Science in Our Schools

Project Description

"Science in Our Schools," part of the "Care for Our Kosovo" campaign, consists of scientific demonstrations and discussions that last for one class period – typically 45 minutes—and visits 5 classrooms per day, on average. During the first six weeks two days each week will be spent performing in the schools of Gjakova and several days will be spent performing in classrooms in other cities while simultaneously recruiting and training Presenters in those locations.

The basic program itself consists of 8 different experiments using common household items, and several discussions. Some of these experiments are:

- Using atmospheric pressure to instantly crush an aluminum can
- Using the aluminum can to discuss what happens to certain objects such as metal, plastic, glass, and Styrofoam when they are placed in the ground.
- Demonstrating the concept of bio-degradation by placing a Smoki (Kosovo Cheese Puff) in water and watching as it dissolves.
- Illustrating the concept of non-biodegradable by placing Styrofoam in water and watching as it remains unchanged.
- Placing the Styrofoam in Acetone and watching as it instantly dissolves.
- Discussing what the impact would be if instead of raining water, clouds rained Acetone.
- Examining the relevance of non-biodegradation and throwing garbage on the ground rather than in containers.
- Discussing what is meant by the term "limited resource" and how that applies to trees, oil, power, water, and metal.
- Using that knowledge to talk about how and why recycling is important.
- Making recycled paper using a blender, a nylon stocking, and some old

paper.

- Watching a chemical reaction occur as baking soda and vinegar react causing a balloon to inflate.
- Illustrating the force of gravity by dropping objects of many sizes and observing that regardless of size they fall at the same rate.

These experiments not only captivate and interest children, but often interest the teachers as well, who afterwards may make their style of teaching more visual and dynamic to better reach their students.

The program engages the children fully throughout. They are constantly asked questions directly connected to the experiments that are being demonstrated. They are also involved as co-experimenters in the papermaking and chemical reaction experiments. The next phase of the program will actively further the child-centered orientation. That is, different experiments and different approaches to the experiments will be explored that put experiments more in the hands of the children. While now they are encouraged to reach conclusions based on what they see, the program will more encourage them to explore and reach conclusions based on what they are doing as well as what they see.

The Presenters will also test many new experiments, gauging children's interest and the value of the experiments in demonstrating various scientific themes.

Hanging posters in every classroom and distributing leaflets to every child will reinforce the connection to the "Care for Our Kosovo" campaign.

Balkan Sunflowers
Volunteers for Social Reconstruction

The Training Manual for Presenters

Getting Started…

Congratulations on being selected as a Presenter for "Science in Our Schools." You are about to embark on a fun and educational journey that will at times be difficult,

but more often rewarding. "Science in Our Schools" is a part of the "Care for our Kosovo" campaign currently working on environmental issues in Kosovo. As a part of this campaign you will have an opportunity to positively affect the environment, stimulate children's interest in science, and serve as a role model to many children.

Science has the ability to be an extremely fun and exciting subject. It can entertain and educate children as well as encourage creativity and imagination. In the field of Science, experiments are often the most fun and interactive element, and that is what our program focuses on. Rarely can lectures or books interest a child in Science in the way that an exciting experiment can. As a Presenter, you must take advantage of that – and make every single action and word as exciting as possible.

One of the goals of the program is to give the kids a special experience. To do that, you must look and act like a true scientist—because now you *are* a scientist. You should understand that kids are scientists, too. They have a natural curiosity and are frequently conducting experiments to learn more about the world around them. Use that natural curiosity to your advantage. Let them ask questions and be willing to do what they suggest. Being a Scientist doesn't mean that you must use big words or act super intelligent. On the contrary, you should attempt to explain things in ways that kids understand.

The easiest and quickest way to look like a Scientist is to wear a white lab coat. The lab coat not only makes you look unique, but it also emphasizes the element of safety, while simultaneously protecting your clothing. Experiments can get messy. When

using Acetone, it is also important that you wear a bright rubber glove. Not only does the glove give you some protection from the Acetone, but it also gives the children a very exciting sense of danger. Using beakers, test tubes, and eyedroppers to mix and measure items is important for the exact same reasons; they are fun for the presenters and children, and they create the genuine laboratory atmosphere.

Experiments

1. Using atmospheric pressure to crush an aluminum can

Materials: empty soda can
tongs
gas burner
lighter
beaker full of water

Procedure: Begin by taking an empty aluminum can and pouring in approximately ½ centimeter of water. Place the can (with the small amount of water) onto the gas burner and ignite. Wait for about 45 seconds while the water comes to a boil. When you can hear the water boiling and see steam rising out of the can, pick up the can with a pair of tongs and quickly turn the can upside down and quickly lower the upside down can just far enough into a beaker of cold water to completely cover the opening. If you move quickly enough, the can will instantly crush.

Explanation: Air is heavy. Weighing an empty balloon versus a balloon filled with air can demonstrate this. At sea level **.**825 cubic meters of air weighs 1 kilogram. All of the combined weight of the air in the atmosphere is known as atmospheric pressure. Atmospheric pressure at sea level is 1 kg per square centimeter. This pressure is immense, but because air is always pushing equally in all directions, we can never notice this extreme pressure. When we remove the air from the inside of a container, it will collapse because atmospheric pressure is only pushing from one direction. The surface area of a soda can is approximately 105cm. That means that when the air is removed, a can will be crushed with 105 kg of pressure.

When water heats up, it expands, turning into steam. When the can is filled with steam, covering the opening with water prevents any more air from entering while the temperature change causes the steam to return to its smaller state—water. Thus, there is a lack of air in the can.

2. Biodegradation in the ground

Explanation: One of the major environmental problems currently facing Kosovo is the improper disposal of aluminum cans. Using the can that you have just crushed, you can open a discussion concerning the difference between biodegradable and non-biodegradable garbage. Paper, apple cores, and banana peels are examples of garbage that quickly decompose in the ground. They are called biodegradable. Other items such as plastic, metal, glass, and Styrofoam decompose VERY slowly in the Earth and are called non-biodegradable.

You can ask the children if they like all of the garbage that they see on the ground. Then, you can explain to them that some of the things that are on the ground are non-biodegradable and might be there forever. You can ask them if they would like to be playing in their yard and dig up somebody else's garbage from a hundred years ago or if they would like for somebody to dig up *their* garbage a hundred years from now.

That is why it is important that we always throw our garbage in a container. If we just throw it in the ground it may be there for a long, long, long time.

3. Demonstrating the concept of biodegradation in water

Materials: beaker full of water
Bag of Smokies (Stobi Flips or cheese puffs)
Piece of Styrofoam

Procedure: After explaining the difference between biodegradable and non-biodegradable, ask the children to guess whether a Smoki will decompose in water or if it will remain unchanged. When they are finished guessing, place the Smoki in the beaker and gently rub it between your fingers as you walk around the classroom, allowing everybody to get a good look. Every 5 or 10 seconds, take the Smoki out of the water and let the children look at it. Ask them if it is the same or if it is decomposing. Next, ask the children whether or not they think Styrofoam will dissolve in water. You can conduct an experiment to check their hypotheses. Repeat the same procedure as before and after a minute or so, ask them if it is the same or if it is unchanged.

4. Demonstrating decomposition in Acetone

Materials: Small glass dish or ashtray
Rubber glove

Acetone
Small piece of Styrofoam

Procedure: Put on a rubber glove and take out a bottle of acetone. Place the Styrofoam in the ashtray and pour a small amount of Acetone over it. The Styrofoam will instantly dissolve. It is a good idea in larger classrooms to repeat this experiment several times so everybody has an opportunity to see.

Explanation: Acetone is the most basic of keytones and is slightly polar. Because it is polar, it has a tendency to attract other molecules. When Acetone attracts certain molecules within the Styrofoam, it changes its structure and causes it to dissolve.

You can ask the children what would the world be like if instead of raining water, clouds rained Acetone. If clouds rained Acetone, Styrofoam would quickly decompose. But because rain is water, Styrofoam will not quickly decompose and therefore is an environmental hazard, and just like soda cans, it will stay in the ground for many thousands of years.

5. So, what is a limited resource?

There are many resources on our planet. Water, power, petrol, glass, trees, plastic and metal are all limited resources. That means that there is only a limited supply of these materials in the earth and when they are all gone, there will never be more. Some materials like trees are limited, but are considered renewable. That means that they can grow back, so if we are careful we will never run out.

In Kosovo, the concept of limited supply should be easily understood. Frequently, Kosovo has power and water outages because of the limited supply. In order to prevent running out of these supplies, we need to conserve. That means we need to use only as much of the resources as we absolutely have to. One way that we can conserve resources is to recycle or reuse these items.

6. How to make recycled paper

Materials: Metal dish with water
Gas stove
Lighter
Several pieces of used paper
Bottle of food dye
Blender
Nylon stocking (one leg)
Large metal pot
Towel

Procedure: Place the metal dish on the burner and pour in about 2 cups of water. Light the burner and heat the water until it is warm. CAUTION: DO NOT MAKE THE WATER TOO HOT!!! When the water is warm to the touch, carefully pour it into the blender. Have the children tear the pieces of used paper (you can get the paper from the children or even from the garbage can) into little squares about 2 cm X 2 cm. When they are finished, have them put the pieces into the blender. Add about

one drop of dye, just for fun. Put the lid on the blender and let the pieces soak for about five or ten minutes. Next, plug the blender in and blend for about 45 seconds. If there is no power, than you will have to shred the pieces of paper by hand. This is not as fun and does not produce the same results, but it is sufficient.

Find a child wearing short sleeves or sleeves that can be easily rolled up. Bring the child up to the front of the class and have him hold his arms out in front of him. Take one of the nylon stockings and stretch it over his arms and have him pull his arms apart. Place the large metal pot underneath his arms. You have just created a screen that can be used to strain the water out of the paper. Begin pouring the mixture onto the nylon screen. CAUTION: IF THE WATER IS TOO HOT, YOU WILL BURN THE CHILD'S ARMS!!! When all of the mixture is on the screen, shake it around a little and press on the paper until most of the water has drained through. When it is sufficiently strained, carefully remove the stocking, taking care not to disturb the paper. Have the child return to his seat.

Next, lay a towel on a desk and lay the stocking and paper mixture on the towel. Fold the towel over the paper and press down very hard. This will flatten the paper as well as soak up the remaining water. When most of the water is soaked up, carefully remove the paper and let the children get a close look. Place it on a windowsill to dry. Drying will take a long time, but when it is dry, it will be real paper. If you have a few pieces that you have made in advance, you can show them what it will look like when it is dry. Pass the dry pieces around.

Explain that the same principle is used in factories on a very large scale and saves many trees each year. Other materials like glass, metal, and plastic can be recycled on a large scale as well. Aluminum cans can be recycled by selling them to a metal shop. Glass and plastic can be reused in the home, instead of thrown away.

7. The Physics of soap

Materials: Dish
Milk
Bottle of dish soap
Pencil (can be borrowed)
Food dye

Procedure: Pour about 2 or 3 cm of milk into the dish. Carefully drop 2 or 3 drops of dye in the center of the milk. Dip the tip of the pencil in the soap so that the very tip of the pencil is just barely coated with soap. Touch the pencil tip to the center of the dye. The dye will instantly shoot to the edges of the dish, away from the soap.

NOTE: The same demonstration can be done by pouring water into a dish and sprinkling pepper on top. When the surface of the water is covered with pepper, touch the pencil to the center of the water and the pepper will shoot away from the soap to the edges of the dish. The milk is more visual, though, and can be seen from farther away.

Explanation: All liquids are composed of many molecules that are bonded together. This cohesiveness creates a thin layer of film on top of the liquid. Some bugs like

water-skippers actually walk on this film. Some small objects, like the pepper, can float on this film. The soap breaks the cohesiveness of the molecules. Since the soap is placed in the center of the dish, the cohesiveness is broken from the inside out. As the cohesiveness breaks, the pepper can no longer float on top, and it is pushed away to the part of the water that is not yet broken. The same thing occurs with the milk.

This is a good opportunity to talk about why we use soap when we wash our hands. It is because it breaks the water into smaller molecules that can more easily fit into the small pores in our skin. We use soap to wash our clothes because it causes the water to fit more thoroughly into the fabric.

When you are finished explaining, just for fun, you can pour a few big drops of soap into the milk and watch the dye swirl around like crazy.

8. Baking soda and vinegar reaction

Materials: Small glass juice jar
Funnel
Balloon
Bicarbonate of Soda
Vinegar

Procedure: With the assistance of a child, fit the funnel into the mouth of the balloon and pour in about 4 tablespoons of Bicarbonate of Soda. Once the Soda is in the balloon, remove the funnel. Next, fill the small glass jar about one-third full of Vinegar. Stretch the mouth of the balloon over the neck of the bottle, but do not let the Soda fall out yet.

Explain to the children that when Bicarbonate of Soda combines with Vinegar, a chemical reaction takes place. That reaction produces a gas. When the soda in the balloon reacts with the vinegar in the bottle, the gas will be trapped in the balloon and the balloon will inflate.

Count to three and shake the soda into the bottle, taking care that the balloon doesn't fly off. Some of the kids will cover their ears or shield themselves in preparation of an explosion. The balloon will not explode, though. It will inflate about 2/3 full and stop.

9. Gravity

Materials: small bouncy ball
Bottle of food dye
Bottle of Acetone
2-liter bottle of water
Piece of paper (borrowed)
Small notebook (borrowed)

Procedure: Stand on a chair and hold up the ball and the bottle of dye (about the same size and weight). Tell the children that you are going to drop both objects at the same time. Ask them which object they think will fall fastest and hit the ground first. Drop them. They will both hit the ground at the same time. You may have to repeat this a few times before the kids will agree that they did indeed hit at the same time. Repeat the same procedure with the ball and the Acetone. Both will hit at the same time. Try again with the ball and the large bottle of water. Each time, select a larger and heavier object and give the kids a chance to guess which will fall fastest.

When the kids are confident that all objects fall at the same rate, hold up a piece of paper in one hand and a small notebook in the other. Let them guess. Some will say "same time" others will say "book." Put the paper on top of the book and let go. If the paper is not overlapping the book, both will hit the ground at the same time. This will anger the children. Try again, this time with the paper in one hand and the book in the other. Count to three and let go. The book will fall and the paper will slowly float down. The kids will cheer. Ask them why the book fell faster. They might reply "it is heavier."

Take the book in one hand and the paper in the other. Ask them which will fall fastest. They will say "the book." Crumple the paper into a ball and ask again. Some will say "same time" others will say "book." Drop them. Both will hit at the same time. Explain that big or heavy, small or light, all objects are attracted to the earth at the same rate. This is called gravity. The thing that affects how fast something falls is its air resistance. How much air supports it as it falls. If we were to suck all of the air out the room (it would collapse like the soda can—but if it didn't collapse) paper would fall at the same speed as a bowling ball. A child would fall at the same rate as a cow.

Explanation: Sir Isaac Newton is rumored to have discovered gravity when an apple his him on the head as he was studying under a tree. Although, this is probably not true, many children are familiar with the story so it might be worth mentioning. These experiments could also be done effectively using a variety of different fruits and vegetables like grapes, plums, apples, oranges, cantaloupes, potatoes, etc.

All objects are attracted to the earth at 9.8 m/s^2. So for our purposes, we can say that they all fall at the same speed. Technically, larger items fall slightly faster than smaller items because it takes them longer to reach equilibrium with the air as they fall (terminal velocity). But don't get bogged down by the details.

Kids naturally assume larger objects to fall substantially faster than smaller ones, so when big things and little things fall at the same speed, it is almost magical. Don't forget what it was like when you first learned this concept.

Supplies for Balkan Science Flower Kits

1 – case
1 – 2-litre bottles of water

1 – gas stove/burner
1 – extra butane canister
1 – empty soda can (per performance)
1 – lighter
1 – glass jar
1 – pair tongs
1 – metal dish
1 – plastic dish
1 – blender
*1 – bottle food dye
1 – pair nylon stockings
2 – towels
1 – large metal pot
1 – bag Smoki (Stobi Flips)
1 – large piece Styrofoam
1 – bottle Acetone
1 – ashtray
1 – pair rubber gloves
1 – bag bicarbonate of soda
1 – bottle vinegar
1 – funnel
*1 – bag balloons
1 – small glass juice bottle
1 – carton of milk
1 – bottle of liquid soap
1 – small bouncy ball
1 – beaker
1 – test tube
1 – medicine dropper
? – “Care for our Kosovo” flyers and posters
1 – roll tape
1 – pair scissors

* These items are potentially difficult to find in Kosovo and must be special ordered.