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Robotics in bioengineering

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Effect of Demonstration in Bioengineering Concentration Selection

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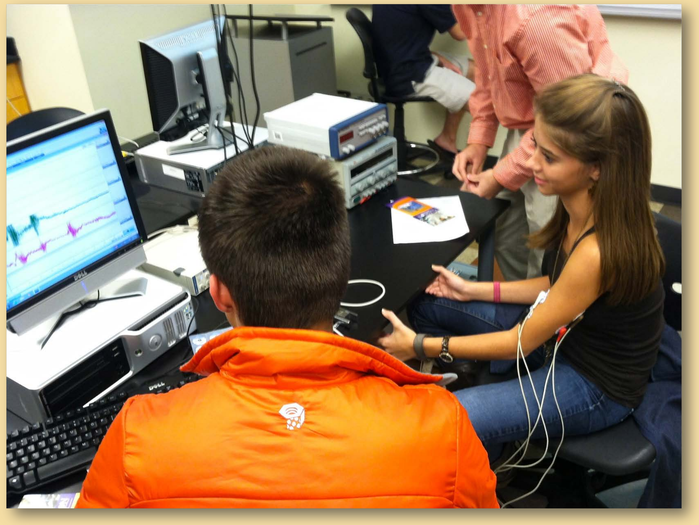

Introduction

- At Clemson University the bioengineering major is partitioned into two concentrations: bioelectrical and biomaterials
- 90% of undergraduates in bioengineering opt to pursue the biomaterials concentration
- The goal of the team was to determine the effectiveness of demonstrations on the bioengineering concentration selection in hopes that it would increase bioelectrical interest
- The participants for the study were those on the Freshmen General Engineering Tour.
- This Creative Inquiry team offered a presentation and demonstrations that allowed participants to interact with their own biosignals using electromyography (EMG).
- The EMG signals were produced by the contraction and relaxation of the brachial muscles, and were used to power the slot cars
- A second demonstration involving electrooculography (EOG) was also performed by a team member during the presentation
- The demonstrations chosen provided insight to biomedical engineers on the practicality of the bioelectrical concentration

Methods

General Engineering tour

- Slideshow: Career opportunities, historical breakthroughs, and recent developments in the bioelectrical discipline
- Q & A session: Prospective bioengineering students free to ask questions to current Creative Inquiry students
- Laboratory demonstrations
  - The main demo involved a presentation controlled by a Creative Inquiry student's elecrooculography (EOG) recordings
  - Touring students saw either the electrical signals that were generated while moving the eyes or the LabView algorithm

Surveys

- Pre-tour survey: Gauge the students' background, future goals, interests, and perceived applicability and difficulty of the biomaterials and bioelectrical concentrations of bioengineering
- Post-tour survey: Gauge effect of demo on the students' academic interests
- Statistical analysis with t-tests was performed by designing a MATLAB program to test for statistical significance between each combination of groups of students and their survey responses

Discussion

- The group's demonstrations combined with the tours of the Department of Bioengineering do increase interest in joining the bioelectrical concentration
- The percentage of participants who expressed interest in the bioelectrical concentration increased from 45% in 2012 to 67% in 2013 (Figure 1)
- The percentage of students whose interest decreased fell from 12% to 8% (Figure 1)
- The sample size of students for the Fall 2013 data was considerably smaller than the Fall 2012 due to freshmen engineering students no longer being required to attend tours
- The addition of the EOG demonstration in the fall of 2013 was successful in increasing the interest in the bioelectrical concentration
- In the fall of 2013 the fact that 80% of jobs in bioengineering are in the bioelectrical area was greatly stressed
- Overall the data shows that the demonstrations provided a more informed decision about whether or not the bioelectrical concentration was the right selection for them

Results

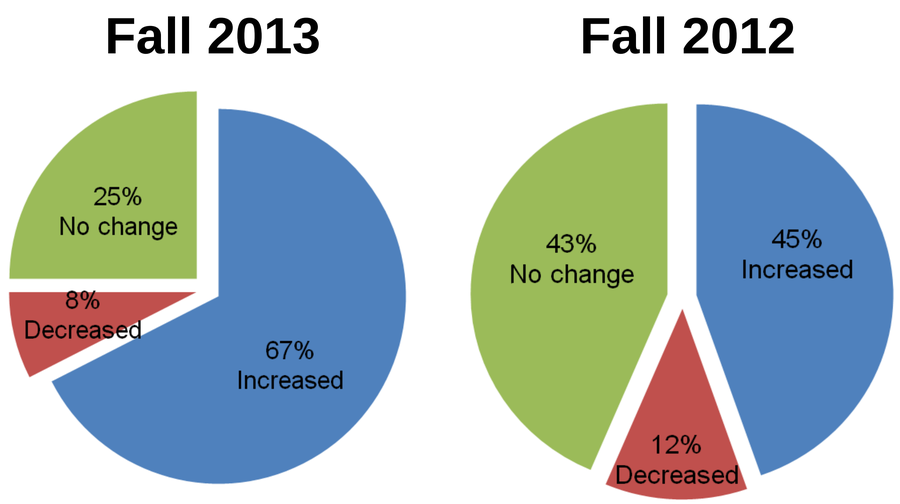

Figure 1: Two pie charts displaying the responses by students when prompted to rate how their interest in the bioelectrical concentration changed after the tour. Fall 2013 students voluntarily came on the tour voluntarily while tours were required for students for students in Fall 2012.

Mean student ratings of the Bioengineering concentrations

Metric	Biomaterials		Bioelectrical	
	Pre-tour	*Post-tour*	*Pre-tour*	*Post-tour*
Interest	4.05	4.03	3.05	3.55
Career applicability	3.75	3.88	3.03	3.38
Difficulty	3.23	3.55	3.30	3.38

Table 1: Direct comparison of student ratings of each concentration. Data shows greater increase for bioelectrical in interest and career applicability

Statistical trends found in survey data

Student group	Survey question	Survey response	p-value
First choice of major is Bioengineering	Initial interest in biomaterials concentration	Higher than rest of sample (10)	< 0.001
First choice of major is Bioengineering	Initial interest in bioelectrical concentration	Higher than rest of sample	0.564
Professional career goal	change in interest in bioelectrical concentration after demo	Higher than students with industrial career goals	0.044
Professional career goal	Perceived career applicability of biomaterials concentration after demo	Higher than students with industrial career goals	0.042

Table 2: Results of four of nearly 300 t-tests performed in MATLAB in an automated fashion. The displayed results directly compare and contrast the students' experiences with the biomaterials and bioelectrical concentrations.