SCHOLARSHIP OF EXCELLENCE IN TEACHING FELLOWSHIP

Strategies For Students Engagement

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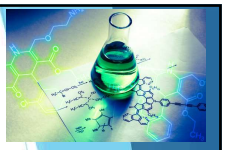

Goal :

Enhance Students learning by creating an environment to engage with each other and learn from one other.

Deepen students understanding of the important role of chemistry in everyday life experiences and processes

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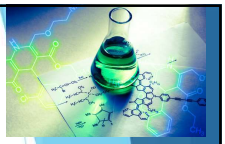
Why this goal is important



Low participation during class discussions

Importance of student- student learning

Importance of enhancing students' skills in the area of research, data collection & analysis, critical thinking, and collaboration

Improving students understanding of the role of chemistry in real-world systems and processes

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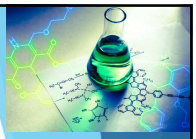
Scholarship that supports this strategy



Engagement is a multidimensional process

Behavioral engagement *(participation, effort)*

Emotional engagement *(interest, enjoyment)*

Cognitive engagement *(deep learning, investment in understanding)*

True engagement includes all three

Elizabeth Barkley, Student Engagement Techniques

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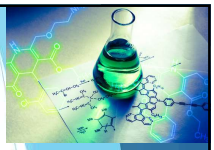
Scholarship that supports this strategy



Motivation is central to engagement

*Students need both **value** (why this matters) and **expectancy** (belief they can succeed).*

*Instructors to make **relevance** visible and to **design** achievable but challenging learning tasks.*

Collaborative learning enhances engagement

*Many Student Engagement Techniques (SETs) use **teamwork**, because structured collaboration builds community, accountability, and deeper understanding.*

Elizabeth Barkley, Student Engagement Techniques

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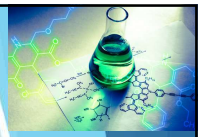
Scholarship that supports this strategy



Teaching is inherently relational

*Learning occurs within a complex web of relationships—**teacher-to-student, student-to-student**, and both connecting to the **subject matter**. Healthy relationships support deep learning.*

Parker Palmer, The Courage to Teach

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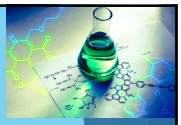
General Chemistry II (CHEM-132) Student Projects:



Project 1: Understanding and Conserving Household Water Consumption

Purpose:

The purpose of this project is to help students evaluate how much water is used in the household and to identify practical ways to conserve water consumption. The aim of this project is to promote environmental awareness and to encourage sustainable living habits.

Learning Objectives:

- Measure daily and weekly water usage across various household activities.
- Analyze data to determine patterns and areas of high consumption.
- Research and propose effective water conservation methods.
- Develop a practical water-saving plan for the students' home.

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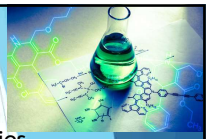
General Chemistry II (CHEM-132) Student Project-1



Instructions/Tasks

Data Collection: Record water usage for daily household activities like bathing, cooking, washing clothes, cleaning, etc. You can use tools like water bills, water flow meters, or manual estimates for measurement.

Data Analysis: Calculate total daily and weekly water consumption of each household activity. Identify which activities consume the most water

Research: Study water conservation methods such as behavior changes, leak detection, low flow fixtures, etc. Study environmental and economic impacts of excessive water consumption.

Action plan: Suggest 3-5 water saving strategies. Predict potential water savings if these strategies are implemented.

Presentation- Report: Prepare a summary report of your findings, and a slide presentation. Prepare a brochure that provides a simple water-saving guide to share with fellow students and community.

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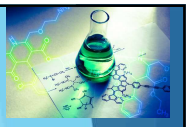
General Chemistry II (CHEM-132) Student Projects:



Project 2 : Wastewater treatment Process

Purpose:

The purpose of this project is to help students gain an understanding of wastewater treatment process and operational parameters the mean cell residence time (MCRT). In wastewater treatment, MCRT is a useful parameter that represents the average time microorganisms that break down waste spend within the activated sludge process.

Learning Objectives:

- Gain an understanding of the numbers and units involved in wastewater treatment calculations.
- Use representative data and calculate volumes, times, and chemical demand
- Develop a better connection to our wastewater treatment facilities, and learn how they operate on a basic level.

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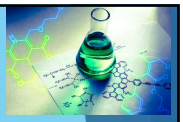
General Chemistry II (CHEM-132) Student Project-2



Instructions/Tasks

Overview of Wastewater Treatment: A brief lecture/description of operations at a wastewater treatment facility. Discuss the basic processes and their respective timelines.

Data Review: Given a set of quantities relevant to wastewater, study and understand them. These data will be given in the context of the mean cell residence time.

Data Analysis: Calculate the mean cell residence time using the given data.

Research: Look at the MCRTs for a variety of facilities in the US and compare based on volume and demand; much of this can be found on local water system websites.

Action plan: Suggest how one could increase/decrease MCRT, discuss the pros/cons and challenges one would face in attempting to manipulate the MCRT at a given facility.

Presentation- Report: Prepare a slide presentation that discusses MCRT, with 3 examples from your research. Include elements from the action plan highlighting the challenges of this particular aspect of wastewater treatment.

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General Chemistry II (CHEM-132- Fall 2025) Student Projects:

Choi	Zechariah	Mesgari Khosrosha	Helya
Delgado	Xavier	Ortiz Canales	Ashley
Feleke	Aaron	Padilla Vidal	Jennifer Carolina
Fishell	Charis	Perez	Alexander
Graham	Derek	Perez	Moises
Jack	Fatoumatta	Peter	Anurag
Lasko	Parker	Psaltis	Roxanne
Lessard	Allyson	Rai	Adishree
Maharjan	Erica	Shaposhnikov	Matvei
Melton	Samantha		

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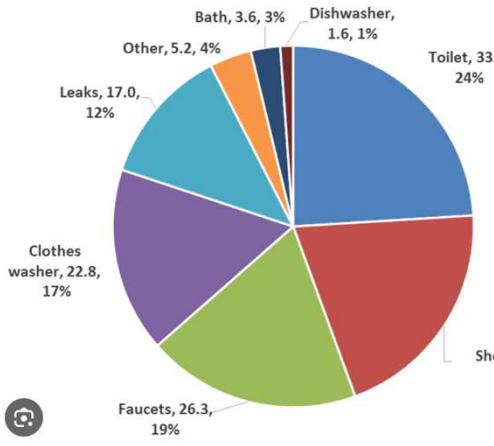
General Chemistry II (CHEM-132) Student Project-1

American household water usage



- **Toilets** - 24%
  The biggest water consumer at home.
  Every flush uses 1.6-3 gallons, and older toilets can use 5 gallons.
  A family can flush away 50 gallons every day without noticing.
- **Showers** - 20%
  A 10-minute shower uses 20-25 gallons.
  For many households, showering uses enough water weekly to fill a kid-sized pool.
- **Faucets** - 19%
  Bathroom sinks, kitchen sinks, handwashing, brushing teeth, cooking.
  Keeping the faucet running can waste 2 gallons per minute.
  That's why leaving it on while brushing can waste 8 gallons.
- **Laundry** - 17%
  Old washers use 30-40 gallons per load.
  That's the same as 240 water bottles for just ONE load of clothes.
- **Dishwashers** - 2%
  Modern dishwashers are surprisingly efficient, using 4-6 gallons per cycle.
  Handwashing can use 4× more water.

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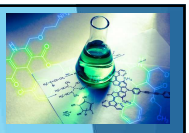
General Chemistry II (CHEM-132) Student Project-1



Helya's data table

Activity / Fixture	Typical Usage / Flow Rate
Washing machine (per load)	24-35 gallons per load
Shower	2.5 GPM (low-flow)
Bathroom sink	2.0 GPM
Kitchen sink / faucet	2.0 GPM
Dishwasher (normal cycle)	5.3 gallons per cycle
Water filter (tap-mounted)	0.4 GPM
Refrigerator ice & drinking water	1.19 gallons/day per household
Toilet flush	1.6-3.5 gallons per flush
Outdoor hose / carwash	8-10 GPM (garden hose or commercial carwash)
Plants watering	~2 cups per plant per watering (0.125 gallons/plant)
Boiling water / cooking	~1-2 gallons per day per person (depends on cooking habits)
Hand washing	0.5-1 gallon per hand wash (≈ 3-5 min at 2 GPM)

Activity	Week 1 min	Week 1 gal	Week 2 min	Week 2 gal	Week 3 min	Week 3 gal	Week 4 min	Week 4 gal	% Change (Min)	% Change (Gal)
Laundry	2 loads	59.0	1 load	29.5	2 loads	59.0	1 load	29.5	–	–
Baths/Showers	65	162.5	80	200.0	45	112.5	35	87.5	–	–
Bathroom faucet	15	30.0	0	0.0	15	30.0	20	40.0	–	–
Dishwasher	60	5.68	65	6.15	45	1.89	15	1.42	–	–
Kitchen faucet	45	90.0	40	80.0	35	70.0	25	50.0	–	–
Water filter	19	7.6	24	9.6	12	4.8	7	2.8	–	–
Refrigerator	7 days	8.33	7 days	8.33	7 days	8.33	7 days	8.33	–	–
Outdoor / Carwash	0	0.0	20	160.0	0	0.0	0	0.0	–	–
Plants watering	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	–	–
Total / Average	204	364.36	229	494.83	127	287.77	102	220.8	+12.25%	+35.73%
% Change vs Week 1	–	–	+12.25%	+35.73%	-37.75%	-21.04%	-50.00%	-39.41%	–	–

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General Chemistry II (CHEM-132) Student Project-1

Recommendation for the Public

- Purchase and implement water conserving utilities such as low water use appliances like dishwashers, toilets, and more.
- Utilize small water conservation habits such as showering for less than 20 minutes a day or not running sinks and faucets high when washing dishes.
- Research what water systems your neighborhood utilizes to determine what larger water conservation utilities and appliances you could implement.

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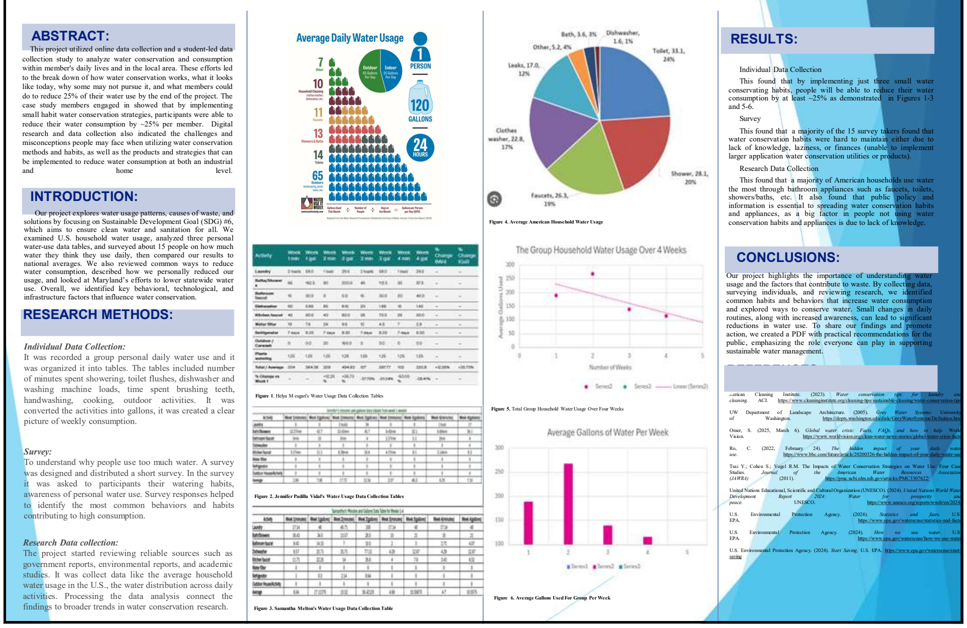
General Chemistry II (CHEM-132) Student Project-1



Helya Mesgari, Jennifer Padilla Vidal
Principles of Chemistry II, Montgomery College

ABSTRACT:

This project utilized online data collection and a student-led data collection study to analyze water conservation and consumption within member's daily lives and in the local area. These efforts led to the break down of how water conservation works, what it looks like today, why some may not pursue it, and what members could do to reduce 25% of their water use by the end of the project. The case study members engaged in showed that by implementing small habit water conservation strategies, participants were able to reduce their water consumption by ~25% per member. Digital research and data collection also indicated the challenges and misconceptions people may face when utilizing water conservation methods and habits, as well as the products and strategies that can be implemented to reduce water consumption at both an industrial and home level.

INTRODUCTION:

Our project explores water usage patterns, causes of waste, and solutions by focusing on Sustainable Development Goal (SDG) #6, which aims to ensure clean water and sanitation for all. We examined U.S. household water usage, analyzed three personal water-use data tables, and surveyed about 15 people on how much water they think they use daily, then compared our results to national averages. We also reviewed common ways to reduce water consumption, described how we personally reduced our usage, and looked at Maryland's efforts to lower statewide water use. Overall, we identified key behavioral, technological, and infrastructure factors that influence water conservation.

RESEARCH METHODS:

Individual Data Collection:
It was recorded a group personal daily water use and it was organized it into tables. The tables included number of minutes spent showering, toilet flushes, dishwasher and washing machine loads, time spent brushing teeth, handwashing, cooking, outdoor activities. It was converted the activities into gallons, it was created a clear picture of weekly consumption.

Survey:
To understand why people use too much water. A survey was designed and distributed a short survey. In the survey it was asked to participants their watering habits, awareness of personal water use. Survey responses helped to identify the most common behaviors and habits contributing to high consumption.

Research Data collection:
The project started reviewing reliable sources such as government reports, environmental reports, and academic studies. It was collect data like the average household water usage in the U.S., the water distribution across daily activities. Processing the data analysis connect the findings to broader trends in water conservation research.

Average Daily Water Usage

Figure 1. Helya Mesgari's Water Usage Data Collection Tables

Figure 2. Jennifer Padilla Vidal's Water Usage Data Collection Tables

Figure 3. Samantha Melton's Water Usage Data Collection Table

Figure 4. Average American Household Water Usage

The Group Household Water Usage Over 4 Weeks

Figure 5. Total Group Household Water Usage Over Four Weeks

Average Gallons of Water Per Week

Figure 6. Average Gallons Used For Group Per Week

RESULTS:

Individual Data Collection

This found that by implementing just three small water conservating habits, people will be able to reduce their water consumption by at least ~25% as demonstrated in Figures 1-3 and 5-6.

Survey

This found that a majority of the 15 survey takers found that water conservation habits were hard to maintain either due to lack of knowledge, laziness, or finances (unable to implement larger application water conservation utilities or products).

Research Data Collection

This found that a majority of American households use water the most through bathroom appliances such as faucets, toilets, showers/baths, etc. It also found that public policy and information is essential to spreading water conservation habits and appliances, as a big factor in people not using water conservation habits and appliances is due to lack of knowledge.

CONCLUSIONS:

Our project highlights the importance of understanding water usage and the factors that contribute to waste. By collecting data, surveying individuals, and reviewing research, we identified common habits and behaviors that increase water consumption and explored ways to conserve water. Small changes in daily routines, along with increased awareness, can lead to significant reductions in water use. To share our findings and promote action, we created a PDF with practical recommendations for the public, emphasizing the role everyone can play in supporting sustainable water management.

…erican Cleaning Institute. (2023). *Water conservation tips for laundry and cleaning.* ACI. https://www.cleaninginstitute.org/cleaning-tips/sustainable-cleaning/water-conservation-tips

UW Department of Landscape Architecture. (2005). *Grey Water Systems.* University of Washington. https://depts.washington.edu/dislc/GreyWaterSystems/Definition.htm

Omer, S. (2025, March 6). *Global water crisis: Facts, FAQs, and how to help.* World Vision. https://www.worldvision.org/clean-water-news-stories/global-water-crisis-facts

Ro, C. (2022, February 24). *The hidden impact of your daily water use.* https://www.bbc.com/future/article/20200326-the-hidden-impact-of-your-daily-water-use

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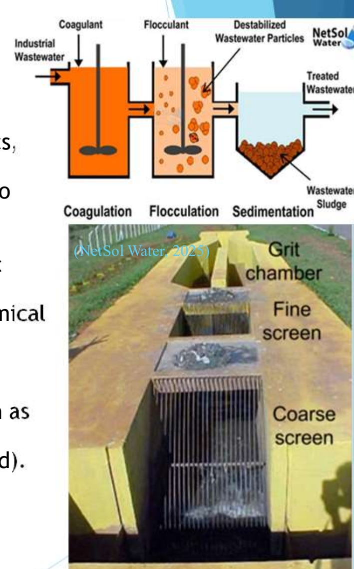
General Chemistry II (CHEM-132) Student Project-2

How Wastewater is Treated

- Removal of Large Sources of Debris (Rags, Plastics, Hygiene Products).
- Coagulation and Flocculation (Chemicals added to group together smaller molecules).
- Grit Removal (Sand and Grit removal).
- Biological Removal (Microbes break down organic matter).
- Secondary Treatment (Further separation of chemical materials).
- Tertiary Treatment (removes further solids, PH treatment and or Flouridation).
- Return to Primary Waterways and Reservoirs such as Lake Mead.
- Distribution to Residents Infrastructure (Locchead).



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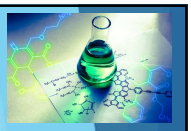
General Chemistry II (CHEM-132) Student Project-2



Comparison of Key Process Parameter

(approximate values based on MGD)

City	MLSS (mg/L)	Volume (MG)	WAS Conc (mg/L)	WAS Flow (MGD)	Plant Flow (MGD)	MCRT (days)
Las Vegas	2000	0.5	5000	0.05	3.0	3.58
Washingt on DC	3200	2.5	9000	0.1	5.0	8.43
Phoenix	2600	1.2	7000	0.1	4.0	4.22
New York	3000	3.0	8500	0.18	7.0	5.63

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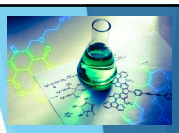

Selected Feedback from students

"I liked how the project applied general chemistry concepts to a real-world system that directly affects us"

"Using realistic values made the calculations more meaningful and helped me see how unit conversions and chemical dosing are used outside the classroom"

"The project was beneficial because it's strengthened my understanding of concentration and multi-step calculations while showing how small chemical amounts can have a large impact at the community level.

"Working on this project increased my engagement with the course by connecting chemistry to real life applications"

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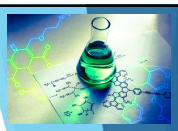

As a result of SET program and implementation of this strategy

1) Students worked together to successfully complete examples of Real World and Relevant projects

2) Students enhanced their understanding of Household Water Consumption & Conservation, and Municipal Water Treatment Process and how chemistry plays an important role in such processes

3) Students practiced and improved their skills in the following area:

- Literature search and research methodology
- Data collection and data analysis
- Effective communication and presentation skills
- Collaboration and Teamwork

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Thank You !

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