges from the seed, and the cotyledons (seed leaves) unfold. The shoot carries the embryonic leaves, which will eventually become the plant's true leaves.

Photosynthesis

As the cotyledons or true leaves emerge, the seedling begins to photosynthesize. Photosynthesis is the process by which plants convert light energy into chemical energy, producing sugars that fuel further growth and development.

Establishment of Seedling

With the root system absorbing water and nutrients from the soil, and the shoot system actively photosynthesizing, the seedling establishes itself as an independent, growing plant. The seed coat may shed, and the plant continues its life cycle.

Seed germination is a critical phase in the life cycle of plants, marking the transition from a dormant state to active growth. The success of this process is influenced by factors such as water availability, temperature, and the presence of suitable nutrients in the environment.

8. Handmade Paper

Did you know you can make paper yourselves by simply sourcing used paper? This activity is excellent to discuss how to up-cycle while also acting as a fun art project.

Integration: This activity can be integrated with environmental studies, social studies and art

Materials Needed



1. Recycled paper (newspapers, magazines, or office paper)
2. Large container or basin
3. Blender or food processor (can also work without)
4. Fine mesh sieve or screen inside a wooden frame
5. Sponge
6. Towels or cloths
7. Rolling pin or brayer
8. Cloth sheets

Other Resources

1. [Video: How to make paper without a blender](#) (4 minutes)
2. [Video: Paper making at home \(short\)](#)

Activity Guide

1. Gather a variety of recycled paper materials. Remove any non-paper items like staples or plastic. Tear the paper into small pieces to facilitate blending.
2. Place the torn paper pieces in a large container or basin and cover them with water. Let the paper soak for a few hours or overnight. Blend the soaked paper into a pulp using a blender or food processor (is available). Aim for a smooth and consistent pulp.
3. Pour a thin, even layer of pulp onto the mesh within the wooden frame. Use a sponge to spread and smooth the pulp, ensuring an even thickness across the frame.
4. Lift the deckle carefully, allowing excess water to drain. The remaining pulp on the mesh should form a thin, wet sheet.
5. Place a nylon or wire mesh over the wet paper sheet. Gently press down with a sponge or by hand to remove additional water.
6. Invert the mesh onto cloth sheet. Press the mesh against the felt to transfer the wet paper sheet. Repeat the process.
7. Use a rolling pin or brayer to remove excess water from the sheet. Allow the paper sheets to air-dry completely. This may take a day or more, depending on the thickness of the paper. Ensure proper ventilation during the drying process. Consider pressing the paper between heavy books for added smoothness after the initial drying.

Possible Extensions

1. Experiment with adding natural dyes or textured materials (flowers, seeds, leaves) to the pulp for unique paper creations. This also means when discarded, the paper decomposes to sprout more plants.
2. Compile all the paper into a class booklet with messages from students to each other.
3. Students can make cards out of the paper with paintings using natural materials (such as imprinting leaves with paint onto the paper) and selling the cards at a school event. Earnings can be donated to a community cause.





Science Behind the Activity

Creating paper from recycled materials is a rewarding and eco-friendly activity that allows you to contribute to waste reduction and enjoy the satisfaction of handmade paper products. It is important to discuss with students the process of mass production and manufacturing. How demand for paper means greater demand for wood pulp which encourages deforestation.

The process of making paper in factories involves several stages, from the collection of raw materials to the final product. Here is a brief overview of how paper is traditionally made.

Harvesting Raw Materials

The primary raw material for papermaking is wood pulp. Trees are harvested, and the logs are debarked and chipped into small pieces. Other sources of pulp include recycled paper, cotton, or agricultural residues.

Pulping

Wood chips or recycled paper is processed through a pulping machine to break down the fibers. This can be done through mechanical means (grinding and refining) or chemical processes (using chemicals to separate fibers).

Bleaching

The pulp may undergo a bleaching process to remove color and achieve the desired brightness. This step is optional, and some paper is left unbleached for products like brown packaging paper.

Paper Formation

The pulp is mixed with water to create a slurry. This slurry is then spread evenly over a mesh screen or conveyor belt, forming a continuous mat of fibers. The water drains away, leaving behind a wet sheet of paper.

Pressing

The wet paper sheet passes through press rollers that squeeze out excess water. This step helps consolidate the fibers and improve the paper's density.

Drying

The pressed paper sheet is then passed through drying sections, where hot air or other drying methods are used to remove the remaining moisture. The paper may pass through large drying cylinders to achieve the desired dryness.

Calendering (Optional)

Some papers undergo a calendering process, where the paper is passed through rollers to achieve a smoother surface and improve its finish. This step is optional and depends on the desired characteristics of the final paper.

Cutting and Finishing

The dried and calendered paper is cut into sheets or rolls according to the intended use. It may undergo additional finishing processes, such as coating or sizing, to enhance specific properties like smoothness or printability.

Quality Control

Throughout the papermaking process, quality control measures are implemented to ensure that the paper meets specified standards for thickness, weight, strength, and other characteristics.

Packaging and Distribution

The finished paper is packaged and prepared for distribution. It may be shipped to manufacturers for further processing into various products like books, packaging materials, printing paper, and more.

This overview provides a simplified explanation of the papermaking process, which can vary based on the type of paper being produced and the specific methods used by paper mills. Advances in technology and sustainable practices have also influenced modern papermaking processes.

9. Cardboard Box Projector

Outdoor classrooms can be made more fun through a fun science project that brings technology to life! Why not bring a movie or YouTube videos to life. This activity is great if you lack a multimedia in your classroom as well.

Integration: This activity can be integrated with science, social studies, math and art

Materials Needed

1. Cardboard box (medium to large size)
2. Magnifying glass (size compatible with the box)
3. Smartphone
4. Scissors
5. Tape
6. Ruler
7. Pencil

Other Resources

1. [Video: Lightbulb Projector \(short\)](#)
2. [Video: DIY Classroom \(short\)](#)



Activity Guide

1. Choose a medium to large cardboard box with a removable lid. Ensure the box is sturdy and can comfortably fit your smartphone.
2. Cut out the shape of your magnifying glass on one end of the box using a craft knife or scissors.
3. Position the magnifying glass over the cut-out hole. Center it and secure it in place using tape or glue. This will be the lens that magnifies and projects the smartphone screen.
4. Set the brightness of your smartphone to the maximum and ensure the screen orientation is set to landscape mode. This will enhance the projection quality.
5. Place your smartphone inside the box, ensuring that the screen aligns with the cut-out hole. Use tape or small cardboard supports to secure the smartphone in place.
6. Move the phone back and forth to find the optimal distance for clear focus. This may require some experimentation to achieve the best image quality.
7. Close the lid of the cardboard box, leaving enough space for the smartphone's power cable if needed. This helps create a darkened space inside the box for better image visibility.
8. For a clearer projection, use the cardboard flaps or additional materials to block external light. This works best in a darkened room or during evening hours.
9. Turn on a video or presentation on your smartphone and project the image onto a blank wall or a white surface. Adjust the focus and enjoy your DIY cardboard box projector!

Possible Extensions

1. Create a 'theatre space' with your students and decorate it with fairy lights and seats to look like a cinema. When the movie starts close the lights and darken the space for a proper cinema experience!
2. Document student activities (such as with previous activities) and display these on the projector as a culmination activity.
3. Watch an environmental documentary or videos
 - [WWF Pakistan - Grey Langur of Kashmir \(5 minutes - Urdu\)](#)
 - [WWF Pakistan - Forgotten Wolves of North \(6 minutes\) - Urdu](#)
 - [WWf Pakistan - Magnificent Markhor \(6 minutes - Urdu\)](#)





Science Behind the Activity

The DIY cardboard projector is a fun and easy way to turn your smartphone or tablet into a mini movie projector. By using a few simple materials, you can create a device that projects movies, videos, or images onto a wall or screen.

When the light from your device goes through the lens in your DIY projector, it slows down and bends, forming an upside-down image on the other side of the lens. This bending of light is called **refraction**.

Even though light usually travels in a straight line, it changes speed and direction when it moves through things like a lens. The shape and thickness of the lens decide how and where it focuses the light waves. Lenses are made to bend light so that images look a certain way. Glasses, telescopes, and microscopes all use lenses to help us see better.

It is essential to adjust the distance between the device, the lens, and the projection surface to get the focal point just right. Since the lens flips the image you have to keep the screen on your phone upside down to see the image right side up on the movie screen. The lenses in our eyes flip images too but our brains correct for the difference so we never even notice.

10. Plant Phototropism

Explore the phenomenon of phototropism, where plants exhibit directional growth in response to light. Create a fun observational activity for the students to learn more about how plants adapt to their environments.

Integration: This activity can be integrated with science, social studies and art

Materials Needed

1. Potted plant (such as a young sunflower, bean plant, or any other potted plant)
2. Cardboard boxes
3. Tape
4. Measuring tape
5. Notebook and pen

Other Resources

1. [Video: Phototropism Explained \(3 minutes\)](#)



Activity Guide

1. Choose a healthy potted plant with young, flexible stems. Ensure it has been watered adequately to eliminate any effects of dehydration.
2. Cut a hole on the far side of one cardboard box while it lays horizontal.
3. Cut a hole on the top of one cardboard box as it stands vertical.
4. Place your potted plant on the end opposite to the cut out. Ask students to measure the length of the stem and positioning of the plant and note it down in their journals.
5. Place the boxes in a location where it receives even sunlight. Ensure the light source is consistent and bright.
6. Observe the plants overtime and note the direction of growth of the stems. Take more measurements of the plant's height and the angle of its stem every few days in your journals.
7. Regularly observe and document any changes in the plant's growth. Take note of the direction in which the plant leans and the overall growth pattern.
8. Analyze the data collected. Note how the plant responded to changes in light direction. Discuss the concept of phototropism and how plants exhibit directional growth towards light.

Possible Extensions

1. Start the experiment by a seed germination activity. Take some seeds, and place them on cotton in a glass jar. Mist the jar with water and watch the seeds sprout. Transfer them into a pot that will then be used for the phototropism activity.
2. Create a maze in the box with cut out cardboard pieces to see how the plant works around these.
3. Conduct similar experiments with different plant species to observe variations in their responses to light.





Science Behind the Activity

This phototropism experiment provides a hands-on opportunity for students to observe and understand how plants interact with light, showcasing a fundamental aspect of their growth and development.

"Tropo" means 'turn, reaction or response' in the greek language. The term "tropism" broadly refers to the directional growth or movement of an organism in response to an external stimulus. The stimulus can be light (phototropism), gravity (gravitropism/geotropism), touch (thigmotropism), or the presence of certain chemicals (chemotropism). Tropisms are essential adaptive responses that help organisms interact with their environment and optimize their chances of survival and reproduction.

"Photo" means light. Phototropism is a natural growth response exhibited by plants in which they orient their stems or leaves toward a source of light. This phenomenon allows plants to optimize their exposure to sunlight for the process of photosynthesis, where they convert light energy into chemical energy to fuel their growth.

A plant has enough energy in it from the seed to germinate and start to grow. However once this energy is used up it makes use of sunlight and photosynthesis to create energy. This is how life sustains itself.