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Making Value for Society

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Making Value for Society

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

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Entrepreneurship Education

- Boosts GPA and retention rates of engineering students[1]
- Provides skills and attitudes students need to innovatively contribute to existing organizations and pursue their own ventures[2]
- Addresses current and anticipated workforce demands[3]
- Is taught most effectively using experiential methods[4]

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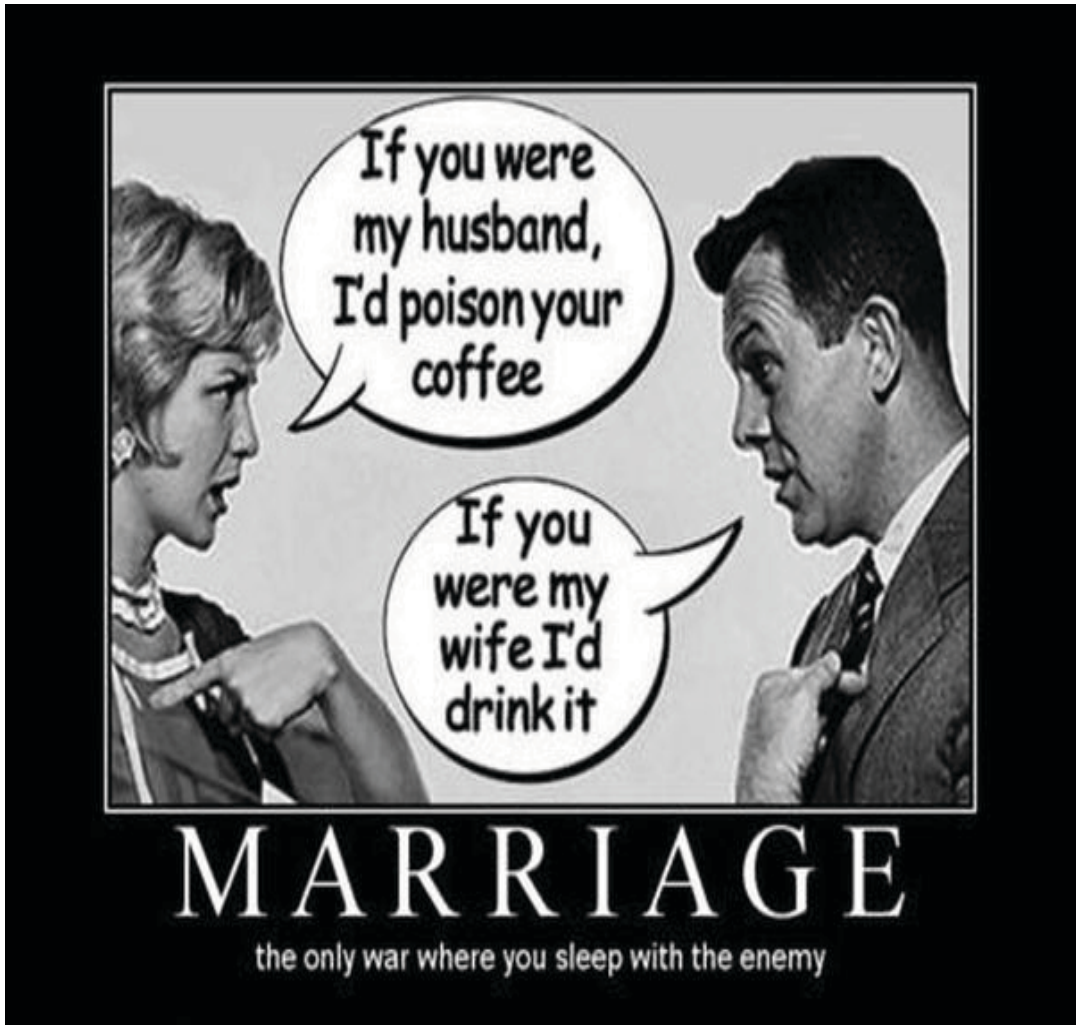
2. Byers, T., Seelig, T., Sheppard, S. & Weilerstein, P. Entrepreneurship: Its Role in Engineering Education. *Bridge Link. Eng. Soc.* 43, 35–40 (2013).
3. Carnevale, A. P., Smith, N. & Melton, M. STEM: Science Technology Engineering Mathematics. (2011). at <https://georgetown.app.box.com/s/cyrrqbjyirjy64uw91f6>
4. Duval-Couetil, N., Shartrand, A. & Reed-Rhoads, T. The role of entrepreneurship program models and experiential activities on engineering student outcomes. *Adv. Eng. Educ.* (2015).

Capstone and Entrepreneurship

An experiential learning match made in heaven?

Or not...


If you were my husband, I'd poison your coffee
If you were my wife I'd drink it
MARRIAGE
the only war where you sleep with the enemy

Capstone Elements	Traditional	Entrepreneurial
Skills emphasized	Technology solution mindset	Entrepreneurial mindset
Student products	Working prototype and report	Customer-validated idea with a working prototype, project report, and a business or commercialization model.
Idea / Problem	Provided by sponsor or instructor	Identified and refined by students based on market/customer need. Constraints and problem space defined by team.
Criteria for success	Defined by sponsor and/or instructor; grades, evaluation of project criteria	Objective success determined by existing solutions (competition), needs of customer/end users, other non-technical factors. Grades based on evaluation of course criteria
Project funding	Usually provided by sponsor	Pool of funding generated from sponsors, donors, institution and student-generated funds via competitions.
Duration	One or two semesters; usually ends with the course	Course duration; project may have been initiated prior to the course from previous work and may continue after the course, especially if launching a venture is warranted.
Intellectual property	Determined by institutional policy and constraints of sponsor terms and agreements	Determined by institutional policy and origins of technology innovations. Team may arrange to have rights to IP or, if underlying technology is generated by students, be student-owned.
Ideal educational impacts	Competent engineers who can effectively work in teams to develop technical solutions to identified problems.	Competent engineers who can recognize market opportunities and understand how to pursue the process of creating an entrepreneurial enterprise.
Commercial or societal impact of project	Limited; use of solution determined by sponsor. Broad dissemination or commercialization possible but not typical.	Potentially greater; if a venture is started, investment and jobs may result as they strive to reach the market.

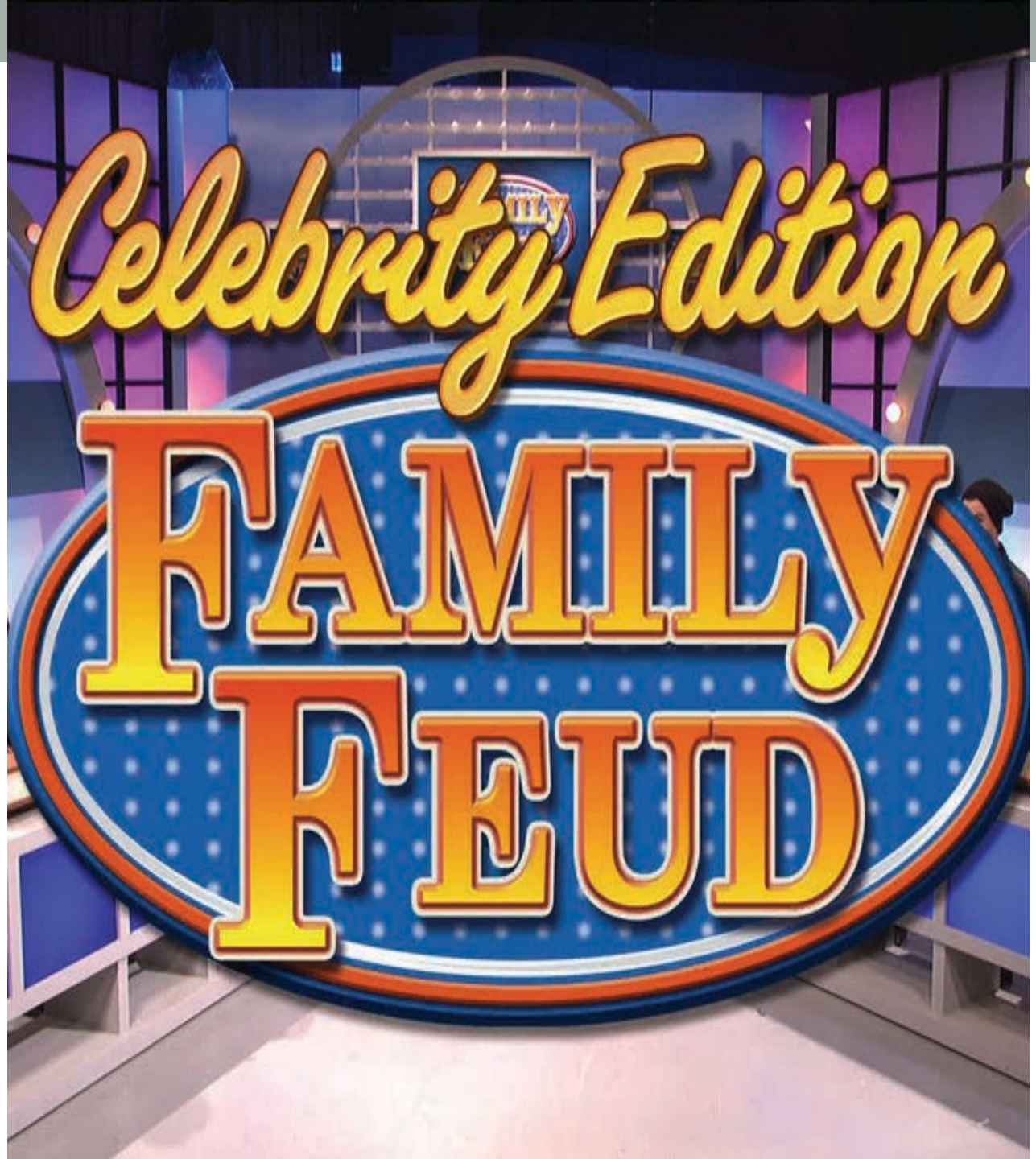
Research Questions

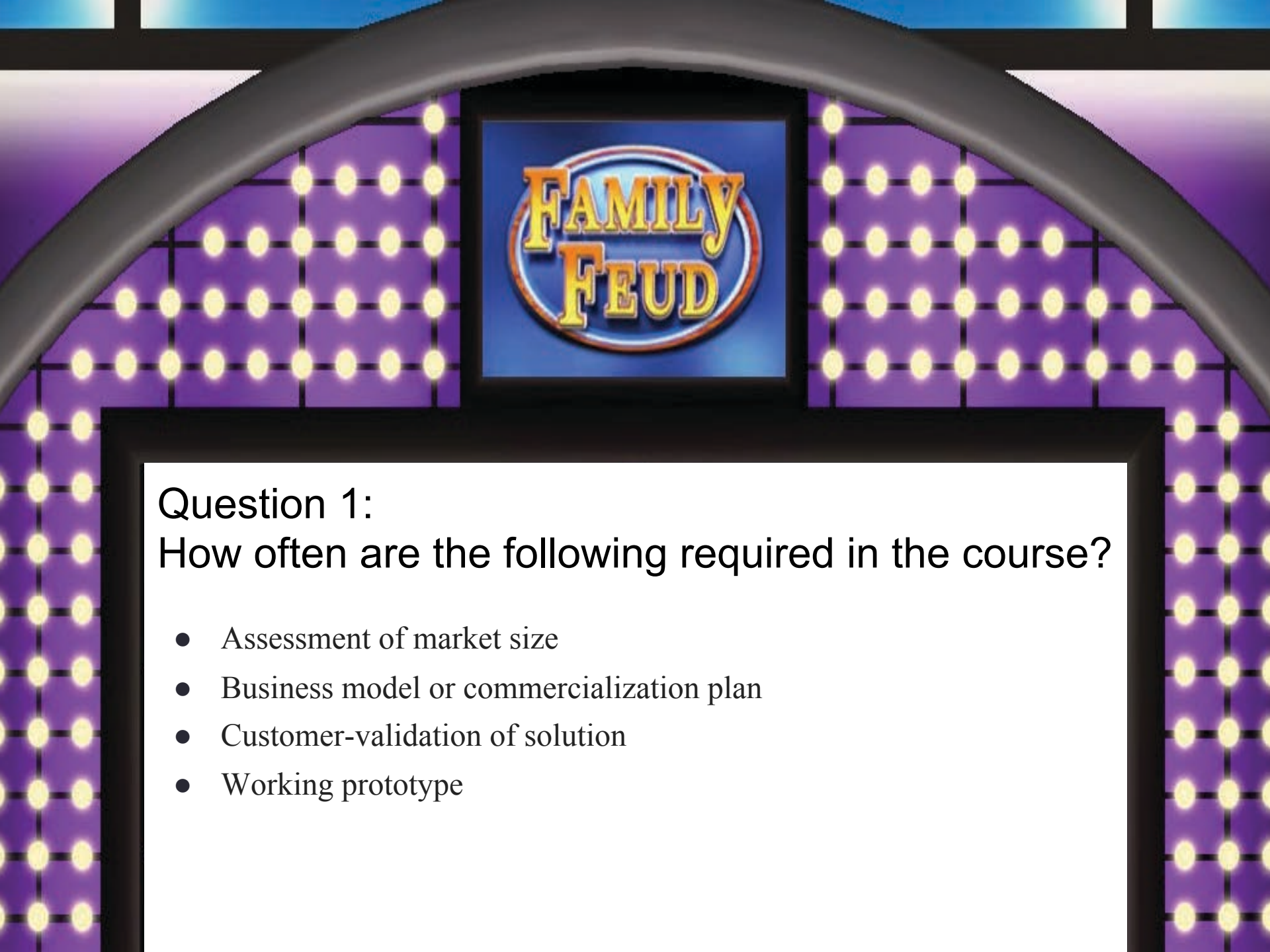
1. How and to what extent do faculty incorporate different entrepreneurial practices in their Capstone design courses?

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

Methods and Analysis

- Survey to asses RQ1 & 2
  - Response rate = 49% (n=111)
- Quantitative data analyzed in SPSS and Excel
- Qualitative data were pattern coded

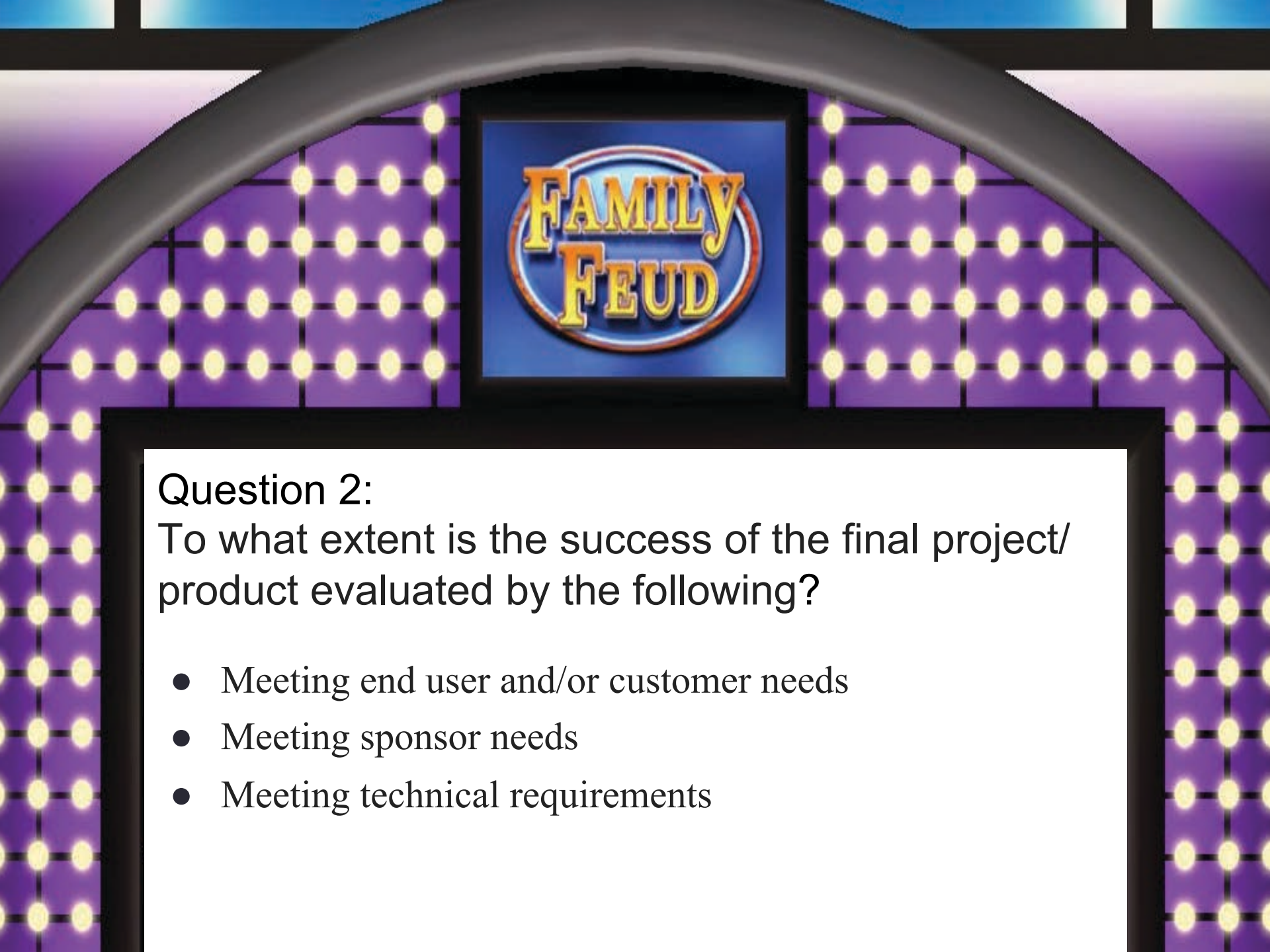

Celebrity Edition
FAMILY
FEUD



Question 1:
How often are the following required in the course?

- Assessment of market size
- Business model or commercialization plan
- Customer-validation of solution
- Working prototype

Criteria for Project Success and Course Requirements								
Question	Item	n	Mean	Never (1)	Rarely (2)	Some-times (3)	Often (4)	Always (5)
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%



Question 2:
To what extent is the success of the final project/ product evaluated by the following?

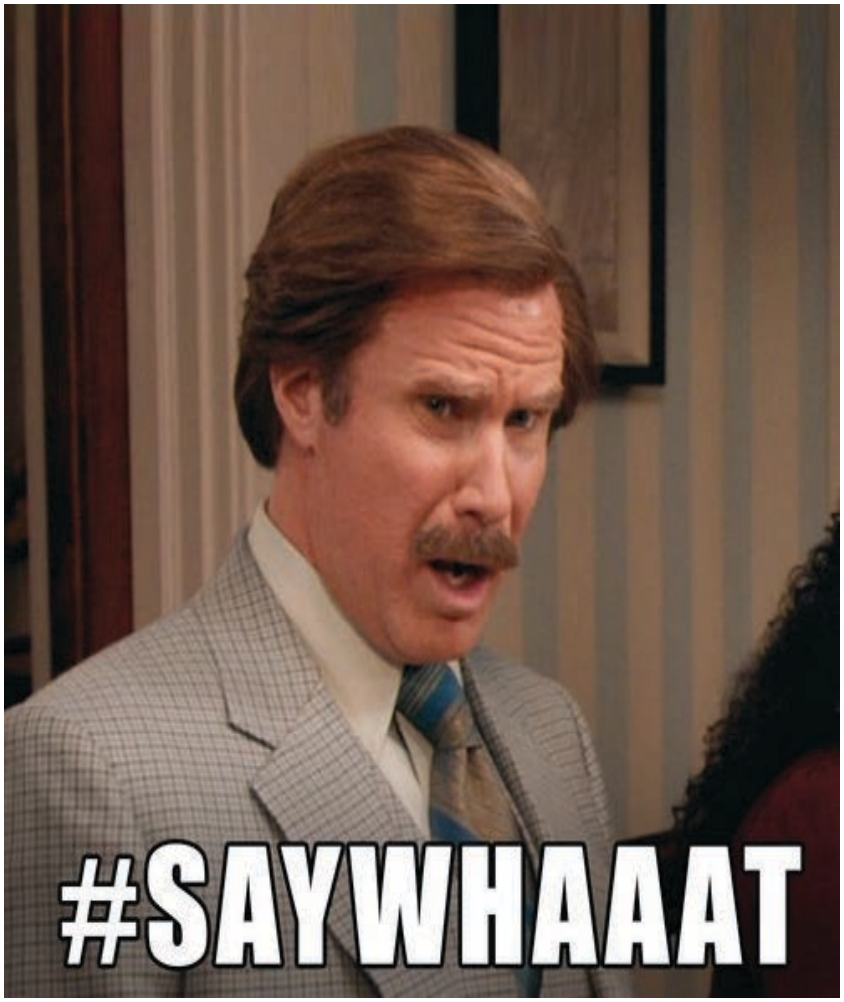
- Meeting end user and/or customer needs
- Meeting sponsor needs
- Meeting technical requirements

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%

Importance Versus Practice

In your opinion, how important is it to increase the degree to which the following are supported in your Capstone design class							
Item	n	Mean	Un-important (1)	Of Little Importance (2)	Moderately Important (3)	Important (4)	Very Important (5)
Customer validation	108	3.68	4%	6%	32%	33%	24%
Assessment of market size	108	2.81	16%	24%	32%	19%	9%
Business model or commercialization plan	107	2.64	21%	25%	30%	19%	6%
Note. Item level response rate varied by construct. Percentages are rounded to the nearest whole number.							

Qualitative Findings: Challenges



1. Resource constraints: financial and human

“I feel this is very important... but it requires support and resources for engineering profs who have little experience in many of these topics and application. It is also difficult to fund entrepreneurial projects”

2. Limited relevance in certain disciplines

“Capstone projects are very different in disciplines where a prototype is possible vs. not possible (i.e. building a dam).”

3. Low student demand

“The majority of students are not able or do not want to define, scope, and commercialize. How do we target the ones who do? Probably not through required courses like mine.”

4. Inappropriate timing

“I strongly believe [entrepreneurship] has to be encouraged from early stages, and not only at the last semester.”

5. Different areas of focus

"...We want to give students the challenge of working on industry sponsored projects for professional and customer purposes. Entrepreneurship can be covered in other project courses…"

6. Competing tradeoffs

"The biggest problem with integrating entrepreneurship into Capstone is the understanding that one has only so much time to do any subset of tasks... Most programs want to say they do 'All of the above' -- but that means 'all of the above' are likely to be mediocre, and in the end, not very realistic..."

Conclusion: Three Themes

- The Capstone Tradition
- Faculty Exposure and Experience
- University Culture & Support

"I didn't just jump to conclusions. I hopped and skipped first."

The Capstone Tradition

- Connects and prepares students for work in industry
- Industry funded; entrepreneurial approaches need alternate funding
- Approved by ABET; models of approved entrepreneurial approaches needed

Faculty exposure and experience

- Broader entrepreneurship definitions
- Models for implementing entrepreneurially focused capstones
- Research on positive student outcomes
- Training and support

University Culture & Support

- Collaboration with faculty/experts with entrepreneurship experience
- University infrastructure to support students
- Multiple entrepreneurial experiences throughout students' academic careers

QUESTIONS?

Thank you!