3D Plants: Students build AVR plant models to understand the role of design in STEM

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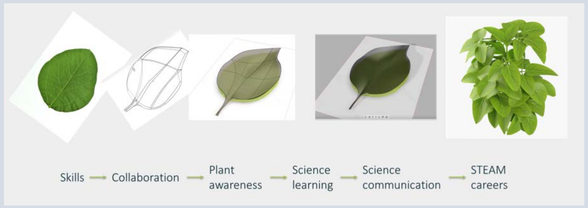
THE GOAL

The overarching goal of this project is to address the disconnect between science, design, and technology. We examine how urban and rural high school students benefit from innovative learning experiences in plant science that integrate these disciplines while gaining interest in and skills for future STEM careers. This project tests a STEAM (Art in STEM) teaching model in which students create scientific products to incorporate in Augmented and Virtual Reality (AVR) platforms. This experience inspires creative learning, provides critical thinking and problem-solving benefits, supports concepts of innovation, and allows students to connect to real-life situations impacting their career paths.

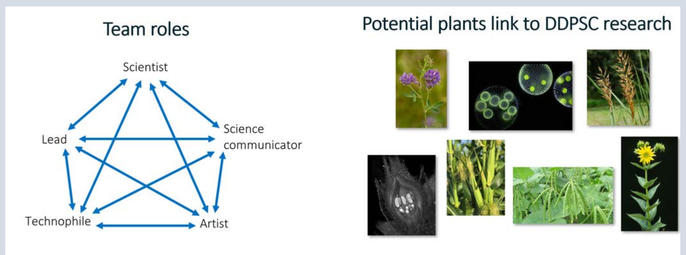


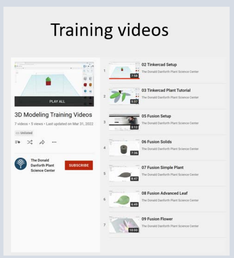
OBJECTIVES

1. Inspire interest in STEM careers among students and provide them with skills for a future STEM career
2. Foster knowledge and appreciation of plant science among students
3. Integrate art/design into STEM plant science education
4. Apply AVR technology to advance in plant science education through the use of novel tools and methodologies.

METHODS

Teams of self-identified science, technophile, and art students receive training in 3D modeling. With support from scientists, they create models of plants under research at our institution, write worksheets, and give presentations in public/scientific events. Teams' products will be shared globally through the education community of our AVR partner institution zSpace.



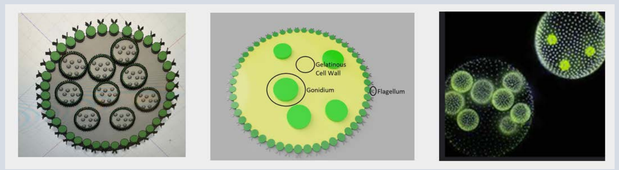


Guide Teacher & Students Protocols

RESULTS

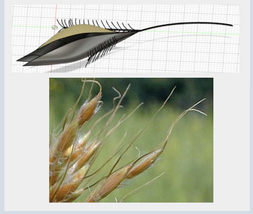
Common milkweed (*Asclepias syriaca*)

Green algae volvox (*Volvox carteri*)



Big bluestem grass spikelet pair (*Andropogon gerardii*)

Indiangrass spikelet (*Sorghastrum nutans*)



- DDPSC summer internship (7 students)
- Spark! Program (21 students)
- MICDS (4 students)
- Missouri Adolescent Program – STL (14 students)

ASSESSMENTS

Mixed-methods approach:
- Open-ended self-reflections (pre/post)
- STEM Semantics Survey with additional questions for A (Art/Design) (pre/post)
- Plant Awareness Disparity Index (PAD-I) (pre/post)
- IRB approval

PRELIMINARY RESULTS FROM REFLECTIONS

Sample size: 15 students

Question 1. How does art and design play a role in science? (pre/post)

Question 2: How does science play a role in art and design? (pre/post)

Questions	Role of art/design in science		Role of science in art/design	
Counts	Pre	Post	Pre	Post
No. of types of codes	7	13	8	9
No. of total codes	24	25	20	20
No. of unique codes (only present in pre- or post-surveys)	2	7	2	3

THE ROLE OF ART/DESIG IN SCIENCE	Pre		Post	
Main codes	Counts	%	Counts	%
Foster new ideas including technological advances and creation of tools	5	21	3	12
Communication and further understanding	6	25	1	4
- Visual representation	11	46	7	28
- Understanding of scientific content			5	20
- Makes science accessible to all			4	16
- Communicate ideas between scientists			1	4
Aid in problem solving	1	4		
Greater appreciation of science	1	4		
Interactivity / Brings ideas to life			3	12
Complementarity between art/design and science			1	4

THE ROLE OF SCIENCE IN ART/DESIGN	Pre		Post	
Main codes	Counts	%	Counts	%
Science influences artistic creation process	2	10	2	10
- Design logistics and specifics	7	35	9	45
- Inspire artistic ideas	3	15	1	5
- Innovation / create new types of art			3	15
Similar process, skills, and principles			2	10
- Creative process and scientific method	1	5		
- Attention to detail	1	5		
Technological advances	2	10	3	15
Science influences interactions with art	3	15		
No role	1	5		

SUMMARY OF REFLECTIONS

The role of art/design in science:
- After the 3D plant modeling experience, the students reported more codes. This suggests that they became aware of more ways in which art and design can be part of science.
- The students also reported more codes related to communication, indicating that they see this factor as major player in the use of art and design in science.

The role of science in art/design:
- After the 3D plant modeling experience, the students reported few additional codes related to innovation and creation of new types of art. This suggests that students have similar understanding of the role science plays in art and design before and after the intervention.

These are general trends that are starting to emerge. We will continue collecting reflections from more schools to increase our sample size.

We continue coding the responses to additional questions about expectations, learning, memorable moments, and challenges.

WHAT IS NEXT

- Participation of more schools including rural schools.
- Analysis of surveys about student attitudes towards STEAM and STEAM careers and plant awareness.

ACKNOWLEDGMENTS

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REFERENCE

Perignat, E. and Katz-Buonincontro, J., 2019. STEAM in practice and research: An integrative literature review, Thinking Skills and Creativity, 31: 31–43. DOI: https://doi.org/10.1016/j.tsc.2018.10.002.