

EVALUATING STUDENT LEARNING AND KNOWLEDGE GAINS DURING AN UNDERGRADUATE SUMMER REUSE WATER RESEARCH EXPERIENCE

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Outline

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 - Results
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Introduction

USDA REEU

- Research and Extension Experiences for Undergraduates (REEU)

“This work is supported by Research and Extension Experiential Learning Fellowships for Undergraduates grant no. 2016-67032-24993 from the USDA National Institute of Food and Agriculture.”

- The National Institute of Food and Agriculture (NIFA) provides leadership and funding for food, agricultural, natural resources, and human sciences. The agency prioritizes ensuring students from all backgrounds have an opportunity to pursue careers in agricultural and related sciences. The agency seeks to provide experiences to undergraduate students, leading them to careers in the agricultural workforce or to continue their education in graduate school.
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TAMU Reuse Water Quality REEU

- Goal of the program:
 - 1) hands-on learning experiences in reuse water quality,*
 - 2) exposure to careers in agricultural research and extension, and*
 - 3) a pathway to graduate school.*
 - Participants will have the chance to interact with a multidisciplinary team of extension specialists, agricultural engineers, and soil and water microbiologists, from the Texas A&M University (TAMU) and Prairie View A&M University (PVAMU) campuses.
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The Why?

- Addressing a critical environmental concern

Reuse water systems demonstrate a proactive approach to addressing water scarcity

- Experiential Learning and Traditional Classroom settings

Opportunity to actively engage in research related to water quality

Real world applications and developing skills that are transferable to careers in water quality

- Long-term impact

Potential to inform the design and improvement of future undergraduate research programs in Food, Energy, and Water Nexus

Importance of Assessment for Summer REEU

- Pedagogical Value
 - Evidence-Based Insights
 - Career Pathways
 - Long-term benefits
 - Research Advancement
 - Educational Innovation
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Research Objectives

- Assess knowledge gains
- Analyze self-evaluation of skills
- Examine attitudes toward research and careers

Assess transition to extension positions

- Study program impact over the past years

Analyze COVID-19 impacts

Background and Methodology

Reuse water REEU

- 5 week paid internship
- In-class lecture

Basic scientific principles related to hydrology, water quality, and their connection to Onsite Sewage Facilities (OSSFs)

- Hands-on research
 - Experience communicating with extension personnel
 - Interaction with industry
 - Field trips
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Assessment

- Pre assessment and Post assessment

To evaluate knowledge levels

- Student assessment of learning gains (SALG)

To understand their attitudes and personal assessment of learning gains

- 40 students, over 3 years from 15 universities

- Data collected 2019, 2021, 2022, and 2023

Post assessment SALG was not collected in 2022

Classroom Knowledge

- OSSF (Onsite Sewage Facility)
- OWR (Onsite water reuse)
- Reuse
- Soil
- Microbiology
- Etc.

The questions in this section evaluate your understanding of the concepts that will be explored in the class

Presently I understand...

	Not at all	Just a little	Somewhat	A lot	A great deal
Water availability as it relates to the quantity of water on earth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Components of water quality, salinity, drinkability, and treatment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
What a centralized sewer system is for	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The functions and purpose of an Onsite sewage facility (OSSF)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The functions and purpose of an Onsite water reuse system (OWR)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Difference between anaerobic and aerobic treatment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At least on type of onsite wastewater treatment technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The concept of Reuse Water Quality sampling, analysis and/or reporting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The composition of soil and how it is formed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

SALG

- Understanding
- Attitudes
- Skills

SALG - Student Assessment of Learning Gains

As a result of your work in this class, what GAINS DID YOU MAKE in your UNDERSTANDING of each of the following?

	No Gains	A Little Gain	Moderate Gain	Good Gain	Great Gain	N/A
What amount of consciousness/curiosity was gained when thinking about what your water contains, and the safety of your water?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Water Quality and Quantity, especially in Texas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Water treatment before and after discharge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
On-site sewage facility	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
On-site water reuse	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
On-site water treatment technologies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reuse water quality (RWQ) sampling, analysis and reporting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Types of water pollutants and environmentally transmitted pathogens	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EPA MCLs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Direct and indirect potable reuse in Texas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Water quality microbial indicators	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Emerging contaminants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Water quality impairments in Texas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Soil formation and composition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The following questions evaluate your attitudes
Presently, I am...

	Not at all
Enthusiastic about the subject of water reuse quality	<input type="radio"/>
Interested in discussing the subject area with friends or family	<input type="radio"/>
Interested in taking or planning to take additional classes in this subject	<input type="radio"/>
Confident that I understand the subject	<input type="radio"/>
Willing to consider a career as an extension specialist	<input type="radio"/>
Willing to consider a career in the Water Industry (consulting, academia, legal, government, etc.)	<input type="radio"/>
Interested in attending graduate school	<input type="radio"/>
Someone who has assisted (an) organization(s) in water quality efforts before (as an employee or volunteer)	<input type="radio"/>

Please comment on your present level of interest

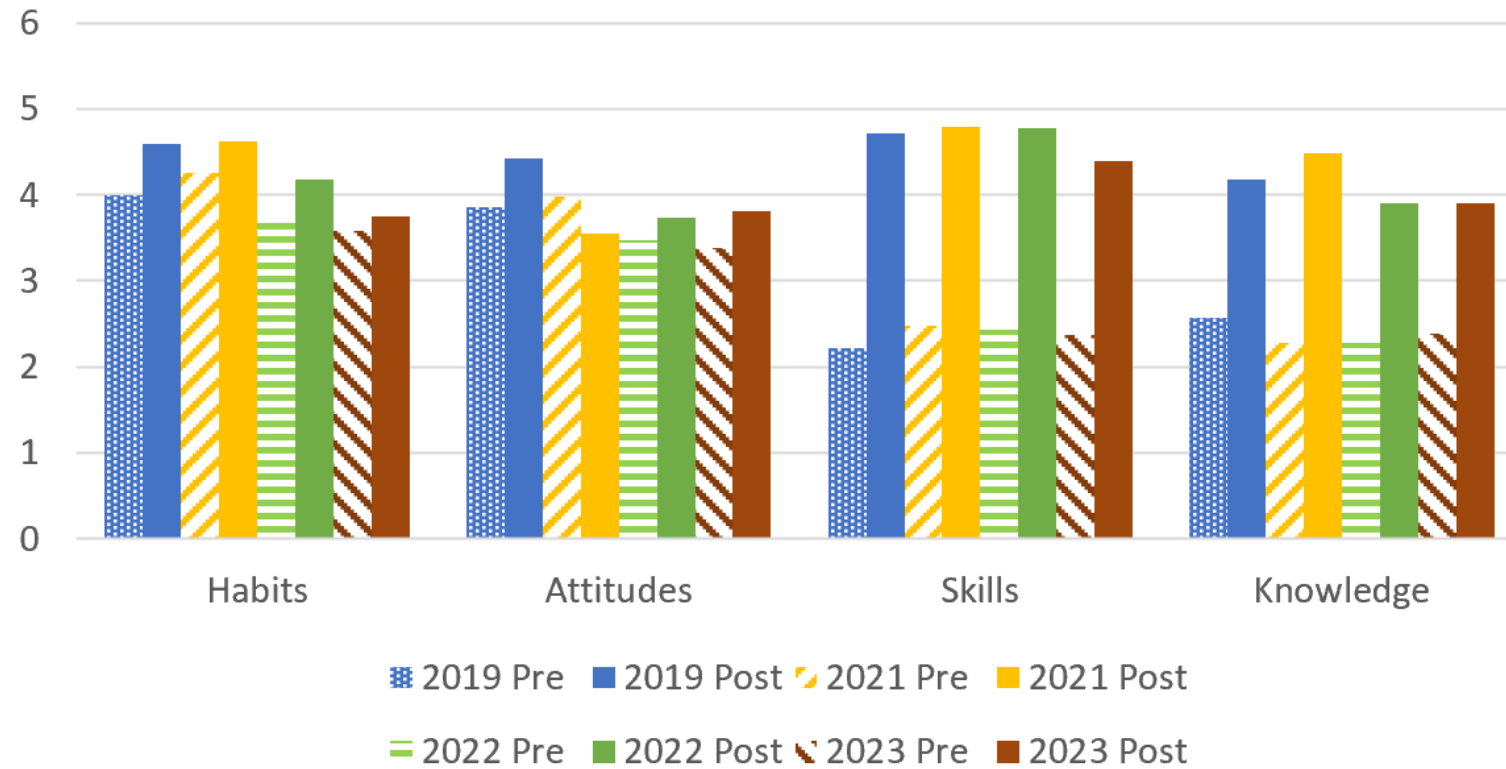
This section evaluates Skills that you have.
Presently, I can....

	Not at all
Name one on-site wastewater treatment technology	<input type="radio"/>
Identify patterns in data	<input type="radio"/>
Perform microbial analysis using plating techniques	<input type="radio"/>
Perform water quality sampling	<input type="radio"/>
Use equipment to measure pH	<input type="radio"/>
Use equipment to measure DO	<input type="radio"/>
Use equipment to measure conductivity	<input type="radio"/>
Use equipment to measure Nitrate and Chloride	<input type="radio"/>
Determine the total coliform from a water sample	<input type="radio"/>
Work effectively with others	<input type="radio"/>
Prepare and give oral presentations	<input type="radio"/>

What do you expect to be able to do at the

Results and Discussion

Pre and Post Assessment



Attitudes, Presently I am	2019		2021		2022		2023	
	2019 Pre	2019 Post	2021 Pre	2021 Post	2022 Pre	2022 Post	2023 Pre	2023 Post
Enthusiastic about the subject of water reuse quality	4.00	4.63	4.56	3.88	4.25	4.10	3.67	4.09
Interested in discussing the subject area with friends or family	3.88	4.88	4.56	3.88	4.33	4.30	4.00	4.00
Interested in taking or planning to take additional classes in this subject	4.00	4.88	4.11	3.00	3.83	3.50	4.00	3.82
Confident that I understand the subject	3.63	4.38	3.33	3.88	2.50	4.30	2.92	4.36
Willing to consider a career as an extension specialist	3.50	3.75	4.00	2.88	3.42	2.70	3.33	2.91
Willing to consider a career in the Water Industry (consulting, academia, legal, government, etc.)	3.88	4.63	4.22	3.75	3.25	3.20	3.67	3.73
Interested in attending graduate school	4.75	4.50	3.89	3.88	4.08	4.60	3.17	3.73
Someone who has assisted (an) organization(s) in water quality efforts before (as an employee or volunteer)	3.25	3.75	3.11	3.25	2.17	3.20	2.33	3.91
Average	3.86	4.42	3.97	3.55	3.48	3.74	3.39	3.82

Student assessment of learning gains

Question	No Gains	A Little Gain	Moderate Gain	Good Gain	Great Gain	Total
What amount of consciousness/curiosity was gained when thinking about what your water contains, and the safety of your water?	0%	0%	0%	35%	65%	26
Water Quality and Quantity, especially in Texas	0%	0%	7%	22%	70%	27
Water treatment before and after discharge	0%	0%	0%	33%	67%	27
On-site sewage facility	0%	0%	7%	22%	70%	27
On-site water reuse	0%	0%	4%	22%	74%	27
On-site water treatment technologies	0%	0%	4%	30%	67%	27
Reuse water quality (RWQ) sampling, analysis and reporting	0%	0%	4%	30%	67%	27
Types of water pollutants and environmentally transmitted pathogens	0%	4%	8%	23%	65%	26
EPA MCLs	4%	8%	15%	31%	42%	26
Direct and indirect potable reuse in Texas	0%	4%	15%	31%	50%	26
Water quality microbial indicators	0%	4%	8%	50%	38%	26
Emerging contaminants	0%	0%	4%	63%	33%	27
Water quality impairments in Texas	0%	7%	11%	48%	33%	27
Soil formation and composition	0%	0%	27%	35%	38%	26

Student responses from 2021

- Student A: “Now I’m awake about the water industry and how important [it is] for us, the humans, and the environment. I would like to continue working in this area in a future.”
 - Student B: “I learned more than I expected”
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Conclusions and Future Direction
