Ventura College Sabbatical

Engineering Curriculum Development and Enhancement Project

Spring 2018

Submitted by Michelle Millea

Engineering Department

Background

Leaking STEM Pipeline: Engineering has been and remains one of the top 5-7 most popular majors at Ventura College. The number of declared engineering majors has almost doubled since 2008. Ventura College transfers 40-50 engineers a year (about 4% of all transfer students) but the numbers are much lower than the many students who start at VC declaring an engineering major.

In addition to engineering courses, the engineering core curriculum includes the college's advanced mathematics, physics, computer science and chemistry courses. With this rigorous preparation for transfer, there are many ways to lose engineering students in the California Community College's Leaking STEM Pipeline.

Gender Underutilization: Nationally, the number of female engineering students is about 20%. Of the 591 Ventura College students declaring Engineering/Engineering Technology as their major in 2016, 74 are female (12.5%). Of the engineering degrees and certificates awarded in 2016, 9% were to females, 91% to males. Compare this to degrees and certificates awarded overall at VC: 60 % female to 40% male.

Sabbatical Deliverable

Research and curriculum development of a robust 3-unit Introduction to Engineering course that will increase the number of transferring engineering students including experiences to attract and retain female students.

The course developed for engineering students will be offered beginning Fall, 2019. It incorporates teaching practices that will contribute to the successful enrollment and completion of engineering degrees and transfer amongst female student engineers and be inclusive of the broad diversity of contemporary engineering students at VC.

The goal of the course is to increase the enthusiasm and commitment of all students and to increase the number of females in the engineering program. The curriculum developed will provide Ventura College students with an in-depth introduction to engineering and focus on becoming world-class student engineers with an awareness of, and commitment to, their potential.

This will include

- Academic goal setting
- Increasing commitment to goal
- Clarifying goal
- Plotting a roadmap for completion of goal
- Strategies to deal with adversity
- Explore attitudes and behaviors that help/hinder student success
- Build relationships and make effective use of faculty/peers/mentors
- Manage time effectively
- Understanding the learning process
- Enhance self-awareness and improve learning strategies

Students will also experience

- Exposure to engineering test equipment
- Worthwhile hands-on experience introducing future engineering courses (Graphics, Circuits, Materials and Statics)
- Experiences that will retain and encourage female student engineers by teaching to their learning style.
- Problem solving via teamwork and hand-on projects at the outset of the engineering curriculum to improve retention rates of all students.
- Connections to industry

Research Activities

- Interviewed Christine Reed, Allan Hancock College, Academic Specialist and MESA Director. Christine Reed leads E^3, *Enticing, Engaging and Empowering Women in Engineering at Allen Hancock College.*

- Interviewed Nick Arnold. Dr Arnold is a member of the National Academy of Sciences Committee on Sexual Harassment in the Sciences, Engineering and Medicine. The Gender Bias teaching module he developed is incorporated in this Introduction to Engineering course.

- Attended Iron Range Engineering (IRE) Bell Program Development Workshop, University of Minnesota in northeastern Minnesota, Jan 14 – 16, 2018 (-26 degrees F). Attended by 30 community college faculty from around the country. The MIT School of Engineering report *The Global State of the Art in Engineering Education* named IRE as one of the top five emerging (world) leaders in engineering education.

- WomenTech Educators Retention Workshop (Attended in OCT 2016).

- Webinar: Sexual Harassment of Women: Climate, Culture and Consequences in Academic Sciences, Engineering and Medicine, June 12, 2018

- Attended SETI, Summer Engineering Teaching Institute, Canada College, May 30 – June 1, 2018

- Interviewed Dom Delbello, PI LSAMP C6 (California Central Coast Community College Collaborative) Pre-Alliance Lead:

  > "In California, there is a dire gap in the number of minority students transferring from the community college system into Baccalaureate programs, particularly for STEM related degrees…In 2012, President Obama set a target of one million additional STEM graduates by 2022, "if the country is to retain its historical preeminence in science and technology" (PCAST, 2012) In 2008, the Public Policy Institute of California (PPIC) predicted that by 2025, "California will experience a serious shortfall of college graduates … unable to meet its needs even through the migration of college graduates from other states" (Reed,

2008). The PPIC identified the following as solutions to the 2025 "skills gap": 1) overall modest increases in college enrollment; (2) increases in the number of community college students who transfer to and graduate from baccalaureategranting institutions; and (3) improved baccalaureate graduation rates, especially in the 23-campus California State University system (Johnson, 2009). Overall, the report suggested that the CSU and University of California systems – which combined awarded approximately 110,000 bachelor's degrees annually – must increase this number by 40% to at least 170,000. This output requires an increase in the overall CSU graduation rate from 50% to at least 69%. Significantly, transfer students were an important factor: "Once they do transfer, however, these students have very high completion rates. Consequently, increasing transfer rates could significantly increase the number of students who earn bachelor's degrees."

Ventura College Engineering is a participant in LSAMP C6.

- ESTEEM (Enhancing Success in Transfer Education for Engineering Majors), NSF grant with UCSB Faculty Lead starting January, 2018.

Two notable research findings:

An example of differences in learning styles was found in Engineering Ethics. Males generally are grounded in justice based morality while females generally present a care-based morality.

Another factor that influences demographic groups are motivations. Being motivated by mentors is stronger among women, whereas behavioral motivation, the making and doing aspects of engineering, is generally stronger among men. The low numbers of women in engineering may be associated with the physical aspects of engineering. Women often feel less confident than men who may have had more physical exposures.

Some of the materials reviewed are included in the appendices.

Curriculm:

In addition to course content and objectives, the goal of this course is to develop successful students and a diverse, confident and competent engineering student body. Readings, classroom discussions and activities, team projects and homework

assignments have been developed. The content fits into the following areas. More details of topics/assignments/projects are found in Appendix A.

- **ACADEMIC SUCCESS STRATEGIES**
- **PERSONAL SUCCESS STRATEGIES**
- **PROFESSIONAL DEVELOPMENT**
- **COMMUNITY BUILDING**
- **TEAMWORK**
- **CAMPUS RESOURCES**
- **ENGINEERING PROFESSION**
- **CAMPUS LIFE**
- **TRANSFER**

Included in the course, the culmination of many of the assignments, class activities and readings, will be "Design YOUR Process of Becoming a World-Class Engineering Student". This was developed by Dr. Raymond Landis, Author of Studying Engineering: A Road Map To a Rewarding Career. Dr. Landis is a nationally recognized expert in the field of engineering success. In his words [1]:

Many students come into an engineering program lacking a strong commitment to stay in an engineering program and to graduate with an engineering degree. For students to accomplish the challenging goal of graduating with an engineering degree requires a strong commitment, and behaviors and attitudes to follow through that commitment. To strengthen the commitment of the freshman engineering students, an innovative project has been developed. The project challenges students to develop their process to become a "World-Class Engineering Student". Having freshman engineering students design their individually tailored learning process as part of a semester long project in the setting of a student focused introduction to engineering course-or any freshman engineering course-will have a significant impact on their academic success by improving the student's confidence and motivation to succeed in engineering.

While instructors adapt the project to their particular student body, it has been found effective in student commitment and retention. The Ventura college version of the project can be found in Appendix K.

[1] "Design Your Process of Becoming a World Class Engineering Student" A Powerful Project for Enhancing Student Success, presented at the Seventh Annual First Year Engineering Experience Conference, Enhancing the First Year of Engineering Education, Roanoke, VA, AUG 2015, by Steffen Peuker and Raymond Landis

Benefits of Sabbatical

Benefit to the College/District/Community

Developing introductory engineering curriculum focused on engaging and retaining all students equitably benefits the college, VCCCD and the community by creating a larger and more diverse engineering student body and workforce with alternative outlooks and solutions.

Benefit to Students

VC students will benefit from the alternative outlooks a more diverse engineering student population will bring. Students will grow in their commitment and enthusiasm to their academic goal. They will learn strategies to deal with adversity and identify beneficial behaviors and attitudes.

Benefit to Instructor

Completion of this project during my sabbatical leave will contribute to my teaching and will be of benefit to my students and other instructors. My goal is to create a more effective and engaging course that provides hand-on projects, teamwork and personal development for students starting out in VC's engineering program. I believe this experience will greatly enhance my service to Ventura College.

APPENDIX A: Projects, homework, activities and discussions

APPENDIX B: Why be an engineer

APPENDIX C: IRE Bell Program

APPENDIX D: Ethics

APPENDIX E: Teamwork

APPENDIX F: Enabling Engineering Student Success

APPENDIX G: Learning Styles

APPENDIX H: Excel

APPENDIX I: Clear and Concise Writing

APPENDIX J: Design and Research Projects

APPENDIX K: Designing YOUR Process for Becoming a World-Class Engineering Student

APPENDIX L: Summer Engineering Teaching Institute (SETI)

APPENDIX M: Tables for Textbook Homework Problems

APPENDIX N: Oxnard Advanced Water Purification Facility

APPENDIX O: Ventura College Noncredit courses

Example appendices follow. Please contact me at mmillea@vcccd.edu if you'd like additional appendices

APPENDIX A: PROJECTS, HOMEWORK, ACTIVITIES AND DISCUSSIONS

ACADEMIC SUCCESS STRATEGIES

University survival skills website/study skills website. Organize students in groups based on topics they choose. Create a presentation and brochure or sheet for rest of class – in notebook

Classroom learning; Preparing for lectures; Note taking; Avoiding distractions; Be here now; Time management; Priority setting (Begin with the End in Mind – Stephan Covey); Preparing for exams

Who or what is your dragon that needs slaying to allow you to thrive personally and academically?

Organizing your learning process and environment

Keys to success in Engineering study

Ability vs effort

Differences between engineering study and high school

Learning style inventory; What can you do to help yourself, once you've identified your learning style

How to get the most from your textbook

Academic skills survey; Plan to improve your weakest areas

Goals – are they of value? How important is your goal of becoming an engineer? What are ways to strengthen your focus?

Design Your Process of Becoming a World-Class Engineering Student

PERSONAL SUCCESS STRATEGIES

TED talks – List of "What is Success?" talks. Success – they do assignment and then we have class discussion.

Discussion item – psychology today Peter Grey – Resiliency (in sabbatical folder on work laptop). How can you become more resilient?

How can we light a path for ourselves or others that don't see a path?

Stress relief – students investigate. Organize in groups of like-focused students. Present and male a paper or brochure to hand out to class (class will put in notebook).

Student notebook – Study skills section; How can you plan for success?

Sources of support on campus and wider reaching (211, etc); What can you do when you feel down? Are not motivated? Family tragedy? Disappointment? Fail an exam or a class? Love or family issues? Drug or alcohol problems? Do you have to leave family behind (Tom Bilyue interview)

Learning about yourself, Stereotypes, Judgements, Behavior modification

Stress: Teams investigate and prepare short presentations

Meditation – first couple of pages of 10% happier and play a couple of minutes from Ester with example of what is going on in our heads.

Overcoming obstacles; Resiliency; Grit

Brainstorm on possible obstacles – have others come up with the solutions.

What if you dropped into this body/this life, not attached to the beliefs you hold to. What would you do – as though this were preprogrammed but you could change the program

Growth mindset; Physical and mental wellbeing; Nutrition, exercise, sleep

PROFESSIONAL DEVELOPMENT

Professional development – ASC class or workshops through the career center/ MESA

Career Center and MESA – assign two workshops during class –their choice – to attend

Resume workshop; Linkedin presentation and photography session

Why you will fail to have a great career – larry smith TED

Academic integrity

Pre-professional employment; Internships; Summer research opportunities

COMMUNITY BUILDING

Students create a VC engineering Brochure

Look like an engineer project

Gender (and other) bias

What are barriers to having students become engineers?

SKILL DEVELOPMENT

Word/Google docs – formatting/presentation

Keyboard skills

Excel – basic lesson; GPA –How to calculate; Create excel spread sheets and graphs, analyzing data for engineering materials and engineering statics student lead demonstrations

Tool usage to even the playing field – disassemble and reassemble

Written and oral communication: Clear Concise writing; Presentations: What skills can we find to help our confidence and abilities; Ah, Um, So, Like, You know challenge

Some of the skills required for academic and professional success that are taught in the following non-credit courses: ATEBN105, ATECN101, ATETN104, ATETN109, ATEWN103, BUSN161, BUSN162, BUSN162, BUSN164. When the program is fully functioning, Microsoft Word, Excel and Powerpoint, career exploration, tools, measurement and writing skills could be incorporated into homework assignments in non-credit courses that would lead to a level field for students as they fill individual gaps in knowledge.

TEAMWORK

Teamwork – what is it, how can you develop it

Advantages of teamwork diversity – discussion and presentations – article from Scientific America.

Share experiences where diversity has improved the team/group.

CAMPUS RESOURCES

Scavenger Hunt: Combine with current homework assignment and include other items to answer/define – take photos of yourself outside Foundation (or with Jaimee), making counseling appointment, at career center looking for schedule of events and attend at least one workshop, with counselor, at Tutoring Center, at least one assignment they have to go to reading/writing center

PROJECTS folder

Pirate's cove – Tutoring center

Using others to help yourself – professors, peers, tutors

ENGINEERING PROFESSION

Define "What is engineering"

Great engineering achievements

Engineering design process

Engineering disciplines – Team presentations

Job functions

Engineering success and failures

ABET accreditation

Rewards and opportunities of an engineering career

Guest speakers – Society of Women Engineers, SHPE

Future job opportunities

Ethics – Engineering Code of Ethics – what is it and why; Incident at Morales; (Teams investigate one of the big 10 engineering disasters and consider ethics aspects.)

USA – brain drain, need for engineers; How do we get more?

Dream big

Engineering Licensure

Bias: Gender bias? What other biases exist?

Field trips (Oxnard water reclamation facility and Aluminum/titanium forging plant)

CAMPUS LIFE

Academic regulations; Advising; Student conduct; Academic roadmap (at VC and to completion of BS at a university of the student's choice); Academic regulations; Advising; Student conduct Academic roadmap to transfer

Library tour and database research

ENGRINEERING COURSEWORK AHEAD

ENGRV02 introduction – create orthographic vies of an object

ENGRV12 Statics introduction – truss loads

ENGRV14 – MATLAB What it can do for engineers

ENGRV16 Circuits Introduction– project with breadboards and lights introduction to circuits

ENGRV18 Materials Introduction – tensile test demonstration, property of material discussion, Excel assignment to input data, formulas for conversion from load deflection to stress/strain and graphs

TRANSFER

Academic roadmap to completion of BS at a university of the student's choice)

University selection criteria

ASSIST.org and AICCU.edu

IGETC

Cross enrollment

Counselor class visit

STEM and ENGINGEERING Careers

What is STEM[(1)]?

STEM is an acronym for science, technology, engineering, and mathematics. Within each of these words exist a wide array of subjects and careers which will shape the future of our world and children. STEM is everywhere and affects nearly every aspect of our lives. You are entering a world where almost all the highest paying and most in demand jobs are in a STEM field. Whether you are looking to change the world or simply for a secure financial future for yourself and your family, a STEM-related career could be right for you.

Why be an engineer?

Engineers save lives and make the lives of people better. Those working in engineering careers use their imagination and creativity to make the world a better place. They tackle problems such as cancer, climate change, clean energy, and cyber crime. On average, students who study engineering and technology in college are happier with their career options upon graduation than students with other majors.

Anthony Carnvale at Georgetown University list of the top 10 highest-paid college majors. All are STEM-related. 8 of the 10 are engineering

Petroleum Engineering	$120,000
Pharmaceutical Sciences	$105,000
Computer Science	$98,000
Aerospace Engineering	$87,000
Chemical Engineering	$86,000
Electrical Engineering	$85,000
Naval Architecture & Engineering	$82,000
Mechanical Engineering	$80,000
Metallurgical Engineering	$80,000
Mining and Mineral Engineering	$80,000

(1) Adapted from http://www.vistapeakstem.com/

America's Brain Drain Crisis

Why our best scientists are disappearing, and what's really at stake.

BY KATHRYN WALLACE
From Reader's Digest

December 2005

In the disciplines underpinning our high-tech economy -- math, science and engineering -- America is steadily losing its global edge. The depth and breadth of our problem is clear:

- Several of our key agencies for scientific research and development will face a retirement crisis within the next ten years.
- Less than 6% of our high school seniors plan to pursue engineering degrees, down 36% from a decade ago.
- In 2000, 56% of China's undergraduate degrees were in the hard sciences; in the United States, the figure was 17%.
- China will likely produce six times the number of engineers next year than we will graduate, according to Mike Gibbons of the American Society for Engineering Education. Japan, with half our population, has minted twice as many in recent years.

There are many more unnerving developments, and they add up to this: As other countries create the learning centers and jobs to hang on to their best and brightest, the United States is losing a dependable pipeline of talent. Moreover, we are doing remarkably little to educate and train a next generation of scientists and engineers.

"Most Americans are unaware of how much science does for this country and what we stand to lose if we can't keep up," says Shirley Ann Jackson, president of Rensselaer Polytechnic Institute and chair of the American Association for the Advancement of Science. David Baltimore, president of the California Institute of Technology and a Nobel laureate, puts it bluntly: "We can't hope to keep intact our standard of living, our national security, our way of life, if Americans aren't competitive in science. Period

The Crisis We Created

In January 2001, the Hart-Rudman Commission, tasked with finding solutions to our major national security threats, concluded that the failures of our math and science education and our system of research "pose a greater threat ... than any potential conventional war."

The roots of this failure lie in primary and secondary education. The nation that produced most of the great technological advances of the last century now scores poorly in international science testing. A 2003 survey of math and science literacy ranked American 15-year-olds against kids from other industrialized nations. In math, our students came in 24th out of 28 countries; in science, we were 24th out of 40 countries, tied with Latvia. This test, in conjunction with others, indicates we start out with sufficient smarts -- our fourth-graders score well -- but we begin to slide by eighth grade, and sink almost to the bottom by high school.

A weaker pipe-line is especially alarming because the science and engineering workforce is graying. For instance, the National Nuclear Security Administration, an agency that responds to nuclear and radiological emergencies here and abroad, will soon experience a retirement crisis, according to the GAO. NASA, too, has an aging staff: In just a few years, a quarter of its workforce will be eligible to retire.

The National Science Board, an independent body that advises Congress and oversees the NSF, recently warned of a "troubling decline" in the number of U.S. citizens studying to become scientists and engineers, even as the number of jobs requiring science and engineering training grows.

"These trends threaten the economic welfare and security of our country," the board concluded.

Ethics in Engineering

One of the most powerful gifts of engineering is how it improves lives. But, in the wrong hands, it can be the opposite. William Marcy, executive director of the Murdough Center for Engineering Professionalism/National Institute for Engineering Ethics, teaches a course on engineering ethics to roughly 600 students per year at Texas Tech University. He advises them to look at all the angles and encourages professional engineers to do the same. “It’s about looking past what people would know about and understanding what your obligation is,” he says.

One example he uses involves a fastening attachment. “Let’s say you project into the future what the consequences might be,” he says. “If an outside inspector said a certain fastening attachment isn’t at the level of quality required, who’s responsible for fixing this? Should the one who did it in 2001 be even though the standards might have been different? If you put something in that no longer is up to code, is your company obligated to say something if that outside inspector was never involved and no one brought it up? Making an ethical decision is thinking about the lifecycle of a project or product or design, not just assuming everything is fine. What may be OK in 2001 may not be fine in 2013 because technology, policies, and design methods can all change.”

An example he had students look at is the Tesla electric car. “It’s very interesting because you would think about the responsibility of the safety of the car—but what about the batteries?” he says. “Some day that car will go to a landfill and how is that battery for the environment? If you think of the life cycle, does the company have a responsibility to properly dispose of the car—should that be part of the offering to a customer when they buy? After all, it may not be a factor for more than a decade.”

It also allows them to consider what assumptions they've always made. "We talked about the technological concept of offering Wi-Fi for free through the government," he says. "So many thought it was a great idea. Then we talked about the fact our taxes pay for the government. Is it fair someone else will have to, in the end, pay for the Wi-Fi? Is it fair to ever call something offered from the government free? Suddenly, [fewer] people thought it was a great idea or that it should be presented as free."

Marcy finds many students are most engaged by ethical decisions that aren't easy choices but require making decisions that can be seen in many ways. "Ethics are opportunities for a healthy debate," he says. "It's a chance to really see different ways to look at a problem. You do that when you create something but also when you look at the moral implications of that creation. Being ethical isn't always about cut and dry answers but getting yourself to actually consider the possibilities. By doing that, you're already ahead of many people."

Eric Butterman is an independent writer.

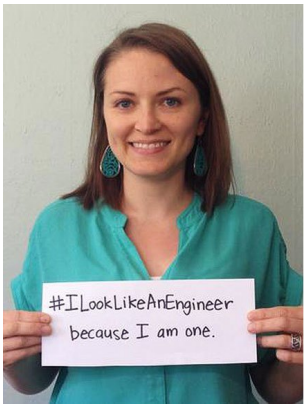
An interactive Class Lesson is available to help students explore:

“Gender Issues in Engineering”

(Be a part of the solution)

Lesson includes:

- PowerPoint slides to Introduce the problem
- Three videos, including designated times to have interactive class discussions using the “Think-Pair-Share” method
  - "Creating a Level Playing Field", Shelley Correll, Stanford.
  - “Inspire Her Mind”, Commercial
  - “Throw Like a Girl”, Commercial



Already implemented by 8 different colleges. All of them plan to use the lesson again.

Instructor Comments include:

- The lesson really helped students examine their thinking around gender bias.
- The majority of the class felt their eyes were being opened.
- I recommend that others use the lesson -- as an educational institution we have an obligation to create awareness, and to challenge thinking and behavior.

Student Comments include:

- All of the videos were very powerful.
- We (my classmates and I) must take what we have learned and make changes when we get to the workforce
- As the father of a 4 year old girl, this topic really hits home for me
- The "Throw Like a Girl" sums up the whole idea best – words are powerful.

Contact:
Dr. Nick Arnold,
Professor of Engineering,
Santa Barbara City College
arnold@sbcc.edu

An interactive Class Lesson is available to help students explore:

"Gender Issues in Engineering"

(Be a part of the solution)

Women are an underrepresented group in most STEM fields, but engineering has the lowest percentage of women[1]:

- Only 12% of working engineers are women;
- Women are the most underrepresented group in engineering;
- The percentage of women in engineering has not increased in the last 15 years;
- More women are graduating in engineering (20%), but many leave or do not enter the profession.

After receiving a degree in engineering, 40% of women do not enter or leave engineering in the first five years, versus 10% of men[2].

- This 4-to-1 disparity between women and men is a huge difference.
- Although some women (and men) leave engineering due to the demands of the profession (long work hours, travel, family obligations, etc.), this is only a small fraction of the cause.
- The main reason women leave engineering is a hostile work environment.

We cannot afford to lose valuable talent:

- It is important to our national economy;
- It is important to our national security;
- It is the right thing to do.

Contact: arnold@sbcc.edu
Dr. Nick Arnold, Professor of Engineering, Santa Barbara City College

[1] "Research and Trends for Women in STEM", Society of Women Engineers, Research.SWE.org
[2] "40 Percent Of Female Engineers Are Leaving The Field", HuffingtonPost.com

Instructions for running the class lesson "Gender Issues in Engineering"

It is helpful to begin the class with a discussion about how important it is to have more people pursuing careers in Engineering (e.g., for the national economy, national security, to help improve the world, etc.), but that women tend to face various obstacles to their success.

I describe the film clips as concerning "gender-related issues". I used to tell the class that their participation is voluntary and that they are free to leave and would suffer no penalty if they choose to not participate. However, it may be more helpful for the entire class to participate so that the rest of the class can hear the viewpoints expressed by those who do not agree with the videos and/or the purpose of the lesson.

We will show 3 videos. The first video is long, so we will only show 3 short segments (not the entire video), which we will analyze after each segment, using the "Think-Pair-Share" approach: Think (by yourself for a minute); Pair (with one other person, or a small group, to discuss); Share (several groups will be asked to share their findings with the entire class, with moderation from the professor). The other two shorter videos will then be shown, each one followed by Think-Pair-Share.

1. Shelley Correll, Stanford University Sociology Professor, "Creating a Level Playing Field"
https://www.youtube.com/watch?v=YPoymWLNjVk
0-4:30, 4:30-8:30, 11:30-13:30.
Think-Pair-Share Discussions in between the 3 segments.

2. "Inspire Her Mind"
https://www.youtube.com/watch?v=XP3cyRRAfX0
Think-Pair-Share Discussion.

3. "Throw Like A Girl"
https://www.youtube.com/watch?v=XjJQBjWYDTs
Think-Pair-Share Discussion.

Note that the order is important. The first video is very factual about gender bias (hard to dispute the evidence). The second video portrays the societal norms that adversely steer girls away from careers in STEMM. The third video ("Throw Like a Girl") is the most "entertaining", in that it is a commercial that was shown during the Super Bowl a few years ago, but it is perhaps the most powerful, delving into the realm of misogyny (and can move people to tears); there is also some humor in the "Throw Like a Girl" video, and I believe that it helps (in many ways) to have laughter towards the end of the lesson.

For moderating the class discussions, I start off by telling the class that this is a sensitive topic.

For the first video, if there are doubters of the validity, I remind them that **Shelley Correll** is a Sociology Professor at Stanford, and the results are from peer reviewed literature – i.e., sound scientific studies.

For the second video, at some point in the discussion I interject that from a well-known sociology study, an experiment takes a baby, and dresses it in pink, and tells a person that it is a girl. That person often say things like “oh, what a pretty baby”, and handle the (supposed girl) very gently. That same baby is then dressed in blue, and then tells a different person that it is a boy. That person often handles the baby much more physically – I joke (somewhat) that they then take the baby and throw the (supposed boy) up into the air, and catches the baby (behind the back, for exaggerated effect). The point being that boys and girls are treated differently, and have different expectations, from the moment of birth.

For the third video, I say that words are very powerful – I think the message from this video is clear, and the class is ready to receive that message after watching and discussing the first two videos.

It may be helpful for the facilitator to request feedback from the class on the 3 videos – this can give some further information about how the lesson went, and to possibly make some adjustments.

It may take a few attempts to get more comfortable giving the lesson.

Effective Teamwork

Being able to work on a diverse team is a skill that is highly valued by engineering organizations. The ability to share knowledge with others while being open to new and creative solutions to problems has a great impact on the academic and job careers of engineers. Engineering practice will continue to require working on diverse teams, thus teamwork is often one of the highest sought after characteristics of a new hire. Criterion 3 of the Engineering Criteria developed by ABET requires "(d) an ability to function on multi-disciplinary teams."

Elements of Good Team Work

A high level of achievement is gained when a team is committed to a task or to a goal. Individual team member performance in a team, depends on the following elements:

- **Tolerance**
- **Honesty**
- **Commitment**
- **Dedication**
- **Flexibility**

1. What do the above words mean to you?

Tolerance	
Honesty	
Commitment	
Dedication	
Flexibility	

2. Read the following description of a good team member

To be a good team member you must:
a) Help other team members
b) Inform others of changes in routine
c) Ask for assistance when necessary
d) Use effective communication and interpersonal skills
e) Be willing to learn new skills and improve old ones
f) Be flexible in assisting other team members when they are busy and need help
g) Be honest; team members must be able to trust one another
h) Have a commitment to the goals and objectives of your team

3. Do you agree with this description of a good team member? Why/why not?

4. Can you think of any other characteristics of a good team member?

5. Do you believe you are a good team member? Explain your answer.

6. Have you ever been in a team where you have had difficulties working co-operatively together? Explain your answer.

7. Why is it important to be part of an effective team? Explain your answer.

Watch Ted talk after building – may show it weeks later

Reflections on the Marshmallow Challenge

Your Name:

Team Member Names – first & last:

Please take some time to reflect on your experience building a spaghetti tower with your team. Thoughtfully write your responses to the prompts below.

1. What worked well for you/your team during the activity?

2. What didn't work well for you/your team?

3. If you were going to get another attempt to build the highest tower you could at some future date, with higher stakes, what would you do to prepare in advance? Please be specific

Gender Differences in Learning Style Specific to Science, Math, Engineering and Technology (SMET)

by Donna Milgram, National Institute for Women in Trades, Technology & Science

There are gender differences in learning styles specific to science, math, engineering and technology (SMET) that teachers of these subjects should keep in mind when developing lesson plans and teaching in the classroom. First, overall, girls have much less experience in the hands-on application of learning principles in lab settings than boys. This could occur in the computer lab, the science lab, or the auto lab – the principle is the same for all of these settings – it requires an overall technology problem-solving schema, accompanied by use and manipulation of tools, and spatial relation skills that very few girls bring with them to the classroom on day one in comparison to boys.

Let's look at some of the reasons why girls come to the SMET classroom with less of the core skills needed for success in this subject area. Overall, girls and boys play with different kinds of games in early childhood that provide different types of learning experiences. Most girls play games that emphasize relationships (i.e., playing house, playing with dolls) or creativity (i.e., drawing, painting). In contrast, boys play computer and video games or games that emphasize building (i.e., LEGO®), both of which develop problem-solving, spatial-relationship and hands-on skills.

A study of gender differences in spatial relations skills of engineering students in the U.S. and Brazil found that there was a large disparity between the skills of female and male students. These studies attributed female student's lesser skills set to two statistically significant factors: 1) less experience playing with building toys and 2) having taken less drafting courses prior to the engineering program. Spatial relations skills are critical to engineering. A gender study of computer science majors at Carnegie-Mellon University (one of the preeminent computer science programs in the country) found that, overall, male students come equipped with much better computer skills than female students. This equips male students with a considerable advantage in the classroom and could impact the confidence of female students.

Are these gender differences nature or nurture? There is considerable evidence that they are nurture. Studies show that most leading computer and video games appeal to male interests and have predominantly male characters and themes, thus it is not surprising that girls are much less interested in playing them. A study of computer games by Children Now found that 17% of the games have female characters and of these, 50% are either props, they tend to faint, have high-pitched voices, and are highly sexualized.

There are a number of studies that suggest that when girls and women are provided with the building blocks they need to succeed in SMET they will do as well if not better than

their male counterparts. An Introductory Engineering Robotics class found that while males did somewhat better on the pre-test than females, females did as well as the males on the post-test following the class's completion.

Another critical area of gender difference that teachers of SMET should keep in mind has less to do with actual skills and experience and more to do with perceptions and confidence. For females, confidence is a predictor of success in the SMET classroom. They are much less likely to retain interest if they feel they are incapable of mastering the material. Unfortunately, two factors work against female confidence level: 1) most girls will actually have less experience with SMET course content than their male counterparts and 2) males tend to overplay their accomplishments while females minimize their own. A study done of Carnegie Mellon Computer Science PhD students found that even when male and female students were doing equally well grade wise, female students reported feeling less comfortable. Fifty-three percent of males rated themselves as "highly prepared" in contrast to 0% of females.

It is important to note that many of the learning style differences described above are not strictly gender-based. They are instead based on differences of students with a background in SMET, problem-solving, and hands-on skills learned from childhood play and life experience and those who haven't had the same type of exposure. A review of the literature on minority students and SMET finds that students of color are less likely to have the SMET background experiences and thus are missing many of the same SMET building blocks as girls and have the same lack of confidence. Many of the SMET curriculum and pedagogy solutions that work for female students will also work for students of color for this reason.

Bridge Classes/Modules to Ensure Core Skills

Teachers will likely see a gap in the core SMET skills of female and minority students for the reasons described above. Below are some solutions applied elsewhere to ensure that girls and women (and students of color) will get the building block SMET skills that many will be missing.

Teachers in the Cisco Academy Gender Initiative study assessed the skill levels of each of their students and then provided them with individualized lesson plans to ensure their success that ran parallel to the class assignments. Other teachers taught key skills not included in the curriculum at the beginning of the course, such as calculating math integers and tool identification and use. Students were provided with additional lab time, staffed by a female teaching assistant, knowing that the female students would disproportionately benefit from additional hands-on experience.

Carnegie-Mellon University came to view their curriculum as a continuum, with students entering at different points based on their background and experience. Carnegie-Mellon's new frame of a "continuum" is purposefully different than the traditional negative model in which classes start with a high bar that necessitates "remedial" tutoring for students

with less experience, stigmatizing them and undermining their confidence. Below is a list of ideas and suggestions that will help ALL students to succeed in the SMET classroom.

1. Building Confidence

How do teachers build confidence in female students who often have less experience than their male counterparts and perceive they are behind even when they are not?

1) Practice-based experience and research has shown that ensuring female students have the opportunity to gain experience with SMET, in a supportive environment, will increase their confidence level.
2) Bringing in female role models that have been successful in the SMET field is another important parallel strategy that should be used to assist your female students in seeing themselves as capable of mastering SMET classes: if she could do it, then I can too!
3) Consistent positive reinforcement by SMET teachers of their female students, with a positive expectation of outcome, will assist them in hanging in there during those difficult beginning weeks when they have not yet developed a technology schema or hands-on proficiency and everything they undertake seems like a huge challenge.

2. Appealing to Female Interests

Many of the typical SMET activities for the classroom appeal to male interests and turn off girls. For example, curriculum in robots often involves monsters that explode or cars that go fast. “Roboeducators” observed that robots involved in performance art or are characterized as animals are more appealing to girls. Engineering activities can be about how a hair dryer works or designing a playground for those with disabilities as well as about building bridges. Teachers should consider using all types of examples when they are teaching and incorporating activities in efforts to appeal female and male interests. Teachers can also direct students to come up with their own projects as a way of ensuring girls can work in an area of significance to them.

Research also shows that there are Mars/Venus differences between the genders and how each engages in technology. Overall, girls and women are excited by how the technology will be used – its application and context. Men will discuss how big the hard drive or engine is, how fast the processor runs, and debate the merits of one motherboard or engine versus another. These are topics that are, overall, of less interest to most females.

The Carnegie-Mellon Study took into account the differences of what engages female students and modified the Computer Science programs’ curriculum so that the context for the program was taught much earlier on in the semester and moved some of the more technical aspects of the curriculum (such as coding) to later in the semester. Authors observed that the female students were much more positive about getting through the tedious coding classes when they understood the purpose of it. Teachers should ensure

that the context for the technology they are teaching is addressed early on in the semester by using real world stories and case studies to capture the interest of all of their students.

3. Group Dynamics in the Classroom

Research studies by American Association of University Women and Children Now have found that most females prefer collaboration and not competition in the classroom. Conversely, most males greatly enjoy competition as a method of learning and play. Many hands-on activities in technology classes are set up as competitions. Robotics for example, regularly uses competitiveness as a methodology of teaching. Teachers should be cognizant of the preference of many girls for collaborative work and should add-in these types of exercises to their classes. Some ways to do this are by having students work in assigned pairs or teams and having a team grade as well as an individual grade. (See Reading 2 on Cooperative Learning.)

Another Mars/Venus dynamic that SMET teachers should be aware of occurs in the lab where male students will usually dominate the equipment and females will take notes or simply watch. Overall, male students have more experience and thus confidence with hands-on lab equipment than their female counterparts. Teachers should create situations to ensure that their female students are spending an equal amount of time in hands-on activities. Some approaches have been: 1) to pair the female students only with each other during labs in the beginning of the class semester so that they get the hands-on time and their confidence increases, putting them in a better position to work effectively with the male students later on, 2) allot a specific time for each student in pair to use the lab equipment and announce when it's time to switch and monitor this, and 3) provide feedback to male students who are taking over by letting them know that their partner needs to do the activity as well.

4. Moving Female Students from Passive Learners to Proactive Problem Solvers

The main skill in SMET is problem solving in hands-on lab situations. For reasons already discussed regarding a lack of experience, most girls don't come to SMET classes with these problem-solving skills. Instead, girls often want to be shown how to do things, repeatedly, rather than experimenting in a lab setting to get to the answer. Adding to this issue, many girls fear that they will break the equipment. In contrast, male students will often jump in and manipulate the equipment before being given any instructions by their teacher. Teachers can address this by such activities as: 1) having them take apart old equipment and put it together again, 2) creating "scavenger hunt" exercises that force them to navigate through menus, and 3) emphasizing that they are learning the problem solving process and that this is equally important to learning the content of the lesson and insisting that they figure out hands-on exercises on their own.

Research has also shown that females tend to engage in SMET activities in a rote, smaller picture way while males use higher order thinking skills to understand the bigger picture and the relationship between the parts. Again, moving female students (and the non-tech-savvy student in general) to become problem solvers (versus just understanding the

content piece of the SMET puzzle) will move them to use higher order thinking skills in SMET.

Finally, many teachers have reported that many female students will often want to understand how everything relates to each other before they move into action in the lab or move through a lesson plan to complete a specific activity. The female students try to avoid making mistakes along the way and will not only want to read the documentation needed for the lesson, they will often want to read the entire manual before taking any action. In contrast, the male student often needs to be convinced to look at the documentation at all. Boys are not as concerned with making a mistake a long the way as long as what they do ultimately works. The disadvantage for female students is that they often are so worried about understanding the whole picture that they don't move onto the hands-on activity or they don't do it in a timely fashion, so that they are consistently the last ones in the class to finish. Teachers can assist female (and non-tech-savvy) students to move through class material more quickly by providing instruction on how to quickly scan for only the necessary information needed to complete an assignment.

5. Role Models

Since the numbers of women in SMET are still small, girls have very few opportunities to see female role models solving science, technology, engineering or math problems. Teachers should bring female role models into the classroom as guest speakers or teachers, or visit them on industry tours, to send the message to girls that they can succeed in the SMET classroom and careers.

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EXCEL lesson (see powerpoint)

Temperature Readings

Enter Celsius, convert to Fahrenheit

Use conditional formatting to color back ground as shown in column F

	Temperature	
Day	**Celsius**	**Fahrenheit**
1/1/2001		
2/1/2001		
3/1/2001		
4/1/2001		
5/1/2001		
6/1/2001		
7/1/2001		
8/1/2001		
9/1/2001		
10/1/2001		
11/1/2001		
12/1/2001		

Degrees F
< 32
32 … 60
60 … 80
80...100

After students calculate GPA from homework, do the same homework problem inputting it on excel

Then input classes already taken at VC, units and grades by semester. Do you get the same GPA as shown?

Input current semester and anticipated grades.

Input ed plan, include units and formulas for determining semester GPA and overall GPA

After materials demonstration, change load deflection data to stress strain and graph. Find important values on the graph.

John Hopkins problem – use excel; to graph and interpolate data?

How to Write Clear, Concise, and Direct Sentences

1. ***Unless you have a reason not to, use the active voice***.

At the heart of every good sentence is a strong, precise verb; the converse is true as well--at the core of most confusing, awkward, or wordy sentences lies a weak verb.

Passive a. It is believed by the candidate that a ceiling must be placed on the budget by Congress.

Active b. The candidate believes that Congress must place a ceiling on the budget.

Passive c. It was earlier demonstrated that heart attacks can be caused by high stress.

Active d. Brown earlier showed that high stress can cause heart attacks.

There are sometimes good reasons to use the passive voice:

- To emphasize the action rather than the actor.

  e. After long debate, the proposal was endorsed by the long-range planning committee.

- To keep the subject and focus consistent throughout a passage.

  f. The data processing department recently presented what proved to be a controversial proposal to expand its staff. After long debate, the proposal was endorsed by . . . .

- To be tactful by not naming the actor.

  g. The procedures were somehow misinterpreted.

- To describe a condition in which the actor is unknown or unimportant.

  h. Every year, thousands of people are diagnosed as having cancer.

- To create an authoritative tone.

  i. Visitors are not allowed after 9:00 p.m.

2. Put the action of the sentence in the verb. Don't bury it in a noun or blur it across the entire sentence. Watch out especially for nominalizations (verbs that have been made into nouns by the addition of *-tion*).

a. An evaluation of the procedures needs to be done.

b. The procedures need to be evaluated.

c. We need to evaluate the procedures.

d. The stability and quality of our financial performance will be developed through the profitable execu***tion*** of our existing business, as well as the acquisi***tion*** or develop***ment*** of new businesses.

e. We will improve our financial performance not only by executing our existing business more profitably but by acquiring or developing new businesses.

3. Reduce wordy verbs.

a. is aware, has knowledge of ----------> knows
b. is taking --------> takes
c. are indications --------> indicate
d. are suggestive --------> suggests

4. Use expletive constructions ("It is," "There is," "There are") sparingly.

a. It was her last argument that finally persuaded me.
b. Her last argument finally persuaded me.

c. There are likely to be many researchers raising questions about this methodological approach.
d. Many researchers are likely to raise questions about this methodological approach.

5. Try to avoid using vague, all-purpose nouns, which often lead to wordiness.

--factor, aspect, area, situation, consideration, degree, case . . .

a. Consumer demand is rising in the area of services.
b. Consumer demand for services is rising.
c. Consumers are demanding more services.

6. Unless your readers are familiar with your terminology, avoid writing strings of nouns (or noun strings!).

a. patient program satisfaction
b. student-professor relationship factors
c. processing step change
d. competitive cotto salami performance test
e. program implementation process evaluation

f. MHS has a hospital employee relations improvement program.
g. MHS has a program to improve employee relations.
h. MHS has a program to improve relations among employees.

7. Eliminate unnecessary prepositional phrases.

a. The opinion of the working group.
b. The working group's opinion.

c. The obvious effect of such a range of reference is to assure the audience of the author's range of learning and intellect.

8. Avoid unnecessarily inflated words.

Instead of	***Use***
cognizant of	aware of, know
facilitate	help
impact on	affect
implement	start, create, carry out, begin
subsequent to	after
utilize	use

*9. Put wordy phrases on a diet.**

Instead of	***Use***
the reason for for the reason that due to the fact that owing to the fact that considering the fact that on the grounds that this is why	because, since, why
despite the fact that regardless of the fact that	although, even though
in the event that if it should transpire/happen that	if
under circumstances in which	

Instead of	***Use***
on the occasion of in a situation in which under circumstances in which	when
as regards in reference to with regard to concerning the matter of where . . . is concerned	about
it is crucial that it is necessary that there is a need/necessity it is important that it is incumbent upon cannot be avoided	must, should
is able to has the opportunity to is in a position to has the capacity for has the ability to	can
it is possible that there is a chance that it could happen that the possibility exists for	may, might, can, could
prior to in anticipation of subsequent to following on at the same time as simultaneously with	before, after, as

*This list comes from Joseph Williams, *Style: Ten Lessons in Clarity and Grace*. 3rd ed. Glenview, IL: Scott, Foresman, 1989.

Revised 10/98
Editing

Design Projects

Created by: John Hopkins University, Engineering Department

Adapted by: Michelle Millea, Ventura College

Design Project – Carbon Footprint

Carbon footprint of ice cream in the U.S.: First, list the factors—from cow to dish—that contribute to the carbon footprint of bringing ice cream to your dinner table. Then, for each factor estimate what the carbon cost is for supplying the entire U.S. with ice cream. You answer should be in CO2 tons/yr. Compare your answer to the carbon footprint of a compact car.

1) Create a plan for research required
2) Assign tasks and construct a timeline
3) Determine the format for your report.

Your report will include the problem statement, assigned tasks and timeline, summary of research and sources of data.

Design Project – Removing paper towels from Sports Stadiums

Many professional sports teams are working hard to make their stadiums more friendly for the environment. Suppose that the NBA (National Basketball Association), the NFL (National Football League) and the MLB (Major League Baseball) organizations worked together and removed all paper towels from their stadium restrooms and replaced these with air hand dryers.

a) How many pounds of paper would be removed from the US waste stream?

b) How many trees would be saved?

1) Create a plan for research required
2) Assign tasks and construct a timeline
3) Determine the format for your report.

Your report will include the problem statement, assigned tasks and timeline, summary of research and sources of data.

Design Project – Highway painting project

The city of Amarillo, TX has received a federal grant to repaint the lines on all the streets and highways in the city limits. You have been assigned the task of ordering enough street paint to paint the lines on the sides of all roads, the lane divide markings for all multi-lane roads and the center lines for non-divided highways. How much paint should you order? If the federal grant money must be spent in 60 days, how many paint trucks are needed to complete the project on-time?

To earn full credit you must provide a list of all your assumptions, the justification for each assumption and the url for all websites you used to answer this question.

1) Create a plan for research required
2) Assign tasks and construct a timeline
3) Determine the format for your report.

Your report will include the problem statement, assigned tasks and timeline, summary of research and sources of data.

Introduction to Engineering
Term Paper Requirements

Created by: Jess Huguley, *Arapahoe Community College*
Adapted by: Michelle Millea, *Ventura College*

Objective

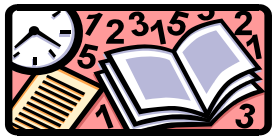
To have the student gain insight into the applica engineering, social and economic principles in a discipline of their choice to products that impact our present quality of life**.**

(1) Requirements:

To successfully complete the course, each student will be required to submit a term paper on one of the attached subjects that represent either success or failure of an Engineering Project. (Additional topics are permissible upon agreement with Instructor). The paper should be a minimum of 10 **double spaced** ***"Microsoft Word" pages. This does not include the standard title page format presented here. Font size must be 12 Helvetica, Arial or Times-no "fancy scripts." Photocopied and downloaded images with annotations supplementing the theme cannot be more than 15 % of the entire package. A photocopy requiring a full page is acceptable. A maximum of 3 such pages is allowed.***

Use of the WEB is highly encouraged as a reference source. ***However, all material drawn from it must be acknowledged as to its source. Use of footnoting to direct the reader to the reference source is required***.

Submit on CANVAS, last day of class.



(2) Grading

Grading will be as follows:

Technical content	50%
Grammar construction	50%

(3) Schedule:

Paper will be due on the last class day. **No late papers will be accepted**.

(4) Minimum content objectives:

Product Success topics:

(a) What was the motivation for the development of the product?
(b) Was new technology developed?
(c) Was new science discovered?
(d) What cardinal mistakes were made?
(e) Did “spin off technology” result as a by-product?
(f) Where is the product in its life cycle today?
(g) How did the product improve the quality of life for the user?

Product Failure Topics:

(a) What was the motivation for the development of the product?
(b) What basic engineering principles were not followed?
(c) Were the errors the result of cost driven decisions?
(d) Were the errors due to a lack of state of the art knowledge?
(e) Were the errors due to basic incompetence?
(f) What Codes and Regulations (if any) were violated?
(g) What did the profession learn from the failure?

Topics:

Mechanical Engineering-Product Success:

Development of the Automotive Air Bag
Development of the Da Vinci Surgical Robot
Development of the dry copy ("Xerox") machine
Development of the DVD player/Recorder

Mechanical Engineering-Product Failure

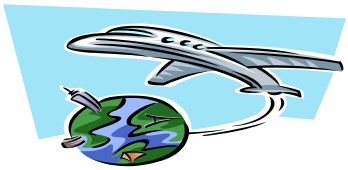
Failure of the British DeHavilland ***Comet*** Jetliner design
Failure of the Space Shuttle ***Challenger or Columbia***
Failure of the ***Baggage System*** at Denver International Airport
Failure of the Composite Fuel Tanks on the NASA ***X33 Prototype***

Electrical/Electronic Engineering-Product Success

Development of the Microwave Oven
Development of the "Smart Phone
Development of the Magnetic Credit Card Reader/Terminal
Development of the Intel Pentium Chip
Development of the Commercial GPS Navigation aids
Development of the Magnetic Resonance Imaging (MRI) machine

Electrical/Electronic Engineering-Product Failure

Failure of the Motorola "Iridium" Cellular Phone network
Failure of the Texas Instruments Personal Computer
Failure to mass market Battery Powered Automobiles
Failure to mass market Solar Powered Automobiles



Industrial Engineering-Product Success

Production of the Boeing 787 ***Dreamliner***-what problems is it now facing?
Production of the C-6 (1997) Corvette-what has it evolved to?
Production of the Intel Pentium Processor
Production of the ***NIKE*** Footwear products

Industrial Engineering-Product Failure

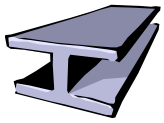
Production of the Firestone "Wilderness" Tire
Production of the Ford "***Pinto*** "-How were they able to continue selling it?
Production of the Convair 880/990 Jetliner-Largest corporate loss in history at the time!
Phase out of the Concorde Super Sonic Jet Liner-What caused its demise?

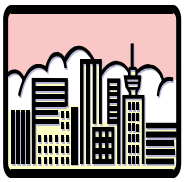
Computer Science-Product Success

Development of Windows and Macintosh Operating Systems
Development of the present Internet
Development of the Personal Computer
Development and Integration of Local Area Networks (LAN)
Evolution of the the CD
Development of the Social Networking Service-*Facebook*-How has it changed daily life World Wide
Development of the Ipad, Kindle, Galaxy etc.…

Computer Science-Product Failure

Demise of the DOS Operating System
Relegation of Main Frame Systems to "Dinosaur" status





<u>Civil Engineering</u>*-*<u>Product Success</u>
Construction of the Verrazano Narrows Bridge
Construction of the Interstate Defense Highway System
Construction of the St. Louis, MO “Archway to the West”
Construction of the Tunnel under the English Channel (Chunnel)

<u>Civil Engineering –Product Failure</u>
Kansas City Hyatt-Regency Hotel balcony collapse (1981)
Collapse of the Tacoma Narrows Bridge (1940)
Chernobyl Nuclear Power Plant Disaster
Three Mile Island Nuclear Power Plant Emergency
Bophal, India Union Carbide Chemical Plant Disaster

Additional Areas: (Consult with Instructor for “success or failure” topics).

Chemical Engineering
Biological Engineering
Aerospace/Aeronautical Engineering
Systems Analysis and Integration

(Cover Page Format)

Introduction to
Engineering
ENGRV01

Application of Industrial Engineering Methods To the Production of the Boeing 777 Jetliner

Student Name

Ventura Community College

Fall Semester, 2019

Created by Mason Hansen, Itasca Community College
Adapted by Michelle Millea, Ventura college

INTRODUCTION TO ENGINEERING

Medical Supply Drop Device

Scenario:

A non-profit organization has contacted Itasca Engineering to submit a design proposal for a device that can protect fragile medical supplies (e.g. glass medicine vials) and sensitive electronic equipment for emergency airplane drops to relief workers. The medical supply drop device could be used during relief efforts for natural disasters, remote villages, etc. Each team's design will be evaluated against the organizations given design criteria.

Parameters:

To simulate these needs, you team will be designing a medical supply drop device that will:

- Protect a $400 dollar data acquisition unit and accelerometer
- Be dropped from the Mount Itasca Ski Jump (~80')
- Be constructed from readily available ("off the shelf") items. These items will be purchased at L&M Fleet Supply in Grand Rapids or be available in large quantity as a recycled item.
- Be ready for testing on Friday, September 7th
- The device must be able to be released from the plane (ski jump) without any connections and cannot incorporate the use of a zip line. This would be an unreasonable risk when used with a plane.
- The device must have a cargo capacity that can contain the approximate 4" x 11.25" x 13" data acquisition unit storage box. The device must allow the storage box to be inserted just prior to the drop and removed immediately after the drop.

Design Criteria: See the following rubric for specific details

Scored Criteria:

- Ability to hit the drop target (~1m^2)
- Minimal volume due to space constraints on airplanes
- Minimal weight due to lift capacity
- Minimal cost ($5 max while readily recycled materials are considered free (ie. cardboard, water bottles, etc.))
- Ease of manufacturing
- Provides a soft (minimal deceleration) impact when dropped from a minimum height of 80 ft to protect the contents

Medical Drop Scoring Rubric

2012 Introduction to Engineering

- Minimal environmental impact (ie. made from reused or recycled materials? reusable on the ground? biodegradable?)

Graded Criteria w/ associated weight	1 point (poor)	4 points (ok)	7 points (decent)	10 points (great)
Small Volume (x2) (Respective to class)				
Low Impact (x3) (Respective 'g's to class)				
High Accuracy (x2) (Distance from target respective to class)				
Low Environmental Impact (Biodegradable/Reusable)				
Low Cost and Easy to Make(Mason's discretion)				

TEAM SCORES OUT OF 90: _____ _____ _____ _____

_____ _____ _____ _____

This rubric is for competition purposes only.
Your group report will dictate your grade on this project.
See Mason with any questions.

Library visit and presentation of data bases of journals.

Follow up with this assignment

Research & Technical Presentation

Based on project assigned by: Elizabeth Cheung, *Pierce College*
Adapted by: Michelle Millea, *Ventura College*

Presentations will be given to your classmates on XXXXX

You will choose a peer-reviewed journal article to read and then prepare and deliver a 5-7 minute presentation a current science or engineering research topic of your choice.

Objectives:

- Learn about a current research topic that interests you through engineering or scientific publications;
- Read and understand a peer-reviewed journal article about a technical topic;
- Communicate a technical topic to a novice audience

Guidelines:

- The first part of this project involves research.
    - Choose a research topic in science or engineering that is interesting to you, but that you're not an expert in.
      Ex. direct air capture of carbon dioxide
    - Use the library online resources to find scientific and engineering articles, including at least one peer-reviewed journal article related to this topic. Ex. (using topic above): Anderson, Kevin, and Glen Peters. "The trouble with negative emissions." *Science* 354.6309 (2016): 182-183.
      Apply what you learn in the library lesson for locating appropriate resources.
- Prepare a presentation describing your science or engineering topic. The goal here is to get some practice in explaining a technical topic in an easy-to-understand way.

    - You must use a digital presentation software (such as Powerpoint, Prezi, or Google Presentation).
    - Use a title slide that includes your topic and your name.
    - Images are usually a good thing to put into a presentation. For technical topics, often diagrams or other technical graphics may be appropriate.
    - Avoid slides that are full of lots of text. This is boring to look at and you'll lose your audience because they can't read and listen to you at the same time.
    - Keep your audience in mind. You are presenting to an audience that is somewhat technically-minded but probably not familiar with your research topic.
    - Cite your source(s) on the last slide of your presentation.
- Submit your presentation file/link ahead of time via Canvas, so it's ready to go.
- You may have notes to refer to while speaking, but reading straight from written notes is discouraged.

Design YOUR Process for Becoming a "World-Class" Engineering Student

Engineers design products or processes to meet desired needs. Your desired need or goal (hopefully) is to graduate with your Bachelor of Science degree in engineering. But what is the process you need to apply to be successful in achieving this goal?

Task:

For each of the following items, develop a plan that will indicate:

d. Where would a "world-class" engineering student want to be on each item
e. Where you are currently on each item
f. What you need to do to move from where you are to where you would need to be to become a "world-class" engineering student

By analyzing a. and b. you will be able to answer c., which will tell you what your process to success is! Keep in mind that your report will describe *your* process to success.

Items:

1. **Goal Setting**
   a. Setting your goal(s), i.e., major, time to graduation, GPA
   b. Strengthening and clarifying your commitment to your goal(s)
   c. Setting up a "Road Map"—a plan to guide you over the next years to graduation
   d. Understanding the essence of engineering

2. **Community building**
   a. Building relationships, and making effective use of your peers
   b. Participating in co-curricular activities

3. **Academic development**
   a. Navigating the university system, resources and academic advising
   b. Understanding teaching styles and learning styles and how to make the teaching/learning process work for you.

4. **Personal development**
   a. Enhancing your self-awareness and improving your skills to practice academic success strategies
   b. Outlining what attitudes and behaviors you need to change/add to be successful
   c. Managing time and tasks
   d. Engaging in good health and wellness practices including management of stress
   e. Developing a high sense of personal and professional integrity and ethical behavior

Additional Information for Items

1. **Goal Setting**
   a. Setting your goal(s), i.e., major, time to graduation, GPA
      - What do you want to achieve through your engineering education (major, time to graduation, GPA, etc.) and beyond
   b. Strengthening and clarifying your commitment to your goal(s)
      - Clarifying what success in engineering study will do to enhance the quality of your life (rewards, benefits, opportunities, payoffs, etc)
      - Understanding the essence of engineering (be able to articulate an answer to the question "What is engineering?)
      - Being aware of past engineering achievements, current opportunities (academic disciplines, job functions, industry sectors) and future directions.
      - Be prepared to deal with inevitable adversity
   c. Setting up a "Road Map"—a plan to guide you over the next years to graduation
      - A term-by-term academic plan, outlining what courses you plan to take to graduation
   d. Understanding the essence of engineering
      - Be able to articulate an answer to the question "What is engineering?"

2. **Community building**
   a. Building relationships, and making effective use of your peers
      - Get to know students in your classes/program/department
      - Build productive relationships for college and beyond
   b. Participating in co-curricular activities
      - Join and actively participate in student organizations including engineering related student organizations (ASCE, ASME, IEEE, etc.)

3. **Academic development**
   a. Navigating the university system, resources and academic advising
      - Become effective at getting what you want and need from the educational system by utilizing campus resources (such as advising, tutoring, job placement services, health center, etc.)
   b. Understanding teaching styles and learning styles and how to make the teaching/learning process work for you.
      - Identify your learning style and your preferred teaching style and how you will use this information to enhance you teaching/learning process

4. Personal development

a. Enhancing your self-awareness and improving your skills to practice academic success strategies
   - Understand and practice the concept of "metacognition" to improve your learning process by observing your learning process, feeding back to yourself what you observed, and making changes based on that feedback.
   - Understand the principles of teamwork and leadership and develop skills to be both an effective team member and also an effective team leader
   - Understand and respect differences in personality types, ethnicity and gender

b. Outlining what attitudes and behaviors you need to change/add to be successful
   - Change your attitudes to those appropriate to success in math/science/engineering coursework. Among those that are candidates for change are:
     - Low self-confidence or overconfidence
     - Reluctance to seek help
     - Resistance to change, grow, develop, improve
     - Tendency to procrastinate
     - Avoidance behavior (avoid difficult or unpleasant tasks)
     - Reluctance to study with other students
     - Negative view toward authority figures
     - Other negative attitudes identified by you
   - Change your behaviors to those appropriate to success in math/science/ engineering coursework to include at least:
     - Devoting adequate time to studying
     - Adopting the principle that you master the material presented in one class before the next class comes
     - Make effective use of your peers through sharing information and group study
     - Make effective use of your professors both inside and outside of the classroom
     - Prepare for lectures by reading ahead, attempting a few problems, formulating a few questions
     - Other behaviors identified by you

c. Managing time and tasks
   - Understand and make effective use of time management and priority management
   - Do a good job of managing various aspects of your personal life including interactions with family and friends, personal finances, outside work, and commuting.

d. Engaging in good health and wellness practices including management of stress
   - Manage stress through stress-reduction methods
   - Understand the benefits and implement good health and wellness practices

e. Developing a high sense of personal and professional integrity and ethical behavior
   - Understand professional ethical codes related to your major
   - Be able to identify academic dishonest behavior and how to avoid such behavior

Some tips to get started on the project:

- Start early, meaning now!
- Make use of your notes. For example, always write down notes when reading new material before class and during class with focus on how you would implement the topics covered to make them work for you.
- Assignments, in class-activities and homework are aimed to accumulate material which will be very useful for your report, for example there will be a homework where you will need to develop a 4-5 year plan to graduation which you can copy into your report.
- Although this will be your process, study/discuss topics with other students from the course
- Avoid copying verbatim from the textbook or other resources. You can reference to sections of the textbook, e.g., "Understanding the importance of early course preparation, as Landis [1] discusses in Chapter 4.1, will help me to implement the following changes in my attitude and behavior..."

Length of Report

The length of the report should be around 10 pages. The minimum acceptable length is 8 pages, there is no maximum page limit. Reports that contain verbatim copied passages without proper citation will receive 0 credit. In addition, reports that contain lengthy copied passages from sources, even if they are properly cited, will be severely marked down.

Format Requirements

Your report as to be to be written in Microsoft Word or some other software program with the following specifications:

- use font styles Arial, Calibri or Times New Roman with a font size of 12
- use 1.5 line spacing
- use 1 inch margins on all sides

Your report needs to have a cover sheet which must include the name of the course, the title of the report, the submission date, your name as the author. You can find a template on blackboard in the "Project" folder.

Submission Requirements

Submit a digital copy of your report by [DATE] through blackboard (see the "Project" folder on blackboard). Only doc(x) and pdf files are accepted! Name your file in the following way:

- lastname_firstname_ENGR151_Project

For example, if your name is Steffen Peuker your file name should be: peuker_steffen_ENGR151_Project

Example Homework Assignments

The table below shows the homework assignments as mentioned in the example Syllabus and how the assignments relate to the Project objectives. The idea is that students generate material throughout the semester for the Project and then compile their material into their final project report. This setup provides students with a repeated exposure of the material. The interpretation which homework corresponds to which objective in the table below is very broad. Depending on the course you are teaching, you can easily add more homework assignments.

1., 3. (1.a.) Setting your goal(s), i.e., major, time to graduation, GPA	Homework #1, #2
2. (1.b.) Strengthening and clarifying your commitment to your goal(s)	Homework #1, #2, #3
2. (1.c.) Set-up a "Road Map"—a plan to guide you over the next years to graduation	Homework #4
2. (1.d.) Understanding the essence of engineering	Homework #3
7. (2.a.) Building relationships, and making effective use of your peers	Homework #5
10. (2.b.) Participating in co-curricular activities	Attend Engineer's Friday night
14. (3.a.) Navigate the UAA system, resources and academic advising	Homework #8
6. (3.b.) Understanding teaching styles and learning styles and how to make the teaching/learning process work for you.	Homework #5
5., 7. (4.b.) Outline what attitudes and behaviors you need to change/add to be successful	Homework #1, #3, #5, #9, #10
9., 11. (4.a.) Enhance your self-awareness and improve your skills to practice academic success strategies	Homework #5, #6, #9
12. (4.d.) Engaging in good health and wellness practices including management of stress	Homework #10
4., 8. (4.c.) Manage time and tasks	Homework #7
13. (4.e.) Developing a high sense of personal and professional integrity and ethical behavior	Homework #11

Note: Numbers in () refer to the alternative project statement objectives (see page 39-42)

Homework #1

Note: The below homework assignment is related to the story "Jane and the Dragon" which was presented in class to the students (thanks to Dan Budny from the Swanson School of Engineering for the idea of using this story in class!). In summary, Jane befriends the dragon, and this can be used to have students think about what is their greatest obstacle (Math, Physics, Chemistry, etc.) and how they can make it their friend. Here is the statement for the students:

Write a 2 page essay about your "dragon" and how you want to "tame" it. (Your "dragon" should be something you are struggling with related to your studies, feel free to write about more than one dragon).

Homework #2

Graduating with a bachelor of science degree in engineering: How important is that goal for you? How can you make it even more important? Write a two page essay.

Homework #3

a) Make your own top ten list of the rewards and opportunities of an engineering career.

b) Write a 2-3 page paper on "Why I Want to be an Engineer" by expanding on your top three items from a).

c) Prepare your statement of the question: What is engineering?

Homework #4

Note: A USB stick was handed out to the students during lecture containing information such as course catalog copy, flow charts, petition forms, etc., of all the engineering programs offered at UAA. Our student success manager also gave a presentation on student advising. Here is the statement for the students:

Use the information provided on your USB stick and develop your plan—your roadmap—to graduation. In case you have not decided on a major yet, chose the one you are most likely to pursue. Set up a table similar to the provided Course Planning Schedule in Microsoft Word (see template below), which outlines what courses your are planning and when you are taking them (year and Fall or Spring semester). Also include a paragraph when you are planning to look for an internship, joining an engineering student club or other club, and/or what you plan for the summers until graduation.

Year	2013, Spring	Credits	Year	2013, Fall	Credits
ENGR A151		1			
Total Credits			Total Credits		

Homework #5

a) List the major differences between the teaching/learning process you experienced in high school and the teaching/learning process you will encounter in an university-level math/science/engineering study based on the in-class group discussion. Write a 2 pages reflection outlining strategies for adjusting to each item on the list.

b) Pick two items from the list of "mistakes students make" we covered in class and write down a commitment how you will implement the required changes mentioned in the right column (1 page).

c) Go to: http://www.engr.ncsu.edu/learningstyles/ilsweb.html and take the survey.

d) Write a 2 pages reflecting about the results from part c). What do the results tell you, and what changes in your behavior you plan to make based on this new information.

e) Peer review the journal of another student and provide constructive feedback.

Homework #6

Pick two of the important academic success skills:

- note taking

- listening

- questioning

and perform and internet search. Gather information from at least 5 different sites and write a 2 page paper on what you learned about these skills and how you plan to implement them. Make sure you list the sites you used at the end of your document and reference it in the text. If you use direct quotations, i.e. you copy directly from the webpage—which you should use extremely sparingly—you have to use quotation marks, for example:

"Real listening is an active process that has three basic steps." [1].

A better way is to rewrite in your own words what your learned from reading the website:

The first webpage [1] emphasizes that listening is an active process and that there are three separate processes: hearing, understanding, judging.

Add the references at the end of your document:

References

1. http://www.infoplease.com/homework/listeningskills1.html

Homework #7

Make a list of at least 20 items/activities you need to do. Think about items/activities which are related to your project. Place each item/activity into the priority matrix. Analyze your matrix, i.e. how many items are in quadrant I, II, III and IV. Write a 2 page reflection what you learned and how you can move items/activities into quadrant II.

I Urgent and Important - - - - -	**II Not Urgent, Important** - - - - -
III Urgent, Not Important - - - - -	**IV Not Urgent, Not Important** - - - - -

Homework #8

- Choose one of the *Engineers among the World's Wealthiest Individuals* we discussed in class.
- Write a brief paper (minimum 1 page) about how you used the Library's resources and tools to find out more information about the engineer you selected.
- Your paper should include information from at least two (2) of the following types of sources:

  Books
  Journals
  Magazines
  Newspapers
  Websites

Homework #9

Write at least one page about today's group discussion: Strategies to overcome barriers to choosing productive actions. Pick your biggest barrier and discuss one or more strategies to overcome them.

Homework #10

a) Read the handout “Stress and the College Student” (go to: http://www.uic.edu/depts/wellctr/docs/Stress and the College Student.pdf)

b) Do the “How do you respond to stress” test on page 3. Write a 1 page reflection on effective ways of coping with your stress reactions.

c) Determine your stress score using the test on page 7. Write a short paragraph what this score tells you.

Homework #11

You will encounter many ethical issues throughout your student career as well as during your professional career.

a) Take the Academic Integrity Tutorial:

http://ahi.commons.uaa.alaska.edu/

On blackboard under Course Material, you find a link to a video "Incident at Morales" which is meant to expose you to possible ethical problems engineers might face. After watching the video answer the following questions:

b) Describe and analyze one ethical issues raised during the first segment of the video, up to time index 22:50 min, and outline a possible response or solution (1/2-1 page)?

c) Describe and analyze one ethical issues raised during the second segment of the video, after time index 22:50 min, and outline a possible response or solution (1/2-1 page)?

Come up with an assignment which addresses objective 3., "Be prepared to deal with inevitable adversity."

Brainstorm for 10 minutes in your group**. Room for notes**

Write a letter to your future self, your end-of-the semester self

This exercise allows you to create what is to come. Sit down and address a letter to yourself. Let your mind run wild. Think big and give yourself permission to be wildly ambitious. What principles will guide your life? What do you hope to accomplish? How are you going to do it? Feel free to let your mind run wild. Think big and give yourself permission to be wildly ambitious. If you vividly imagine your future in concrete terms, it becomes a self-fulfilling prophecy.

Give advice. It helps to use the second person (address the letter to "you" rather than "I".

Feel free to just write or you can use this for inspiration. Divide the letter into two parts: Academic and Personal, and use the 4 steps below for each of them.

1. **Current mood & state of affairs** — How are you feeling, what's happening in your life right now? What causes you the most anxiety about your future? What keeps you up at night?
2. **Questions for your future self —** What are grappling with now? What are you curious to ask your future self?
3. **Aspirations for the semester** — What do you hope to achieve? You can include academics, finances, relationships, personal goals, spiritual growth, etc
4. **Stop, Start, Continue** (3–5 things you should stop doing, start doing, continue doing)

Don't know where or how to start? Don't worry. You don't have to write an essay. It doesn't matter if you choose to elaborate or jot down bullet points. Of course, the more detailed your entry is, the more fun it'll be to read it in the future. What's important is that you do it.

Write a letter to your future self, five year from now

This exercise allows you to create what is to come. Sit down and address a letter to yourself. Let your mind run wild. Think big and give yourself permission to be wildly ambitious. What principles will guide your life? What do you hope to accomplish? How are you going to do it? Feel free to let your mind run wild. Think big and give yourself permission to be wildly ambitious. If you vividly imagine your future in concrete terms, it becomes a self-fulfilling prophecy.

Give advice. It helps to use the second person (address the letter to "you" rather than "I".

Feel free to just write or you can use this for inspiration. Divide the letter into two parts: Academic and Personal, and use the 4 steps below for each of them.

1. **Current mood & state of affairs** — How are you feeling, what's happening in your life right now? What causes you the most anxiety about your future? What keeps you up at night?
2. **Questions for your future self —** What are grappling with now? What are you curious to ask your future self?
3. **Aspirations for yourself 5 years from now** — What do you hope to achieve? You can include academics, finances, relationships, personal goals, spiritual growth, etc
4. **Stop, Start, Continue** (3–5 things you should stop doing, start doing, continue doing)

Don't know where or how to start? Don't worry. You don't have to write an essay. It doesn't matter if you choose to elaborate or jot down bullet points. Of course, the more detailed your entry is, the more fun it'll be to read it in the future. What's important is that you do it.