

Unit Overview

Topic: Cell Transport: Simple Diffusion and Osmosis

Standards:

1. Explain how the cell membrane controls movement of substances both into and out of the cell and within the cell SC-HS-3.4.3 SC-H-UD-S-2
2. Explain how the cell membrane maintains homeostasis SC-HS-3.4.3 SC-H-UD-S-2
3. Describe and contrast these types of cell transport: osmosis, diffusion, facilitated diffusion, and active transport SC-HS-3.4.3 SC-H-UD-S-2

Activity Structure

Title: Cell Membrane Engineering Project

Objectives:

1. Identify the different parts of a phospholipid bilayer
2. Define osmosis, diffusion, and facilitated diffusion
3. Model a semi-permeable membrane
4. Design and build a semi-functional model of the bilayer

Guiding Questions

1. What are the components of a phospholipid bilayer?
2. What is the difference between osmosis, diffusion, and facilitated diffusion in a cell?
3. How can you model a semi-permeable membrane?
4. What ways can you design and build a semi-functional model of the phospholipid bilayer?

Acknowledgements

The author would like to thank Debora Liberi, Dr. Anant Kukreti and the NSF for the opportunity to participate in the Choose Ohio First Scholarship Program. The would also like to thank Emily Hoffman for welcoming her into Dixie Heights High School and allowing her to implement this activity.

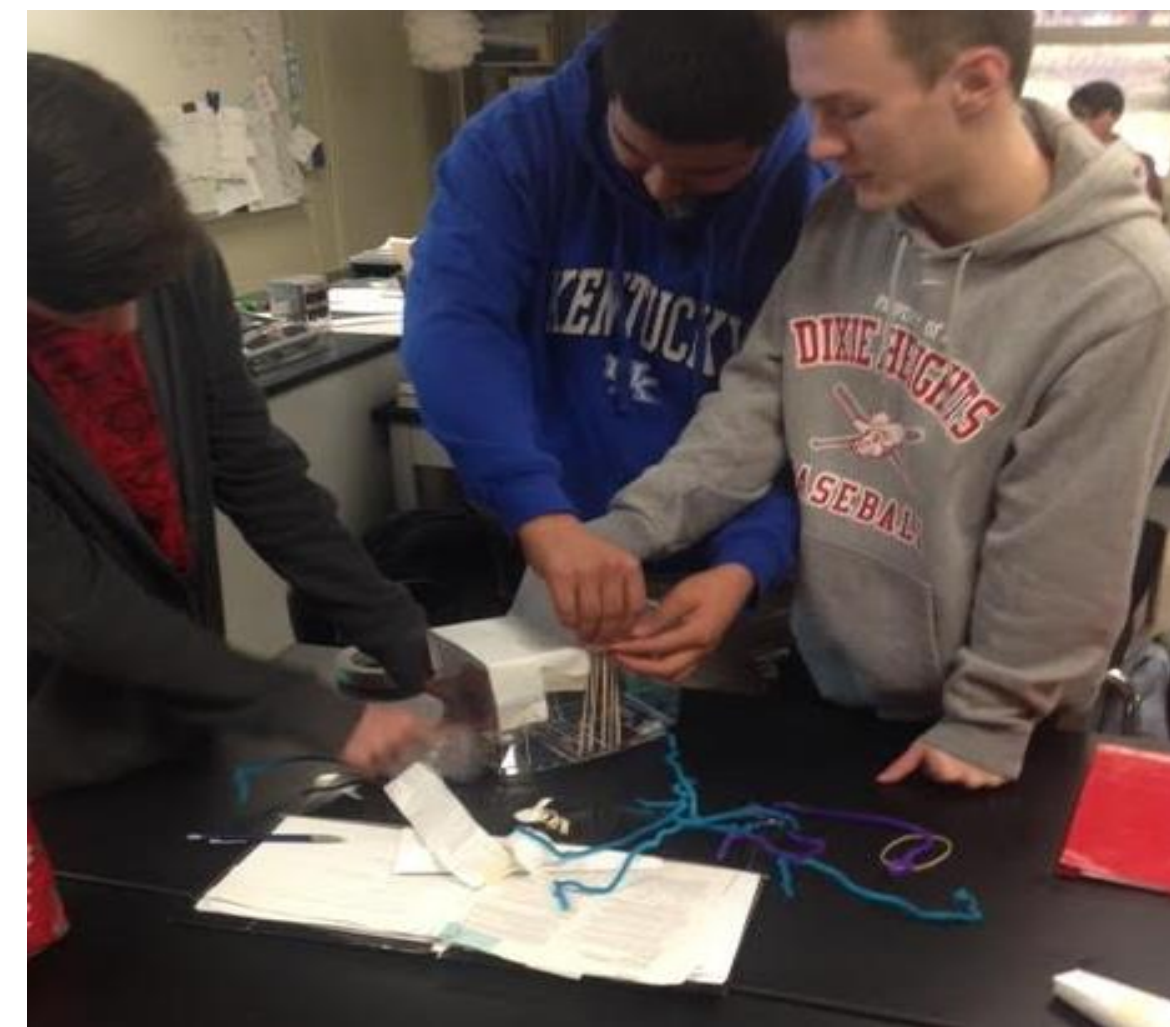
Activity Implementation

Challenge: Design and construct a working semi-permeable membrane

Materials: Paper, Tape and Rubber Bands

The membrane should be permeable to: Cotton Balls, Rice, Bingo Chips and Beans

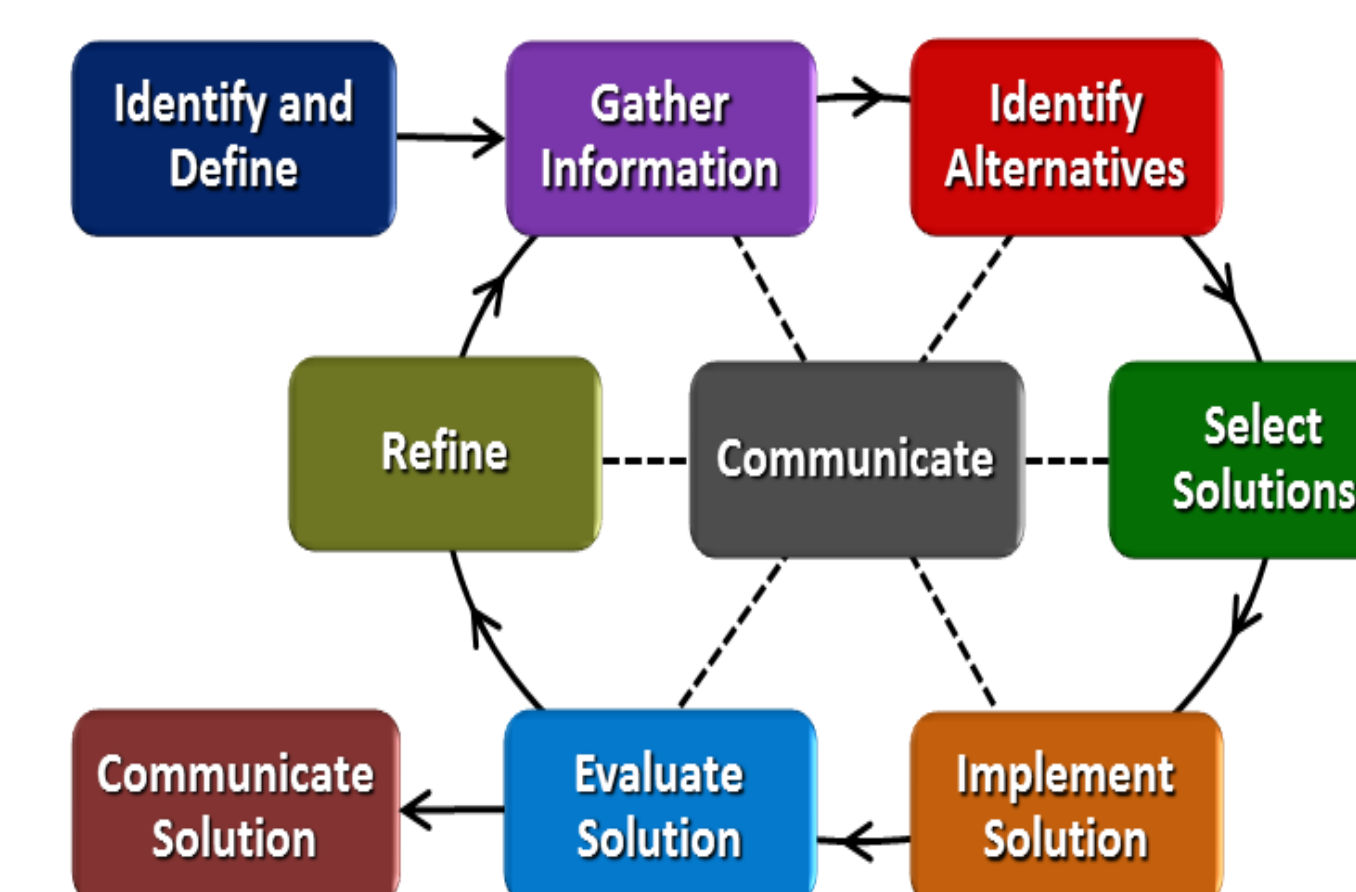
The membrane should be impermeable to: Marbles and beads



Engineering Design Process

This project allowed students to step through the engineering design process by:

- Coming up with individual designs
- Presenting designs before construction
- Building of concept
- Testing and redesign after testing



Diffusion and osmosis present in everyday life:

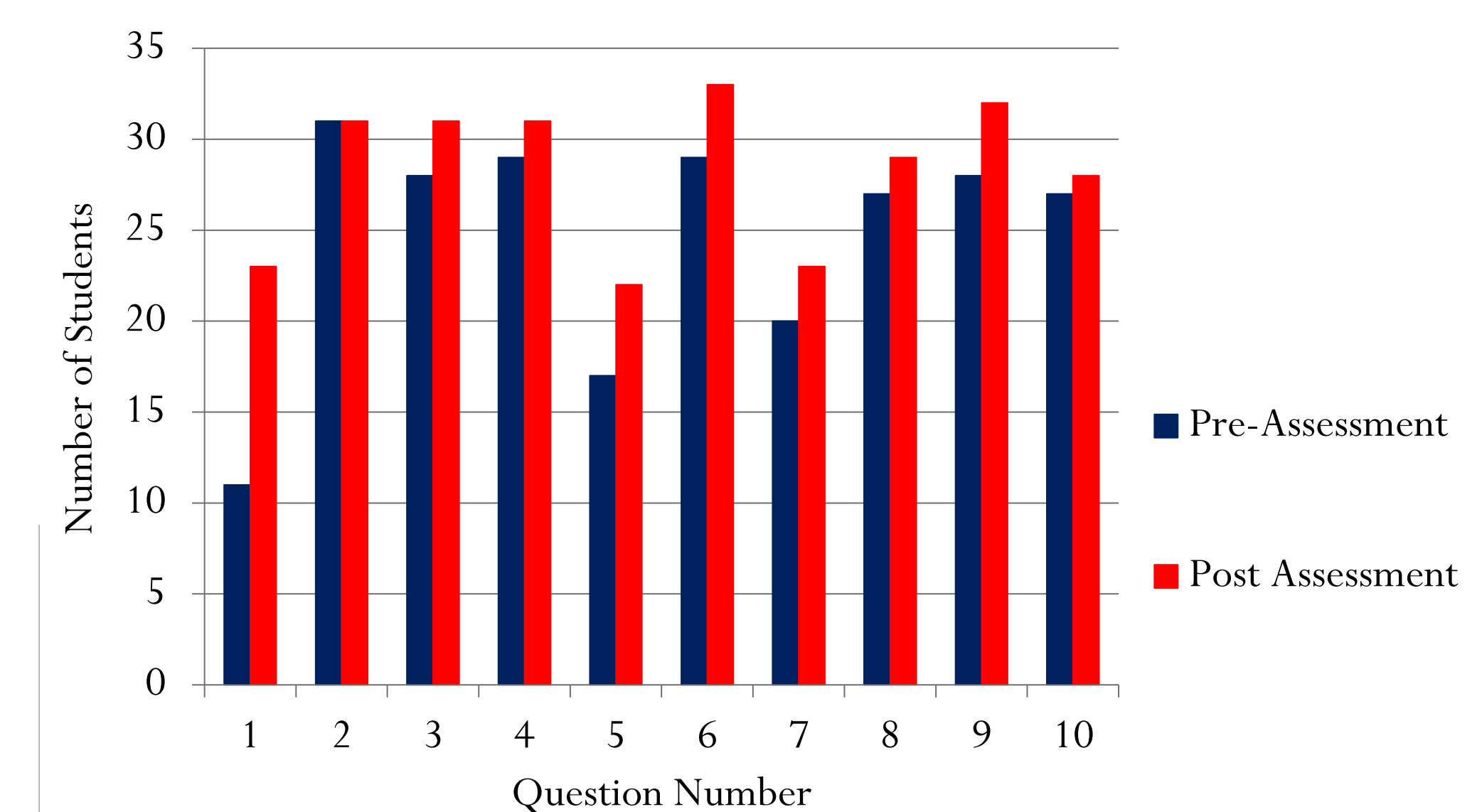
- Biology
 - Cell behavior
 - Plant survival
 - Medical Care
- Preservation and Dehydration of food
- Extremely prevalent in medical treatments
- Senior capstone project involves treating excess oxygen in the body with microbubbles, utilizing concentration gradients

Student Work



Assessment Results: Impact on Student Learning

Number of Correct Answers Pre vs. Post Assessment



From pre to post assessment:

- Average score increased 14.6%
- Every question increased in correct answers
- Question 1 more than doubled in number of correct answers

Reflection and Conclusion

Successes

- Students fully cycled through EDP
- Majority of student involvement
- Increased scores pre/post assessment
- Creative implementations
- Each group improved after redesign

Improvements

- Implement over a longer time period
- Give constraints on material
- Better instructions on material dropping placement
- Assign materials names of particles that can an cannot go through membrane