ANGELA RUSS –AYON

STEM IN THE KITCHEN AND GARDEN

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STEAM is based on the idea of educating students in five specific disciplines — science, technology, engineering, art, and mathematics, embracing teaching skills and subjects in a way that resembles real life. Since these fields overlap and connect, many experiments fit into multiple categories that lead to further discovery, extensions, and enrichment. Always have some idea of the next steps children can take based on the materials at hand.

We have so many facts at our fingertips on smartphones and computers, that education is no longer about memorizing facts. The **process of the scientific method** involves hypothesizing (guessing), making predictions, thinking logically, experimenting to test our hypothesis, observing the results, and then troubleshooting, changing variables, and trying again. Children who learn how to explore, evaluate information, integrate, think critically, work together, and problem-solve have the potential to become future innovators. They become resilient to change.

Adults can't just assume children already know something. **Always start with the basics – from the simplest form -** and build from there.

GUIDING THE JOURNEY TO DISCOVERY…

- Provide **age-appropriate tools** for children to use: ruler, scale, magnifying glass, measuring cups, tweezers, gloves, funnels, sifters, buckets, aprons, clear containers for observing, recording implements, a camera, a thermometer, Petri dish, lab coats, gardening tools, etc.
- Encourage **children** to **make discoveries on their own**: to predict, question, ponder, use their senses, and experiment repeatedly in different ways.
- Ask **open-ended questions** that present an alternative to the actions children take to guide them in their decision-making process or through their next steps. *"What would happen if you…?"*
- Give children **plenty of time** to process open-ended questions and respond with thoughts and actions.
- **Read stories** and **display reference books** with pictures that support interests, actions, and experiments.
- **Sing songs**, **act-out** stories, engage children in finger plays, chants, arts & crafts, and **play games** that relate to the concepts they're exploring.
- Help children **make connections to real life** as often as possible. Don't just read a book. Invite speakers. Visit a factory, community garden, or a commercial kitchen. Watch a documentary on the subject.

PROVIDING INSTRUCTIONAL SUPPORT

Ask open-ended questions, questions that cannot be answered with one word, such as yes, no, 5, or yellow. If a child answers with one word, follow up with, "How?" or "Why?"

- "How did you decide to…?" "Why did you…?"
- "What if you…?" "Tell me about…?"
- "How else could you…?" "Why do you think…?"
- "How are they alike/different?" "How can you tell…?"
- "What might happen if…?" "How do you/did you…?"

Discover how children arrive at their conclusions by asking for explanations. Avoid teaching and preaching.

- Use whole sentences - not fragments.
- Use a variety of words in simple phrasing.
- Phrase and re-phrase questions until children understand the question.
- Build on what children say by affirming, encouraging (rather than praising), and then fishing with more open-ended questions. Guide them to the next level of learning when play stalls.
- Do not BOMBARD children with questions. Asking one question may be enough for the entire day. The goal is to get them thinking beyond what they are doing - beyond what they already know and into the next experiment or solution.
- Give children time to answer the question you ask.

EMBED SCIENTIFIC CONCEPTS throughout each day using terms and expressions that give children more exposure to the language of STEM. Describe actions using **STEM terminology.** Do your homework. Prepare a word wall, use flashcards, and display signs at science stations with related terms and a written purpose to help teachers and aides remember content.

EXAMPLES OF EARTH SCIENCE

All fields of natural science related to the planet Earth – geography, geology, ecology i.e.:

- Day and night: Moon, night sky, stars, sun, sunrise, sunset.
- Effects of the sun on different objects and people
- Shadow chasing, measuring, marking, use to build
- Weather: sunny, rain, snow, hail, wind, ice, shade
- Clouds and formations
- Terrain: mountains, valleys, desert, grass, plants, flat lands
- Dirt and soil exploration and discovery: mud, compost, sand, clay
- Solids vs liquids (sand is a solid)
- Water: oceans, lakes, rivers / flow on ramps, pouring, mixing, condensation, evaporation, freezing
- Changing seasons: temperature changes, cause and effect
- Rocks: sedimentary, metamorphic, igneous
- Observation of rocks: shapes, color, crystals, streaks, hardness, cleavage and cracks, luster
- Colors of the rainbow
- Destructive weather: tornadoes, hurricanes, floods, earthquakes, tsunamis
- Taking care of the Earth: litter, recycling, conservation
- Fossils
- Gravity

Examples of Life Science - Plants and Animals:

A natural science - The study of life and organisms, i.e.:

- Living things
- The human body / 5 senses
- Animals: wild versus tame / farm / pets
- Health / nutrition / germs / diseases
- Lifecycles of animals, insects, plants
- Eggs and birth
- Parent and baby animals
- Comparing leaves / pinecones / trees / bark / flowers
- Growing root vegetables in clear glass with water
- Plant a seed or an edible garden
- Examine fruits & veggies: pumpkins, oranges, shucking corn, etc.
- Flowers: water, xylem, petals, symmetry, scent, etc.
- Earthworm, mealworm, and other insect observation
- Collecting ants / observing an ant farm
- Collecting caterpillars / observing transformation to butterfly
- Spider webs and ways of hunting
- Fish and sea creature observation
- Characteristics of animals and insects
  - Movement of animals and insects: feet, fins, skin, wings, etc.
  - Animal and insect sounds / habitats / features (hair, fur, feathers, skin, scales, etc.)
  - Location of habitats: underground, in trees, in water, etc.
  - Food sources and hierarchy of animals and insects (survival of the fittest)
  - Sleep and movement patterns: day, no sleep, nocturnal, etc.
  - Survival skills: hiding, camouflage, webs, etc.
- Human use of animal and plant products
- Metamorphosis and physical changes over time

Examples of Life Science – Human Body

- How body parts are used
- Movement, heart rate, perspiration
- Meditation and mindfulness
- Keeping teeth and gums healthy
- Purpose of doctors and dentists
- Five senses
- Motor skills
- Balance

Examples of Physical Science

A Natural science – the study of nonliving materials; explains and predicts nature's phenomena - physics, chemistry, astronomy, math & statistics, i.e.:

- Ways to measure time: timer, routine, sundial, clock, hourglass
- Force and motion
- Cause and effect
- Magnetic attraction (WARNING!)
- Ice freezing and melting
- Sponges and water absorption
- Archways and bridges
- Magnification
- Simple machines
- Gravity
- Sink or float
- Static electricity
- Battery electricity
- Liquid vs solid
- Classifying / Sorting
- Weight and balance
- Temperature changes

Quick and Fun Experiments

Always begin with the questions, "WHY and HOW?" and invite children to answer the question.

- **SCIENCE: Unbreakable Baggie**

"Why can you stick sharp pencils through a plastic baggie of water without it leaking?" Plastic storage bags are made of polymer called low-density polyethylene. It is flexible and moves out of the way of the pencil, forming a seal around the edge of the sharp pencil.

Extensions:

- Use a plastic grocery bag or a water balloon.
- Puncture with a toothpick, metal skewer, or stick pin

Tap Water

Salt Water

- **SCIENCE & MATH: Egg Sink or Float**

"Why does an egg sink and then float when you add salt to the water?" An egg is denser (closely compacted) than water, so it sinks. But when enough salt is dissolved in the water, the water becomes denser and the egg will float.

Extensions:

- Adding baking soda to the water
- Adding corn starch to the water
- Adding flour to the water
- Measure the depths
- Testing different things: orange with peel and one without

- **SCIENCE: Bending Light**

"Why does a pencil bend when it is placed in a glass of water?" When light traveling through the air hits water, some of the light is reflected off the water. The rest of the light passes through the water but it bends (or refracts) as it enters the water.

Refraction occurs when light travels from one medium to another (ie. air to water, water to air).The same thing happens when light hits glass or any other transparent material.

Extensions:

- Replace the pencil with a clear straw and other objects
- Shine a laser light through the water (supervision)

- **SCIENCE: Chemical Reactions**

"Why does baking soda and vinegar fizzle when combined?" When baking soda is mixed with vinegar there is a chemical reaction. The acid breaks down baking soda, releasing carbon dioxide gas which causes the fizz.

Extensions:

- Add food coloring
- Freeze the baking soda and water mixture. Drop vinegar on the ice.
- Secure a balloon on top of a water bottle. The gas will inflate the balloon.
- Seal the mixture in a baggie

- **SCIENCE & MATH: Baking Bread**

How do you bake bread? Why does the dough rise? Measure and mix basic bread ingredients: flour, yeast, water, salt. When the yeast digests the sugar, carbon dioxide is released (fermentation). It is trapped as tiny pockets of air within the dough. This causes it to rise. During baking the carbon dioxide expands and causes the bread to rise further.

Extensions:

- Try to bake bread in the freezer.
- Note how the consistency changes as you add ingredients:
- Change the amount of ingredients. Leave some out, add new, and then compare how the dough rises, cooks, and tastes.

- **SCIENCE & MATH: Fresh vs. Decay**

Why does a sliced pumpkin rot faster than a whole pumpkin? Like all fresh foods, pumpkins will eventually rot and decompose. Pumpkins rot when exposed to air, through the process of oxidation, and when they lose moisture, so these vegetables slowly begin to decay once cut from the stem. Warm weather and extremely low temperatures can also make a rotting pumpkin worse. Mark calendar days with photos of the decaying process.

Extensions:

- Keep one in the refrigerator and one out.
- Carved pumpkin vs. uncarved. Mold spores and bacteria float in the air. When they land on the exposed pumpkin, they start to eat the pumpkin and grow.
- Examine the decay with a magnifying glass.

- **TECHNOLOGY: Static Electricity**

Why does the spoon charged with static electricity pick up more pepper than salt? When you rub a plastic spoon against a dish cloth, wool fabric, or hair, you manually move electrons from one material to another, causing static electricity (a charge imbalance). Wool more easily sheds electrons than cotton. When the spoon is charged full of electrons, it can attract small objects. Pepper is lighter than salt, so it is attracted first and sticks longer.

NOTE: Cultural differences in hair.

Extensions:

- Rub a plastic pen on wool and try to pick up small pieces of paper.
- Rub a balloon on wool or your hair. Hold it to the wall and see if it sticks.
- Rub a balloon on your hair to see what happens to your hair.

- **ENGINEERING: Straw Plane**

Build a plane out of a straw and two strips of paper. Planes fly using the physics of aerodynamics and flight. Air moves through both the straw and the paper circle which enables the plane to lift and fly.

Extensions:

- Measure how far the planes fly.
- Redesign the plane.
- Change the width and length of the straws.
- Modify the length of the paper strips.
- Make the strips out of different materials. (paper plate, trimmed paper cup, tissue paper, copy paper, file folder)
- Add paper wings.
- Add weight, like paperclips.

- **SCIENCE & MATH: Absorption, Color, Weight**

What happens when you drop water onto a sponge? Liquid absorption is when something takes in another substance. Materials that are thicker and contain more cellulose absorb more water. The fibers in tissues and paper towels are made of cellulose molecules (tiny sugar molecules chained together). Water molecules rush into the cellulose fibers when cellulose and water meet.

Extensions:

- Compare different brands of the same material (paper towels & napkins).
- Compare various materials: napkins, paper towels, dishcloths (cotton), etc.
- Weigh different objects.

- **SCIENCE & MATH: POPCORN MATH - CONSERVATION**

Does the weight of popcorn change after the corn is popped? The law of conservation of mass states that mass is neither created nor destroyed in a chemical reaction. No matter how the materials change chemically in a closed system, the weight will remain the same.

Extensions:

- Open the bag and weigh it again
- Conduct a kernel/popped corn sink or float test.

<u>INTERESTING STEM ACTIVITIES:</u>

- Use the senses to examine and compare fake and real fruit and vegetables.
- Smell and examine fresh and dry spices.
- Mix food coloring in whip cream, water, shaving cream, oil, etc.
- How to pickle to prevent spoilage.
- How to make jelly or jam.
- Dry fruits.
- Take the temperature of different solids/liquids or foods before eating it.

- Use beets, blueberries, etc. to dye fabric.
- Measure objects and journal results using a ruler, tape measure, and non-standard means such as string or paper strips.
- Construct 2D and 3D shapes and designs with paper towel rolls, toothpicks, Popsicle sticks, cups, recycled materials, etc.
- Practice folding napkins into different shapes before dining.
- Make a puzzle out of a cereal box, sponge, coloring book covers, etc.

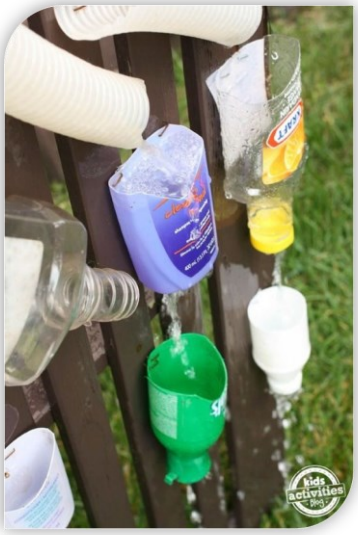
- Make a puzzle by tracing everyday kitchen objects on construction paper using a Sharpie.

- Examine how ice freezes and melts under different conditions.
- Freeze food and objects in the ice. Use tools to chisel and drip warm water over the ice.
- Spoon sugar on a slice of cucumber to see how sugar absorbs moisture.
- Use a sifter/strainer to see what passes through and what doesn't.
- Pour water & other liquids through coffee filters.
- Transfer water from a container to containers of different sizes.
- Demonstrate and use simple machines (kitchen tools): pick up with spatulas, transfer objects with tongs, strain ingredients, etc.
- Conduct water experiments by mixing it with oil, solids (sugar, baking soda, salt), liquids (vinegar, corn syrup, dish soap), food coloring, etc.
- Experience chemical reactions with vinegar and baking soda.
- Make a sensory bin using water, beans, bottle caps, rice, etc.
- Dip coffee filters or press paper towels into food coloring.
- Discover how a salad spinner, blender, whisk, mixer, toaster, works.
- Build bridges, enclosures, or towers out of Popsicle sticks, plastic utensils, cups, paper plates, etc.
- Make a catapult out of Popsicle sticks, rubber bands, and plastic spoons/bottle caps.
- Test absorption on paper towels, sponges, napkins, and dish cloths, foil, baggies, Saran wrap, etc.
- Test wet and dry weight loads on paper towels or napkins.
- Rub wax/crayon on an egg before painting/dying.
- Use egg cartons for sorting and number games.
- Compare different colors and types of eggs: chicken, quail, etc.
- Make home-made Playdoh from a recipe.
- Bake bread from scratch.
- Use weekly food ads to make a food pyramid, go on a healthy food hunt, or sort by color/food group.
- Identify different sounds using items in containers (plastic eggs) or utensils against a metal bowl, etc.
- Make a paper plate wind spinner, puzzle, or use the plate to weave thru.

- Make a parachute out of a coffee filter and pipe cleaner or string.
- Blow and pop bubbles using dish soap.
- Wind: blow cotton balls or ping pong balls using straws or condiment bottles, etc.
- Design a windsock for the garden.

- Scavenger hunt in the kitchen and garden by giving verbal or visual clues.
- Make patterns out of Skittles and then pour water on the plate.

- Stuff thin metal lids or playing cards into plastic containers with slits cut into the holes.
- Thread spaghetti, straws, chopsticks, or flowers through a colander.
- Thread chopsticks or spaghetti with Cheerios, beads, buttons, etc.
- Lace and weave shoelaces, string, or strips of paper through holes punched into paper towel rolls, paper plates, cereal boxes, oven grates, etc.
- Sort different shapes and colors of pasta or beans.
- Stamp paint with cookie cutters, mashers, or the end of paper towel rolls.
- Use cookie cutters to cut shapes into sandwiches and other food.
- Press and mold foil over different objects.
- Build a system of ramps out of paper towel rolls or recycled plastic food bottles.



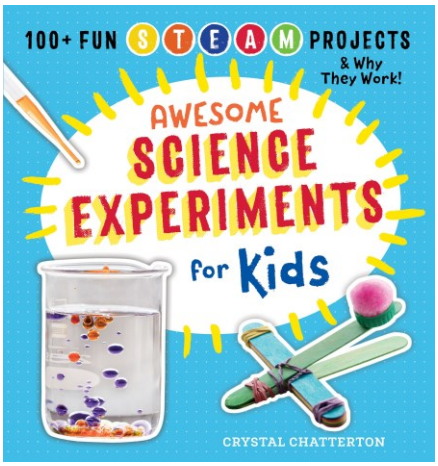
- Use shelf liners, dishcloths, paper towels, and other textures on the surface of the ramps to test friction.
- Use cups to sort items, make number or letter match games, and counting games.
- Grow lettuce or celery from a stem sitting in water.

- Set a flower or celery in die to see how water travels in plants.
- Dig in and examine dirt with a magnifying glass.
- Start a compost heap.
- Examine insects in the garden.
- Observe the lifecycles of caterpillars/butterflies/moths.
- Build an ant or worm farm in a recycled jar/compost heap.
- Compare and contrast fresh vs dying plants.
- Plant a seed. Monitor and measure growth.
- Experiment with plant growth using sun vs. darkness, dry vs. wet.
- Grow plants using different light sources.
- Examine fruits and vegetables as they decay.
- Harvest crops for meals.

Thank you for listening,
and welcome to the CLUB!

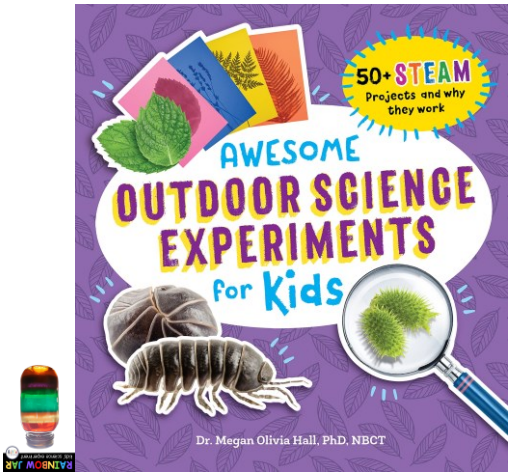
Many of the following photos samples are from various early childhood blogs online.

Here are some wonderful books filled with experiments you can try.



Awesome Science Experiments for Kids,
by Crystal Chatterton
ISBN-10: 9781939754660

Awesome Kitchen Science Experiments for Kids,
by Megan Olivia Hall
ISBN-13: 978-1641526210



Awesome Outdoor Science Experiments for Kids,
by Megan Olivia Hall
ISBN-13: 9781648769368