

# Water Resources Research Center



College of Agriculture and Life Sciences

## Water Education for the 21<sup>st</sup> Century - Arizona Project WET

Public Perceptions/Acceptance  
Working Group

Phoenix, Arizona

March 26, 2010

Arizona Project WET, Director



# Water Education Is the Key

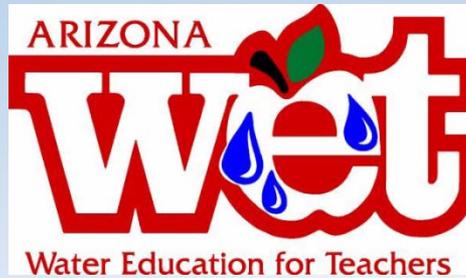
How do we get people to shift their thinking, change their behavior; in this case become knowledgeable water stewards?

Learning is a process:

- Awareness
- Knowledge
- Understanding

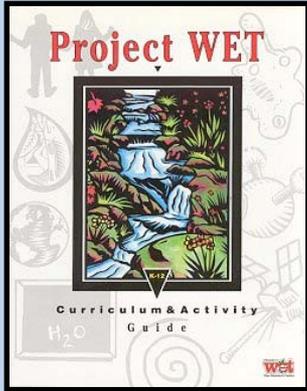
Only then can we shift public perception.



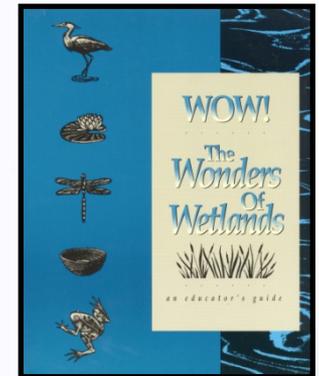
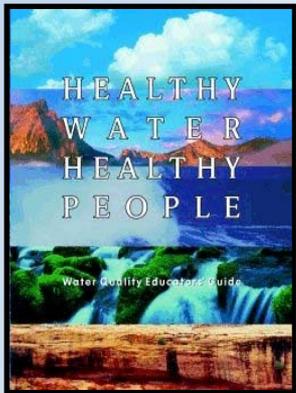
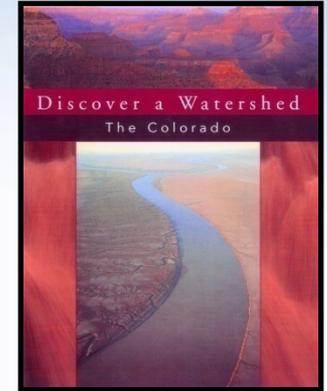


The mission: to promote responsible water stewardship through excellent and effective water education.

# Curriculum & Lesson Guides: Content & Method



- Developed in group writing events with teachers and specialists working together
- Use research-based pedagogy
- Address multiple intelligences and learning styles
- Develop critical thinking and problem solving skills



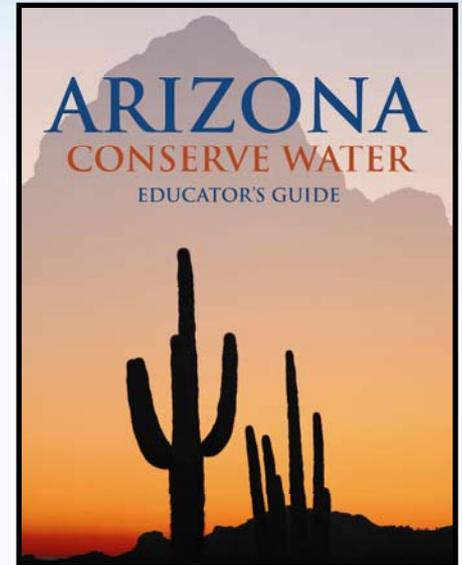
# What do teachers and professors say about APW?

- *Arizona Project WET provides us with the science-based educational resources to raise the students' environmental awareness and problem solving skills.* **Budd Turner, 7th & 8th grade teacher, Mansfield Middle School**
- *The lessons are very applicable for my seventh grade science class. The curriculum guides are excellent and are ready to use in the classroom, and the activities are very engaging. Also, all workshop presenters are very well informed, professional and used engaging teaching techniques.* **Ben Briggs, 7th grade teacher**
- *Thanks so much for all your great ideas, wonderful presentation, and energy. Think the soon-to-be teachers really benefited. Judging by the number of students who are turning in lesson plans that borrow heavily from your guide, I would judge that they are very appreciative of your workshop!* **Linda Sargent Wood, Ph.D., Professor, History Department, Arizona State University**

# Arizona Conserve Water Educators' Guide

This Curriculum Guide:

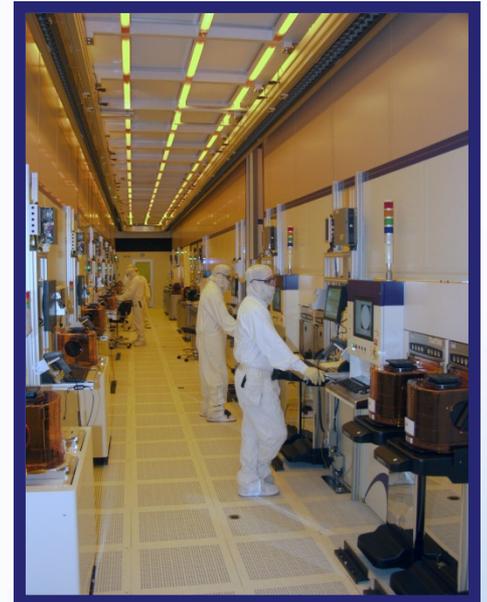
- was published May 2007,
- covers Arizona's specific water resources management picture, and
- focuses on water conservation which is to say that **it focuses on reuse as well!**



Arizona Project WET instructs learners about water use and reuse by referring to the four R's: the **right** amount, at the **right** time and place, at the **right** quality, at the **right** price.

# Water Reuse Case Studies

- Intel separates water needs by water quality from ultra pure to wastewater: they built the City of Chandler RO treatment plant where clean rinses from the manufacturing process go and are then recharged to the groundwater.
- The Desert Sweet Shrimp operation in Gila Bend reused nutrient-rich water from the shrimp ponds to irrigate crops.



# Water Reuse Case Studies

- In Flagstaff, SCA Tissues now uses reclaimed water in it's papermaking business after some study to ensure public approval of the process.
- In Yuma, AlSCO is utilizing the discharged water from Dole Fresh Produce for their laundry facility.

**Arizonans accept water reuse when they are educated on the subject!**



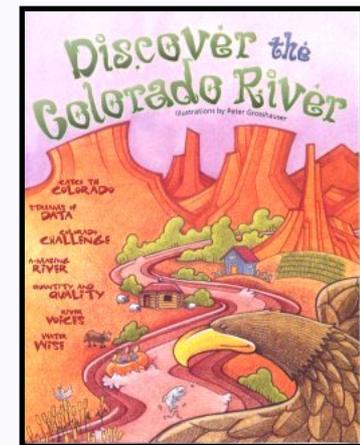
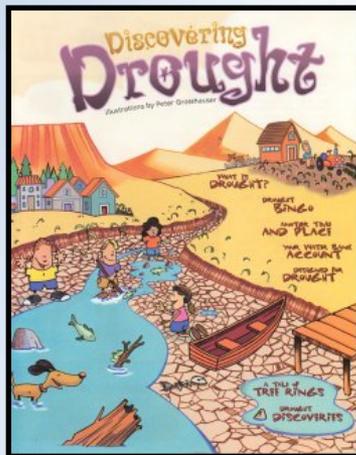
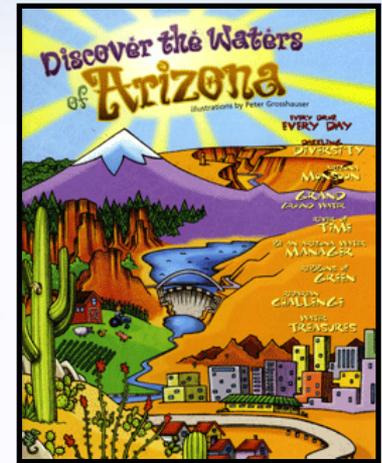
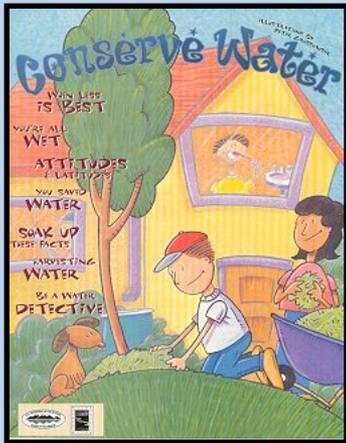
# *Arizona Conserve Water:* **What are workshop participants saying?**

- *Wonderful – I can't wait to apply it to the classroom.*
- *I really believe all children need to be aware of water conservation and the fact that we use groundwater. This was great!*
- *This was a great workshop. Arizona Conserve Water is the best WET book so far!*
- *The ideas & activities were wonderful and will definitely help in water education.*

# Supplemental Materials

## Content Specific Student Booklets

Offer in-depth content for teachers and students to engage in learning about key water resource topics.



# No Child Left Behind

## Students

- Arizona Academic Standards
- Arizona Instrument to Measure Success (AIMS) test

## Schools

- Adequate Yearly Progress
- Improvement Plans

## Teachers

- Highly Qualified Teachers – pd plans
- Teacher Certification Requirements



# All Educator Guides are correlated to the Arizona Academic Standards

Lesson Title	Subject	Grade level (select all that apply)
<p><b>-- Browse All Lessons --</b></p> <p>A Drop in the Bucket 238 A Grave Mistake 311 A House of Seasons 155 Adventures in Density 25 After Math 289 A-maze-ing Water 219 Aqua Bodies 63 Aqua Notes 66 Back to the Future 293 Branching Out 129 Capture, Store, &amp; Release 13 Check It Out 3</p>	<p><input checked="" type="radio"/> Writing</p> <p><input type="radio"/> Reading</p> <p><input type="radio"/> Science</p> <p><input type="radio"/> Math</p> <p><input type="radio"/> Social Studies</p> <p><input type="checkbox"/> Show all applicable lessons for each result</p> <p><i>*Note: 'High School' grade level applies only to Science and Math</i></p>	<p><b>-- All --</b></p> <p>0 1 2 3 4 5 6 7 8 9 10 11</p>

It's as easy  
as 1,2,3!

- 1) **Click** on lesson
  - 2) **Click** on subject
  - 3) **Click** on grade level
- View the Results!**

# Statewide Collaboration & Delivery Network



**It's all about  
partnerships!**

# Programming Examples

# School Water Audit Program: SWAP Goals

- Educate students about the need for water conservation, by engaging in ***real-world, action-based*** projects that integrate science, language and math skills and utilize technology.
- Determine the amount of water used in a school.
- Implement **behavior & technology-based** conservation alternatives in schools and homes.
- **Incentivize community involvement** through student-led technology retrofit installments and student presentations to decision makers.
- **Decrease water use** in the school and community.

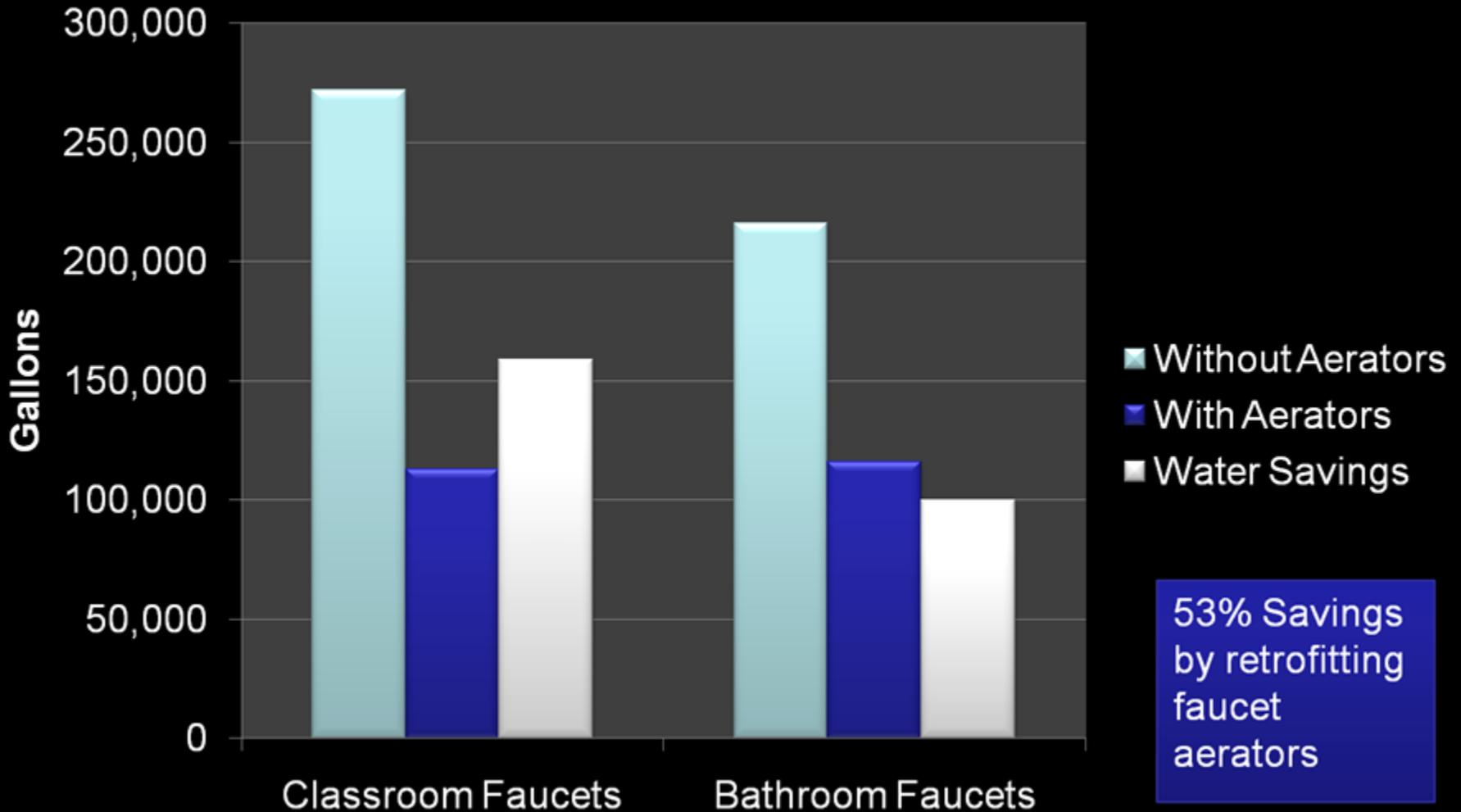
# Cottonwood MS Case Study

- Students Involved: 120 7<sup>th</sup> Graders
- Volunteers Involved: 18, 100+ hours (including the mayor & ADWR AMA director)  
(at Independent Sector volunteer rate of \$19.51 = ~\$2,000)
- Monetary Investment: 0
- City of Cottonwood provided:
  - 270 aerators
  - 72 catch cans
  - 250 dye tabs



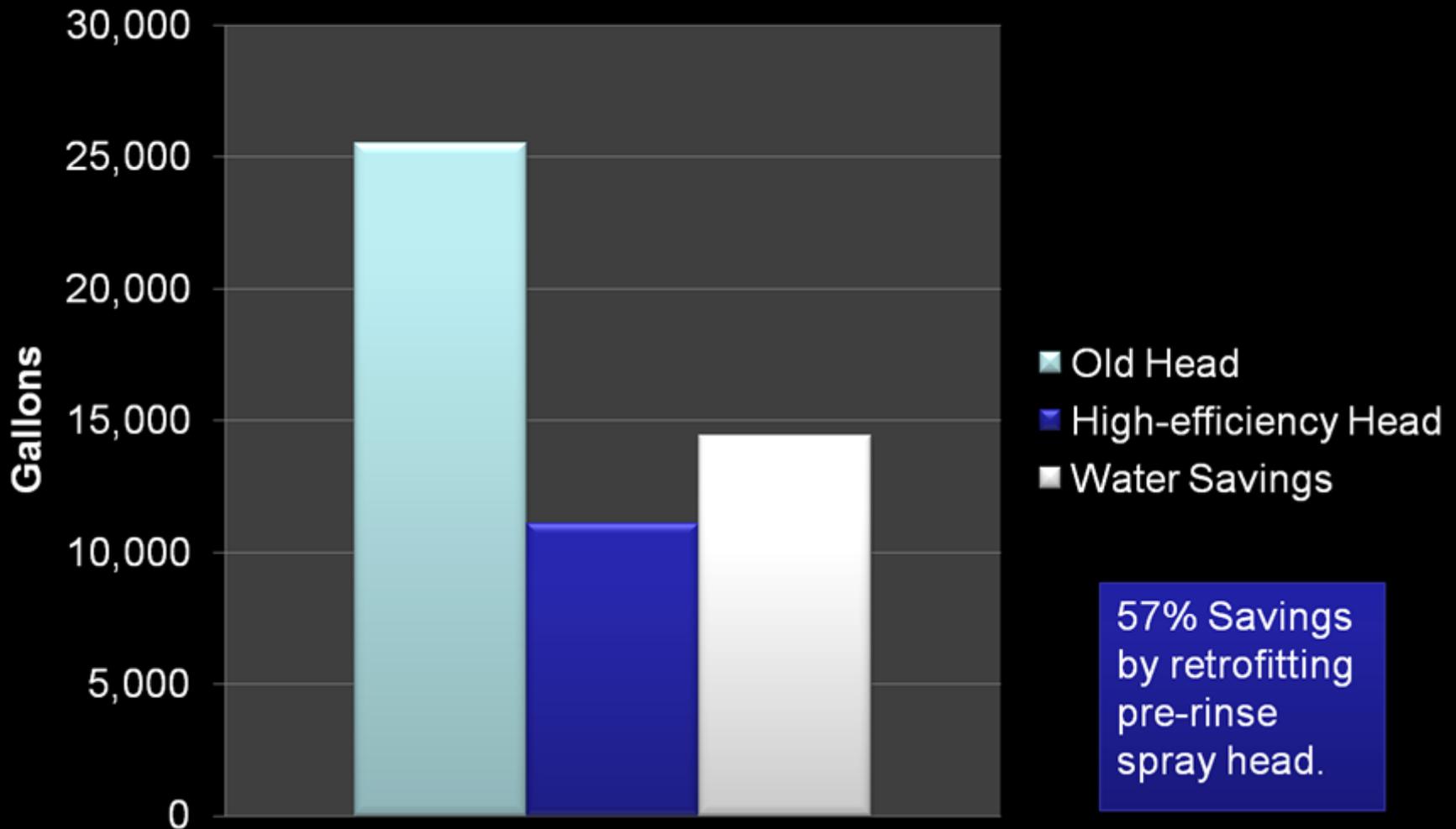
# Cottonwood MS Projected Water Savings

## Annual School Water Savings with Faucet Aerators



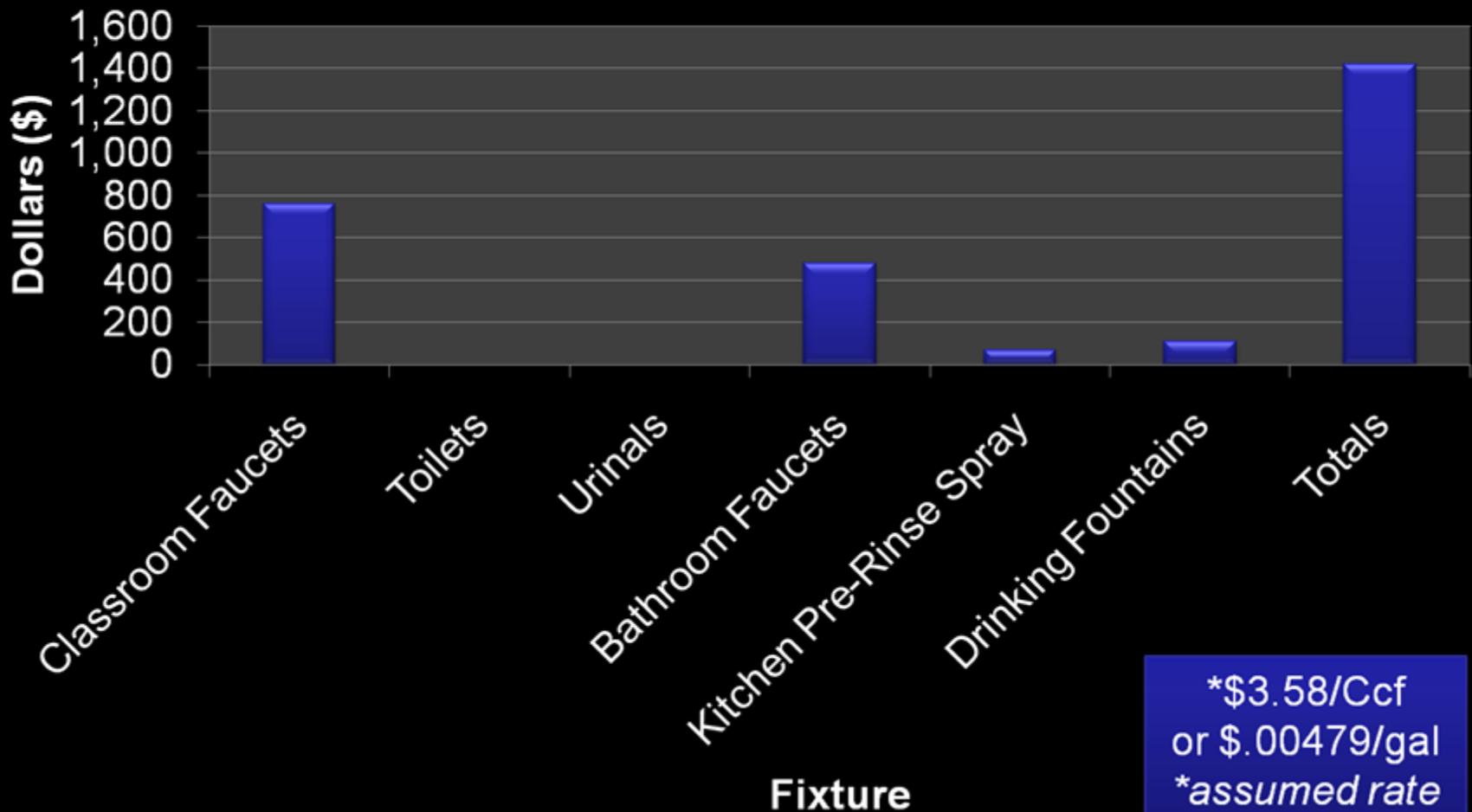
# Cottonwood MS Projected Water Savings

## Pre-rinse Spray Head Annual Savings



# Cottonwood MS Projected Financial Savings

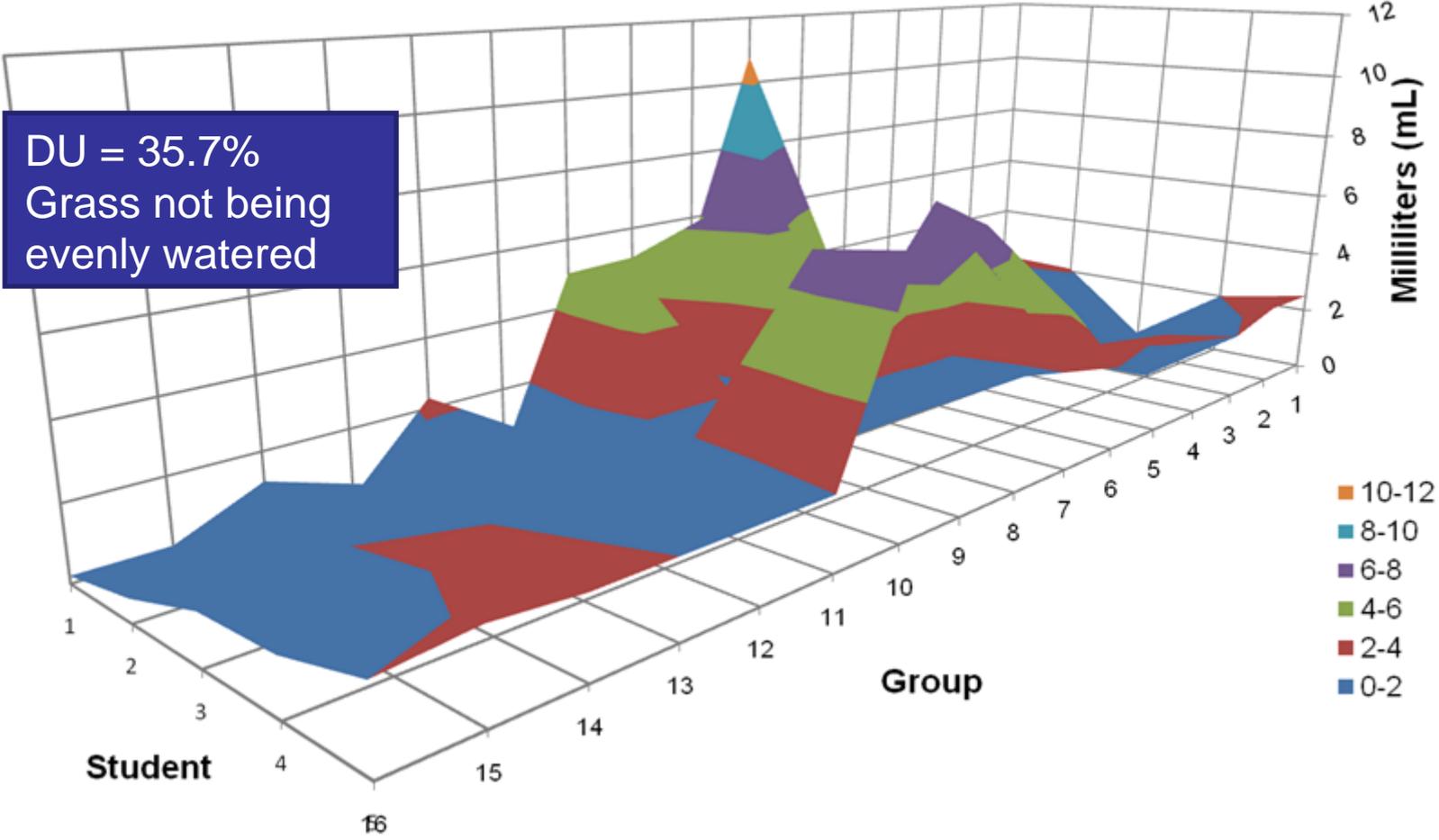
## Annual Financial Savings of Cottonwood MS Retrofits



# Outdoor Irrigation Audit

## Turf Watering Uniformity Analysis

DU = 35.7%  
Grass not being evenly watered



# Home Water Audit Projected Savings

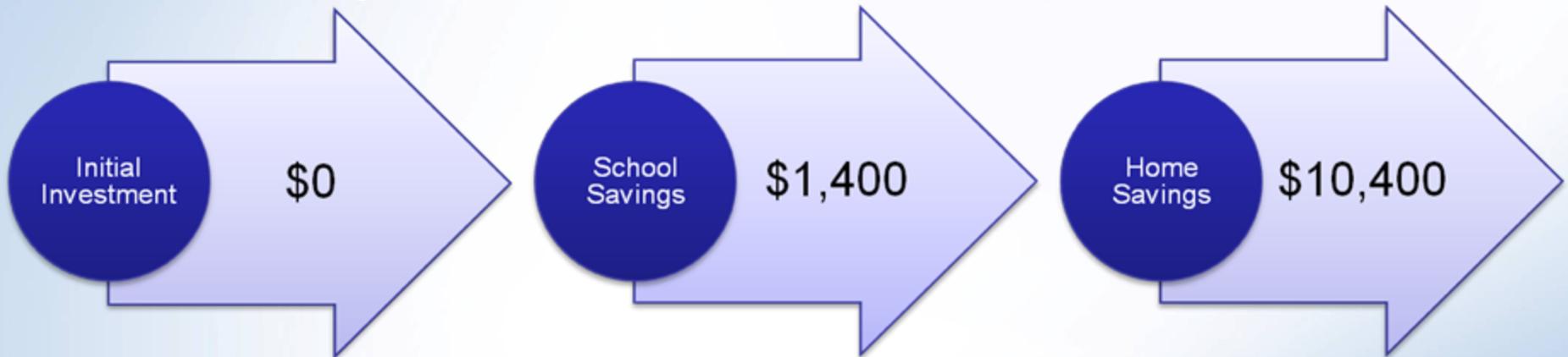
Home Retrofits	Annual Savings (gallons)	Annual Savings* (dollars)
Aerators	876,000	\$2,715.60
Dye Tablets (16% toilets had leaks)	2,464,480	\$7,639.89
<b>Total</b>	<b>3,340,480</b>	<b>\$10,355.49</b>

\*Water rate = \$3.10/1,000 gallons

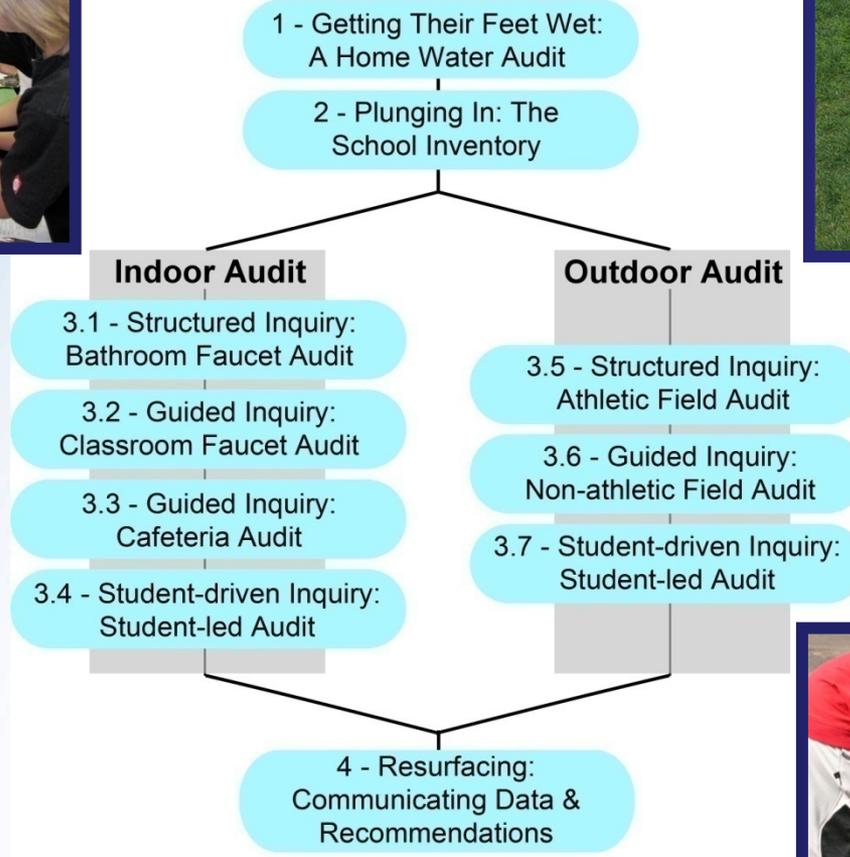
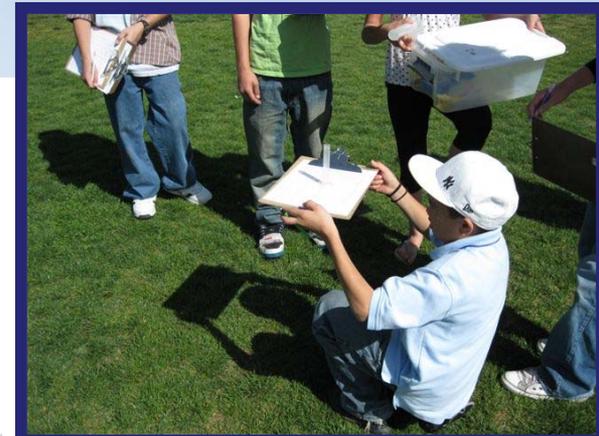
Toilet savings based on 200 gallons/day for leaky toilets

# Cottonwood MS Results

- Outdoor Audit led to an IA professional audit
- 6 Students presented findings to county Water Advisory Board
- Governor's Excellence in Economic Development Award, Future Leaders



# The SWAP Process



# APW Professional Development

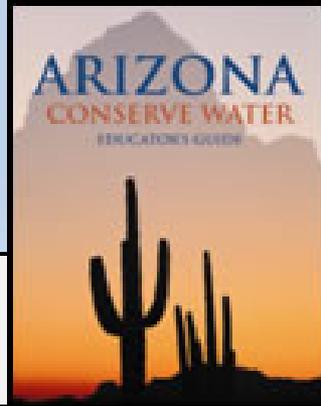
- New National Staff Development Council Standards for professional development have been adopted by Arizona Department of Education.
- Guidelines for professional development have changed and APW is changing with them!



# ADE Expectations

- **Development of Learning Communities**
- **Ongoing continuous instructional improvement**
- **Support of adult learning and collaboration**
- **Assessment that uses multiple sources of information to guide improvement and demonstrate its impact**
- **Uses applied research that improves critical thinking skills**
- **Incorporates differentiated instruction**
- **Deepens teachers' content knowledge**
- **Provides research-based instructional strategies to assist students in meeting rigorous academic standards**

# Conservation Champion



## Conservation Champion

*Arizona Conserve Water Educators' Guide*

Orange lapel pin and puzzle

Puzzle Piece	Target Competency	Teacher Action	Incentive
State of AZ (body)	Understand that the properties of water allow it to move and change form in the Earth's water cycle.	Take the Plunge! Begin APW training	<i>Arizona Conserve Water Educators' Guide</i>
Face	Describe the interconnection of all water sources in the Earth system.	Register a friend for any WET workshop	<i>Arizona Water Map</i>
Arms and legs	Explain the direct and indirect uses of water.	Utilize any APW teaching tool. Submit at least three photos depicting classroom use.	Pictures posted on APW web site. Grade appropriate teaching materials.
Star	Identify the conservation adaptations of plants and animals	Present student work to others at an APW workshop	Student work posted on APW web site
Water drop	Investigate water conservation methods including rainwater harvesting and use of native plants.	Complete one specific portion of the SWAP	Beautiful Arizona photo DVD
Lasso	Communicate a message of efficient water usage	Support five Junior Water Champions or hold a water festival at your school	Classroom sets of PW's <i>Discover the Waters of Arizona</i>

# Master Water Champion



## Master Water Champion

Gold lapel pin

Special designation for those who have completed all four Champion programs.

Puzzle Piece	Target Competency	Teacher Action (completed during the overall Champion process)
State of AZ (body)	Know where the water that we use comes from	Become WET Water, River, Healthy Water, and Conservation Champions.
Face	Understand that life would not exist without water	Register four friends for any WET workshop
Arms and legs	Act to keep watersheds clean	Utilize four APW teaching tools. Submit at least twelve photos depicting classroom use.
Star	Exemplify water stewardship for others	Present student work to others at four APW workshops.
Water drop	Work actively toward a sustainable future	Complete all components of the school-wide SWAP or develop and complete any water stewardship/conservation project.
Lasso	Use water efficiently	Support twenty Junior Water Champions

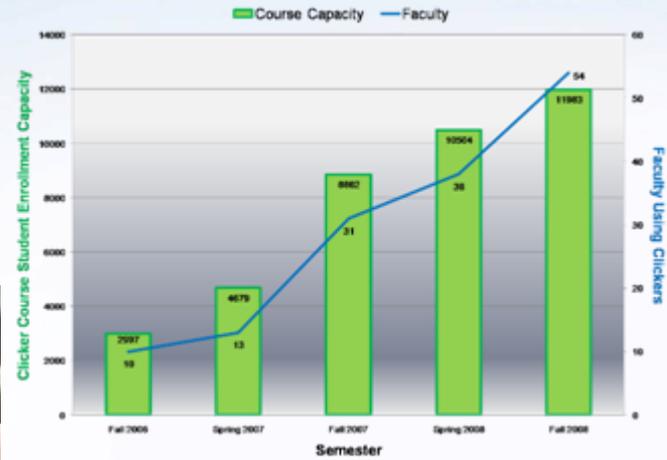
# Digital Natives

Today's students represent the first generations who've spent their entire lives surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age. **It is probable that today's students think and process information fundamentally differently from their predecessors.** These differences may go far further and deeper than most educators suspect or realize.

# CPS Responders

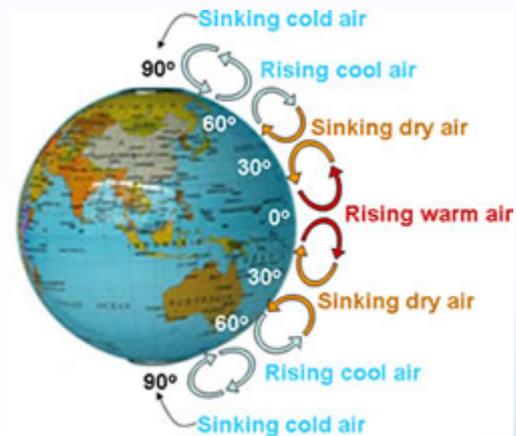
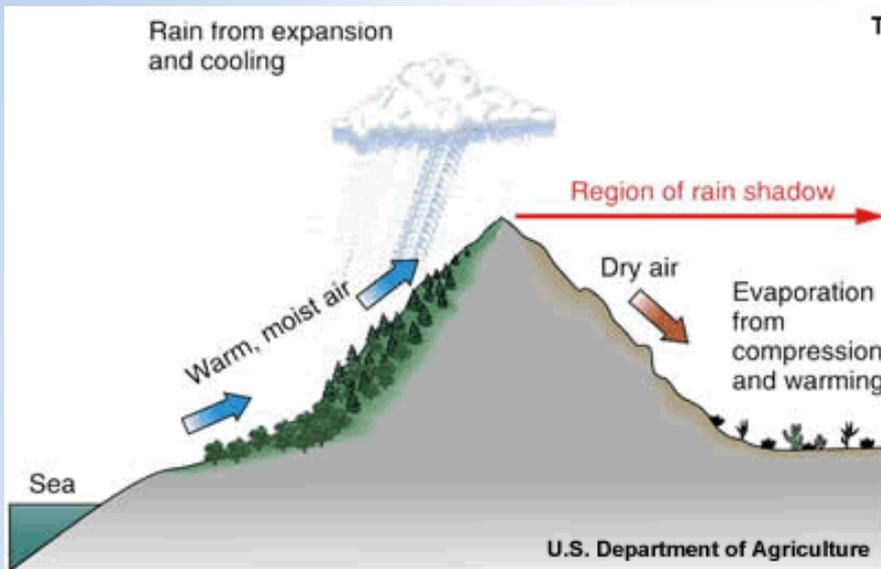
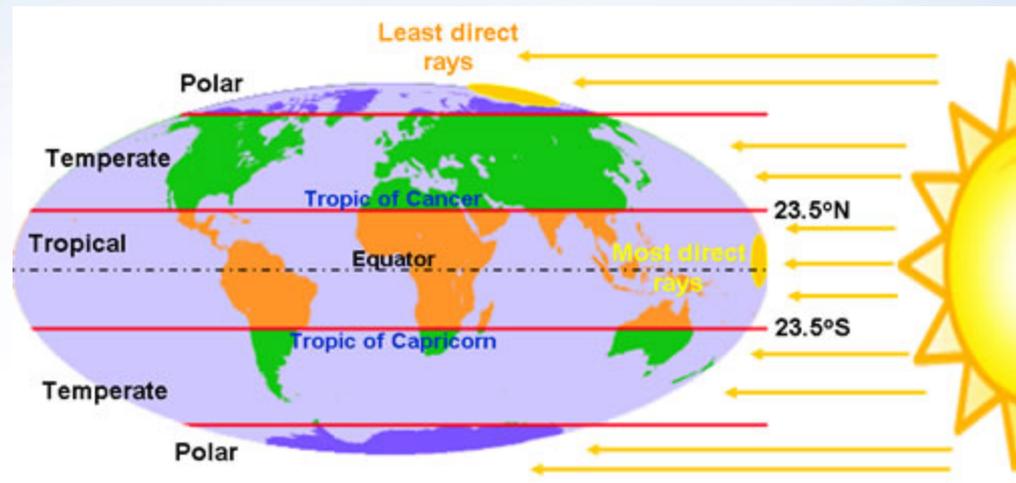


SDSU Faculty and Student Clicker Participation



# Standards-based water education module for 6<sup>th</sup> grade students

An innovative interactive computer module engages students in instruction and assessment about the water cycle and weather.



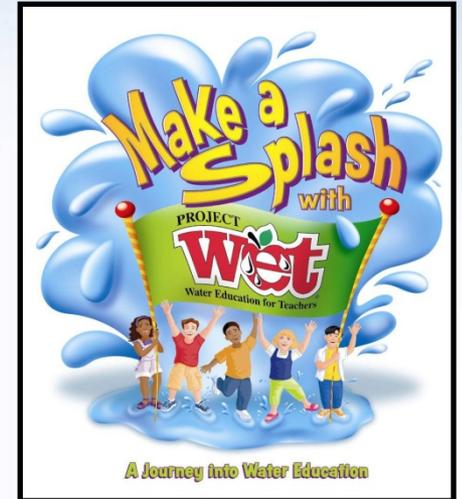
# Notebooking

## Supporting Research

Klentschy and Molina-De La Torre (2004) advocated writing in science notebooks as a way for students to **understand first** and **communicate second**. They found that students who used science notebooks also spent more time writing.

# The Water Festival Model

APW developed the standards-based Arizona Water Festival (AWF) model which has engaged & instructed 33,337 4<sup>th</sup> grade students and 1,023 teachers in 20 Arizona communities.



Model includes: 1) pre- and post-festival lessons conducted in-classroom by teachers, 2) Teacher professional development, 3) volunteer training and 4) program evaluation.

# The Water Festival Model

The Water Cycle



Children move through the hydrologic cycle

The Value of Water



Students learn the history and value of water

Groundwater



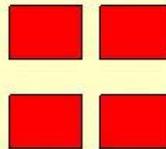
Children learn what water looks like underground

Watersheds

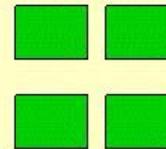


Students learn hands-on about their watershed

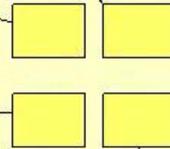
Red Area



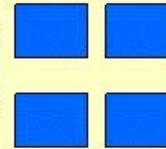
Green Area



Yellow Area



Blue Area

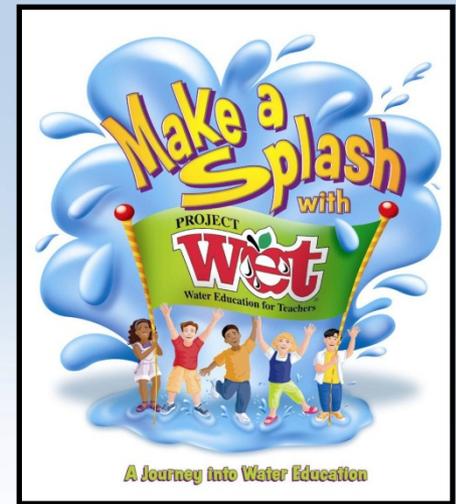


Staging Crew

Parking and Bus Drop-off

**WATER FESTIVAL LAYOUT**

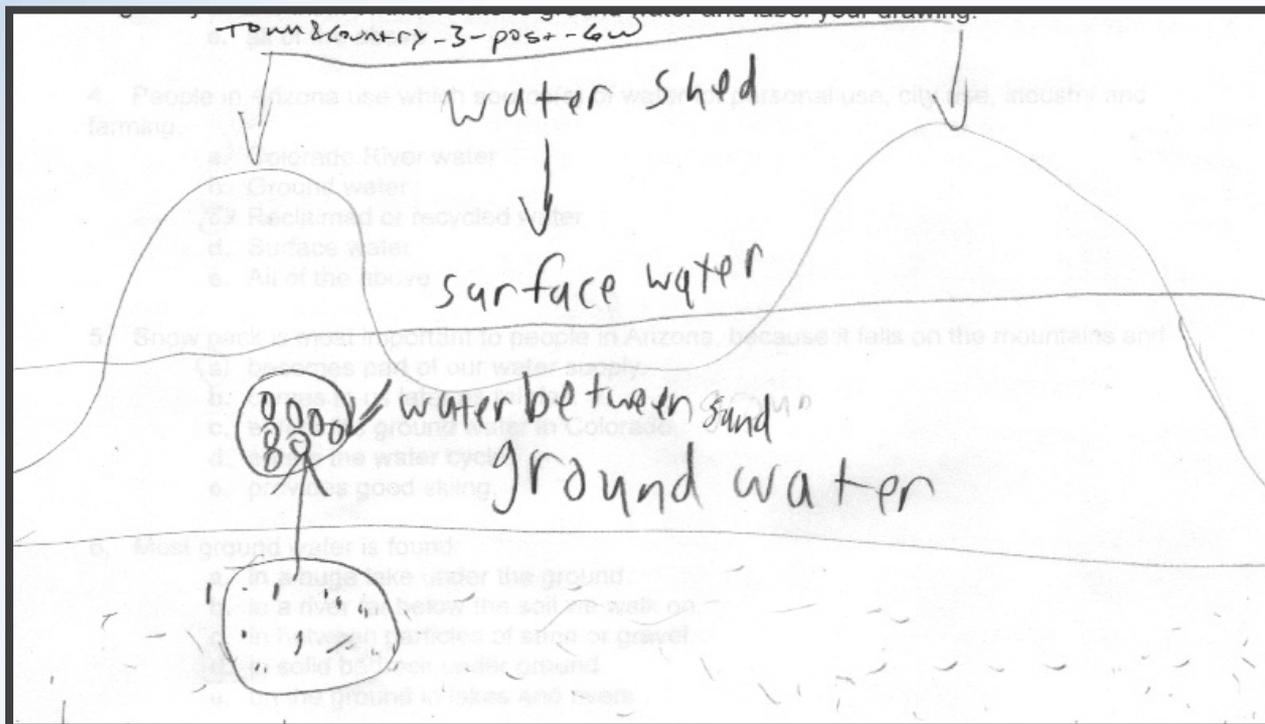
# Arizona Water Festival 4<sup>th</sup> Grade Learning Module



Summative Evaluation (2009) demonstrated statistically significant results:

- Student knowledge about water increased pre- to post-water festival and their enthusiasm for water conservation and learning about water increased.
- Students in the classes of teachers who participate in the professional development workshop show greater gains than those who do not.

Before the water festival students only recognize groundwater as water under the ground, typically in a large lake or underground cave. After the water festival:



# An AWF Success Story

- *I heard nothing but positive things from teachers, administrators and children about the Arizona Water Festival. It was a fabulous hands-on learning opportunity for the children of the Verde Valley. I am sure they have a much stronger understanding of the complexity of water systems due to your work. Thank you so much for your efforts and for your support of this top notch activity.*
- Barbara U'Ren  
Superintendent  
Cottonwood Oak Creek School District



# What does District Science Coordinator say about the Water Festival field study?

*It's a true field study. It's not a 'We're going out to have fun' field trip. It's just been great because for years we've had different business communities create and develop curriculum and say, 'Here, schools, this is what you need.' But **in the case of the water unit and water festivals**, she said, **the community honored its teachers by asking what the teachers needed and offering to make it happen.** What we need is for businesses and partnerships to look at our curriculum and say, 'This is how we can make it come alive.'*

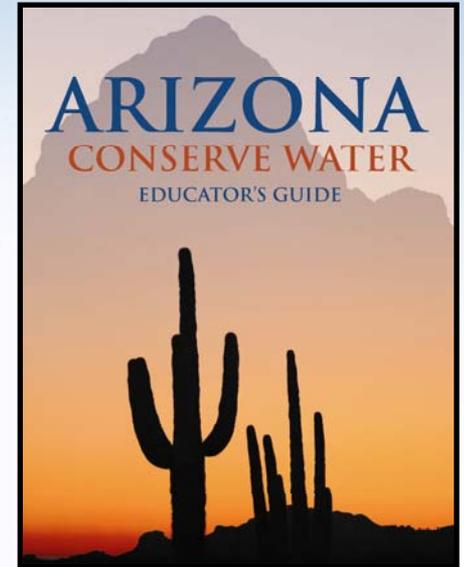
Quote from Arizona Daily Star

# Summarizing Arizona's Water Education Program

- Research-based, relevant and comprehensive content
- Built in to state education requirements
- Statewide delivery mechanism
- Programming that interests and inspires learning ....

So what's needed?

# WaterReuse Foundation Unsolicited Proposal Submitted



## Project Objective:

Development and Distribution of an effective Water Reuse Curriculum Supplement and an Integrated Water Management Simulation Model

# So how do People Learn?

How do we shift preconceived notions and influence public perception?

- Constructivism
- Learning Styles
- Multiple Intelligences
- Neuroscience
- Brain-Based Learning
- Communities of Practice
- More research every day .....

# What is effective teaching according to most research?

- activating background knowledge,
- building on pre-existing knowledge to deepen understanding,
- breaking the task into smaller, more manageable parts
- prompting concretely & questioning effectively,
- verbalizing thinking processes when completing a task,
- learning in cooperative ways,
- coaching and modeling,
- addressing misconceptions

# Conclusions

It's not just about content; instruction or messaging is just as important.

Efficient water use and reuse matters and is important for Arizona. APW can assist in the development of effective education programs.

Teachers can't do it alone. Real world education that teaches lifelong lessons, critical thinking skills and problem solving is a community education project that will instill the practice of wise water use ... the right quality for the right use.

# Contact Information

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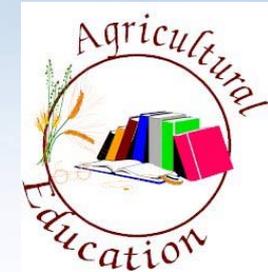
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