One World Montessori School

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Waste Reduction and Education Program

One World Montessori School was named the 10th greenest school in the country by the Green Schools Guide, a division of National Geographic, in 2006. We are seeking to expand upon our green commitment by working to eliminate as much as possible from our waste stream, diverting materials instead to recycling and composting efforts here on campus. We are also planning to involve our students in this process through hands-on experiences and monthly lessons on waste reduction and its importance to the community and the environment. We expect this project to have an impact on our students and school community in a number of different ways.

One of the tenets of the Montessori educational philosophy is to impart children with respect for the earth and all life. Children study the life cycle of plants and animals, and gain an awareness of the interconnectedness of all things. Learning about recycling and waste reduction will give the children a better background in how humans impact the environment, and will give them a better base from which to make better choices concerning our environment as they grow.

Committing to waste reduction also reinforces One World's commitment to a sustainable lifestyle. We already have recycling and composting programs in place at our San Jose campus. We are expecting to increase our output of recyclable materials, thereby avoiding unnecessary additions to landfills, as well as to increase our output of compost for use in the school's organic gardens, thereby producing enough compost for all our garden boxes.

During the 2009-2010 school year, we created a project to help increase our students' awareness of waste reduction, and ways in which they could participate in this process. We had an ongoing activity where recyclables were weighed and tracked to try to determine how much waste we diverted. We also conducted monthly lessons and hands-on activities with our students.

This document presents the lesson plans we used for our activities, and a description of our waste tracking project. We intend to implement this program again next school year, using this year's plans and activities, and the experience and insights we gained from doing them, to expand and improve upon this year's efforts.

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Lesson 1: Where Does Trash Go?

Part 1: Where Should It Go?

(adapted from Cornell University's "Trash Goes To School")

Grade Levels: Pre-K to 3

Subject Areas: Math, science

Materials:

- a bag of clean garbage that contains various items that would fit in the categories below
- three boxes, containers, or small floor rugs where students may place items
- marker and paper to make signs

Keywords: compost, landfill, recycle

Background: Our solid waste problem is very complex. To solve this problem, each community must look at all the possible solutions and make a comprehensive solid waste plan. These plans must include reduction, recycling, composting, incineration, and landfilling. No single method will solve the problem, so each community has to decide which alternatives best meet the local needs.

We are all garbage producers and therefore part of the problem. We must also all be part of the solution.

Procedure: In this activity, we want to make students think about where garbage can go. At present it may all go to a landfill, or some may be recycled or composted.

1. Take three boxes and place them at one end of the room and ask the students to label them: recycle, compost, and landfill.
2. Take a bag of clean garbage and dump it out on the floor at the opposite end of the room.
3. Have teams of students sort the garbage by taking one item at a time and placing it in a container.
4. After the students have sorted the garbage, go through the bins and ask why items were placed in certain boxes. Some items may appropriately fit into more than one box. The answers are not always clear, depending on options available in your community.
5. Discuss the following questions: Can all items be recycled? *No, some items are made from many different materials that are hard to separate, or have been contaminated and cannot be used for recycling.*

   Can everything be put directly in a landfill? *No, some items can be recycled, and hazardous waste should be diverted.*

   Can we reduce the amount of things being sent to the landfill? *Yes. We can recycle and compost, we can reuse items rather than dispose of them, or we can reduce waste before that by being careful about packaging and purchases.*

Follow-up: Discuss the idea of waste reduction. What items are not needed in the first place? Could we have used durable products rather than disposable ones? Could we have purchased products with less packaging?

Part 2: What Happens In a Landfill

Grade Levels: Pre-K to 6

Subject Areas: science, language arts

Materials:

- Large pan or container
- Soil

- Various trash items to bury in the soil: things that are biodegradable and things that are not; food items (fruit, bread, fast food/processed items); paper products; plastic items.
- A fork for digging up items later on.

Keywords: biodegradable, decomposition

Background: When we throw things away, they often wind up in the city landfill. What happens to these things when they're buried? Why should we try to reduce the amount of items we send to the landfill?

Procedure: In this activity, we want to make students understand what happens to trash in a landfill, and we want them to think about why waste reduction and recycling are important and have an impact on our environment.

1. Make a list of all the items you are going to bury in your landfill.
2. Fill your pan or tray half way with soil.
3. Lay your garbage items on top of the soil.
4. Cover your garbage with more soil.
5. Water the landfill to simulate rain, and set it outside.
6. After 10 days, dig up your garbage and examine it. Rebury everything for another ten days, and then dig it up again for a second examination.
7. Discuss the following questions: How has the trash changed? *Biodegradable items have begun to decompose. Natural food breaks down more readily than processed food. Plastic and metal items do not change at all.*

   Why have some things changed and some things have not? *Plastic and metal do not decompose. Processed foods have high amounts of salt and preservatives, which slows decomposition. Things that can break down naturally in a landfill are called "biodegradable".*

   What should we do about things that are not biodegradable? *Try to keep them out of our landfills through reuse or proper recycling.*

Follow-up: Discuss the idea of waste reduction. How do we keep things that are not biodegradable out of our landfills? Can recycling help? Can reusing items help?

Lesson 2: Recycling: Let's Get Organized

(Adapted from Cornell University's "Trash Goes To School".)

Grade Levels: Pre-K to 6

Subject Areas: social studies, technology, and home economics

Materials: paper, pencils, rulers

Keywords: brainstorming, disposal, recycling, organization

Background: Teaching youth to be organized and efficient is important. In the following activity, they will help set up a collection system that is efficient for students, teachers, and custodians. Involving students in the planning of their school and home recycling projects gives them a vested interest in the program's success.

Procedure: In this activity, we want to make students think about what needs to be done to organize a collection system for recyclables.

1. Check with the recycling coordinator to see what items are being recycled in your area and then decide which ones you want to collect.
2. Have a brainstorming session to find the most efficient way to set up a recycling collection system. This discussion may center on the classroom, cafeteria, or other offices.
3. Sketch out or explain your own designs and tell why your design will work well.

Further exploration: As a homework assignment or project have them design a system for their own homes.

Follow-up: Sketch a design of the recycling program in school or home.

1. Which material will be collected?
2. What types and sizes of containers will be used? What will they cost?
3. Where will the containers be placed?
4. Who will collect the recyclables?
5. How often will they be collected? If collection occurs one time per week, you will need larger containers than if it occurs every day.
6. Where will the recyclables go after they are collected?
7. What kinds of products can they be made into?
8. Does your family buy those products?

Lesson 3: "Diverting Toxic Waste"

Grade Levels: Pre-K to 6

Subject Areas: science and language arts

Materials:

- 2 glass jars or small clear drinking glasses
- 2 coffee filters
- 1 cup
- Water
- Sand
- Food coloring
- Battery

Keywords: hazardous waste, leaching, water cycle

Background: Hazardous waste is a big threat to our drinking water. Chemicals inside landfill items like batteries and electronic devices can leach out into the soil, and from there into our drinking water supply.

Procedure: In this activity, we want to demonstrate to students how dangerous chemicals can leach out into landfills.

1. Explain the water cycle to children, so they understand the source of our drinking water.
2. Show the children the battery and explain that it has hazardous chemicals inside that can get into the ground water if the battery's case is breached.
3. Prepare the two jars. Put a coffee filter in each one, and put sand in the filters.
4. Put food coloring into the sand in one jar.
5. Fill the cup with water to simulate rainfall and pour some into the jar without food coloring. This is the normal water cycle—the water filters through the ground unchanged.
6. Now pour water over the sand with food coloring. Show the children how the food coloring passes through the sand and into the ground water.
7. Discuss the following questions: What would happen if that contaminated water got into a lake or a river? *It could hurt the wildlife.*

What about our drinking water? *It could hurt us.*

Should we just throw away items with dangerous chemicals inside them? *No. We should divert them from the waste stream.*

Follow-up: Discuss the idea of diverting hazardous waste. Hold an e-waste event at school to demonstrate to the children how to safely dispose of hazardous waste.

Lesson 4: Composting

(Adapted from "The Secret Life in a Composter" by Recycle Utah)

Grade Levels: Pre-K to 6

Subject Areas: Science, language arts

Materials:

- Samples of compost from compost bins/piles, in Ziploc bags
- Paper plates
- Latex gloves or plastic spoons for examining compost
- Magnifying glasses
- Examples of compostable items from list below

Keywords: compost, decomposition, organic, organisms

Background: Our world is changing, and resources are getting scarce. Another thing that is getting scarce is room in our landfills—some of these are projected to fill up in the next decade. We need to recycle, conserve, and divert waste from the landfills. A good way to divert waste is by composting. Composting is nature's method of recycling.

Composting is how we recycle organic waste. This process needs micro-organisms, small insects, and small soil organisms to work. These organisms—or small living creatures—eat organic yard waste. Worm composting boxes are a really good way to compost organic waste because worm castings make especially rich compost. We can then use this compost in our gardens, to help our plants grow.

Procedure: In this activity, we want to show students how the composting process works, and show them what can and can't go into a compost pile. We also want to show them how various organisms help in the composting process.

1. Show the students our composting bins and explain to them how the process starts. Composting should happen in a bin or even just a pile, in a sunny spot near a source of water. Green and brown materials are added in equal amounts, along with a shovel of earth for soil organisms. Water is added to keep the mixture moist—as moist as a wrung-out sponge—and the compost should be turned every time new materials are added. Brown and green materials should be added in roughly equal parts. In the bin or the pile, worms and other soil organisms work to break down the organic waste into compost.

2. Have the students examine the compost samples in small groups. They can examine them through the plastic bags, or they can spread some of the compost out on paper plates and examine them with gloved hands or a spoon. Have the children describe what they see, how the compost looks and feels. Point out that the compost does not smell. Explain to them that any worms or organisms they see present in the compost sample help to break the soil down into compost we can use.

3. When the students are done examining the compost samples, have them take the compost out to the garden and spread it around, so they see how their lunch scraps and yard waste help our plants thrive. Compost returns important nutrients to the soil so they can be used again by living things, continuing the cycle of life.

4. Discuss the following questions: What are brown materials? *Fallen leaves, sawdust, shredded paper, branches, small twigs.*

   What are green materials? *Grass clippings (free of pesticides), fruit and vegetable scraps, houseplant trimmings, soft prunings from the garden, egg shells, spent flowers and plants, coffee grounds and tea bags.*

   What can we NOT put into our compost piles/bins? *No animal products (meat, bones, fats, dairy), anything treated with herbicides or pesticides, stones, metal cardboard, glass, diseased plants, large branches or wood chips, pieces of eucalyptus, red cedar, or black walnut trees, citrus fruits, animal manure.*

   How does composting ease the burden on our landfills? *Organic waste is diverted and does not go there.*

   How does composting continue the cycle of life? *Composting takes things that grew from soil, and gives nutrients back to help new plants grow once those things are broken down.*

Lesson 5: Plants from Trash

(Adapted from Cornell University's "Trash Goes to School")

Grade Levels: Pre-K to 3

Subject Areas: science

Materials:

- Water
- Potting soil
- Containers for plants
- Seeds, pits, fruit, or vegetable parts
- Newspaper

Keywords: propagation

Background: What can we do with seeds, other than throw them away? Did you know some of the things you throw away can be grown into attractive houseplants? All you need are a sunny window, some water or potting soil, flower pots or containers, and a little tender loving care.

Procedure: In this activity, we want children to observe how plants recycle themselves.

If possible, take a trip to the grocery store or farmers market with the students. If this is not possible, the instructor will need to shop for produce.

Discuss the different types of propagation. See **Plants from Plant Parts, Plants from Seeds,** and **Plants from Exotic Fruits**, which follow.

Plants from Plant Parts

- White potato in soil: take a white potato that is showing "eyes and cut a section that includes an eye (about 1 square inch). Place it in a pot of moist soil, about 2" deep. Keep the plant moist but do not drown it. Field potatoes are planted in this way
- Sweet potato in water: in the middle of a sweet potato, stick 3 to 4 toothpicks, evenly spaced. Place the potato in a glass of water and put it in a sunny window. Either end can be rooted. Keep the water level high, and after a week or more the potato will usually sprout roots and vine-like stems and leves.
- Carrot top in water: cut about 1"-1 ½" off the top of 4-6 carrots. Fill a shallow bowl 2/3 full of washed pebbles (pebbles help support the carrot tops). Place the carrot tops over the pebbles.

Add water to the level of the pebbles and maintain this level at all times. Soon the tops will sprout pretty foliage.

- Pineapple in water: to separate the top from the fruit, hold the fruit firmly with one hand and twist the leafy head with the other. The top should come right off. Remove the lower leaves until the stump is about 1 ½" long. Put the top in a glass of water and change the water weekly. When roots are 3"-4" long, transplant to a pot.

Plants from Seeds

- Avocado pits: remove the pit from an avocado and allow it to dry for 2-3 days. Peel away as much of the onion-like skin as possible. One-third of the way down, inset four toothpicks at regular intervals. The flat end is he bottom and the pointed end is the top. Put the pit in a glass of water so that ½" of water covers the base of the pit. When the roots are 4" long, transplant the pit to a pot and keep it in a bright, warm window. Keep the soil evenly moist at all times.

- Mini fruit trees: citrus plants can be grown from seeds removed from oranges, grapefruits, lemons, and tangerines. Soak the seeds overnight in water. Plant in ½" moist potting soil. Cover the pot with a plastic bag or a piece of plastic wrap and put it in a warm spot. When the seeds start to grow (in a few weeks), remove the plastic. Keep the plant in a warm, sunny window.

- Beans, peas, and lentils: soak dried beans, peas, or lentils overnight in warm water. Fill a pot 2/3 full with potting soil. Place three seeds on top of the soil and cover with 1/2 " of soil. Cover the pot with plastic wrap. After the seeds start to grow, remove the plastic. Put the plant in a warm, sunny window, and keep the soil moist. It may be necessary to tie the plants to a small stake as they grow.

- Herbs: use anise, caraway, coriander, celery, dill, or fennel seed. Fill a 6" pot 2/3 full with moist potting soil. Place six seeds on top of the soil and cover with ½" of soil. Cover the pot with plastic wrap and place in a warm spot. After the seeds begin to grow (3-8 days), remove the plastic and place the plant in a sunny window. After a few weeks, you will have a lovely feathery foliage that can be snipped and used in cooking.

- Peanuts: make sure you use fresh, unroasted peanuts. Fill a large, 4" deep plastic bowl 2/3 full with moist potting soil. Shell four peanuts and place them on top of the soil, covering them with 1" of soil. The plant will sprout quickly. In a couple of months small, yellow pealike flowers will develop along the lower part of the stem. After the flower fades, the ovary swells and starts to grow toward the ground and pushes into the soil. Peanuts will be ready to harvest in about six months.

Plants from Exotic Fruits

- Mango: in the center of the mango, there is a large hairy husk with a pit in it. Scrape off all the excess flesh from the husk and gently pry open with a dull knife. The pit is best started

in a sphagnum bag. Fill a Ziploc bag with dampened peat moss or sphagnum. Place the pit in the bag and make sure it is completely surrounded by moss. Check every day to make sure the pit is not dried out or rotted from too much moisture. When the roots are 4" long, transplant to a pot that is at least 1" larger than the pit.

- Papaya: Papayas are not easy to grow because the plants have a tendency to dampen off (die) at about 6"tall. When you cut the papaya open, you will find hundreds of black seeds surrounded by a gelatinous aril (seed covering) To remove the aril, spread some seeds on a paper towel and roll them with your fingers until the aril squashes off. Plant the seeds immediately in a container with sterile potting soil. Give them bottom heat and high humidity until they pass the critical stage of 6" high. Papayas are rapid growers, and once they are established, they will not need a lot of water and fertilizer.

- Tamarind: tamarind pods look like brown lima beans. The outer shell is brittle and easily peels back, revealing a sticky brown pulp. Within this pulp there are five or six shiny black pits. Nick the pits (with a nail file) and soak them until they swell, usually in a few hours. Plant the pits in a container with potting soil and place in a sunny window. Tamarinds are water-loving plants and should never be allowed to dry out. As they grow, pinch them back to make the plant fuller.

Plant the various seedlings and have the students observe their growth. The students can also help tend the plants as they grow, and can take them home to continue caring for them or to plant in home gardens once the lesson period has passed.

Lesson 6: Durability vs. Disposability

Grade Levels: Pre-K to 6

Subject Areas: Language arts, science

Materials:

- Regular and rechargeable batteries
- Ziploc bags and reusable storage containers
- Paper lunch sacks and a lunch box
- Paper cups and drinking glasses
- Single-serve water bottles and reusable water bottles
- Any other pairs of items where you can show one is disposable and one is reusable

Keywords: disposable, durable

Background: Our landfills are rapidly running out of space. In order to conserve the little space that is left, we need to divert as much waste as we can. One of the ways we can reduce waste is by using more durable items, and less recyclable items.

Procedure: In this activity, we want to show students the difference between disposable and durable items, and get them thinking about ways to include durable items in their everyday lives.

Show the students the various pairs of items, and have them discuss how the durable item reduces waste. It is helpful to explain scale to them—for instance, you can use the storage container over and over, every day for a week, but if you threw out one Ziploc bag every day at lunch, that would be five bags in the landfill. Using the storage container saves five bags a week.

Also discuss how some disposable items can be reused—the single-serve water bottle could be refilled and used a few more times before it's recycled, you can use your paper cup all day instead of getting a new one each time you want a drink, etc.

Activity: Tracking Recyclables Diverted from Waste Stream

Grade Levels: Pre-K to 6

Subject Areas: Math, science, language arts

Materials:

- Large plastic bins, preferably with handles for ease of use by students
- Bathroom scale
- Paper and pencils or some means for recording weight
- A chart or some means for tracking weight

Keywords: diverting, recycling, waste

Background: How much waste is diverted from the waste stream by recycling? Does it make a difference?

Procedure:

1. Weigh each participating student while they hold the empty plastic bin. Record their weights.
2. Have students collect recyclables from bins in every classroom, in the office, and in the kitchen.
3. Fill bins and then have the students stand on the scale with filled bins. Record their weights.
4. Have them figure out the weight of the recyclables based on the difference between their weight with the empty bin and their weight with the full bin. For younger students, have them

count starting with their empty-bin weight, counting on fingers until they reach their full-bin weight; older students can do subtraction.

5. Track the weight of recyclables diverted over time to give the students some idea of scale. For instance, 50 lbs is the weight of a student, 150 lbs the weight of a teacher, etc.
6. If it's safe for them to do so at campus, students may also use the bins to carry the recyclables out to the designated collection bin, so they can see where it goes next in the process.