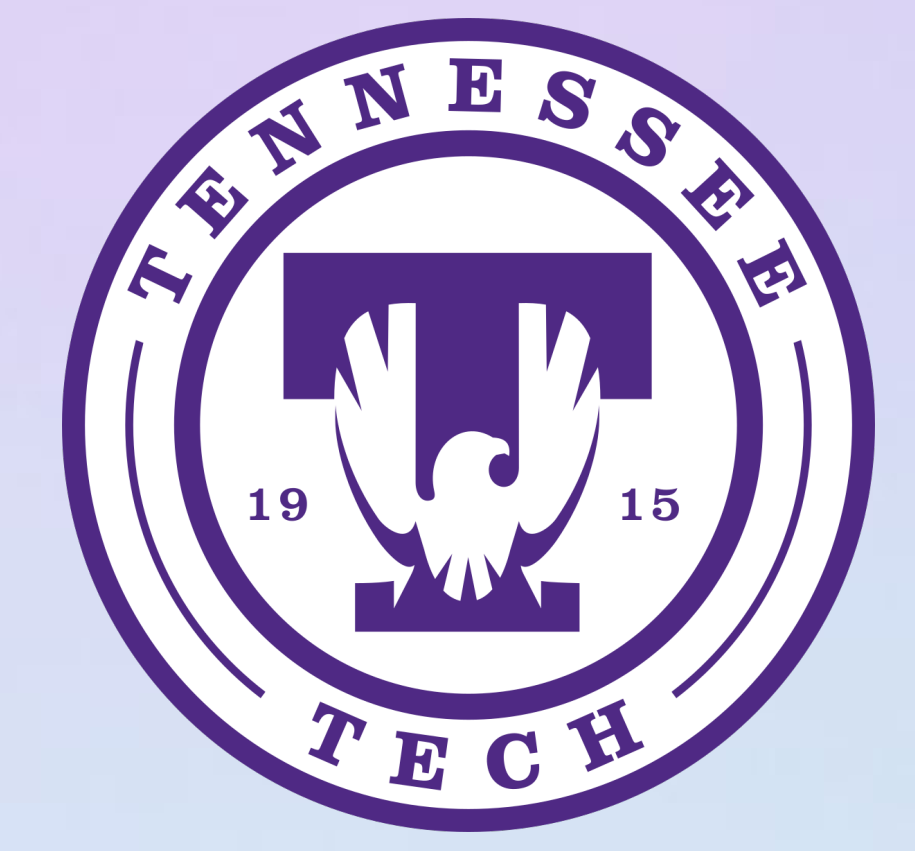


# The EOP BioFoundry Initiative at Tennessee Tech University:

## *The Integration of the Engineering for One Planet Model as a Structured Approach to Sustainable Design via the Renaissance Foundry Model*

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### INTRODUCTION

The Renaissance Foundry Research Group is an interdisciplinary team that proposed to magnify the focus on Sustainability in engineering programming at Tennessee Technological University (TNTech) by systematically incorporating the Engineering for One Planet (EOP) model **into core** components of the design process of at least four chemical engineering courses (EOP, 2020).

In each of these courses, student-team-developed **prototypes of innovative technology** addressing societal challenges are a required outcome using the Renaissance Foundry Model (Arce et al., 2015). In Spring 2021, the BioFoundry Initiative was implemented in select courses of the Chemical Engineering program at TNTech. Pilot data from this initiative was analyzed as part of the EOP proposal and leveraged to make improvements in the implementation of the EOP BioFoundry Initiative in the Spring 2023 semester (Arce, Arce-Trigatti, & Wagle, 2023). The data analysis and findings are presented in this contribution.

Based on these pilot projects, a proposal to systematically incorporate the Engineering for One Planet (EOP) model into core components of the design process in select chemical engineering courses was developed.

### PROCEDURE/METHODS

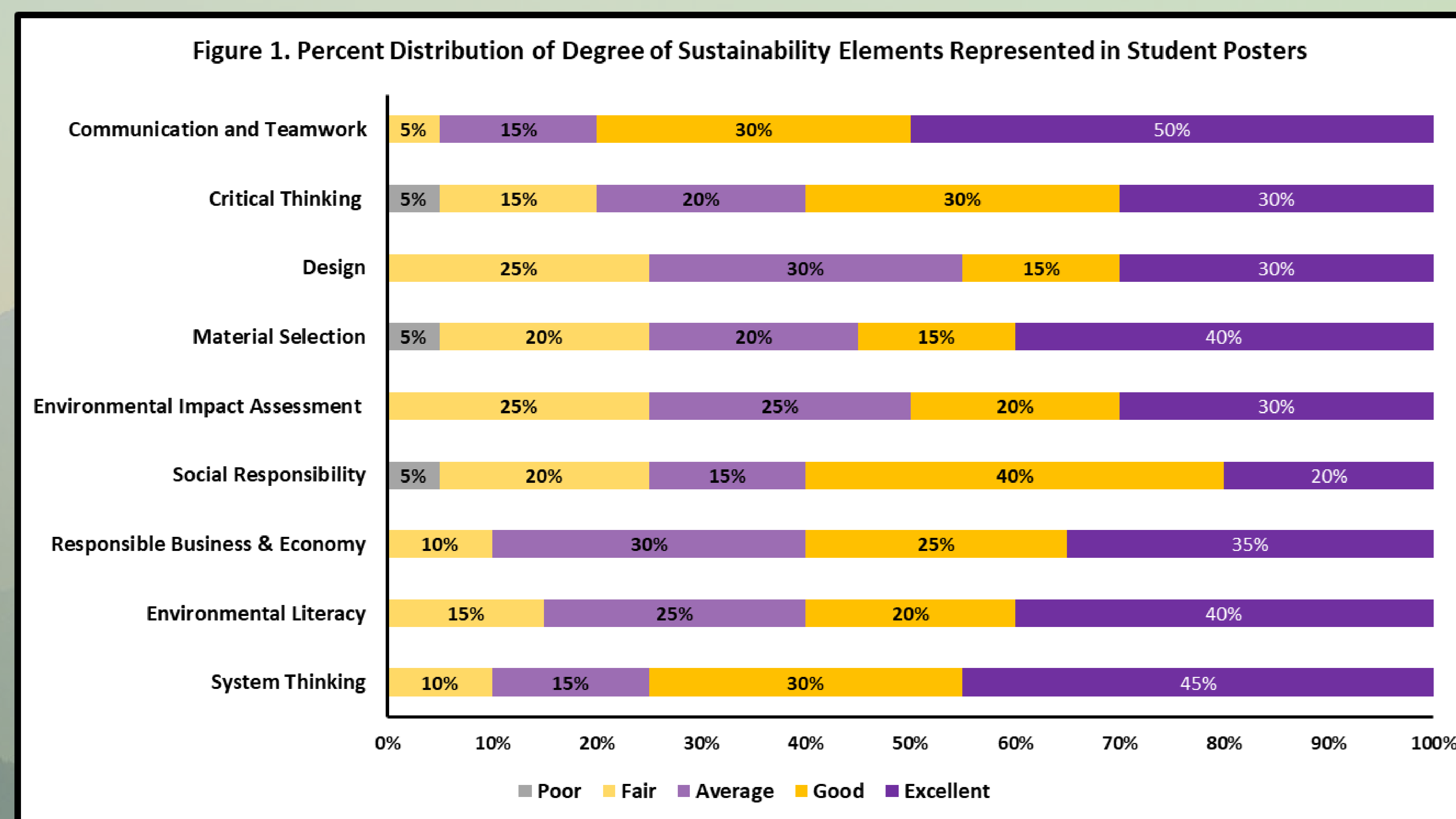
#### Spring 2021 data

- 16 team projects of
- 60 students were analyzed for sustainability evaluation based on the overall inclusion of the 9-elements of EOP framework in their design project

#### Analysis

- Percent distribution of student degree to which 9 Elements of the EOP were integrated into the design process during the first iteration of the BioFoundry Initiative
- The analysis presented in *Figure 1* provides an overview to understand on what extent the students' prototypes from these courses aligned with current sustainability efforts.
- The analysis also suggests the necessary areas for improvement., including Environmental Impact Awareness, Material Selection, and Responsible Business and Economy.

### FALL 2022 ANALYSIS OF PILOT DATA (Arce et al., 2023)



### EVALUATION AND IMPACT

#### Fall 2022 Evaluation and Findings

- Quantitative Approach
  - Statistical Methods using descriptive statistics
  - Analysis of EOP elements on Spring 2021 posters
  - Identification of areas of strength that are in alignment with Renaissance Foundry Model elements
  - Identification of areas to focus on for improvement in Spring 2023 using EOP Framework

#### Spring 2023 Evaluation Approach

- Mixed Methods Approach
  - Build on findings from Fall 2022 analysis
  - Inclusion of qualitative data
  - Student Perceptions from Survey Data (Pre-/Post-)
  - Student Submissions from EOP Framework Activities
  - Rubric data from Student-Team Prototype Evaluations

### PROGRESS AND PLAN FOR SCALING UP

#### Planning

- Based on the results from the pilot study, the plan is to modify a series of courses to systematically incorporate the ideas behind the EOP model
- We will start with planning and strategic ideas for one pilot course (CHE 3052, Fluid Mechanics) during the Fall 2022 (Planning Term), including obtaining Institutional Research Board permission, and the creation of all evaluative protocols
- Implementation is planned for the Spring 2023 semester

#### Plan for Pilot Study

##### Knowledge Acquisition Paradigm

Students will have the opportunity to learn about the **EOP model** and the connections that brings to modify the content of the course so that they are aligned with an understanding of Biomimicry as other sustainable approach to the environment.

##### Knowledge Transfer Paradigm

Students guided by the Foundry Model will work on a Challenge related to the course content and produce a team-centered **Prototype of Innovative Technology** that is centered on the EOP model. This is planned to be a semester long project with support from the instructor.

### REFERENCES

Arce, P., Arce-Trigatti, A., & Wagle, D. (2023). Implementation of the Engineering for One Planet (EOP) Model Guided by the Renaissance Foundry Model (RFM). Paper presented at the Southeastern STEM Education Research Conference, Tennessee Tech University, January 14, 2023.

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### ACKNOWLEDGEMENTS

We would like to thank the Lemelson Foundation, the ASEE, and Tennessee Technological University for their generous support of this project. We would also like to acknowledge the Southeastern STEM Research Conference, hosted by the Tennessee Technological University Oakley STEM Center and the Middle Tennessee State University, wherein a previous iteration of this information was presented (January 14, 2023).