

A Critical Analysis of Learning Outcomes and Engineering Competencies Promoted in Introductory Aerospace Engineering Syllabi: From A Student's Perspective.



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Background

The goal of this research was to identify the engineering competencies most valued by employers in industry and compare them to the competencies being emphasized in introductory aerospace engineering courses. This comparison provides an opportunity to examine the presence of valuable core items that an ABET accredited program is supposed to ensure. As a student who has attended an introductory aerospace course in university, my hope is that providing this critical analysis will help inform more beneficial practices in engineering education.

Objectives

- Determine the engineering competencies most valued by employers in industry
- Filter and transcribe the language being used in aerospace syllabi to perform analysis.
- Establish and implement a framework for analyzing the skills promoted in course syllabi and for mapping these skills to engineering competencies.

Research Design

- I consulted a secondary source to obtain the engineering competencies most valued by industry[1].
- I used Bloom's Taxonomy as a lens to analyze the language being used in the syllabi.
- NVivo software and qualitative coding to record the frequency and type of language being used in the syllabi[2].
- Conceptual content analysis to map the language to Bloom's tiers, and then mapped the tiers to their associated engineering competencies.

Evaluation & Results

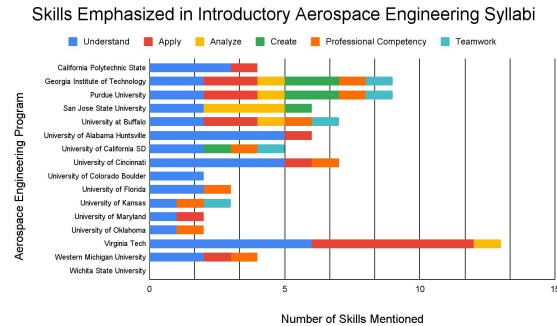


Figure 1. Bloom's Skills in Introductory Aero Course Syllabi

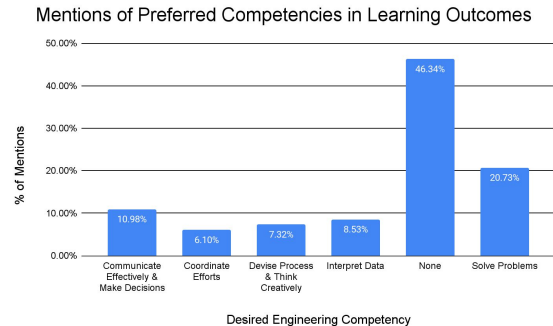


Figure 2. Mentions of Preferred Competencies in Learning Outcomes

Conclusions

- In discerning between outstanding and ordinary engineer performance, the top tier competencies were found to be *communicate effectively*, *coordinate efforts*, and *devise process*. Others denoted as high importance and core engineering competencies were *interpret data*, *take initiative*, *think creatively*, *solve problems*, and *make decisions*.
- A majority of the language used in course learning outcomes is geared toward promoting lower level thinking. Over 46% of mentions were mapped to the bottom tier of Bloom's Taxonomy.
- Of the 8 desired competencies, 7 were promoted in the learning outcomes. The largest emphasis is placed on *solve problems* (20.73%). This is an accurate representation of my experience, where a majority of time and effort was spent on solving textbook problems, and other engineering competencies were rarely discussed and developed.

Future Plans

- Advocate for implementation of education practices that better promote the competencies desired by industry and explore extracurriculars which can provide me with the competencies that matter.
- Raise awareness to the disparity between the competencies being heavily promoted in courses, and those desired in an industry setting.

Resources

[1] H. J. Passow and C. H. Passow, (2017), "What competencies should undergraduate engineering programs emphasize? A systematic review", Journal of Engineering Education vol.106 no.3, pp. 475-526.

[2] Saldana, J., (2013), *The Coding Manual for Qualitative Researchers*, SAGE, Thousand Oaks, CA.