Connecting Art and Science

Using clay, creativity and colours to teach environmental science concepts to 10-18 year olds.

Photographs: Amanda Berlinski

By **Amanda Berlinski**

WHEN IT COMES TO TACKLING the task of teaching difficult scientific concepts, art can be a gateway to helping students better understand what's going on.[1] World-renowned physicist Albert Einstein said: "the greatest scientists are artists as well." [2] Leonardo DaVinci was a painter, Charles Darwin drew his theories of evolution, and Einstein himself was often seen playing his piano or violin. In fact, our current understanding of colors began with a scientist: Sir Isaac Newton. He was the first person to discover the rainbow and draw its colors as a color wheel, which gave artists a useful way to view colors and their complements.[3]

In the past, these famous scientists, as well as many other researchers, experimenters, and explorers of every kind worked in both the arts and sciences simultaneously.[4] Unfortunately, in many schools today, art and science have been divided. Policymakers have chosen to take funding away from the arts in favor of bolstering specific core curricula, such as science and math.[5] But, the practice of art supports scientific thinking and learning,[6] demonstrating that these two subjects really do go hand-in-hand.

Making art helps students make sense of their world.[7] It also helps them learn how to problem solve and think with ingenuity. When students create a piece of artwork they ask themselves questions (What do I want to make?), take action (How do I make it?), and reflect on what they made (Does this look how I want it to look?). This process mirrors the process of scientific inquiry, where students engage in a similar cycle that puts them in charge of their own learning.[8]

This article presents two art-based activities that will help reunite science and the arts. The first employs the color wheel to help students understand the concept of biodiversity. The second uses sculpture to help students learn about the process of evolution. As students participate in these lessons, they'll be making art while simultaneously learning about science.

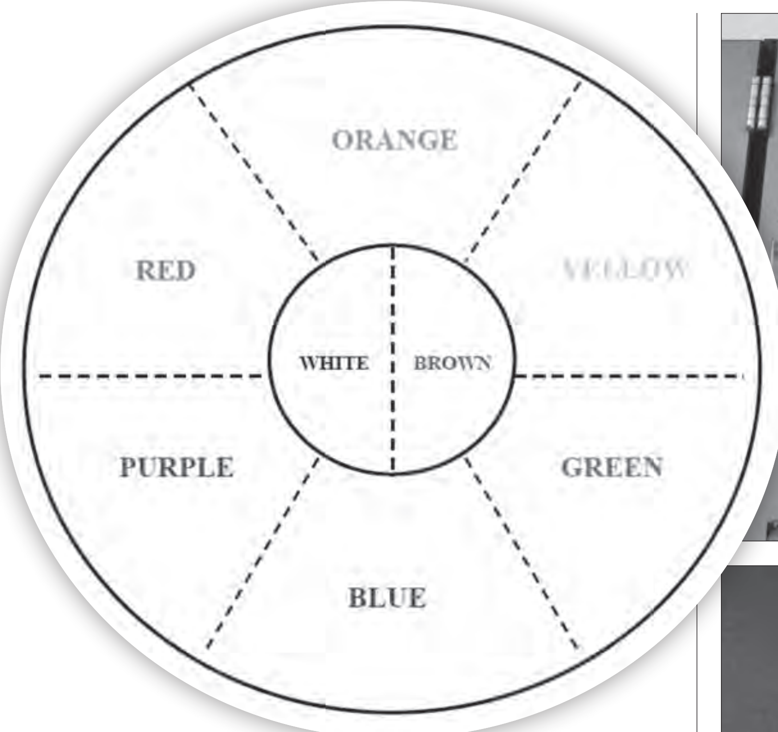
Colors of Biodiversity

This activity uses fundamental art principles to introduce students to the concept of biodiversity. Students work together to make single color collages on individual segments of the color wheel. The color wheel represents a multi-color world: a world filled with biodiversity.

Goals:

- To help participants see the beauty of biodiversity.
- To help participants understand the importance of biodiversity.

Materials: Posterboard, colored markers, old nature-themed magazines, scissors, glue, masking tape.



Prep: Create template for the Biodiversity Color Wheel.

Time: 30 – 45 minutes

Grade Level: Junior High School (Grades 6-8)

Procedure:
Divide students into groups, and have each group sit together in different areas around the classroom. Explain to the students that they will be working together to create a color wheel, which is a tool that artists use to better understand how to combine colors.

Hand out a blank segment of the color wheel to each group, along with magazines, scissors, and glue. Explain that group members will need to work together to look in the magazines and find images of living things that are the same color as the color wheel segment they received. For example, the students in the group with the Red segment must find pictures of living things that are the color Red, such as ladybugs, strawberries, cardinals, roses, etc…

When they find these pictures, students should cut them out of the magazine and glue them onto their color wheel segment to create a collage. Allow students to share magazines so that every group can find enough images to fill up their color wheel segments. When all groups are finished making their collages, collect all the separate segments and tape the completed color wheel up on a wall or board.

Help students reflect on this experience with the following questions:

- For each group: Did you find more plants or animals of your color?
- Were there some animals or plants that were two or more colors? On which segment of the color wheel did you decide this living thing belonged? (For example, is a Monarch Butterfly Orange or Black?) Why?
- How can the color of an animal benefit it? (Camouflage, Warning color, etc…)
- Were there any living things that were a color you did not expect?
- What happens to the wheel if we take one segment away? (Loss of biodiversity)
- What happens if we take an animal from one color segment and put it onto another color segment? (ex. Take a polar bear from the white segment and place it on the blue segment).

Extension:
First, have students make drawings using only one color. These are called *monochromatic* drawings. When students are finished, ask them how it felt to only use one color to make their drawings. How do they think their drawings look? Are they vibrant, boring, interesting, etc…?

Next, have students make drawings using as many colors as they want. These are called *polychromatic* drawings. When students are finished, ask them how it felt to use all the colors they wanted while making their drawings. How do they think their drawings look? Are they vibrant, boring, interesting, etc…?

Finally, students can compare how it felt to make monochromatic drawings and polychromatic drawings. They can also compare how the drawings look. Students may have felt limited when they were only able to use one color, but not so when they were able to use all the colors. They may think their monochromatic drawings are less vibrant and interesting than the polychromatic ones. Similarly, a world with little biodiversity is limited, less interesting, and less engaging, while a world filled with biodiversity is colorful, vibrant, and engaging for all our senses.

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Making Adaptations

This activity puts students in the evolutionary drivers' seat, as they work together in groups to make one species of animal evolve over time. First, students make sculptures of their species. Together, these sculptures represent one population. Students then change their sculptures in response to a series of prompts, which represent real-life events, such as climate change and habitat fragmentation – events that influence how species evolve.

Goals:

- To help participants understand the process of evolution.
- To help participants understand the importance of adaptations.

Materials: Non-hardening modeling clay, pencils, "Making Adaptations" (see www.greenteacher.com/contents96.html) worksheets and prompts, timer or stopwatch.

Time: 60 – 90 minutes

Grade Level: High School (Grades 9-11)

Procedure: Students will also work in groups for this activity. As a group, have students decide on a species of animal to sculpt: as an example, let's say one group of students has chosen Capybaras. First, that group of students will need to learn about Capybaras, and research information on their lifespan and habitat needs. Then, all students in the group will make a sculpture of a Capybara, as together their group of animals represents a population.

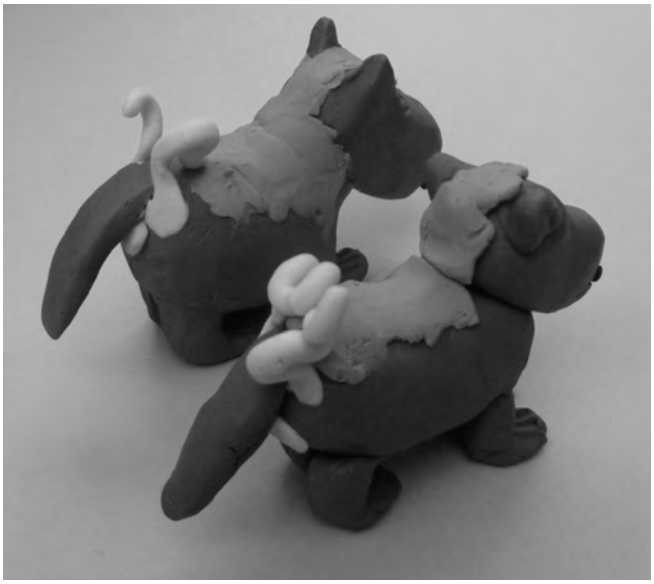
Once students have created their initial sculptures, give each student a "Making Adaptations" worksheet, and give each group of students a set of six "Making Adaptations" prompts (see below). Students should fill in their worksheets as they respond to the prompts, which explain the changes that are happening in their animal's environment. Explain to the groups that they should read one prompt at a time, and then decide what useful traits will be selected from within their populations that will enable their species to adapt and survive in the new environment. For example, if our group decides that in response to the first prompt, their population of Capybaras will develop webbed feet as they start to swim in a newly formed lake, all the students in the group will need to change their original Capybara sculptures by re-sculpting the toes into webbed feet.

Students will notice, however, that there is a time limit

"Making Adaptations" Prompts

1. Over the past 500,000 years natural events have separated your population from the rest of your species. Your population is now isolated from the larger population. What events have taken place to isolate your population, where is your population now living, and how has your species adapted? (30 minutes)
2. There has been a steady decline in your source of food over the past 150,000 years. Although your food source is still available, levels are 50% lower overall. How has your species adapted? (15 minutes)
3. Suitable habitat for your species has been increasing over the past 25,000 years. Your population is now spreading out over a larger area and finding a mate is more challenging. How has your species adapted? (10 minutes)
4. The precipitation patterns in your habitat have been changing over the past 1,000 years. Your habitat has begun experiencing a monsoon season instead of steady annual precipitation. How has your species adapted? (5 minutes)
5. Over the past 30 years, global temperatures have been increasing. How is this affecting your habitat? How has your species adapted? (30 seconds)
6. Look at the differences between the members of your population (each other's sculptures). Are there any useful traits? Develop these traits over a period of 25 generations. (Hint: look at the number you wrote down for the lifespan of your animal. One generation = number of years for one lifespan.)

If your animal has a lifespan of 5 years or less, you have 30 minutes to sculpt
If your animal has a lifespan of 6-9 years, you have15 minute to sculpt
If your animal has a lifespan of 10-19 years, you have 10 minutes to sculpt
If your animal has a lifespan of 20-39 years, you have 5 minutes to sculpt
If your animal has a lifespan of more than 40 years, you have one minute to sculpt



listed on each prompt. This is how much time the students in each group have to modify their sculptures, as the time animal populations have to evolve depends on how quickly their environment changes. After each group has decided how their populations will adapt, one student in the group should set the timer. Then, each student will need to modify his or her own sculpture in order to make adaptations. When the timer goes off, students must stop sculpting. If one or more students do not finish their sculptures in the given amount of time, their animals did not have time to adapt!

Groups should repeat this process for the first five prompts. The sixth and last prompt asks students to reflect on their populations. Instead of responding to a change in habitat or climate, students must look at their sculptures and identify an anomaly that they wish to evolve. This is because animals do not consciously adapt to their environment in order to survive. Adaptations actually arise from existing genetic differences or from beneficial mutations among individuals.

For example, the tail of one student's Capybara sculpture may be longer than the rest in the population. The group may decide that this is a useful adaptation and choose to naturally select this adaptation by re-sculpting all of their Capybaras with longer tails. Since the process of evolution affects populations and not individuals, students will again be given a certain amount of time in which to sculpt, depending on the lifespan of their animal.

Once all groups have finished responding to all the prompts, each group will place their individual sculptures together. This is the current population of their species. Give each of the groups time to present their populations to the class, so that other groups can check out their classmates' animal populations. At this point, students may also discuss how the process of "making adaptations" went. In the wild, sometimes the only option for the animal is extinction, as not all individuals will possess the useful traits that will develop into new adaptations.

Extensions:

- Have students make a timeline of or write a short story about their species' evolution.
- Give each group a camera (or journal pages if cameras are not available) at the start of the activity and have students take pictures of (or draw) their animals after completing each prompt. Students can then use these images to make a cladogram for their species.
- If students decide that their final animal is a new species, have them write a fact sheet for that animal, including information on its range, diet, and classification.
- Have students resume sculpting if they didn't make an adaptation in the given amount of time, then see which individuals are more fit at the end of the activity.

Conclusion

Making art in science class may be new to some students. It may even be new to you. But don't be scared. Have fun with these activities. There's no right or wrong way for students to create their work. More often than not, you'll find that students will form ideas and run with them, testing and trying things out as they go.

This is what you want to have happen, as this is the process of inquiry.[9] To support students in their creative work, use your science skills: prompt them with questions and encourage them to make thoughtful observations. Students will begin to develop their own understanding of the scientific concepts, and will learn how to process what they find: which is exactly how these art activities support scientific thinking and learning.[10]

Amanda Berlinski is an artist and informal educator who specializes in using art to teach students about nature and science. You can view more student work from these activities on her website: amandaberlinski.com.

Download the "Making Adaptations" worksheet from the Green Teacher website at the following URL: www.greenteacher.com/contents96.html.

Endnotes

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