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Building Awareness of Inclusivity through Scalable Hands-On Activities.

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Work in Progress: Building Awareness of Inclusivity through Scalable Hands-On Activities

The importance of diversity, equity and inclusion (DEI) have become incorporated into the culture of engineering and ASEE has established a diversity recognition program to recognize Schools that have incorporated these aspects into their mission, a piece of which is the curricula [1]. In addition, the revisions to ABET criterion 5 (curriculum) now include the need to address DEI [2]. To accomplish part of the curricular component, we have been working on hands-on activities that are scalable from a first-year program to upper level courses in the Fred DeMatteis School of Engineering and Applied Science (SEAS) at Hofstra University, a midsized, private university located in Hempstead, NY. Hofstra is situated in a region that represents a very diverse community and the students in our engineering programs mirror this diversity. For example, SEAS boasts a 63.7% enrollment of Persons of Color. In addition, the school of engineering does not restrict high-school graduates to register to the engineering program even when they may not have an academic background in mathematics and physics. Therefore, the combination of being in a multiethnic / multicultural region with less restrictive entrance to the engineering program results in a larger proportion of first-generation students with diverse academic backgrounds prior to entering the University. To aid students who experience academic challenges we have developed two activities that are introduced in the first-year engineering curriculum and then revisited in an upper-level engineering course. The idea is that this will create connections from the first-year courses to upper-level courses and give the students some familiarity with the topic. The activities will also address aspects of equity, accessibility, and inclusion. One activity addresses equity and water infrastructure through a water filtration activity, teaching students about filtration materials and testing water for iron content. The second activity introduces the concepts of noise measurement and logarithmic calculations to bring awareness to hearing and the importance of OSHA standards in the workplace. This paper will measure, through student surveys, the impact of the activities on building awareness and feelings of DEI as well as the success in communicating the subject matter.

Introduction

Hofstra's School of Engineering boasts an extensive first-year engineering curriculum complete with a computer programming for engineers course and an engineering design course. The pedagogy for both courses is built on the concept of active, hands-on learning designed to impart knowledge in a given subject area while developing collaboration and cooperation among first-year students. The two hands-on activities presented in this paper were originally designed and developed for first-year students. The "Sound Activity" was first implemented in the computer programming for engineering students course in Fall 2019 and modified to its current state (See Appendix A.) in Spring 2021. The accompanying worksheet (See Appendix B.) is used by students to collect data and submit for grading. The activity is designed to take, at most, one ninety-minute lecture. The "Water Filtration Activity" was first implemented in the engineering design course in Spring 2022. (See Appendix C.) It is designed to take a maximum of two ninety-minute lectures. In addition to engaging students in STEM, the activities also bring awareness to potential socio-economic differences and public policy. This is a work-in-progress and the research team hypothesizes that there is also the potential for an understanding of diversity, equity, and inclusion. The activities are presented to first-year courses but are also part of upper level courses. It is hypothesized that by repeating the activities, students will gain a deeper understanding of diversity, equity and inclusion.

Literature Review

A brief review of literature on the incorporation of curricula related to DEI and the assessment methods utilized was conducted. These treatments ranged from separate courses related to DEI [3], activities embedded into first-year courses [4,5,6], design courses and design experiences [3,6,7], and embedded activities across multiple courses within the curricula [6,7]. The methods utilized to assess the impact of DEI curricula were survey instruments using a Likert scale. These instruments varied in breadth and degree of validation. The short form of the Miville-Guzman Universality Diversity Scale (M-GUDS-S) [8] was considered to be too general and not directly applicable to the engineering profession. Even the short form has 42 items in the survey. DEI surveys which were focused on engineering are being considered for the future. One is the "Valuing Diversity and Enacting Inclusion in Engineering Scale (VDEIE)" [4,5] which contains two surveys, "Valuing Diversity," and "Inclusive Behavior." The former survey consists of two themes: fulfill a greater purpose, and serve customers better. The latter also contains two themes: challenge discriminatory behavior, and promote a healthy team environment. Several survey questions were given under each theme. A second instrument utilized a 24-question, Likert scale survey on perceptions of DEI and was also considered too broad for this purpose [6]. Both were considered a little too broad for the single activities being evaluated. However, there is potential for the activities to be revised so that these assessment methods may be more relevant. Other instruments considered and perhaps to be utilized in the future are the Midwest Flooding Problem (MWF) [9] along with the revisions and inclusion of contextual social awareness by Perez et al [3]. This would be adapted to the local region and can be utilized to assess the extent students consider social awareness in design.

The incorporation of the DEI component into a hands-on STEM activity within several types of courses is supported by the work done by Wormly [10]. Handley and Marnewick [11], present a DEI model for engineering curricula which was adapted from incorporating international competencies into systems engineering courses. They selected two competencies necessary to be successful global engineers that were particularly relevant to creating an inclusive engineer. The competencies were cognitive style awareness, and teamwork. Cognitive style awareness is the recognition that people approach problem solving in different ways. This includes recognizing that people think and respond in different ways and adapting to these varied views, values and beliefs. Teamwork represents the ability to work on diverse teams by recognizing that team members may think differently. This can be manifested by examining the knowledge of team goals, contributing to team assignments, participating in team decisions, and respecting team members and their contributions. They propose that this requires the addition of social learning to the engineering curriculum. In addition, they used the Kolb learning cycle [12] to develop learning activity related to the two competencies.

The proposed activities for this paper are scalable for both technical and DEI awareness and incorporation to design. These activities are currently being assessed for awareness and learning style. Base level assessments are being utilized at this point but in the future more complex assessments will be conducted, such as team assessments.

Methodology

To date, the activities have been piloted in both first-year courses. Based on feedback from previous minute papers and an end–of-semester survey, the activities have been revised and improved. Once receiving IRB approval, the activities will be implemented in the respective first year classes this semester, Spring 2023. The team is piloting several assessments this semester. To assess the perceived impact on learning and perceived difficulty we will be asking the students to complete a simple survey (See Appendix D.) To assess a delta in comprehension of diversity, equity, inclusion, and social justice, we will be giving the same pre- and post-assessment asking students to define each of the above. (See Appendix E.) After the hands-on activity students will also reflect on how they think the activity is related to diversity, equity and inclusion. The team seeks to investigate if there is any correlation between a student's learning style and their comprehension of DEI and justice. Hence, each student will complete the Felder/Soloman Index of Learning Styles Questionnaire [13]. (See Appendix F.) Finally, it is not enough to understand the definitions for diversity, equity, inclusion, and social justice. The authors attempt to measure the feeling of diversity, equity and inclusion by measuring self-efficacy as it relates to imposter syndrome. A first attempt will include having students assess their performance on the activities through a reflection exercise. NVivo will be used to assess the student reflections for common themes. These evaluations will be conducted in the upper level courses with the scaled up activities.

Treatments

Water Filtration Activity including Water Infrastructure Equity

There is a global and national disparity in access to safe drinking water and infrastructure. In the US the water infrastructure is failing. Heavily publicized incidents like the corrosive water in Flint, Michigan leading to a health crisis from lead and Legionnaires' disease [14] and more recently the failure of the water treatment plant in Jackson, Mississippi where water pressure dropped significantly for a week and boil alerts lasted months [15]. This is just the tip of the iceberg as many other systems failures do not make the news. Not only are these failures occurring but they are more likely to occur in neighborhoods of low socio-economic status and predominantly minority. To bring awareness to this growing crisis for both the public and future engineers a revised version of the typical water filtration activity is presented. The activity has been revised to bring in design concepts as well as a more realistic and consistent performance of filters. The EPA filtration activity requires the use of dirty water and can be inconsistent in performance and difficult to implement [16]. In addition, the only mechanism of removal is by physical filtration. This revised activity removes contaminants by both chemical and physical means. In the revised activity the dirty water is created from iron supplement tablets which are dissolved and partially oxidized to create both a dissolved pollutant and particulate pollutant. The students are tasked to design a filter to remove the particulate (by visual comparison to standards) and for more advanced students the dissolved iron level can be tested. Students utilize pool filter sand, zeolite and activated carbon to design filters to remove the dissolved and particulate iron. Each item is given a cost and students develop the best performance for the least cost using a Water Quality Index. The activity has been utilized in an after school program, in a first-year program course and will be utilized in a unit processes laboratory course for civil engineers. Data will be collected for the first-year course and the civil engineering course. The activity in the past renditions did not include a component about social justice and equal access to infrastructure. For this paper, the activity will be framed in terms of access to safe water and environmental injustice. Students will review case studies presented in the slides in Appendix G.

After reviewing the slides, students will reflect on the similarities and differences in each of the case studies. Students will describe whether these case studies represent diversity equity or inclusion or all. In groups the students will discuss and describe what they think environmental injustice means. In the first year course, the activity will involve designing and testing filters by measuring the color and iron continent in the water using simple comparative colorimetric methods. In the upper level course, students will also study case studies and complete reflection assignments. In the upper level course students will utilize several other techniques to assess water related to lead/iron content. This will include measuring the potential corrosivity of local water using a Langelier Saturation Index in addition to the filtration activity.

Sound Activity

The Sound Activity consists of measuring noises of varying decibels and performing logarithmic calculations, as a way to introduce students to the Occupational Safety and Health Administration's (OSHA) [17] guidelines for occupational noise exposure and to its relationship with hearing preservation.

Hearing loss is a prevalent problem in the US. It is estimated that 18 percent of adults with ages between 20 to 69 years have some level of hearing loss [18]. According to The Center for Disease Control (CDC) estimates that 22 million workers are exposed to potentially damaging noise at work each year [19]. Furthermore, many workers are exposed to high levels of noise at work for more than five years or more.

Unfortunately, hearing is not only affected by the high levels of noise at work but also from using headphones at high volume levels. This could be particularly true for young users who are unaware of the risks from hearing music at a high volume because the consequences of this exposure are often recognized after a long exposure. Headphone use in the U.S. is ubiquitous, it is estimated that on average, a person in the US acquired 0.52 headphones in 2022, or 1.04 headphone units for every 2 years [20]. Unfortunately, headphone use is more prevalent for younger users (19-29 yearolds) with an estimated use of 405.6 hours per year. The incorrect use of these devices by listening at high amplitudes can generate hearing problems and early hearing loss.

In order to familiarize students with the risks of noise exposure, we developed a noise measurement activity that includes a combined noise calculation. The activity shows students how to measure the sound pressure from different sources starting from “harmless” objects such as balloons and headphones to more professional equipment used in an industrial setting such as power tools, air compressors and other equipment from a machine shop.

After recording the different noise levels from the several devices, students are then shown how to calculate the combined sound pressure level in the event that all of these noise sources would be operated simultaneously. This calculation requires students to use logarithmic calculations. Furthermore, students are asked to perform these calculations using matlab.

Finally, students are required to determine the Time-Weighted Average (TWA) for the combined noise exposure and to determine if such exposure is or is not safe based on the noise guidelines of the National Institute for Occupational Safety and Health (NIOSH) [21]. If the calculated value falls outside the safe parameters students are asked to generate an understanding of the causes of such values, its meaning and to propose a multifactorial solution that would result in a safe working environment.

Therefore, by performing the practical exercise of collecting data, performing calculations, using standards and developing noise control interventions students learn not only how to collect data but the relevance and social responsibility expected from future engineers. In the following senior course students will not only be asked to generate calculations but also to develop strategies for the inclusion of hearing impaired or deaf individuals [22].

Conclusion / What’s Next

Due to a delay in the IRB proposal process, we were unable to administer all the proposed surveys in time for this paper. An unofficial effort to pilot the Pre- and Post-Assessment Survey on DEI and Social Justice (Appendix E) provided interesting results and learned lessons. QR codes were used to administer the survey and all students completed the survey using their phones. It was unexpected that students would Google, copy, and paste the definitions for diversity, equity, inclusion, and social justice so warnings will be posted prior to administering the survey in the future. Surprisingly many students defined equity in the context of finances, having no concept of the intended meaning of understanding that everyone should reach the same level given different needs.

Students are given the opportunity to provide anonymous feedback via minute papers which will continue to be collected. Feedback from minute papers will be used to assess the perceived usefulness of the activity and to make improvements. The activities and DEI materials will be analyzed for student awareness of DEI and their learning styles. If the results are positive and improvement in awareness is recorded then expansion of the study will be conducted to include more activities and more courses. Surveys will be examined and revisions of the assessment methods will be discussed. In the future we may explore other DEI survey methods as well as assessing changes to self efficacy as potentially relative to imposter syndrome.

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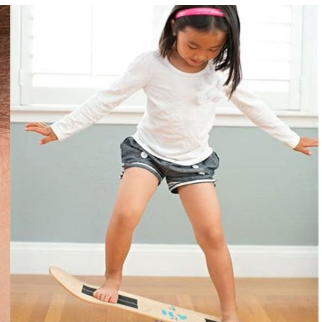
Appendix

A. Sound Pressure Activity PowerPoint Slides



HUMAN FACTORS

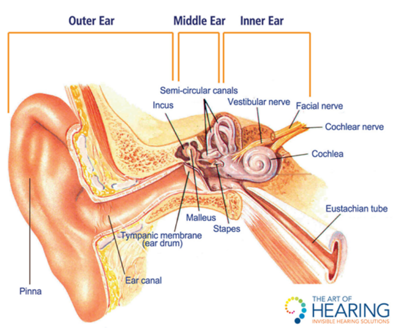
The auditory, and vestibular sensory systems

Chapter 5

Fall 2020

Human Ear

- The outer part of the ear serves as a collector of sound vibrations to the eardrum. The auditory canal has a resonant frequency (which multiplies sounds) around 3,000 Hz.
- The eardrum is extraordinarily sensitive and will move in response to changes of as little as
- 0.000 02 N/m^2 and then it will move
- only 0.000 000 001 cm!
- (about .000 000 001 cm = 1/2 the diameter of a hydrogen molecule.)
- The vibration of the eardrum (tympanic membrane) is transmitted to the oval window through three small bones (ossicles) known as the hammer (malleus), anvil (incus), and stirrup (stapes).



Human Ear

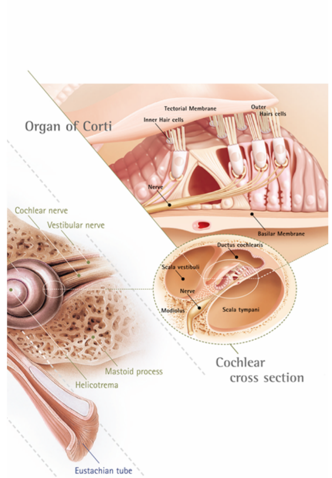
Performs a series of energy transformations:

Sound travels using original pneumatic pressure waves.

Pneumatic pressure is then converted to mechanical vibrations

mechanical vibrations are later converted to hydraulic waves

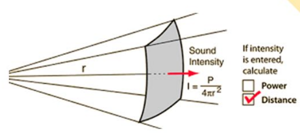
hydraulic waves and then back to mechanical vibrations, which are finally converted to electrical impulses



Sound and sound pressure

Sound

- An object that is set into vibration causes the air adjacent to it to be compressed at a frequency equivalent to the vibration.
- The sound pressure waves travel out from the source of vibration in a spherical fashion as more surrounding air becomes compressed.



How to measure sound pressure?

- There are two relationships: sound pressure and sound power.
- **Sound power** or acoustic **power** (watts) is the rate at which **sound** energy is emitted, reflected, transmitted or received, per unit time. This is dependent on the source for example an AC system
- Pressure changes in a medium (air) caused by vibration or turbulence
- Pressure produces wave motion from source
- Amplitude = Loudness = Decibels = dB
  60 dB = Average Speaking Voice
- Frequency = Cycles per Second = Hertz = Hz
  1000 Hz = 1 Kilohertz = 1 kHz = Human Voice

How to measure sound pressure?

- Absolute levels of sound pressure detectable by the human ear vary by **l,000,000,000,000 to 1**.
- Therefore the value of the ratio 1 * 10^{-12} is used as power reference level.
- This scale is too large to use conveniently. The scale was compressed by using a log ratio (originally called the Bell, after Alexander Graham Bell, but since a smaller measure was needed, it was divided by 10 and called the deciBel or decibel).

Sound Power level

$$PWL, dB = 10 log_{10}\left(\frac{W}{W_0}\right)$$

Where:

PWL = Power watt level of the noise, decibel

W = Acoustic power of the noise, watts

W_0 = Reference power level

W_0 = 1 x 10^{-12} watt

Since 1 x 10^{-12} watts = -120 dB, it can be expressed as:

PWL = 10 log W + 120

How to measure sound pressure level?

- **Sound pressure level (decibels)** the difference between the instantaneous pressure at a point in the presence of a sound wave and the static pressure of the medium. This is dependent on the medium and the distance between the source and the receiver

SPL = 20 log (P / Po)

Where:
P= Pressure produced by source
Po= Minimum pressure detectable by human ear (2 x 10-5 N/m2)
(threshold for auditory pain: 20 N/m2)

Let's understand the units

PWL = 10 log *W* + 120

- If W = 1 then 10 log 1 = 0 then W=1 is 120 dB of power
- Then how many decibels correspond to 0.1 W ?
- PWL = 10 log W + 120 -> 10 log (0.1) + 120 -> 10 *(-1)+120 = 110 dB

Is 110 dB + 110 dB = 220 dB?

- Consider a machine generating noise with a PWL = 0.1 W. Assume that we add another identical machine at the same distance. Determine how much noise in dB is generated?

PWL = 0.2W (because we have two machines)

PWL = 10 log (0.2) + 120

PWL = 10 * (-0.69897) + 120 ≈ 113 db

Is 110 dB + 110 dB = 220 dB?

- Therefore, two identical machines positioned at the same distance with a power of 0.1 W that generate 110 dB each one **do not** generate 220 dB

Yet that 10-dB difference represents a tenfold increase in intensity

Let me understand this…

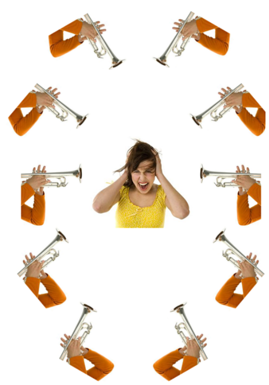
- If we add 10 machines with a PWL = 0.1W at the same distance. how much sound pressure (loudness) is generated?

Then PWL = 0.1W *10 => PWL = 0.1 * 10 =1

PWL = 10 log *W* + 120

PWL = 10 log (1) + 120 → 10 * (0) + 120 ≈ 120 db

Therefore, a 10 dB difference represents a tenfold increase in intensity (**power)!**



Let me understand this…(2)

- Consider two sources one generates M_1 = 60 dB and the other generates M_1 = 70 dB what is the power difference ?
- First, calculate the power for M_1 = 60 dB

PWL = 10 log *W* + 120

- 60 = (10 * log w)+ 120 --> [60 - 120] / 10 = log w --> -60/10 = log w --> -6 = log w
- w is the number that is equal to 10^-6 so it is 0.000001

- Now, calculate the power for M_2 = 70 dB
- 70 = (10 * log w)+ 120 --> [70 - 120] / 10 = log w --> then we get -50/10 = log w
- -5 = log w
- then w is the number that is equal to 10^-5 so it is 0.00001 and this number is 10 larger than the previous value

Calculation with dbs

- Sound pressure level combined is calculated by the following formula
- SPL (dB)= $(10 * \log[10^{snd1/10} + 10^{snd2/10} + ...])$

Example Problem

- Calculate the combined sound pressure level if two machines produces a sound pressure level of 110 dB.
- $I = 10 * \log [10^{110/10} + 10^{110/10}]$
- $I = 10 * \log [10^{11} + 10^{11}]$
- I = 113.01 dB

B. Sound Activity Worksheet

Course Number | Name of University

Recorder name: ______________________________

Date: ______________________________

1. Record the sound pressure level in dBA at fast sampling mode for the following noise sources

Quiet classroom: :______________

Large Balloon Popping : ______________

Your Headphones at max volume playing hard rock: ______________

2. In the engineering machine shop using a sound meter you will record three different machines (a lathe, a drill, and a metal cutter), while they are idle and while they are processing a piece of aluminum.
3. The sound meter must be placed near to the machine without any obstruction with a slow sampling rate using dBC, remember dBC is best for equipment and dBA is best for human voices.
4. After recording the sound pressure levels you will perform the following tasks:
    a. Calculate the power generated from each noise source.
    b. Calculate the combined sound pressure level assuming all three noise sources are working simultaneously.
    c. Plot the sound pressure for each noise source under both conditions and the combined sound level calculated in part a.
    d. Determine if the noise level is safe for an operator working under these conditions for eight hours (is below 85 dBC)
    e. information under the different working conditions and will answer the following questions:

5. Compare the recordings from point 1 to the machine shop. Describe if using your headphones at high volume is safer or more dangerous than working in the machine shop.

C. Water Filtration Activity PowerPoint Slides

Water Filtration

Design Challenge: Creating clean water is very important; there are many parts of the world, and in this country, where the water quality is not good; not suitable for drinking. Clean water is essential for a healthy life. Environmental Engineers can make a difference by turning unpleasant water into potable water by designing water purification systems. Your challenge is to remove the color (oxidized iron) and iron (dissolved) from the water sample. Your filter will be judged by how effectively it cleans the water for the cost of the materials. You may use up to 2 cups of sand and ½ cup of zeolite.

¼ cup Zeolite = $0.50
¼ cups Sand = $0.20

Filter Rating = Clarity x Iron Content x Cost

You want your design to have the **lowest** filter rating.

What is in the water?

To select the best method to treat the water you need to know what is in the water. The water sample contains dissolved iron and oxidized iron (particulate). Iron causes the water to have a metallic taste and can cause staining of laundry and plumbing fixtures. If oxidized iron is present it causes the water to have a yellow/red or brown color. Iron in water can be from groundwater flowing through rocks and minerals, corroding pipes or iron bacteria.

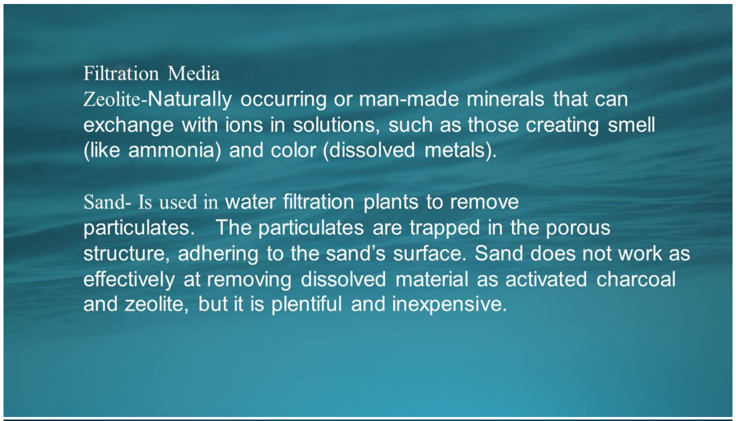
How much do I need to remove?

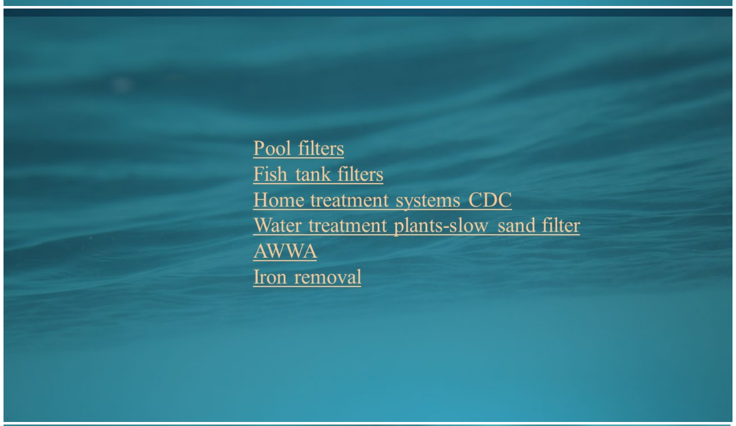
Safe Drinking Water Act –Primary and Secondary Standards

Secondary Standard for Iron is 0.3 mg/L

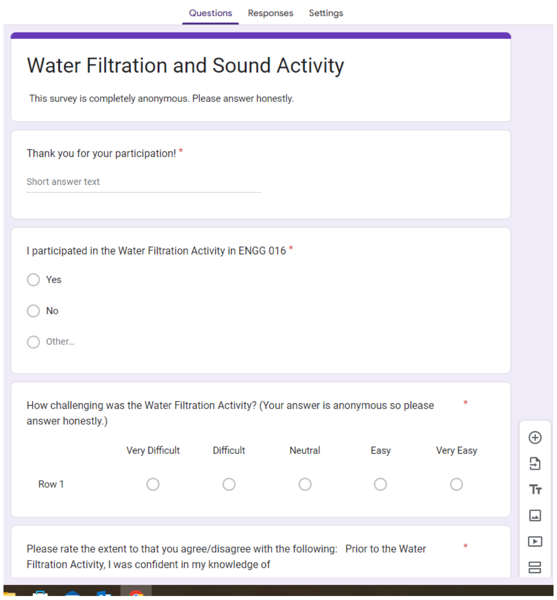
Water Treatment Methods for iron Removal

- Sequestering Agents (polyphosphates)
- Ion Exchange
- Oxidation and Filtration





D. Perceived impact on learning and difficulty



Questions Responses Settings

Water Filtration and Sound Activity

This survey is completely anonymous. Please answer honestly.

Thank you for your participation! *

Short answer text

I participated in the Water Filtration Activity in ENGG 016 *

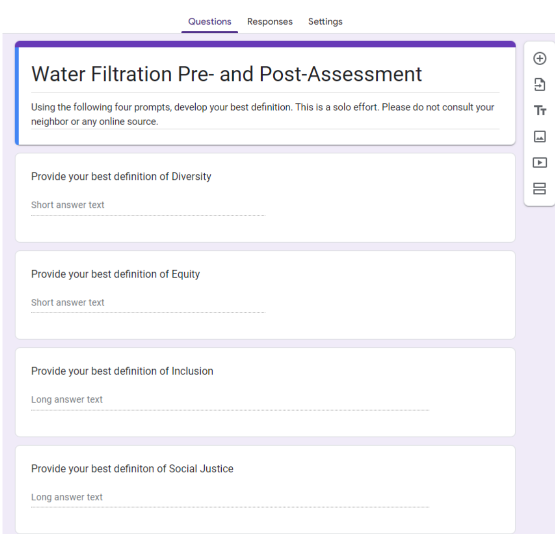
- Yes
- No
- Other...

How challenging was the Water Filtration Activity? (Your answer is anonymous so please answer honestly.) *

	Very Difficult	Difficult	Neutral	Easy	Very Easy
Row 1	○	○	○	○	○

Please rate the extent to that you agree/disagree with the following: Prior to the Water Filtration Activity, I was confident in my knowledge of *

E. Pre- and Post-Assessment Survey on DEI and Social Justice



Questions Responses Settings

Water Filtration Pre- and Post-Assessment

Using the following four prompts, develop your best definition. This is a solo effort. Please do not consult your neighbor or any online source.

Provide your best definition of Diversity

Short answer text

Provide your best definition of Equity

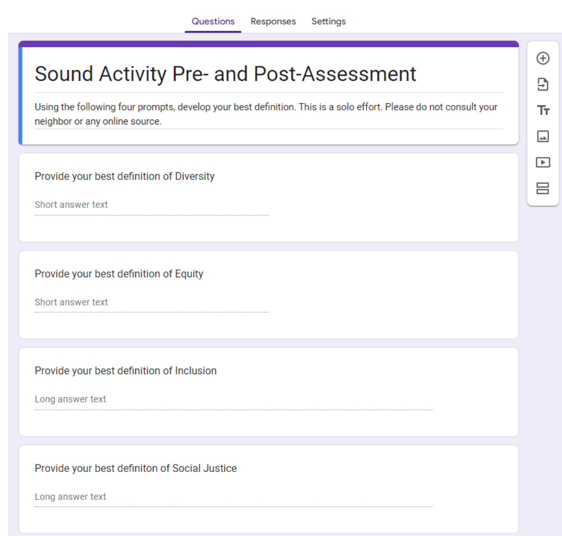
Short answer text

Provide your best definition of Inclusion

Long answer text

Provide your best definiton of Social Justice

Long answer text



Questions Responses Settings

Sound Activity Pre- and Post-Assessment

Using the following four prompts, develop your best definition. This is a solo effort. Please do not consult your neighbor or any online source.

Provide your best definition of Diversity

Short answer text

Provide your best definition of Equity

Short answer text

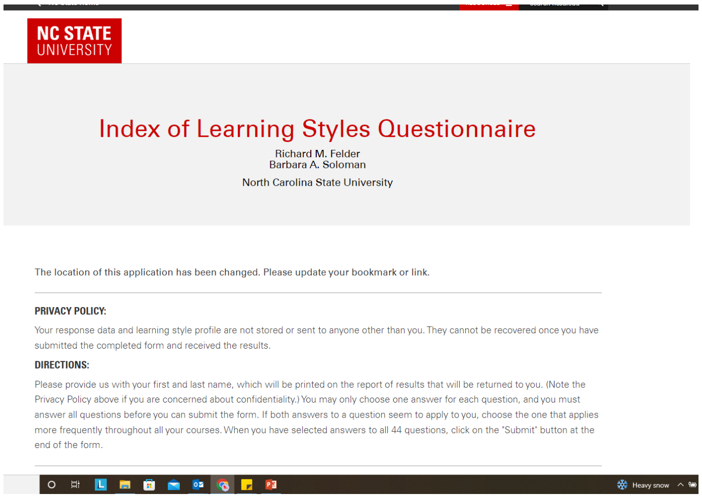
Provide your best definition of Inclusion

Long answer text

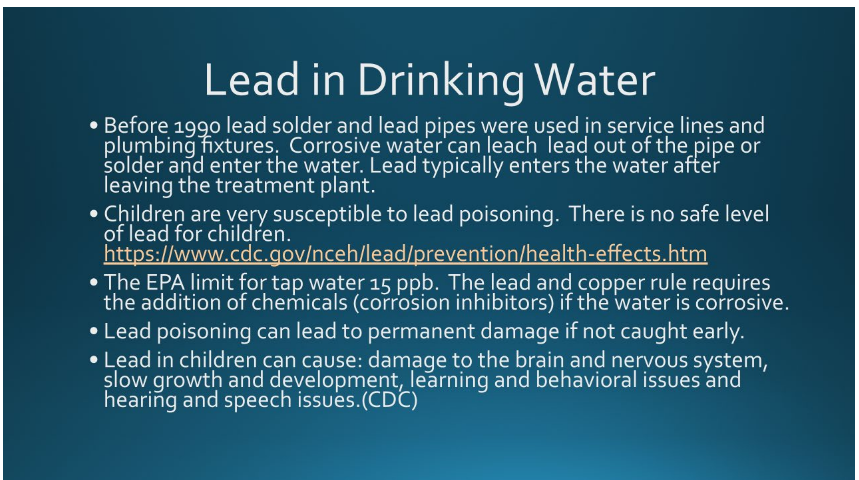
Provide your best definiton of Social Justice

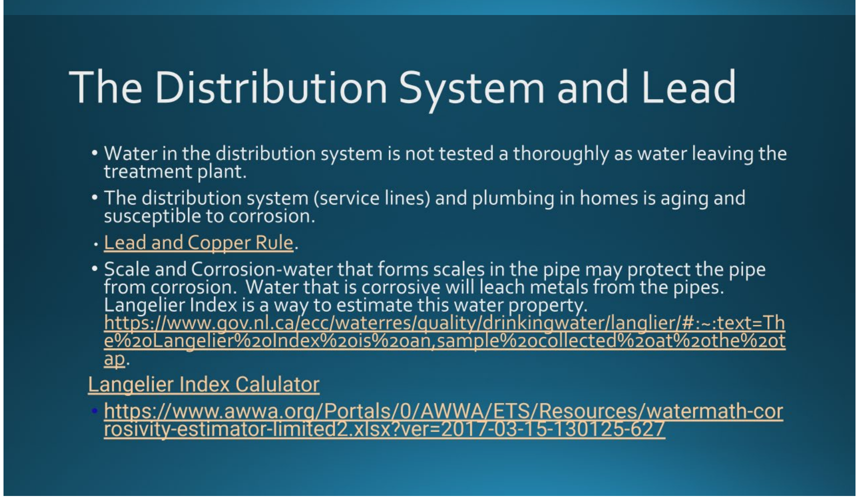
Long answer text

F. Index of Learning Styles Questionnaire



G. Water Filtration Case Studies





How do you remove lead from water?

- Reverse Osmosis
- Distillation
- Filtration
  - Ion exchange
  - Activated Carbon
- NSF certification for Lead removal https://www.nsf.org/consumer-resources/articles/lead-drinking-water
- EPA Filter Study in Benton Harbor Michigan

https://www.epa.gov/mi/benton-harbor-michigan-drinking-water-study-results

Water Crisis in Flint, Michigan.

Summary

To save money Flint , Michigan switched its water source from the Detroit system to the Flint river in 2014. Appropriate treatment and testing were not conducted and it resulted in a water quality and health crisis. Complaints by residents were ignored by government officials . A concerned resident contacted a professor at Virginia Tech and he helped them conduct sampling and measurements of the tap water. It was found that the water in many homes in Flint had elevated levels of lead in the water.

https://www.nrdc.org/stories/flint-water-crisis-everything-you-need-know#sec-summary

https://www.cnn.com/2016/03/04/us/flint-water-crisis-fast-facts/index.html

Demographics

Population in 2020 : 115451

Black or African American: 56.7%

Hispanic or Latino: 4.5%

Persons in Poverty: 35.3%

https://www.census.gov/quickfacts/flintcitymichigan

Water Crisis in Newark, NJ.

Summary

In June of 2017, the NJ Dept. of Environmental Protection determined that the lead levels in Newark's water exceeded the federal action level of 15 ppb. The city had not added required corrosion inhibitors to the water which would have reduced the amount of lead leaching from service lines and plumbing fixtures. In 2017 the city was still exceeding the federal action limit and failed to notify its residents. At the start of 2019 more than 10 percent of homes had levels exceeding 65 ppb 4 times the federal action level. Concerned residents have founded groups like the Newark Water Coalition to help its citizens with this crisis.

https://www.nrdc.org/stories/flint-water-crisis-everything-you-need-know#sec-summary

Demographics

Population in 2020 : 311549

Black or African American: 48.2%

Hispanic or Latino: 36.8%

Persons in Poverty: 25.8%

https://www.census.gov/quickfacts/fact/table/newarkcitynewjersey/PST045222

Water Crisis in Yonkers, NY.

Summary

Due to concerns about lead in drinking water NY passed a first in the nation law requiring lead testing in public schools. The Safe Drinking Water act does not require routine testing of public schools. Eighty two percent of public schools in NY had at least one tap that was over the state action limit of 15ppb. In Yonkers every school building had at least one tap that exceeded the state action level. This was attributed to the school building being old (in some cases as old as 100 years) and old buildings can have deteriorating pipes and fixtures which can cause elevated levels of lead. The majority 58% of students in Yonkers school district are Hispanic or Latino and 80 percent of the students are considered economically disadvantaged (receive economic assistance).

https://www.nrdc.org/stories/flint-water-crisis-everything-you-need-know#sec-summary

Demographics

Population in 2020 : 211569

Black or African American:: 18.7%

Hispanic or Latino: 40.0%

Persons in Poverty: 13.2%

https://www.census.gov/quickfacts/fact/table/yonkerscitynewyork/PST045222