

Biomimicry as an Authentic Anchor (Resource Exchange)

Ms. Tyrine Jamella Pangan, Tufts University

Tyrine Jamella Pangan is a STEM Education PhD student at Tufts University and a Graduate Research Assistant at the Tufts University Center for Engineering Education and Outreach (CEEEO). She is interested in integrating social and emotional learning (SEL) in engineering, specifically within the elementary school context. Tyrine hopes to explore how Transformative SEL can be implemented to cultivate socially responsible engineers.

Dr. Kristen B Wendell, Tufts University

Kristen Wendell is Associate Professor of Mechanical Engineering and Education at Tufts University. Her research efforts at the Center for Engineering Education and Outreach focus on supporting discourse and design practices of engineering learners from all backgrounds and at all levels.

Geling Xu, Tufts Center for Engineering Education and Outreach

Geling Xu is a Ph.D. student in STEM Education at Tufts University and a research assistant at Tufts Center for Engineering Education and Outreach. She is interested in K-12 STEM Education, AI Education, MakerSpace, LEGO Education, and curriculum design.

Dr. Michael Cassidy

Dr. Ethan E Danahy, Tufts University

Dr. Ethan Danahy is a Research Associate Professor at the Center for Engineering Education and Outreach (CEEEO) with secondary appointment in the Department of Computer Science within the School of Engineering at Tufts University. Having received his graduate degrees in Computer Science and Electrical Engineering from Tufts University, he continues research in the design, implementation, and evaluation of different educational technologies. With particular attention to engaging students in the STEAM content areas, he focuses his investigations on enhancing creativity and innovation, supporting better documentation, and encouraging collaborative learning.

William Church

BIOMIMICRY AS AN AUTHENTIC ANCHOR (RESOURCE EXCHANGE)

Design Challenge: Airborne Transport



SUGGESTED GRADE LEVELS:

Middle School
(6th - 8th grade)



TOTAL ESTIMATED TIME:

1 - 2 hours
(1 class period)

WHAT IS BIOMIMICRY?

"A practice that learns from and mimics the strategies used by living organisms to solve challenges comparable to the ones we face as individuals and societies" (Biomimicry Institute, n.d.)

INSPIRATION FROM NATURE

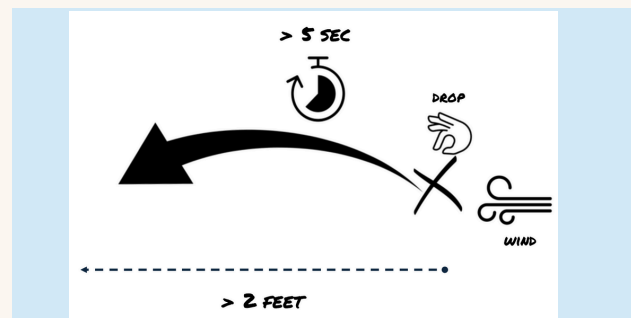


- Dandelion Seeds (top left)
- Anisoptera Tree Seeds (top right)
- Maple Tree Seeds (bottom left)
- Pine Tree Pollen Grain (bottom right)



DESIGN CHALLENGE

Create a device that can carry one plastic bead in the air for at least **5 seconds** and at least **2 feet** away from the drop location



COLLABORATIVE DESIGN PROCESS

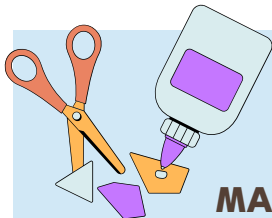
- Look at different organisms that carry out task of floating/twirling through the air
- Develop different design concepts and choose a design to explore and prototype
- Investigate the strengths and weaknesses of these different nature-inspired design ideas



Design Challenge: Airborne Transport

ANALYZING NATURAL INSPIRATIONS (SAMPLE ANSWERS)

Organism	Parts that support seed dispersal	Properties or characteristics of those parts	Action(s) enabled by parts and their properties
Pine tree	Sacci (spheres)	Air-filled, located on pollen wall outer layer	Increase surface area w/out increasing mass --> more air resistance, slow fall rate
Anisoptera tree	2 wings	3-dimensional, curve upward and outward	With wind, creates whirling helicopter motion --> disperse seeds far in wind
Maple tree	2 samara	2-dimensional, flat, wing-shaped, joined, ribbed, lightweight	Whirl and spin
Dandelion	Parachute made of bristles; tube connecting to seed	Jointed for open/close; lightweight	Closes when humid b/c won't get far in heavy air; when open, parachute catches wind



DESIGN CHALLENGE CONSTRAINTS

MATERIALS:

Construction paper, cardboard, tissue paper, tracing paper, paper clips, craft sticks, pipe cleaners, florist wire, tape, balloons, rubber bands, foil, paper cups, thumb tack

TOOLS:

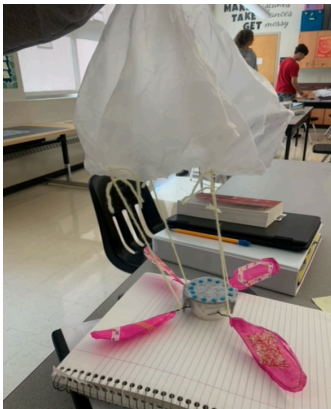
Hole punchers, scissors, hot glue guns, glue sticks, ruler, tape measure

TIME:

30 minutes to build, test, and iterate

SHARE-OUT

- Share your prototypes
- Compare prototype(s) to the original inspiration from nature
- Tell what you learned about their strengths and weaknesses in meeting the challenge



STUDENT EXAMPLE



- Inspiration from Anisoptera (spinning wings) and Dandelion seeds (parachute)

INSIDE TEST

- Average Distance from Target: 34 cm
- Average Air Time: 2.28 seconds

OUTSIDE TEST

- Average Distance from Target: 35 cm
- Average Air Time: 1.26 seconds



SCAN ME

INTERESTED IN DOING BIOMIMICRY IN YOUR CLASSROOM? SCAN THE QR FOR MORE INFORMATION