

# Integrating Entrepreneurship into Capstone Design: An Exploration of Faculty Perceptions and Practices

## Purpose

This study examined entrepreneurially focused curricular practices among engineering Capstone design faculty. The two primary research questions for this study are:

### Literature Review

Incorporating entrepreneurship into the engineering curriculum is compelling for many reasons. Entrepreneurship education 1) boosts GPA and retention rates of engineering students,<sup>1</sup> 2) provides skills and attitudes students need to innovatively contribute to existing organizations and pursue their own ventures,<sup>2</sup> and 3) addresses current and anticipated workforce demands,<sup>3</sup>

Entrepreneurship is taught most effectively using experiential methods,<sup>4</sup> which makes Capstone design, a typically applied and experiential course, an optimal context for integrating entrepreneurship. Indeed, Ochs et al.<sup>5</sup> illustrated ways to integrate entrepreneurship into Capstone while simultaneously adhering to ABET standards. Shartrand and Weilerstein<sup>6</sup> also identified practices for incorporating entrepreneurship into Capstone design courses, and identified traditional and entrepreneurial Capstone elements.

However, it is unclear what Capstone design instructors actually practice in this area.

**“I actually teach my engineering capstone with the class and instructor of the entrepreneurship capstone, where we develop teams of engineering and entrepreneurship students. This has worked well.”**

### Method and Analysis

- A survey was sent to 252 faculty members affiliated with the bi-annual Capstone Design Conference, VentureWell, or the Epicenter Pathways to Innovation Program. (Response rate of 49%, n = 111)
- Quantitative data were analyzed using descriptive statistics in SPSS and Excel.
- Open-ended responses were pattern coded using thick descriptions and anonymous quotes.<sup>7</sup>

### Quantitative Results

While many faculty expressed an interest in integrating entrepreneurship into Capstone design, most continue to follow a more traditional Capstone approach.

- Typically projects are evaluated on technical merit, sponsor needs, and developing a working prototype.
- Some have incorporated entrepreneurship principles such as failing forward, meeting customer needs, and intellectual property.

Many respondents indicate an unrealized desire to increase the integration of entrepreneurship and stated that the following should be supported in capstone design courses:

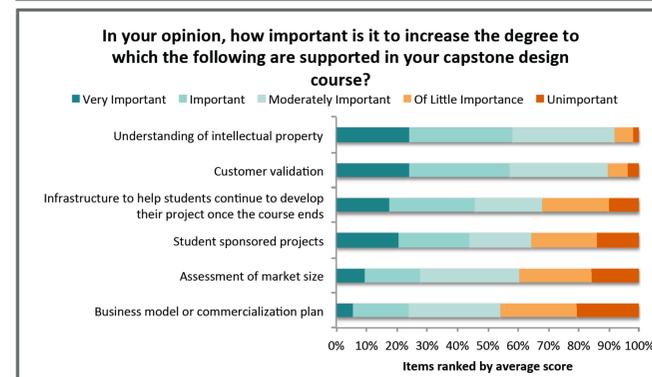
- Understanding of intellectual property
- Customer validation practices
- Infrastructure that supports students who want to develop their projects outside of class
- Student sponsored projects

## Research Question 1

How and to what extent do faculty incorporate different entrepreneurial practices in their Capstone design courses?

Criteria for Project Success and Course Requirements								
Question	Item	n	Mean	Never (1)	Rarely (2)	Some-times (3)	Often (4)	Always (5)
To what extent is the success of the final project/product evaluated by the following:	Meeting technical requirements	111	4.62	0%	1%	5%	24%	69%
	Meeting end user and/or customer needs	111	4.29	1%	4%	9%	39%	48%
	Meeting sponsor needs	110	4.03	5%	7%	15%	25%	48%
How often are the following required in the course?	Working prototype	111	4.26	5%	4%	7%	27%	57%
	Customer-validation of solution	111	3.39	6%	22%	21%	30%	22%
	Assessment of market size	111	2.53	20%	34%	27%	11%	8%
	Business model or commercialization plan	111	2.26	30%	33%	23%	10%	5%
How often is “Failing forward” (using failure to iterate the design) encouraged?		110	3.61	4%	17%	23%	27%	29%

Note. Item level response rate varied by construct. Rates ranged from 99% to 100% (110 to 111). Percentages are rounded to the nearest whole number.



### Qualitative Results

Content analysis of open-ended survey responses shed light on challenges and strategies faced by Capstone design faculty when attempting to incorporate different entrepreneurial practices. Integrating entrepreneurship into Capstone design was challenging due to either:

1. A lack of financial and/or faculty support
2. Inappropriate timing (students should be exposed sooner)
3. Limited relevance in certain disciplines (e.g. civil engineering)
4. Low student demand (engineering students want jobs)
5. A difference in focus (capstones help students foster partnerships with industry)
6. Competing tradeoffs (teaching entrepreneurship might compromise the core curriculum)

## Research Question 2

How important is it to increase different entrepreneurial practices in the Capstone design class?

### Conclusion

Three themes emerge that capture the perceived challenges encountered when implementing entrepreneurially focused Capstones. Themes and potential solutions are listed below:

#### The Capstone Tradition

Traditionally, Capstone Design:

- Connects and prepares students for work in industry
- Is industry funded; entrepreneurial approaches need alternate funding
- Is approved by ABET. Models of ABET approved entrepreneurial approaches are needed to foster adoption

#### Faculty exposure and experience

If faculty are to teach more entrepreneurially focused capstones, they need access to:

- Entrepreneurship definitions that incorporate venture creation and intrapreneurship
- Models for implementing entrepreneurially focused capstone in different engineering disciplines
- Research illustrating the myriad of positive student outcomes
- Training and support to help them with implementation

#### University culture and support

The university can foster the adoption of entrepreneurially focused capstone courses by:

- Fostering collaboration between engineering faculty and faculty/experts with entrepreneurship experience
- Supporting the development of University infrastructure to support students beyond the life of the course
- Encouraging the development of multiple entrepreneurial experiences throughout students' academic careers

**“While entrepreneurship is important, I strongly believe it has to be encouraged from early stages, and not only at the last semester.”**

### References

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