

Arizona Project WET – Arizona Department of Water Resources Annual Progress Report - Tucson AMA July 2020 – August 2021

I. Introduction

Arizona Project WET (APW) entered into a 1-year Intergovernmental Agreement (IGA) with Arizona Department of Water Resources in July 2020 to educate K-12 students about Arizona's interconnected water resources and their importance to our future in support of Tucson AMA's statutory goal of safe yield.

The Scope of Work defined in the IGA encompasses a multi-day Engineering Academy for teachers, expansion of existing Direct Student Outreach and Arizona Water Festival programs, and continuation of Equipment Loan Program for classrooms. **The Scope of Work was defined and approved at a time that everyone believed that students and teachers would be able to provide a normal classroom experience. "Normal" was an elusive concept for everyone in 2020 and as classrooms shifted, APW led the way creating new learning experiences that encompassed the goals of the Scope of Work, reaching new and familiar audiences.**

Arizona Project WET (APW), an arm of the University of Arizona (UA) Cooperative Extension, develops and delivers targeted programs to accomplish two overarching goals through three pathways. APW develops water stewardship and STEM (Science, Technology, Engineering and Math) literacy by 1) providing teacher professional development to evolve instructional practices and deepen content knowledge, 2) direct student outreach to deliver or extend classroom learning, and 3) community engagement to effectively involve adults in K-12 education.

II. Task 1: Teacher Multi-Day Academy

Underwater Robotics Camp 4-H STEM YOUiversity

Midway through the 2020-21 school year, we realized that the in person multi-day hands-on summer engineering academy to engage educators in learning and practicing the engineering design process would not be possible because of ongoing COVID-19 restrictions and concerns. APW pivoted from the traditional academy and partnered with 4-H (both UArizona Cooperative Extension programs) to provide the online Underwater Robotics Camp 4-H STEM YOUiversity. This program was offered to youth, teachers, educators, and 4-H volunteers in Arizona 4-H counties (15) and Federally Recognized Tribal Extension Programs (5). **Fifteen households registered for the camp in 5 counties.** The teams were composed of combinations of student-parent, siblings, and adult 4-H leaders. It was offered to classroom educators, but they were unable to take on any more commitments. The 9-week camp used the Canvas LMS (Learning Management System) to manage progress and engage teams in discussions beyond the 13 live Zoom sessions. The Canvas platform provided organized and direct access to the video demonstration of tasks and audio enhanced presentations of the content. Four student teams and 3 adult leader teams completed ROVs through the online 4-H STEM YOUiversity camp.

AZ MATE ROV Remote Scout Competition

The AZ MATE ROV Remote Scout Competition was an opportunity to assess, demonstrate and celebrate student learning. The [2021 MATE ROV Challenge](#) was modified to provide the opportunity

for student teams to compete within a COVID-safe environment. The challenge required teams to form their own companies to respond to a Request for Proposal (RFP) to design, build, demonstrate, and market an ROV to perform tasks removing plastic pollution in the water, retrieving and analyzing samples to monitor water quality, and mitigating the effects of climate change on coral reefs. The ROV demonstration tasks were modified so that the teams could perform them in a portable 12-foot diameter pool. Props, modeling real life artifacts such as coral branches and ghost fishing nets, were built and distributed so that teams could manipulate them in the 30" deep pool for the ROV demonstration portion of the competition. Teams submitted marketing displays in Google Slides and participated in online engineering presentations. The judges for all the events included volunteers composed of University of Arizona STEM students and retired engineers.

One classroom teacher/coach, a previous participant in the Underwater Robotics Teacher Academy, was able to implement the ROV program at her school with the minimal in-person time she had with students. **This classroom teacher worked with 26 students, building 7 ROVs, and entering 3 teams in the remote competition. Four teams from the 4-H camp entered the competition,** and 3 of the teams were able to perform their ROV demonstrations in a portable pool set up at the University of Arizona's Maricopa County Extension office. The other team participated from home in southeast Pima County with equipment provided by 4-H.

ROV Competition Impact Data

Thirteen of the 35 students that participated in the modified ROV program this year provided responses to the *2021 MATE ROV Competition - Student Survey*. The respondents had a positive experience building and competing with their ROVs with **46% rating the experience Good and 54% provided Excellent ratings**. The survey questions were grouped into three categories: STEM Topics, Interest Level, and Skills Assessment. Students chose responses to statements from the options: *Strongly Disagree, Disagree, Neutral, Agree, or Strongly Agree*. Numerical values were later assigned to assess the data using the range of 1 - *Strongly Disagree* to 5 - *Strongly Agree*.

In all the survey questions, only one statement received a negative response falling slightly below the 3.00 Neutral rating. *I am more interested in taking math courses* received an average rating of 2.92. All the other statements received favorable ratings within the average range of 3.23 – 4.23. The highest rated statement, at a value of 4.23, was *I increased my skills and knowledge in engineering*. Along a similar thread, students learned how engineering is used to solve problems. They agreed at a value of 4.15 that *I know more about the competition theme: engineering solutions to global problems - plastics in the ocean, climate change's impact on coral reefs, and maintaining healthy waterways*. The highest rated interest questions showed that students are *more interested in taking hands on classes or club activities like robotics, electronics, and shop courses* followed by an interest in taking engineering courses. A graphical representation of the student responses is shown in the Figures 1-3.

The partnership with 4-H STEM YOUNiversity provided the opportunity to directly affect both educators (4-H leaders) and students, engaging them in hands-on engineering, improving student STEM skills.

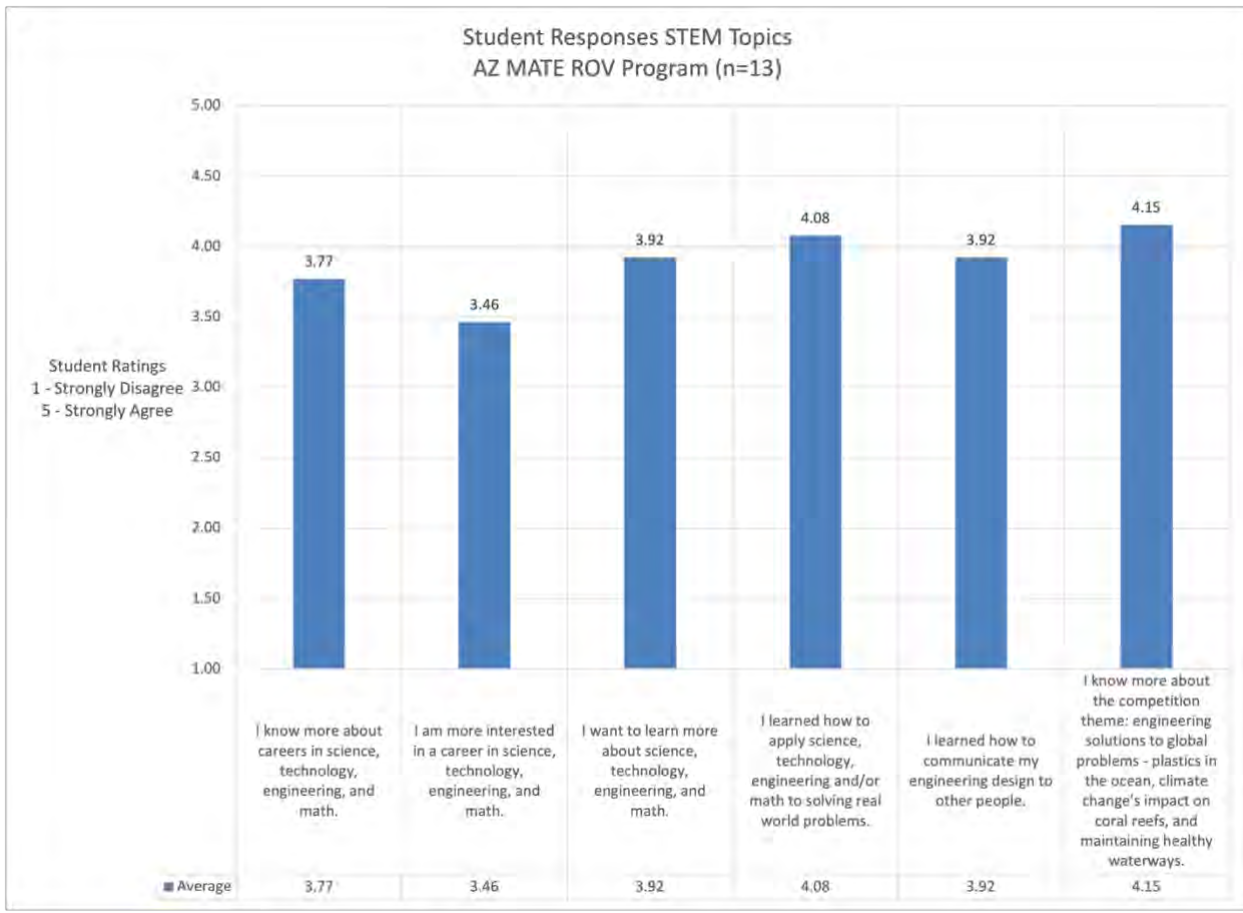


Figure 1 – ROV Student Responses STEM Topics

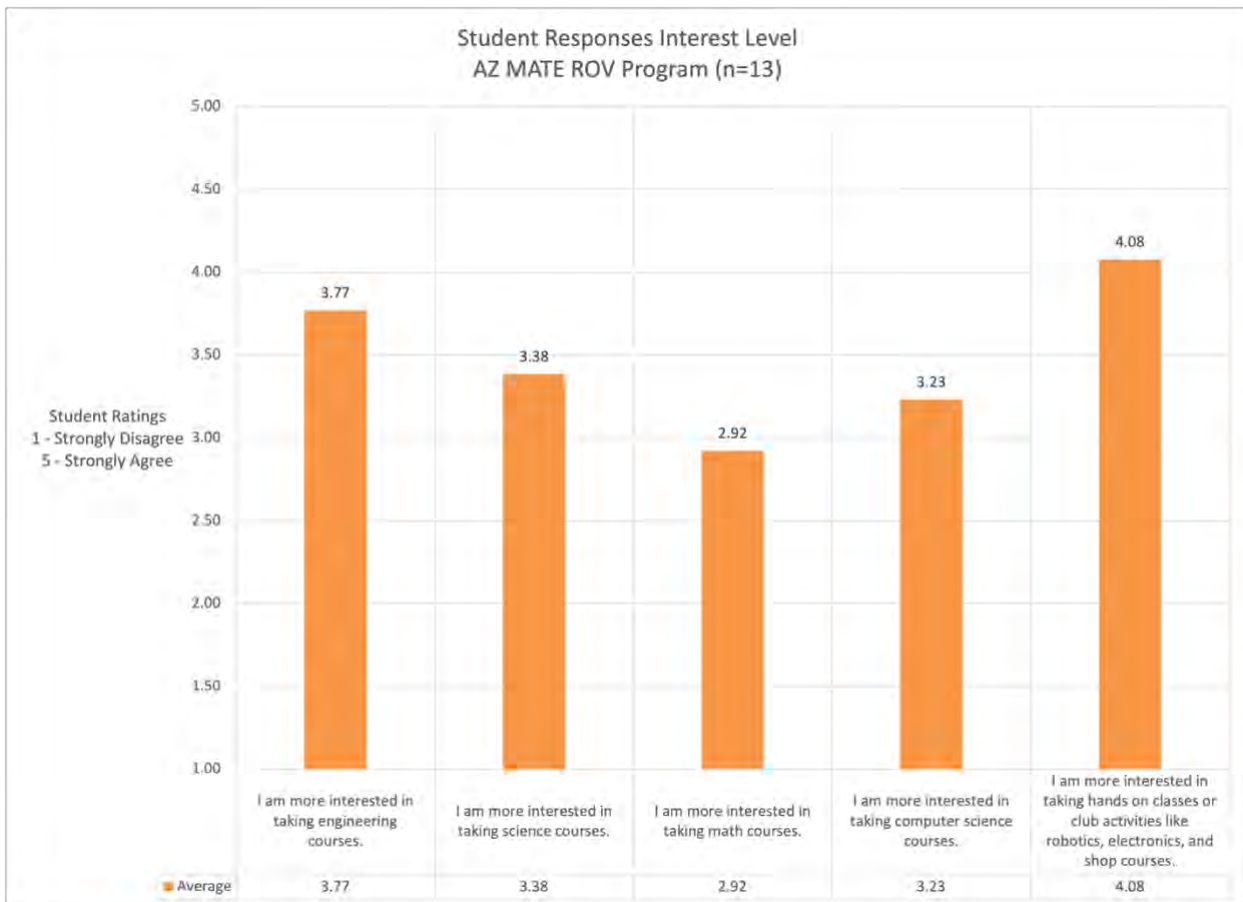


Figure 2 - ROV Student Responses Interest Level

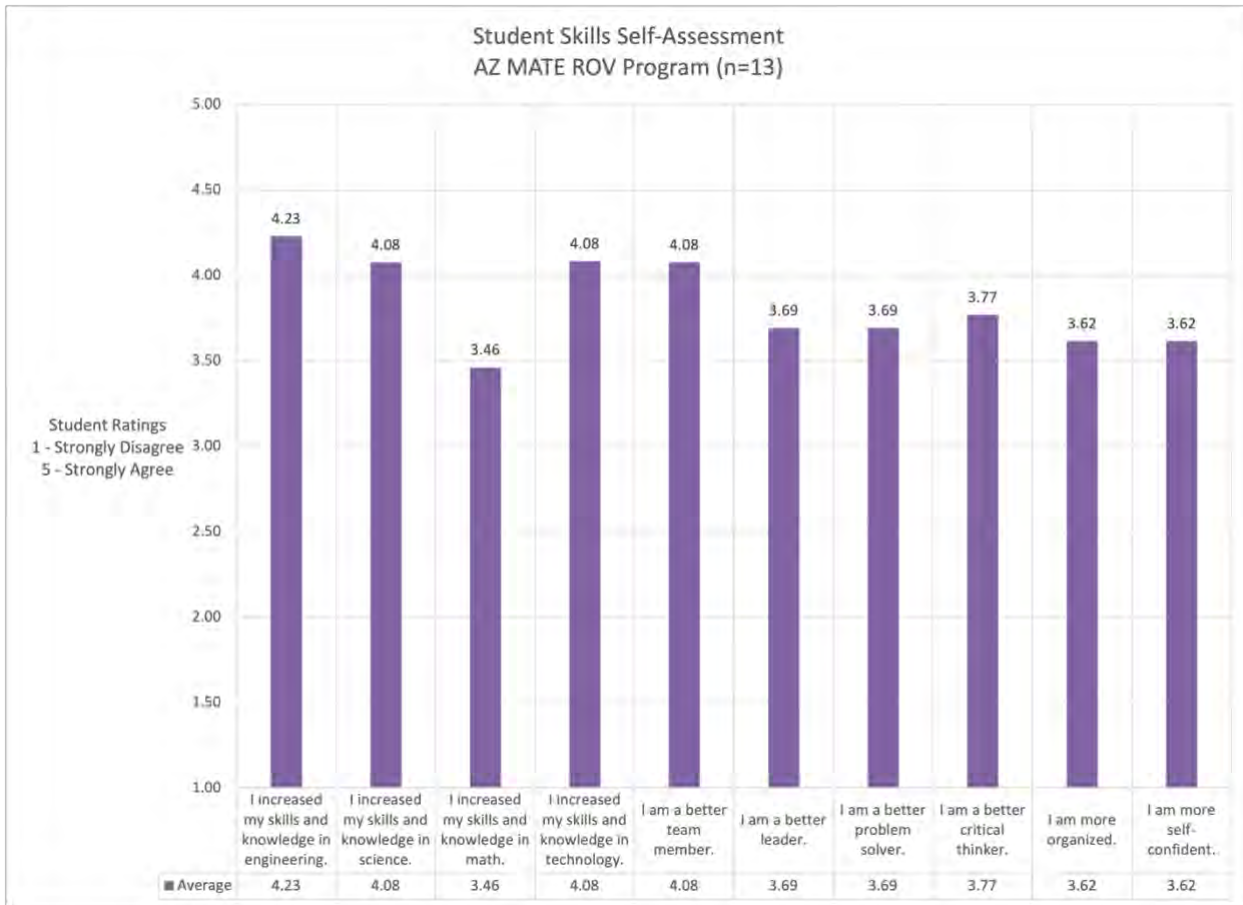


Figure 3 - ROV Student STEM Skill Self-Assessment

III. Task 2: Direct Student Outreach Programs

Because of ongoing COVID-19 restrictions, in-person direct student outreach was not possible for this school year. APW quickly pivoted our programming and developed a variety of online interventions for students learning remotely. Titles below show the intended work from the IGA and online equivalent.

3rd & 4th Grade Sweetwater Wetlands Water Festival & 6th-12th Grade Science Investigations at Sweetwater Wetlands = Discover Sweetwater Wetlands Virtual Field Trip

APW developed a series of 4 videos to introduce students to Sweetwater Wetlands in an online environment. The videos focused on showing students how to make close observations of a natural place and approach taking observations as a scientist. We used those videos as a centerpiece for a 50-minute virtual field trip to Sweetwater Wetlands, where students explored the wetlands and made observations from [close-up videos](#) of organisms and shared their drawings. A total of **970 students in 46 classrooms at 17 schools** participated in virtual field trips to Sweetwater Wetlands as a part of their learning during COVID-19 remote learning.

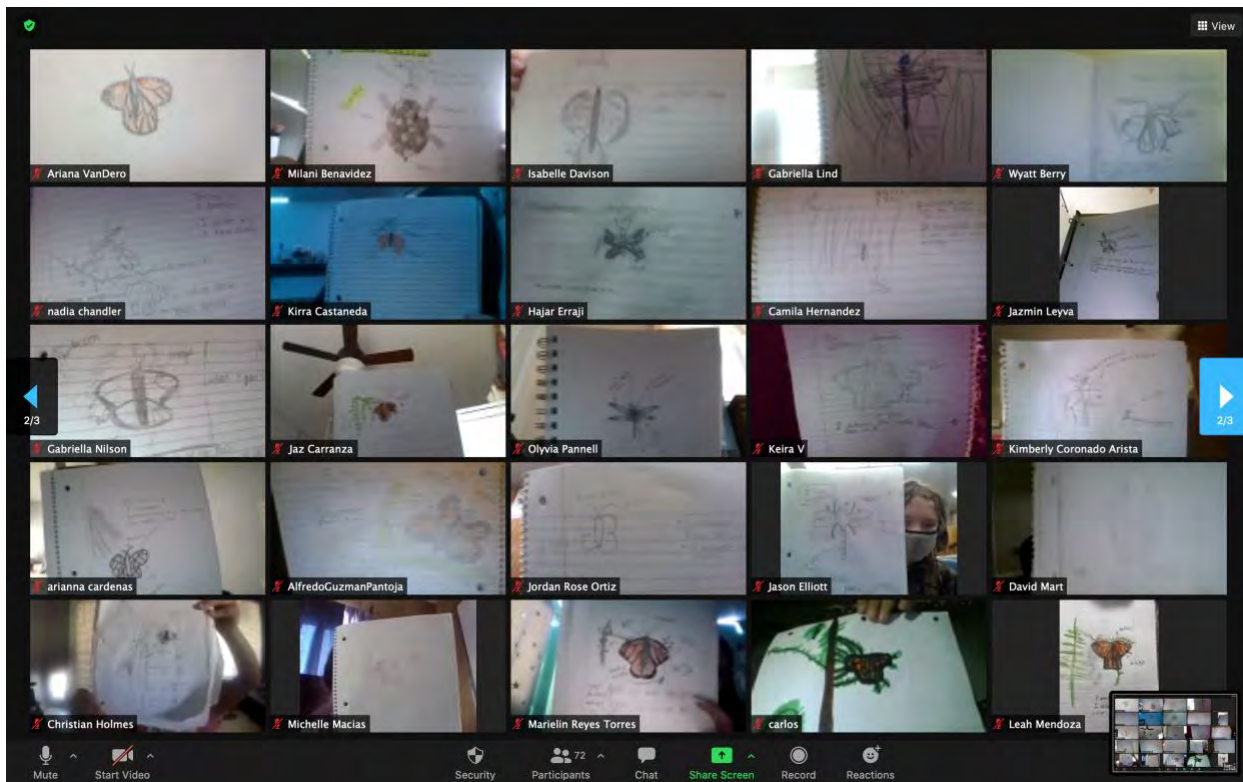


Figure 4 - Student work Sweetwater Wetlands virtual field trip

6th Grade Groundwater Presentations = Virtual Groundwater Model Presentations

Arizona Science Standards incorporate earth science and water concepts into the middle school curriculum. APW Water Educators developed a presentation based on the use of a digital groundwater flow model for students from upper elementary through high school. Through these virtual presentations, we were able to provide a 1-hour groundwater presentation to classrooms as an integral part of their science curriculum. The science standards were written to have older students spiral back to important concepts to build on the foundational knowledge acquired in earlier grades. For APW, first and foremost, that content is groundwater, the least understood and least taught part of the hydrologic cycle. **A total of 240 students in 11 classrooms at 4 schools were reached with facilitated middle school groundwater presentations in the 2020-21 school year.**

The lesson emphasized the groundwater/surface water connection and engaged students in thinking like a hydrologist to solve the problem of groundwater overdraft. It included the core concepts for understanding groundwater: 1) *Groundwater is in the pore spaces between sand grains, gravel and other particles*, 2) *Groundwater flows, because gravity works below ground just like it works above ground*, 3) *Groundwater is part of the water cycle*, 4) *Groundwater and surface water are connected*, and 5) *We use groundwater in our homes*. Students were able to think about changes in groundwater levels over time and collaborate on strategies to maintain “safe yield” in their digital models while still supplying water to their communities.

3rd and 4th Grade Groundwater Presentations= Build Your Own Groundwater Model Presentations

A one-hour classroom presentation was developed for mostly 3rd and 4th grade students by APW Water Educators. Students constructed their own simple groundwater models using a clear dish or tub, a lotion or soap pump, and some rocks or dirt. Then, using those models, students explored the groundwater system hands-on during a live Zoom session with APW facilitators. Using the individual groundwater models, Water Educators build foundational knowledge by asking questions and facilitating learning. Students learn that: 1) Groundwater is between the grains of sand and gravel, 2)

Groundwater moves through sand and gravel due to gravity, 3) Groundwater is connected to surface water, 4) Groundwater is part of the water cycle, and 5) We use groundwater. Students were directed

through a hands-on exploration of each of the concepts and then looked at drawings of groundwater cross sections to understand the visual representation of the concepts in a 2-D model. Lesson scripts are available upon request. **APW Water Educators conducted 10 in-classroom presentations for 187 3rd and 4th grade students and 27 teachers at 7 schools in 2020.**

The assessment covers the main ideas of the lesson and requires students to make connections between illustrations and the text as outlined in the Arizona English Language Arts/Literacy standards.

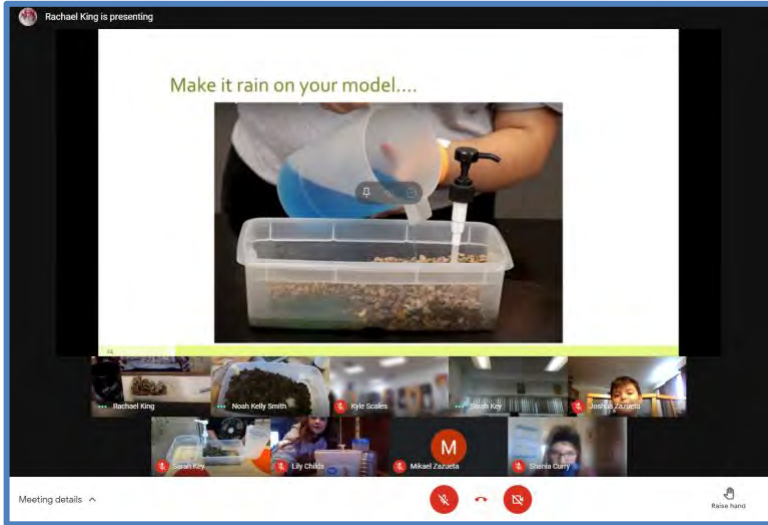


Figure 5 - Build Your Own Groundwater Model presentation

The assessment is administered before and after the lesson. **Overall students' knowledge gain averaged 38%.** The highest gains in learning were for the concepts, *Groundwater moves through sand and gravel due to gravity*, 44% gains and *Groundwater is part of the water cycle*, 46% gains.

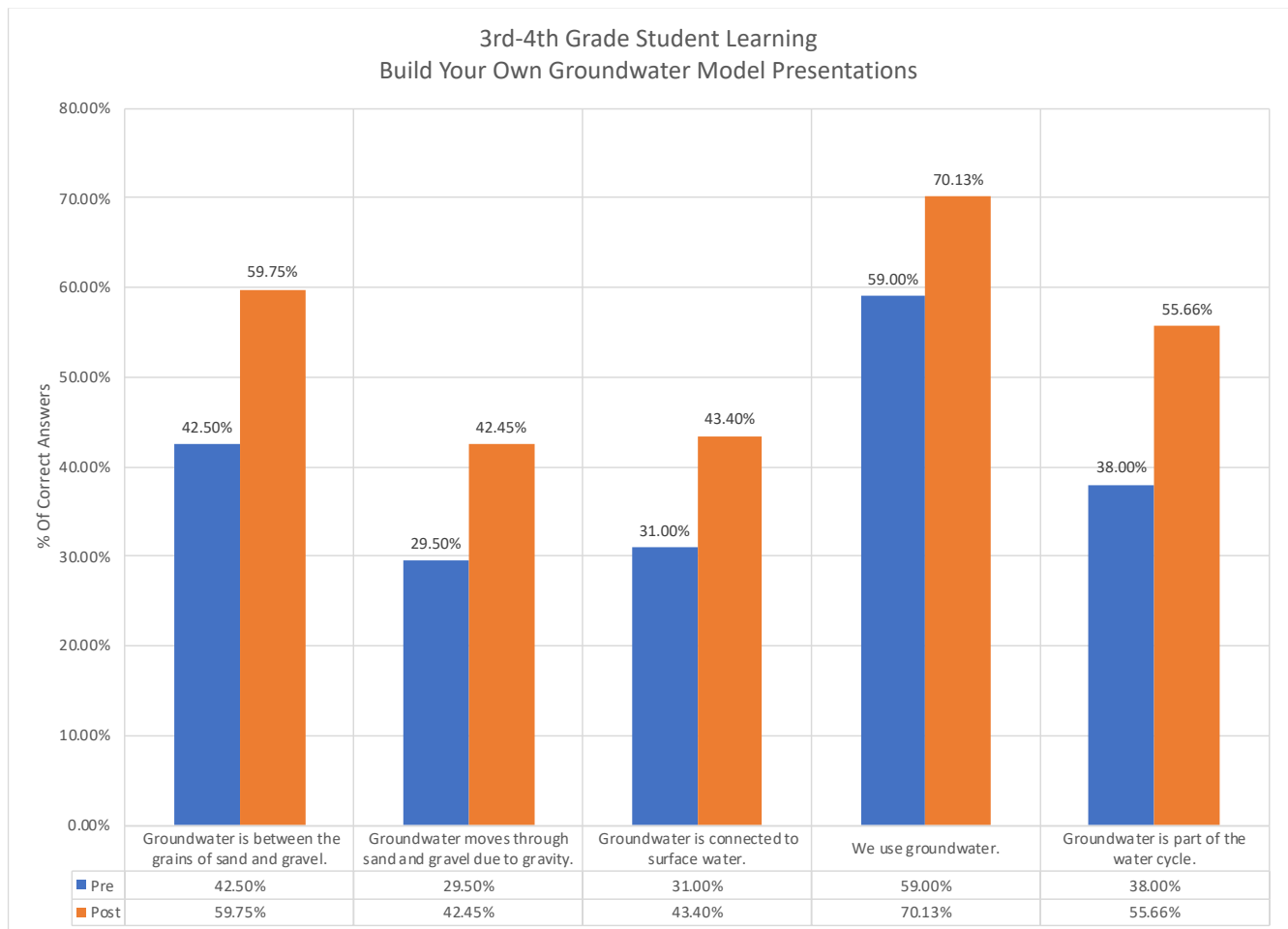


Figure 6 - Groundwater assessment results

Water Scene Investigation Program

The Water Scene Investigation (WSI) program offers students an opportunity to apply their learning and skills regarding water audits and water efficient technology at home. Water Scene Investigators measure the average flow rate of their bathroom faucets before and after the installation of a new water efficient aerator, and interview family members about their water use patterns. This program was truly an example of the right project at the right time, providing students learning from home with an opportunity to do a hands-on science project that could save their families water at a time where washing hands was more important than ever. The WSI was adapted to two virtual sessions: 1) Students played water conservation technology trivia to learn more about water efficient technologies, and 2) Shared their water saving experiences, making sense of their water savings data together.

APW facilitated the WSI curriculum at 10 schools for 522 students. Students reported a projected water savings of 728,759 gallons/year on APW’s website.

IV. Task 3: Arizona Water Festivals

Arizona Water Festivals (AWF) instill a deeper understanding of water in the earth system and Arizona’s water resources through a community water festival event, teacher professional development workshop, and extensive volunteer and community involvement. The AWF program first engages teachers in professional development that builds understanding about water and water resources, knowledge not covered in a primary grade teacher’s preparation. After attending the workshop, teachers implement the standards-aligned curriculum modeled in the workshop, which prepares students for the water festival. The curriculum also deepens students’ investigatory learning after the water festival. This year, APW delivered teacher professional development fully online and provided teachers with several adaptations to engage their students in an online learning environment.

Because a traditional Arizona Water Festival could not be held, APW adapted our program so that students learned most of the content of the Arizona Water Festival lessons through online modules and then gathered for an online *Celebration of Learning* with magician Richard Steele as emcee. The Marana Water Festival serves students in Marana School Districts not reached by the Sweetwater Wetlands Water Festivals. **This school year a total of 862 students, and 40 teachers participated in the Arizona Water Festival Unit and Online Celebration of Learning.** Learning gains are depicted in the table below.

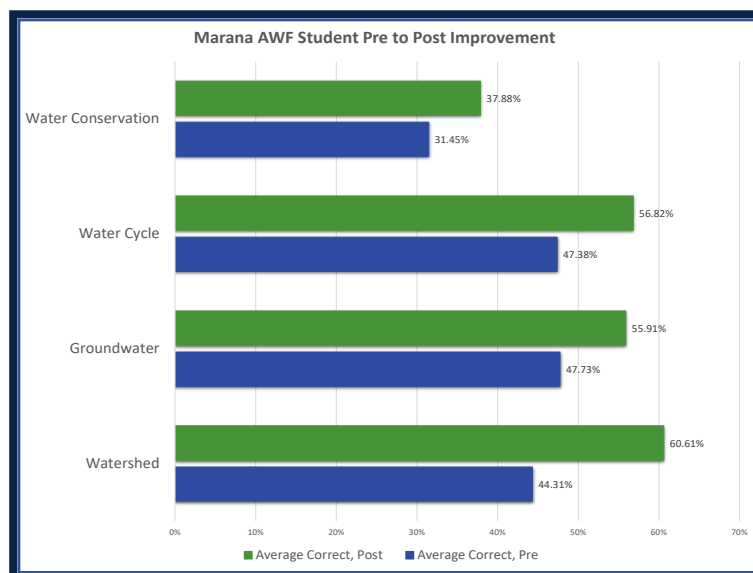


Figure 7 - Marana Water Festival Student Learning

V. Task 4: Equipment Loan Program




COVID-19 Safety restrictions imposed by schools suspended the equipment loan program in the 2020-21 school year.

IV. Conclusion

Strategic support for APW provides effective educational opportunities to an extensive network of educators, young adults and children. We appreciate your partnership in helping to ensure that Arizonans understand their interconnected water resources, are conservation savvy and are prepared to help ensure a safe reliable water supply.

Appendix

Task 1: Teacher Multi-Day Academy




4-H STEM YOUiversity Online Underwater Robotics Camp Spring 2021

Open to youth, teachers, educators and 4-H Volunteers
March 3 - April 28, 2021
Remote Competition May 1-15

[Learn More](#)


Arizona Teachers, Educators, 4-H Volunteers



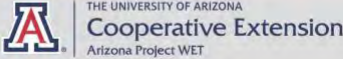
Would you like to learn about underwater robotics alongside your students or club members after attending this camp? We want you to make a difference become a STEM Counselor! Teachers and Educators will need to become Certified 4-H Volunteers, begin the process with your County Agent.
[Register Here to start the process](#)

6th-12th Grade Students

Do you enjoy hands-on activities, learning about engineering design process, circuitry and soldering? Then this project is right for you!
[Register a Team Here](#)



Registration Closes February 24



20 Teams Maximum Questions?
[Contact Betsy Wilkening](#)
or
[Jerry Lopez](#)




Figure 8 - ROV Marketing

The ROV Camp Modules are available in [an online spreadsheet](#).

Task 2: Direct Student Outreach



Virtual Science Programming!



Arizona Project WET has developed a variety of programs to support you by relieving a bit of the planning burden and giving your students a great hands-on, virtual learning experience that will build science practice skills, engage them in deep thinking, and generate excitement about nature at a time when being outside is the safest place to be! We can also Zoom into your physical classroom if you go back to in person learning.

Now scheduling for March, April, and May!

[Register](#)



3rd-5th grade: Hands-on Groundwater

Explore the groundwater system, by using simple models consisting of a container and gravel. Students will explore the groundwater system by observing relationships between the parts of the model as they make it rain and pump water from the for human use.



6-12 grade: Groundwater Simulator

Students use a virtual groundwater system simulation model and other interactive learning components to explore how water moves under the ground, how pumping affects groundwater levels, and how groundwater and surface water are connected.



4th-8th grade Plant Superheroes!

Learn why desert plants are superheroes with a unique superpowers that help them to survive. Students will construct a Superhero Guild to fight against extreme heat, drought, or empty habitat.



6th-12th grade: Water Scene Investigation

This two-session program invites students to investigate water use at home and take action to save water. We'll mail a flow rate bag and aerator to each student. The first session starts with a game of water conservation technology trivia and invites students to change an aerator at home. In session 2, we'll quantify water savings in each household and as a class.



K-12th grade: Discover Sweetwater Wetlands

We'll meet wildlife at Sweetwater Wetlands and practice our scientific observation skills in this virtual field trip. Using video clips taken on site, we'll "go live" to Sweetwater Wetlands to learn about how important water is in desert ecosystems. This a great jumping off point for backyard investigations, ecosystem studies, or learning about the water cycle.



2nd grade: Land, Water, and Watersheds

In this session, we'll use our Mt. Lemmon forests and the recent fires as a jumping off point to think about how these things can impact all the land that makes up our community—our watershed! We'll use photos and videos of the forest to think about what helps keep land and dirt in place and use our own simple models (a container of dirt) to explore how humans can protect our watersheds from erosion and flooding.

Available now for March, April, and May. Register now!

[Register](#)

Follow us on social media!



Figure 9 - Direct student outreach marketing

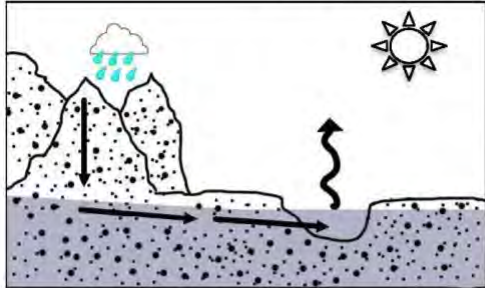
Outreach – Assessments

3rd - 4th Grade Groundwater Assessment: This assessment was administered through Qualtrics in an online environment for Pre and Post.

Name: _____ School: _____ Teacher: _____

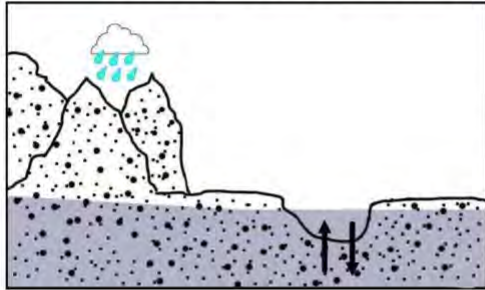
Pre-Assessment

Write the letter of the picture that best matches the sentence.



A

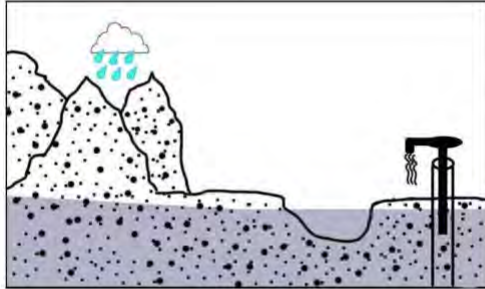
_____ Groundwater is between the grains of sand and gravel.



B

_____ Groundwater moves through sand and gravel due to gravity.

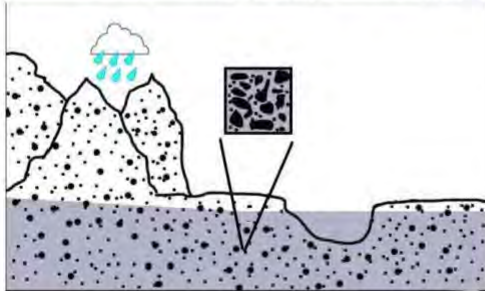
_____ Groundwater and surface water are connected.



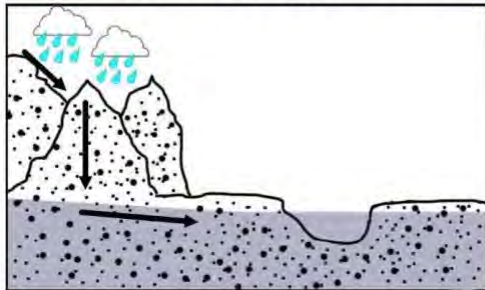
C

_____ Groundwater is part of the water cycle.

_____ We use groundwater.



D



E

MARANA WATER FESTIVAL: 4TH GRADE CELEBRATION OF LEARNING!

Join us for this **magical**, 1-hour event for your students to showcase their new understanding of water in Arizona.

The AWF Curriculum Unit drives this learning. Participating teachers complete 7 hours of online curriculum PD:

- ✓ Includes distance & online learning tools/resources
- ✓ Incorporates 3-Dimensional Learning
- ✓ Meets 2 of the 11 4th Grade AZ Science Standards*
- ✓ Next workshop: January 21, 28 and February 4, 2021, 3:30pm-5:00pm each day

Give your students the chance to put themselves at the center of their own water cycle & observe the phenomena relating to the environment in which they live.

***4.E1U1.6** Plan and carry out an investigation to explore and explain the interactions between Earth's major systems and the impact on Earth's surface materials and processes.

***4.E1U3.9** Construct and support an evidence-based argument about the availability of water and its impact on life.

SIGN UP TO PARTICIPATE:
https://uarizona.co1.qualtrics.com/jfe/form/SV_8qRBSivu0fuOIIJ

ARIZONA PROJECT WET

AWF
Arizona Water Festival

**THE UNIVERSITY OF ARIZONA
COLLEGE OF AGRICULTURE & LIFE SCIENCES
WATER RESOURCES
RESEARCH CENTER**

Figure 10 - AWF marketing