Student Perceptions of Creative Opportunities in Engineering Design: Preliminary Findings

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Background

- The goal of this work is to understand the structure of design tasks and their level of creative engineering opportunity in which students engage in courses in the College of Engineering.
- This research project will contribute to an understanding that can be shared across all departments to optimize the way projects are defined and presented to allow and encourage creative engineering design solutions.

Research Question

- Do engineering students perceive ENGR 100 design projects to be structured in a manner that encourages students to generate new concepts, ideas, or processes?

Participants

Participant	Gender	Race	ENGR 100 Section	Survey Participation
1	Female	Asian	A	1
2	Male	Caucasian/White	A	1,2,3,4
3	Male	Caucasian/White	D	1,2
4	Male	Caucasian/White	F	1,2,3,4
5	Male	Caucasian/White	F	1,2,3,4
6	Male	Native Hawaiian or other Pacific Islander	G	1,2,3,4
7	Female	Caucasian/White	B	1,2,3,4
8	Male	Caucasian/White	E	1,2
9	Female	Caucasian/White	A	1,2,3,4
10	Male	Caucasian/White	C	1,2,3,4
11	Female	Caucasian/White	B	1,2,3,4
12	Male	Asian	C	1,2,3,4
13	Male	Caucasian/White	H	1,2,3,4
14	Female	Other	C	1
15	Male	Caucasian/White	D	1,2,3,4
16	Male	Caucasian/White	G	1,2,3,4
17	Male	Caucasian/White	C	1,2,3,4
18	Female	Caucasian/White	A	1,2
19	Female	Caucasian/White	A	1,2,3,4
20	Male	Asian	C	1,2
21	Female	Black or African American	D	1
22	Female	Caucasian/White	H	1,2,3
23	Male	Caucasian/White	E	1,2,3,4
25	Female	Black or African American	H	1,2,3,4
26	Female	Caucasian/White	A	1,2,3,4

Methodology

- Recruitment
  - ✓ Recruited & selected freshman students enrolled in Design-Build-Test sections of ENGR 100. Eight sections are represented.
- Survey Spacing
  - ✓ 4 Qualtrics surveys distributed bi-weekly beginning after the students' receipt of the final project statement
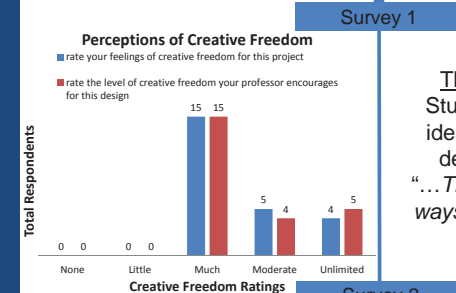
Survey Samples

- Survey 1: Perception of Creativity in Engineering Design
  - ✓ "How do you define creativity?"
  - ✓ "Rate the level of creative freedom your professor encourages for this design project."

- Survey 2: Design Project Progress & Decisions Made
  - ✓ "What were the 3 biggest decisions that you or your team made concerning your design project?"
  - ✓ "What are you finding most challenging about your design project?"

- Survey 3: Design Project Progress & Decisions Made
  - ✓ "Would you rather develop something that will definitely work or something that is creative, but has a bigger risk of failure?"
  - ✓ "List 3 words that you consider to be synonymous with your definition of creativity."

- Survey 4: Perception of Risk of Creativity in Engineering Design and Final Project Outcome
  - ✓ "What risks are involved in incorporating creativity in engineering course design projects like the one you just completed?"

Preliminary Findings

Survey 1

Perceptions of Creative Freedom
- rate your feelings of creative freedom for this project
- rate the level of creative freedom your professor encourages for this design

Creative Freedom Ratings: None 0,0 | Little 0,0 | Much 15,15 | Moderate 5,4 | Unlimited 4,5

Themes from survey 1
Students emphasized the idea of "newness" in their definitions of creativity.
"…The ability to think in new ways to make new things." - Participant 19

Survey 2

Themes form survey 2
Students identified constraints on creativity such as time, resources and skill.
"The most challenging part is the coding and learning to find new ways to accomplish something under a time constraint. " – Participant 25

Reported Design Project Challenges
- Team Coordinate & Communication 27%
- Learning New Tools 4%
- Time 15%
- Planning 15%
- Meeting Design Expectations 27%
- Limited Resources 12%

Survey 3

Develop something creative with a risk of failure or something that will definitely work
- Will definitely work: Students 9, Professors 6
- Creativity with a bigger risk of failure: Students 7, Professors 12
- Combination of both: Students 2, Professors 1
- Students preference
- Professors preference (as perceived by students)

Themes from survey 3
The students preferred developing something that would "definitely work."
"I am much more concerned with the functionality of the design .."- Participant 13
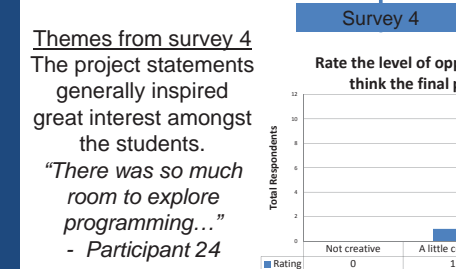
Survey 4

Themes from survey 4
The project statements generally inspired great interest amongst the students.
"There was so much room to explore programming…" - Participant 24

Rate the level of opportunity for creativity you think the final project statement had
Rating: Not creative 0 | A little creative 1 | Somewhat creative 6 | Very creative 10
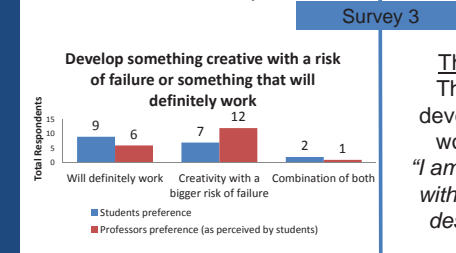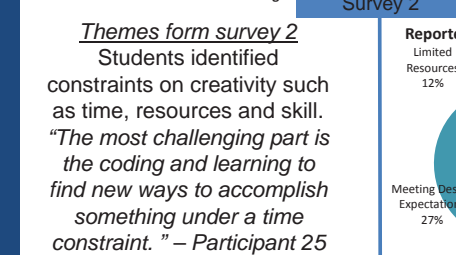
Conclusions

- At the beginning of students' projects, they feel there are many opportunities for creativity
- As they progress, they perceive that constraints of time and technology limit the opportunities to bring their creative ideas to fruition.
- At the conclusion of the project the students conclude that creativity is ideal but not always realistic.