BME 402 Outreach Presentation Deliverable
MR Airway Pressure Team

1. Overview

Our design team preformed our outreach activity at Greenfield High School in Greenfield, WI, a suburb of Milwaukee where one of our team members attended high school.

The presentation was given to Mrs. Melinda Carothers' advanced physics class, which had about 12 junior and senior students. As our audience was students who are going to be attending college soon, we tried to tailor our presentation to not only explaining what engineering is but also what types of classes they would take, what it is like to be an engineering student at Madison, and why they should choose to go to Madison over other universities. We also included a jeopardy game at the end of our presentation based on the facts we spoke about and offered candy prizes.

We were allowed the entire class period for our presentation, which was about 45 minutes. We spent approximately 20 minutes presenting orally, utilizing the chalk board to highlight important points rather than a power point, and 25 minutes on the jeopardy game. We did not use a power point presentation because we were informed that there was no screen in the classroom to project it onto, so we planned our presentation accordingly.

Overall, the presentation went quite smoothly. Some students were more responsive to the presentation than others, but we did have quite a few questions from a handful of interested senior students. It seemed as if the class enjoyed the jeopardy game, and wished that they had paid better attention during our oral presentation so that they would have known more of the jeopardy question answers. The students really enjoyed hearing about UW-Madison and engineering in general, but seemed a bit confused when we started to talk about all of the different types of biomedical engineering such as bioinstrumentation, biomaterials, etc.

In order to improve upon our outreach activity we could have allotted about 5 more minutes for the jeopardy game, as we were not able to answer the last 3 or so questions before time was up.

2. Presentation

Introductions

- *Hi, my name is …I am majoring/minoring in … engineering at the University of Wisconsin-Madison.*
- *I am originally from … and went to high school at …*

"About UW-Madison" – 1 team member (Jon Cappel)
Goal: *Introduce the students to UW-Madison and tell them a little bit about what it's like to be an undergraduate student and why they should a) go to college and b) consider attending UW-Madison*

Information presented:

- Located in downtown Madison on the border of Lake Mendota, with State Street and the State Capitol nearby (933 acre campus)
- **Why attend Madison?**
    - School known for its academics, one of the top schools in the Big Ten in terms of academics
    - In-state tuition ($3000 per semester), public
    - Coming into college, wasn't sure what I wanted to do
        - Had an idea I wanted to do biomedical engineering but not 100% sure
        - If I decided to change majors, 136 total undergraduate majors to pick from (including 8 other engineering majors)
        - Only public school in state that offers law, medicine and veterinary medicine programs
    - Always have been a Badger fan, enjoyed going to athletic events
    - Reputation of fun campus
    - Research
        - A lot of discoveries and inventions are made on campus
            -Eg. – first cultivation of embryonic stem cells
- **What I like about College**
    - Living on own, making own decisions, independent
    - Less time spent in class, but more work outside of class
        - Responsible, balance of study and leisure time
    - Learn to use time better, since have so much work
    - More difficult than high school
    - The campus is really pretty, historic, and has a great atmosphere
    - Extracurricular
        - Student organizations: approximately 700 (anything from academic/honor societies, fraternities and sororities, recreational clubs)
            -Meet others with similar interests
        - Intramural sports – hockey, volleyball, tennis, ultimate frisbee, BBall, Flag football
    - Meet people (from student orgs, dorms, eating, walking around campus, classes)
        - 41,000 (28000 undergrad) students, different backgrounds
    - Memorial Union Terrace (during summer, early fall, and late spring)
        - Place to go on the lake to hang out with friends and listen to live music
    - Going to sporting events (football and basketball games) – 80000+ people at Camp Randall

<u>"Introduction to the Engineering Disciplines"</u> – 1 team member (Kevin Johnson)
Goal: *Introduce the students to the different types of engineering offered at UW-Madison and explain a little bit about what each type of engineer designs/does*

Information Presented:

- Qualities of Engineers:
  - Communications skills
  - Organizational Capabilities
  - Practicality
  - Creativity
  - Foresight
  - Imagination
  - Logic and reasoning
- Types of Engineers
  - Electrical Engineers
    - Design Electronics and Electrical Systems
    - Computers / Communications
  - Mechanical Engineers
    - Design Devices using Mechanical principles
    - Cars/ Parts/ Elevators/ etc
  - Chemical and Biological System Engineers
    - Deal with the manufacture/ processing of Chemicals
    - Oil refining / water purifications / soaps
  - Nuclear Engineers
    - Design/maintain Nuclear equipment
    - Particle accelerators / nuclear reactors
  - Civil Engineers
    - Design infrastructure
    - Buildings / transportation/ sewer
  - Biomedical
    - Design medical devices
    - X-ray / hospital beds / drug pumps

<u>"Specifics about Biomedical Engineering</u>" – 1 team member (Laura Sheehan)
Goal: *Introduce the students to biomedical engineering and the different types of specialties within this major*

Information Presented:

- BME Concentrations
  - Medical Instrumentation: Bioelectronics (Electrical)
    - Cardiac pacemakers, defibrillators
  - Medical Instrumentation: Biosignals & Medical Imaging (Electrical)
    - Sensors to measure blood chemistry, such as potassium, sodium, 02, CO2, and pH
    - Designing, building and investigating medical imaging systems based on X-rays (computer assisted tomography), isotopes (position emission tomography), magnetic fields (magnetic resonance imaging), ultrasound, or newer modalities
  - Medical Instrumentation: Biocomputing (Electrical)

        - Computer systems to monitor patients during surgery or in intensive care, or to monitor healthy persons in unusual environments, such as astronauts in space
    - Health Care Systems and Medical Informatics (Industrial)
        - Designing clinical laboratories in the hospital that utilize advanced technology (computerized analyzer for blood samples, ambulances for use in rural areas)
        - CPOE and electronic medical records
    - Biomechanics (Mechanical)
        - Devices for fracture fixation or joint replacement
        - Tissue engineering to create replacements for damaged tissues
    - Biomaterials (Chemical)
        - Designing and constructing biomaterials and determining the mechanical, transport, and biocompatibility properties of implantable artificial materials
- Undergraduate Research
    - Coops and Internships – 200+ companies recruting
- After Undergrad
    - Industry – starting salaries in $50Ks
    - Graduate School
    - Law School
    - Medical School
- Potential Employers
    - Industry
    - Hospitals
    - Research Facilities (Academic and Medical Institutions)
    - Teaching
    - Government Regulatory Agencies

<u>"What It's Like to Be an Engineering Student and Why Women Should pursue Science and Engineering"</u> – 1 team member (Noelle Simatic)
Goal: *Speak about how to begin majoring in BME and give an overview of the classes engineering students take in college. Also encourage the female students to consider engineering and dispel the myth that "only guys can be engineers"*

Information Presented:

- Typical Coursework for Freshman BME Student

    At UW-Madison, new students admitted to the College of Engineering are assigned to the pre-engineering classification. All pre-engineering students take the same basic science and math courses and transfer into a degree-granting program as soon as they are eligible, usually in the first semester of the Sophomore year. Since space is limited, the admission criteria for BME is higher than the minimum required for other degree programs in the College of Engineering. The BME Program admits only outstanding students – so work hard your freshman year of college!
    - Chemistry
    - Calculus – 1st or 2nd semester

    - Communication requirement
    - InterEgr 160 – Freshman design course

  Throughout your degree you will also take physics courses, biology, anatomy and physiology, electrical circuits, computer science, and statistics. You also will be able to take elective classes in humanities, foreign language, etc.

    - One of the main components of the BME curriculum is the design course sequence.

- Design Teams and Real-life Projects

  The design experience and close advising characterize the undergraduate program. Students take an advising/design project course every semester during the sophomore through senior years. Real-world biomedical engineering projects are selected by students from a client list proposed by faculty throughout the university, particularly from medicine and the life sciences, and by engineers in industries

  This gives the students an exceptionally balanced education by incorporating clinical and biomedical industry issues including human and animal study considerations, technical communications, FDA regulations, ethics, and intellectual property management. Students can elect to have optional coop experiences with local or national medical device manufacturers, hospitals, or laboratories.

- Women in Science and Engineering
    - Statistics
        - Total BME Students: 198
        - M=128 F=70
        - Total Undergrads Only: 134
        - M=84 F=50
    - Student Groups to help girls in Science of Engineering
        - SWE
        - WISE Residential Program

Q& A Time: We allowed approximately 5 minutes for the students to ask questions before starting the jeopardy game. One suggestion would be to have one person begin setting up the jeopardy game cards (taping them on the chalkboard) while the others fielded student questions.

3. Description of Demonstrations or Hands-on Activities

For our activity, we played jeopardy with the students. We had them form three teams and brought candy for prizes. Here is a list of the materials we used, all purchased at the local Walgreens store:

- 4”x 6” index cards for 5 categories, with 5 cards in each category
- Tape to stick cards onto wall or chalkboard in classroom
- 1 bag of Reese’s peanut butter cups
- 1 bag of Jolly Ranchers
- 1 bag of Kit Kat bars

Making the jeopardy questions on the index cards was the only preparation required for this activity. We chose five categories related to college and engineering, and wrote the questions on one side of the cards and the dollar amount for answering it correctly on the other side. The questions were based on information we presented at the beginning of our talk with the students. This way it helped them to remember the things we presented and also tested their listening skills. We had each team "buzz" in to answer by raising their hand, and kept track of the points by writing on the chalkboard. Once the game was over, each of the teams received candy as a reward for participating.

Recommended time to complete activity (including set-up time): 30 min

Suggestions for Jeopardy categories:

- UW-Madison Fun Facts
- Engineering Trivia
- BME Trivia
- "Mystery" (include high-school level science equations, etc)

Example Questions:

<u>Category "UW-Madison Fun Facts"</u>
200 : The name of the UW-Madison mascot
What is Bucky Badger
400 : The number of undergraduate majors
What is 136
600 : The name of the football stadium
What is Camp Randall
800 : The place where live music is played on the shore of Lake Mendota
What is the Memorial Union Terrace
1000 : The land area of the university
What is 933 acres

<u>Category "BME Trivia"</u>
200: Developing fracture fixation or joint replacement devices
What is biomechanics
400: Involves determining the mechanical, transport, and biocompatibility of implantable artificial materials
What is biomaterials
600: Designing clinical laboratories in the hospital that utilize advanced techology
What is health care systems engineering
800: Developing computer systems to monitor patients during surgery or in intensive care
What is biocomputing
1000: Developing sensors to measure blood chemistry
What is biosignals