

# Engineering Students’ Perceived Value of Campus Makerspaces For Future Career Preparation



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## Introduction

As the popularity of makerspaces in higher education continues to grow, we seek to understand how students perceive these spaces as tools to prepare them for future engineering careers.

Introduced in engineering education in early 2000’s, makerspaces have the potential to foster development of 21<sup>st</sup> century and technical skills through hands-on constructionist learning [1], [2]. The core tenants of the maker mindset include [3], [4].

- Growth Through Failure
- Collaborative Learning
- Creativity and Innovation
- Student Agency

## Methods

**Research Question:** *How do engineering students perceive campus makerspaces help prepare them for future engineering careers?*

**Qualitative Open Ended Survey** - As part of a homework assignment students were asked to visit two on campus spaces for making

(a) A contemporary makerspace

(b) A traditional engineering shop

After visiting both spaces students were asked to answer the following question:

*“Thinking about the functions of development or production how do you think these spaces would help prepare you?”*

**Population and Coding:**

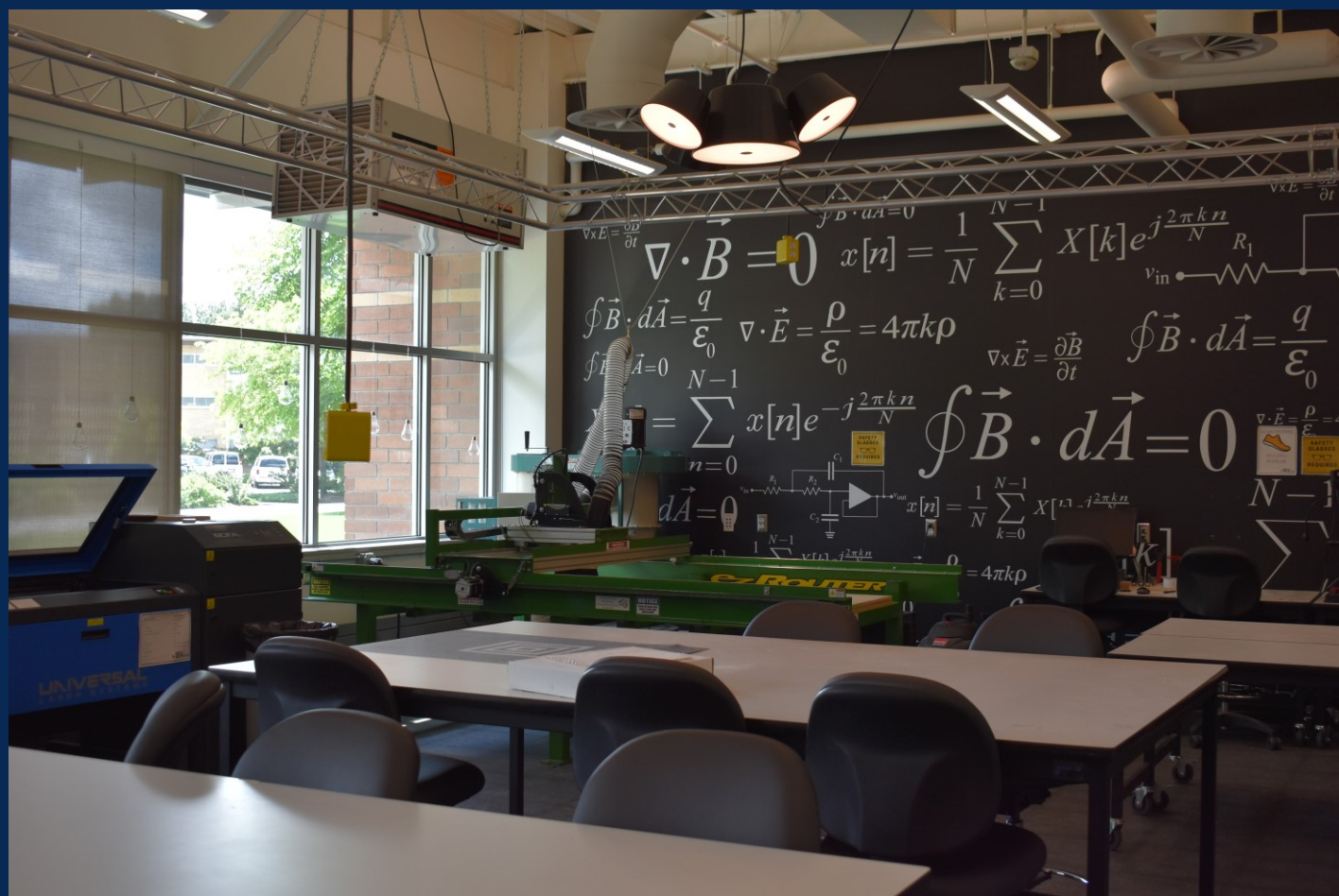
- Introduction to Engineering Course at a large western university
- Fall 2017 Section with 41 students, 37 male 4 female
- 32 responses were collected and analyzed using thematic coding (93% Inter-coder agreement)

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## Makerspace



## Engineering Shop



## Results

Value in Designing a Physical Product
<i>“Before production can begin, an engineer must have a safe place to construct and test new designs. A design on paper may look great, but it has no purpose until it is actually constructed. This requires a lot of equipment and tools, which can be found in labs such as these. These spaces also allow for group work, which can greatly speed along the develop process.” -Participant 27, Line 169</i>
Utility in Learning Technical Skills and Equipment
<i>“This equipment is an engineer’s future. Using these labs could help me prepare for my career path. As a mechanical engineer there is a lot of design and production involved in it, so using these cutters, presses, etc. can teach me how to design and produce a product. - Participant 32, Line 204</i>
<i>“They allow you to use tools and fundamentals that are going to prepare me for my future. I think it is very important to get a little bit familiar with all of the different types of machines so that if I am ever in a job situation and they want me to use it I will already have experience. -Participant 5, Line 43</i>
Value in Hands-On Learning
<i>“Anything that teaches you hands-on how to fix a problem or create something will teach you faster than any lecture in my opinion. These labs are great to advance the learning of those to work on projects from the real world. To me experience is sometimes a greater incentive for someone to hire you over getting straight A’s.” -Participant 14, Line 92</i>
<i>“Using these spaces has great potential for hands on learning how the manufacturing process works. By understanding how something is made, you can better understand how to design things with the production process in mind.” - Participant 29, Line 176</i>

Perceived Learning Themes	Frequency
Understanding Design for Manufacturability	5
Learning Machining Processes	7
Learning the Production Process	7
Testing and Iteration	7
Creating a Physical Prototype	13

## Discussion

Students recognize that being involved in makerspaces can help prepare them by providing opportunities to learn in a hands-on environment with the support of peers and trained staff.

- This collaborative and hands-on environment can foster many of the competencies that future engineers will need including teamwork, problem-solving, communication and lifelong learning [5], [6]
- Additionally, students recognize that these spaces can help them understand the translation of a conceptual design into a physical object. Engaging in this transformation, from a design on paper to a physical model, has been show to produce higher quality and more effective designs [7]
- Students recognize that working in these spaces can help them develop the technical skills in prototyping and manufacturing that employers are looking for [3]

These student perceptions, as well as the growing body of research on makerspaces, support the integration of these spaces as a learning tool in engineering education.

## References

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