

# Cyberlearning and Constructionism in Sustainable Life-Cycle Engineering

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## About Me

Bertha Wang is a third-year undergraduate at Princeton University. She is majoring in mechanical and aerospace engineering, with certificates in robotics and computer science.

## Project Introduction

Wayne State University, Penn State University, and Oregon State University are collaborating to develop a web-based sustainable lifecycle engineering design education portal called Cool:SLiCE (Constructionism in Learning: Sustainable Life-Cycle Engineering).

Cool:SLiCE is a cyber-learning platform that takes a constructionist approach to provide an interactive learning environment and enable engagement in sustainable design and analysis. The participating universities each contributed a different tool to reflect the multi-disciplinary facets of sustainable engineering. The platform consists of three modules to fulfill learning objectives (Figure 1). It is in developing stages, and the team is currently working towards evaluating its usability.

### Learning Objectives:

- 1: Analyze the impacts of product architecture, manufacturing processes, and supply chain decisions on the economic and environmental sustainability of a product;
- 2: Articulate the impacts of product architecture, manufacturing processes, and supply chain decisions on the economic and environmental sustainability of a product;
- 3: Construct product design solutions that address technical requirements, in addition to economic and environmental sustainability goals.

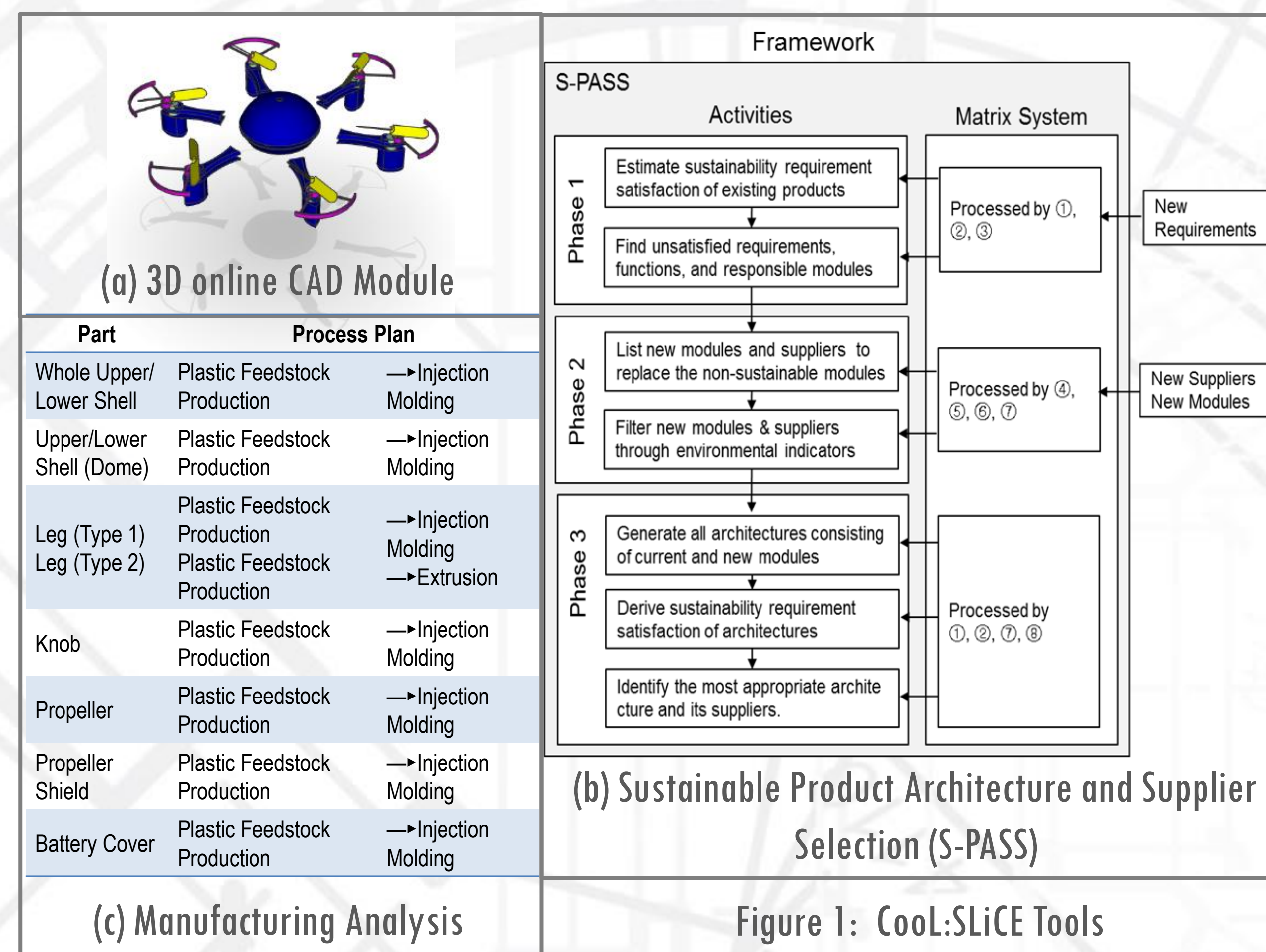


Figure 1: Cool:SLiCE Tools

## Relation to Sustainable Manufacturing

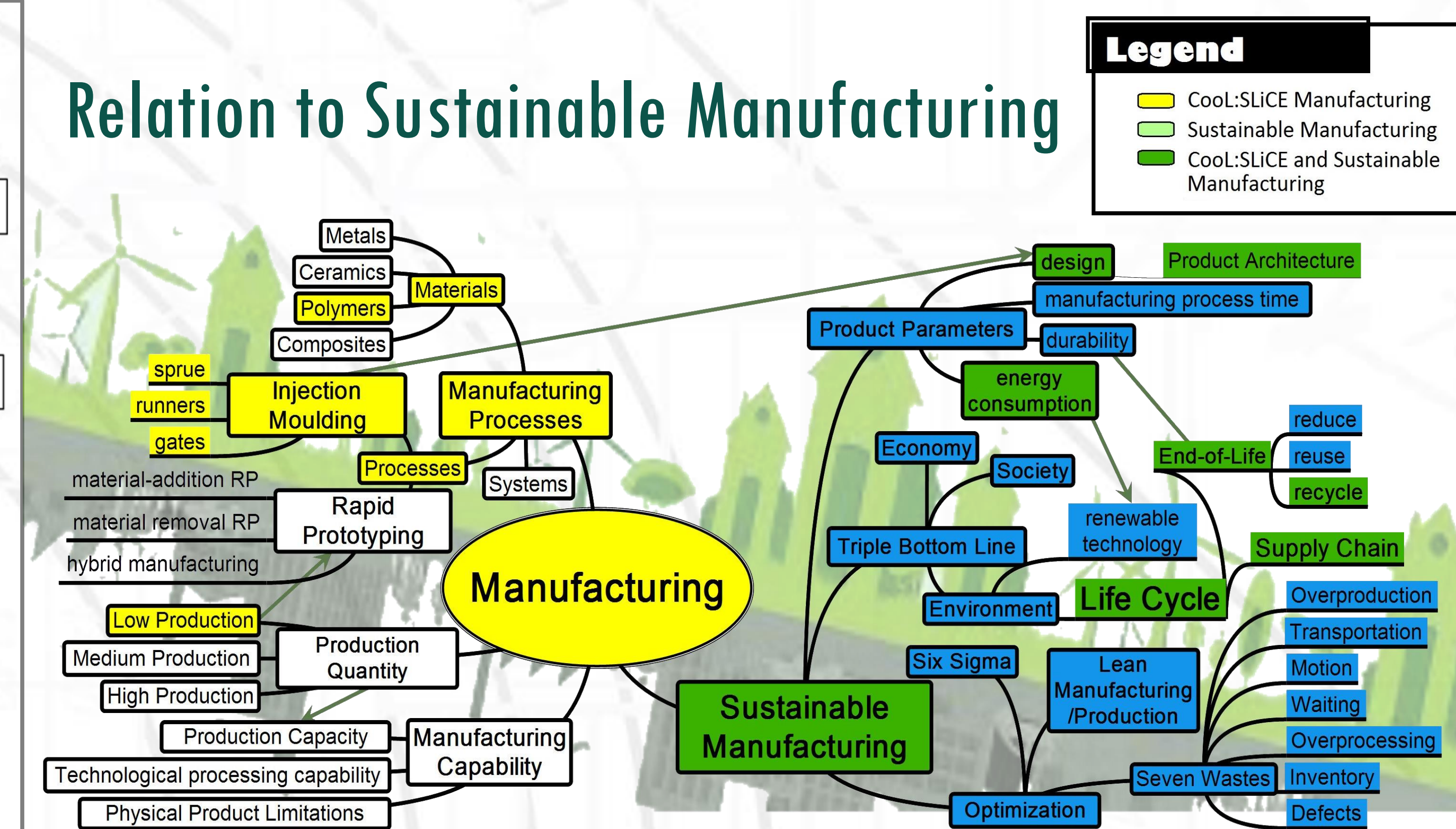
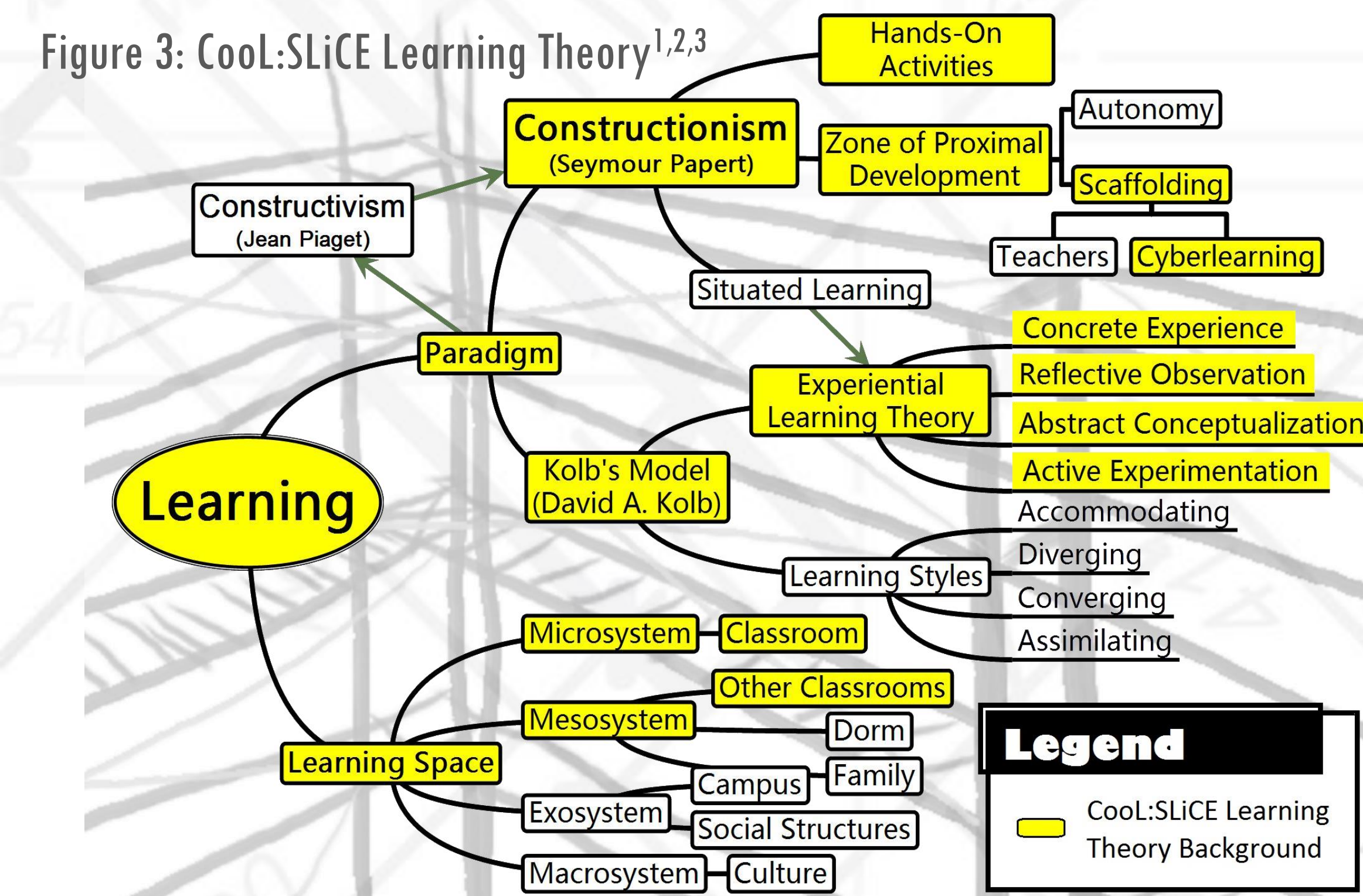


Figure 4: Cool:SLiCE's Relationship to Sustainable Manufacturing<sup>4</sup>

## State of Knowledge

The current lack of integrated sustainability analysis has motivated the Cool:SLiCE team to develop the cyberlearning platform. The team has taken a constructionist approach to provide appropriate scaffolding in a multidisciplinary cyberlearning environment.



## Inter-University Multi-Disciplinary Team Project

### Goals:

- Evaluate how Cool:SLiCE addresses sustainable engineering
- Evaluate how Cool:SLiCE facilitates group work.

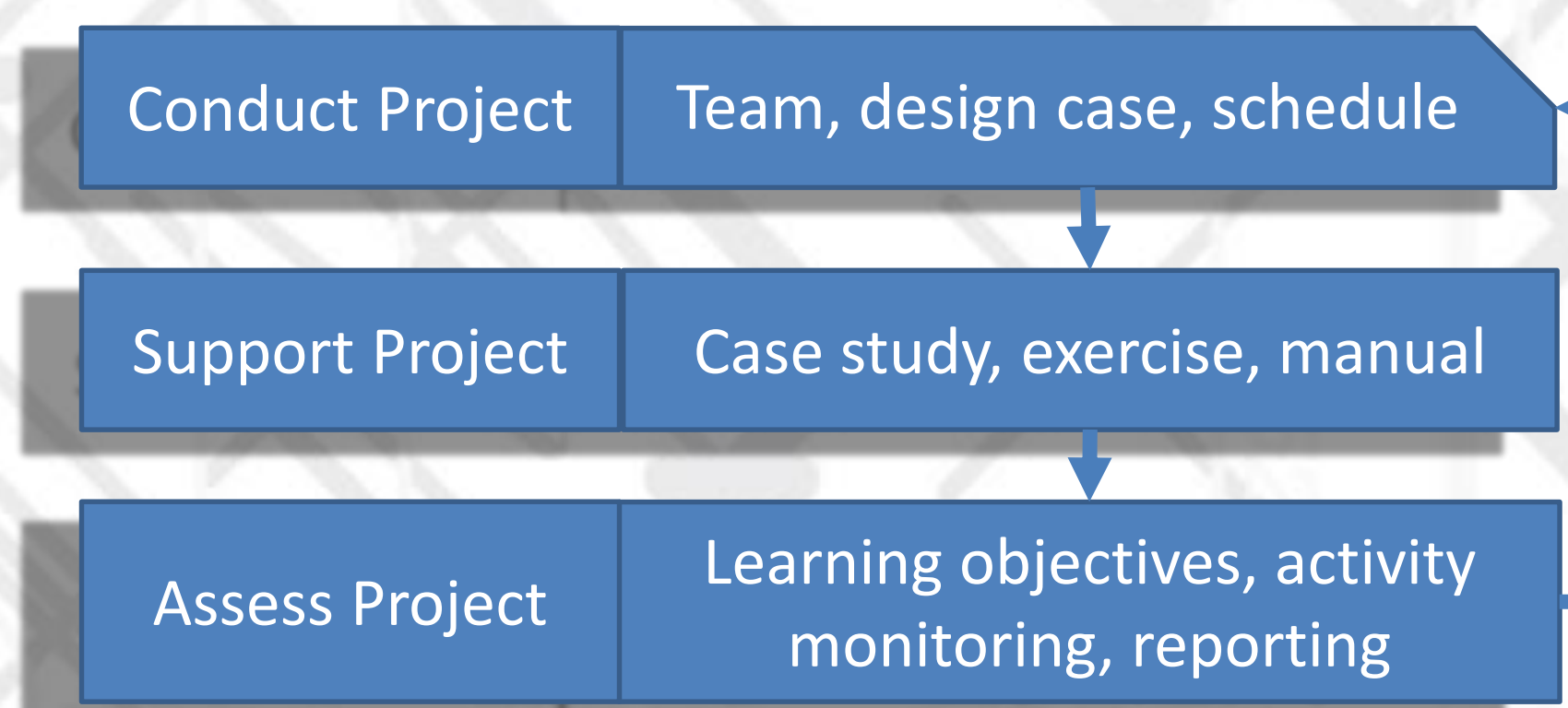
Student Team: For the pilot test, the graduate student developers are acting as Cool:SLiCE users. The team varies in areas of engineering disciplines.

Task: Design and perform sustainable manufacturing analysis of drones for a custom purpose

Data Collection: To record group interactions, the team is using Slack.com to coordinate and record meetings, share ideas, and note decisions.

### Approach

The formation of the inter-university multi-disciplinary team project has resulted in a cyclic approach towards evaluation.



## Current Needs and Future Direction

It is important to note that the evaluation is an ongoing process.

The project has produced feedback for future direction:

- Need for tutorials or initial instruction to motivate student
- Need to generalize S-PASS Tool to address any product
- Suggestion to integrate 3D online CAD with other tools

## Acknowledgements

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### References

1. Harel, Idit and Seymour Papert. "Situation Constructionism." Harel, Idit and Papert Seymour. Constructionism: Research Reports and Essays, 1985-1990. Norwood: Ablex Pub., 1991.
2. Kolb, David A. "The Process of Experiential Learning." Kolb, David A. Experiential Learning: Experience as the Source of Learning and Development. Englewood Cliffs: Prentice-Hall, 1984. Print. June 2016.
3. Kolb, Alice Y. and David A. Kolb. "Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education." Academy of Management Learning & Education 4.2 (2005): 193-212. Web. June 2016.
4. Groover, M.P. Fundamentals of Modern Manufacturing: Materials, Processes, and Systems. John Wiley & Sons, 2010.



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