



Empowering the Engineering Undergraduate in an Era of Economic Globalization

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ABSTRACT

Empowered engineers in an inherently unstable workforce are better able to remain internally stable in an externally unstable work environment. These engineers are likely to be more creative and productive, enhancing their net contribution to engineering through their careers. The purpose of this study is to evaluate the perceptions which engineering students bring with them to an introductory electrical engineering course before they embark on their technical degree pathway. This study examines how empowered the student feels at the start of the course and how their self-perceptions may affect their performance in the class. This study is part of a larger investigation, evaluating the impact of shifting the defining metrics for success from external to internal factors on the engineering student's performance and sense of fulfillment in the classroom.

Research Experience

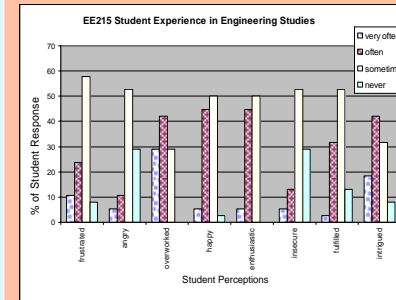
Struggles:

- Enormous body of literature on engineering education made it difficult to define a specific scope.
- Students did not understand the purpose behind the research and were unenthusiastic about the Savvy Sessions. As sophomores, was it premature to ask them to address such internal issues?
- Conducting interviews was the greatest challenge:
 - students are too busy
 - students are not vested in spending the time to answer questions

Successes:

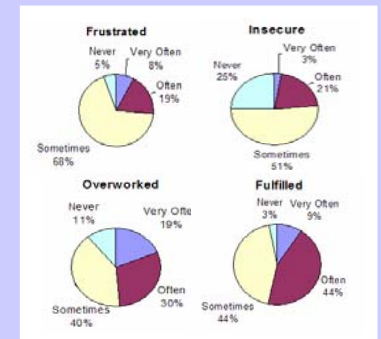
- We were pleasantly surprised by how enthusiastic engineering students really are despite their difficulties.
- We received strong support from ISEE.

Results



Students expressed contradicting responses towards their technical studies (responding to simultaneous feelings of frustration and enthusiasm).

- A large number of students (49%), felt *often overworked* and a concerning 24% felt *insecure*.
- Yet, 53% felt confidently *fulfilled* in their technical coursework.
- An overwhelming number of students responded with "sometimes" across all attributes, suggesting that feelings of *uncertainty* was a common attribute.



More detail on four essential attributes:

- While one-fourth of students felt *frustrated* or *insecure* about their technical studies, half of the students expressed feelings of being *overworked*.
- Interestingly, over one-half of the students also felt *fulfilled*, which clearly contradicts their responses to the other three attributes.

Research Methodology

COMPARISON OF UW STUDENTS TO NATIONAL POPULATIONS

Category	2002 U.S. Degree in Engineering (M)	UW EE 215 Students
All	16,322 100%	77 100%
Men	14,810 87.7%	67 87.0%
Women	2,012 12.3%	10 13.0%
Caucasian	9,174 56.2%	50 65.0%
AE-As.	1,047 6.4%	1 1.3%
Hispanic	1,070 6.6%	1 1.3%
Asian	2,787 16.9%	23 30.0%
Am. Ind.	33 0.2%	0 0.0%

Participants:

- 77 Students in introductory electrical engineering course at UW (EE215)
- Majority were electrical engineering majors, although some computer science engineering, mechanical engineering, aerospace engineering, and other science discipline majors
- Table to the left illustrates gender / ethnicity representation as compared to national trends

Data collection:

- Baseline survey at beginning of quarter on sense of success and fulfillment in classroom
- Academic progress was tracked to analyze performance outcomes during the quarter
- Interviews to follow-up and expand on basic outcomes generated in the surveys

Intervention – designed and implemented by D.M. Wilson:

- 50-minute seminar on empowerment topics and a series of follow-up “Savvy Sessions” (to educate students in the development of a holistic and integrated perspective of their education, life and career)
- Based on speculations about students in an introductory technical class not being inclined to reflect on issues of empowerment, purpose, and fulfillment.

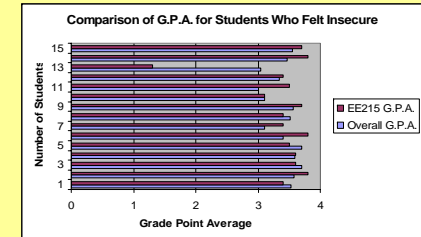
Future Work

Ongoing research in Engineering Education investigating methods to provide students with creative control (empowerment) of their education and career; contextual knowledge of the 21st century workplace and educational practices; and personal awareness in reaching for their full potential as successful engineers.

SECURE AND FULFILLED STUDENTS BY RACE/ETHNICITY AND GENDER

Category	Total	Never Insecure	Often Fulfilled
All	77	21 100%	40 100%
Men	67	20 95.0%	37 92.5%
Women	10	1 4.8%	3 7.5%
Caucasian	50	16 76.2%	28 70.0%
AE-Am.	1	0 0.0%	0 0.0%
Hispanic	1	1 4.8%	1 2.5%
Asian	23	2 9.5%	8 20.0%

Student responses to claims that they *never* felt *insecure* and *often* felt *fulfilled* were evaluated according to race/ethnicity and gender. The men constituted 95% of the responses for *never* feeling *insecure* and 92.5% for feeling *fulfilled*. Self-perceptions of security and fulfillment were critically low for women and minority engineering students.



We also evaluated how student perceptions correlated to academic performance. We counted 17 of the 77 students in the class who identified themselves as *often insecure*. Among the 15 insecure students who reported their grades, 53% had a cumulative G.P.A. above 3.50 and 86.6% achieved a grade of 3.40 or higher in EE215. The most insecure and unhappy group of students earned high grades. Interestingly, of the 17 students, 7 were women. Although there were only 10 women in the class, 70% of them felt insecure about their technical classes, yet most performed academically very well.

Conclusion

A preliminary study on a small population of engineering students was presented. Our research found that many of the students expressed feelings of contradictory emotions at the same time when asked to reflect on their experiences. The mixed signals of self-reflection conveyed by these students, raise concerns about whether they are acquiring the proper training to maintain inner stability in an increasingly unstable work environment. The concern is notably more critical for women and minority participants in this study.