WRI (Water Resources Institute) Final Report

Waterwise Community Center

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Executive Summary

My internship at Waterwise Community Center, or Chino Basin Water Conservation District, assisted me with gaining hands-on experience in the education field and allowed me to learn about how water is delivered to the members of our community as well as how we, as the members, can save the environment by being *wise*, or smart, about using water. There were a number of field trip programs designed particularly for K-12 students, and the programs were mainly divided into three categories according to the level of understanding of students: (1) TK-K, (2) Elementary (1-3 / 4-6), (3) High School. During the first half of the program, students participate in outdoor field observation and receive a special opportunity to visit the Groundwater Recharge Basin, through which water in the Chino Basic area is gathered and distributed to the community. During the second half of the program, students learn water science and engineering in a classroom setting. I will be introducing the field observation

program in detail as well as the lesson plans that were used to educate students with how water circulates in our community and what approaches they should take to using and saving water.

Field Observation

The field observation program always starts with engaging students with an entertaining activity called the *Garden Connect 4*. Students are divided into groups, and each group receives a clipboard and a marker. Students are then instructed to observe the garden located near the center (as part of the center) and discover the listed items on the clipboard, including bees and butterflies flying around the flowers, water fountains, fish in the pond, and nine more. One of these items that students observe and discover is *bioswales*, linear channels that concentrate and carry stormwater runoff (Scharenbroch, Morgenroth, & Maule, 2015). From this activity, students learn that bioswales are beneficial in recharging groundwater, which is about the half of the water sources that we use in our daily lives. The main message that this activity intends to convey is the importance of bioswales in its role of gathering stormwater and saving it under the ground, but the water saved under the ground is limited in terms of its amount; therefore, we must use water effectively and save it as much as possible.

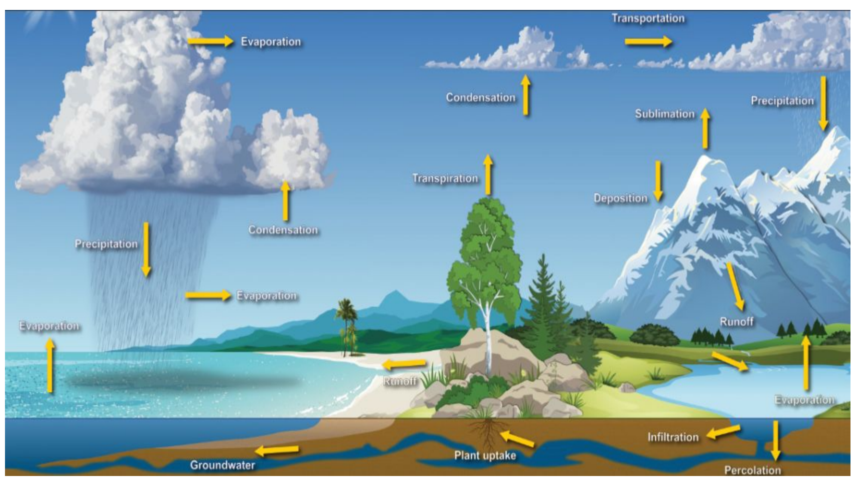
This message connects the *Garden Connect 4* to the next activity, *Runoff Model*. Before conducting this experiment, students learn that bioswales consist of rocks. Students are given the models of three different types of surfaces, including rocks, soil, and grass and instructed to share what part of the community is made of each surface. For instance, the parking lots of the shopping center are made of rocks, and mountains are made of grass and soil. Students are then anticipated to predict which type of surface is likely to create the largest amount of runoff, water that is not collected and drains away from the surface (Sklash & Farvolden, 1979). After several predictions are heard, I, or other instructors, work together with students and pour the same amount of water, from the same height, at the same rate on each type of surface. The results of this experiment teaches students that rocks create the largest amount of water, and this is the reason for using rocks to create bioswales as well as the parking lots and sideroads in the community, so that unnecessary water is not collected around the surface area. Students also learn that the community collects and saves water in the ground through a mechanic called *Groundwater Recharge Basin*, a bigger version of bioswales designed to serve the whole community.

After the entertaining activities and experiment, students expect to take a rest, and I, or other instructors, let them take a rest and learn more about water simultaneously. The *Groundwater Recharge Basin* is open only for staff, but students become special guests during the field trip and are allowed to observe the basin directly. While observing the basin, students notice that a long tunnel that looks like a slide connects the basin and the sideroad, or freeway. The slide is the place through which all the *runoffs* in the community are gathered, and it passes the runoffs to the ground, which slowly soaks up the runoffs and saves them. The community then pumps the water out of the basin when we need to use water. Also, since groundwater is constantly recharged each time it rains in the community (Bouwer & Rice, 1989), the place is called *Groundwater Recharge Basin*.

Classroom Lessons

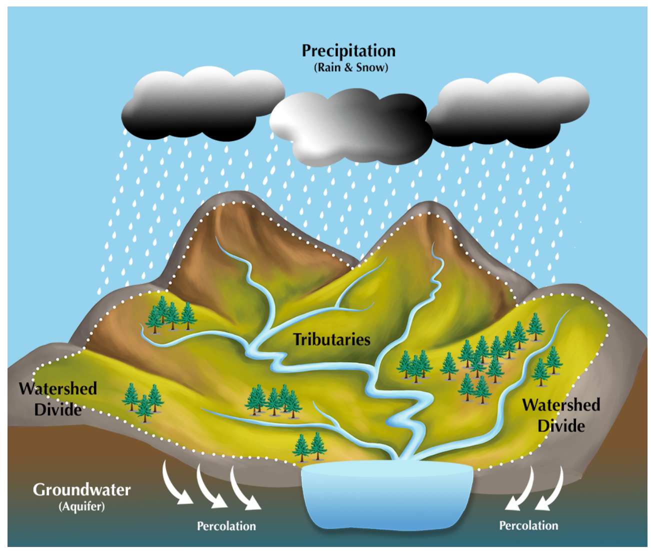
As an instructor intern, I developed and implemented 6 existing lesson plans - *Water Cycle, Plants and Pollinators, Watershed Stewards, Plant Adaptations, Dig In! Soil Exploration,* and *Groundwater Guardians* - and created 2 new lesson plans - *Natural Resources and People* and *Capture That Rain!*.

Water Cycle is a program designed particularly for TK-1 students, which allows them to discover how water cycles or circulates around the earth. Students explore the cause and effect of the water cycle with scientific models. Since this program is for TK-1 students, it includes entertaining activities such as learning the water cycle with dance moves and making a bracelet as a model of the cycle. Through this program, students learn the water resources that are used in their daily lives.



Plants and Pollinators is for K-3 students. In this program, students explore the garden and observe parts of plants and seasonal happenings, including the relationship between pollinators and plants and plant reproduction. Before going out to the garden for observation and exploration, students learn the basics of how pollinators move from plants to plants to expedite and support their reproduction process. Students walk around the classroom and move nectars (small beads) in plants to other plants, pretending as if they are pollinators. After this activity, students explore the garden, observing plants and pollinators and collecting data to interpret pollinator behavior based on the concepts they learned in the classroom.

Watershed Stewards is for students at the grade level of 2 to 8. Students are divided into groups, and each member of a group is assigned with his or her own task in building a watershed model. Once a watershed model is built up, students investigate the spots or places where water is found and how it moves around landscapes. Students then critically analyze and discuss human impacts, such as pollution, on water availability and quality. This program leads students to brainstorming potential solutions to environmental issues related to community water while enjoying the process of building up a watershed model through collaboration.



Plant Adaptations is for students at the grade level of 3 to 6. In this program, students discover how plants adapt to the environment to be waterwise by learning about the relationship between structure and function of plants and water in the community. All of the plants in the garden are waterwise or have structure with waterwise adaptations, and students explore the garden and observe those plants to strengthen what they have learned in

the classroom. The waterwise plants in the garden include Spanish lavender, which requires moderate water to survive, Ceanothus, which needs no summer water, Aloe, Fairy duster, which needs minimal water, and fifteen more.

Dig In! Soil Exploration allows high school students to participate in the activities in the program. Students investigate different types of soils - roam, sand, and silt - to understand the connections between water conservation and soil properties. Students develop hypotheses on how quickly water circulates through different soil types and test these hypotheses through direct experiments. Students learn that clay soil holds most water because it has a greater surface area, which is conducive for absorbing water. In other words, clay soil has the greatest water holding capacity, which means that it takes a long time to reach water saturation, and therefore the community basin is built with clay soil (Duley & Kelly, 1939).

Natural Resources and People is also designed for high school students. Students investigate the history of biological anthropology in regards to the usage of water in different people groups. Students are then instructed to gather a particular type of plants from the garden and make rope, medicine, tea, and ointment with the plants they have gathered. Through this activity, students identify medicinal and nutritional benefits of native plants and learn how to manage human impact on water for an environmental-friendly future.

Groundwater Guardians targets a wide range of grade levels, from 3rd to 12th. In this program, students implement the environmental engineering and design process to purify water by creating filters. Students identify sources of water pollution in the community and discuss solutions to these issues. The most popular sources of water pollution include trash, soap or sanitizer, and woodchips. Students are given a granola bar as a snack, and once they finish their snack, they are instructed to cut trash into pieces to create a model for one of the sources of water pollution. They also gather wood chips in the garden and use the soap in the classroom and mix them altogether to create the ultimate water pollution that actually exists in the community. Students create filters with plastic bottles and poor water with pollution though these filters and learn that several particles of pollution still remain in water even after going through filters. Through this activity, students learn the importance of using water wisely and keeping the environment clean and safe.

Capture that Rain! is for the grade level of 4 to 8. Students participate in this program only on rainy days because rainwater is the essential component of the main activity of the program. Students are engaged in a team competition to discover places where rainwater is concentrated in the garden and capture the water. Since the garden is designed with three different types of surfaces, soil, grass, and rocks, which students are anticipated to have already learned in the field observation, students discover the relationship between urban structure and water availability. The structure of the garden represents the structure of the community.

Conclusions

As an instructor intern, I was responsible for developing and implementing lesson plans for environmental science and delivering these plans to students to teach them about how water circulates in the community and how we, as members of the community, can use water wisely. In this process, I myself learned a lot about water and its relationship with the environment. This experience has changed my perspective on water and how the community operates with water. Nature is victory and beauty.

References

Bouwer, H., Rice, R.C. (1989). Effect of water depth in groundwater recharge basins in infiltration. *Journal of Irrigation and Drainage Engineering*. 115(4).

Duley, F.L., Kelly, L.L. (1939). Effect of soil type, slope, and surface conditions on intake of water. *Historical Research Bulletins of the Nebraska Agricultural Experiment Station No. 112*.

Scharenbroch, B.C., Morgenroth, J., Maule, B. (2015). Tree species sustainability to bioswales and impact on the urban water budget. *Journal of Environmental Quality Abstract - Special Section: The Urban Forest and Ecosystem Services*. 45(1): 199-206.

Sklash, M.G., Farvolden, R.N. (1979). The role of groundwater in storm runoff. *Developments in Water Science*. 12: 45-65.