Designing a program for Recruitment and Retention of Female Engineering Students

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Outline

Discussion on the Overall Issue & SF State U. Strategies

- Importance of exposing K-12 Girls to Engineering Field
  - Camps & Conferences
  - Project Based Learning Technique

- For Collegiate & K-12
  - Real world experience, role models and mentors
  - Female students’ needs & Support systems

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About San Francisco State University

- Part of the 23 campuses in CSU system
- Number of undergraduate students: 24,456
- Graduate students: 4,445
- Student breakdown by gender: 61% female, 39% male
- Percentage of freshman students receiving Pell grant is 47%
- 118 bachelors degrees
- 96 masters degrees
- 26 Doctor of education and Doctor of physical therapy in science
San Francisco State University Goals

- Create stronger Connections between University and K-12 Educators
- Support Women and Under-represented Groups in Undergraduate and Graduate Studies
- Create on-going Bridges to Professional Community with Mentors, Workshops, and Faculty Support
The Big Issue

- STEM Workforce overwhelmingly represented by men
  This situation is even more severe in the engineering field

- Lack of Encouragement
  Girls widely under-estimate their learning abilities & earning abilities

- Girls’ lack of interest and access in STEM Field
  Girls tend to like art over action, or building the toy

- Women receive less academic support than their male counterparts at the Collegiate Level

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URM STEM Majors @ CSU System

2,662 URM freshmen began in STEM in fall 2005

463 of those students graduated in STEM six years later

recapturing the 2,199 URM who didn’t graduate in STEM:
- represents “low hanging fruit” for improved degree production
- suggests targeted action such as STEM Summer Bridge, STEM service learning, and community-based research
- such “high-impact practices” benefit all students, and URM students in particular
Key Statistics in the STEM Field

The Data in the NSF report 15-311, January 2015 provides the information below:

- Women have earned 57% of all Bachelor Degrees
  - Only 28% of those are in the STEM Field

- The proportion is lowest in Engineering and Computer Science (19%) and highest in Bioscience (28%)

- Female representation in STEM fields declines further at the graduate level
Negative Perceptions

About girls’ abilities in math at high school: Boys “naturally” excel in math and girls “naturally” excel in fields using art/language skills.
Why Exposure Needs To Come Early

- It is important to focus the attention on girls to cure negative perceptions that girls may develop at early age.
- Many believe that exposure needs to come before high school, but our research have shown that 2nd & 3rd year of high school is not too late.
- Many girls across the nation are not aware of the opportunities in STEM Career Path.
- More time is needed for personal growth & exploration.
How To Encourage Girls

- Nurturing the enjoyment and the confidence to persevere in mathematics and engineering
- Using career focus curricula associated with implementation of innovation
  - Science education should be on the curriculum from an early age
- Exposing girls to successful female role models in math & science and engineering
- Providing a network of support, SWE, AWIS, IEEE WIE
- Providing female engineering mentors
- Providing Job-shadow experiences: internship & research fellowship
Promising Practices/Strategies

- Policies that support gender equity are vital in STEM field
  Science & Engineering Equal Opportunities Act (Title IX)

- Schools and Colleges
  Gender friendly curriculum and instructions should be adapted
  Effective Mentoring, Special programs (MESA & Metro Academy)
  & Workshops should be provided
  “growth mindset” environment should be created
  Departmental culture should be improved by hiring female faculty

- Community Involvement
  Girl Scouts, Society of Women Engineers & Expanding Your Horizons

- Workplace norms and culture should be more friendly for the girls
Exposure

- Summer camps are a fun way to expose young girls to Engineering while conducting exciting hands-on projects.
  - Many girls that attend camps at a university, and decide to pursue engineering, often return to the site of camp where they were first exposed to the engineering field.

- STEM Outreach
  - EYH Network Conference, SWE retreat, Techbridge (afterschool & Summer programs for Girls)

- Job Shadow Program
Summer Engineering Institute (SEI)

Two week residential program at SF State Campus since 2001

- Lectures, hands-on projects, demonstrations on the major fields of engineering (CE, Comp, EE, ME)
- Workshops on the nature of engineering education, and skills/resources for success
- Group activities, social events, and company tours with faculty, engineers, and graduate students
- Mornings focused on lecture sessions, group activities, and hands-on workshops
- Evenings focused on working on group projects

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SEI Workshop Topics

- Exploring Major Fields of Engineering
- Guaranteed 4.0 Workshop
- Computer Aided Design (CAD)
- Renewable Energy
- Robotics, Programming
- Experimentation and Data Analysis
- Resume Writing and Preparing for a Job Interview
- Financial Aid
- Effective Communication & Technical Presentation
About The Expanding Your Horizons Network

- Founded in 1974, EYH is a non-profit membership organization of educators, scientists, mathematicians, engineers, parents, community leaders, government and corporate representatives.
EYH Mission

- To encourage girls to pursue Science, Technology, Engineering and Mathematics (STEM) careers
- To provide STEM role models and hands-on activities for middle and high school girls
- To motivate girls to become innovative and creative thinkers ready to meet 21st Century challenges

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Typical EYH Conference Schedule

- 8:30 A.M.  Pick up registration materials
- 9:00 A.M.  Welcome & Keynote Address by a notable woman scientist/engineer
- 9:45 A.M.  Hands-on Workshop #1
- 11:00 A.M. Break & snacks
- 11:15 A.M. Hands-on Workshop #2
- 12:30 P.M. Lunch
- 1:15 P.M.  Hands-on Workshop #3
- 2:30 P.M.  Closing Plenary Session / Fill in evaluation survey, Raffle
- 3:00 P.M.  Closing

It's organized by a group of local volunteers with expert assistance from the EYH Network

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Job Shadow Program

➢ Place Junior and Senior year high school girls with working professional engineers

➢ These girls are able to obtain a clear idea of what an engineering career might entail

➢ Encourage girls to pursue a degree in the field of engineering.
Benefits of Summer Camps & Conferences

- Increase the knowledge of the engineering/science fields, and also boosts girls’ self confidence

- Girls in summer camps and conferences participate in hands-on activities within various projects in a variety of engineering and science fields

- Leads to increased interest and improved attitude toward engineering fields and career
Effective Teaching Strategies

- Making appropriate resources readily available for the engagement of girls in Engineering
- Girls learn best with ‘hands-on’ learning activities
- Improved attraction for girls can be achieved with gender-aware teaching styles
- Methods include more discussion time, poster presentations, practical project work and ‘girl-friendly’ examples of problems
- Girls that participated in the robotics program showed a positive attitude towards engineering
Project-Based Learning

- Project based learning integrated curriculum could increase effectiveness, and influence girls’ attitude to choose engineering career path

- Establish a link between theoretical knowledge and its application to solve everyday life problems

- Focus on hands-on activities to increase the engagement of girls in the traditional school science curriculum

- Makes learning real, relevant and seamless
Emphasis on Different Environment Settings

- Girls that participated in the robotics program showed a positive attitude towards engineering

- Research show that the workshop model in the study did significantly increase female interest to pursue an engineering degree (EYH Inc.)

- All-girl environments did level the responses closer to responses of mixed gender
Recruitment Support Service

- Providing basic information about gaining financial aid and choosing colleges

- Students often find out how the university works “the hard way”

- Recognizing and identifying of available resources actives the access of resources and leads to smooth university transitions.
How To Give Support

- Providing additional and proactive mentoring at the high school, community college and undergraduate level
- Recognizing potential role that community colleges can play in the educational process of women & under-represented students
- Improving parental education
  - Language barriers should be taken into account in appropriate ways when designing events and activities for parents
Why Support is Needed

- Promote the development of strong peer networks
  - Faculty urged to move from their traditional roles of teaching and research to establish meaningful relationships with students
- Provide students who have significant employment obligations additional advising or academic assistance

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Importance Of Confidence

- Hands on learning boosts confidence
- Confidence is more important to Women in Engineering Students (WES) for retention rates
- Girls were given the opportunity to pick their own project ideas
  - WES were allowed to form their own network and community of support
Social Environment

- Study groups
  - Are often described as the best things that happened to engineering students

- Clubs
  - Offer students the opportunity to interact with like minded women seeking engineering

- Sense of community can be instilled from project based learning classes
College Social Environment

- Higher instances of learning through interaction with the instructor outside of class time, or “student-faculty informal” meetings
- Providing more information outside of class
  - Mentorship
  - longer office hours
  - group projects
- Encouragement needs to be passed from one generation to another
How To Form A Community For WES

- Technical Workshops delivered by the female professionals
- Annual Student welcome events
  - Welcome event hosted for incoming freshmen/transfer students by current students
  - Organize an evening of social activities to establish a welcoming environment

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Retention Plan for Collegiate

- Encouragement through a tough field
- Work experience through internship and maintaining bigger picture
- Creating research opportunities
- Providing mentors as a role model who have gone through the same process
- Conquering a male dominant field
- Professionals and friends for support in engineering field through societies and programs
Role Models

- Female Engineering students seek female role models
- Encouragement needs to be passed from one generation to another as a means to attract students and build their confidence
- Having female engineering faculty teach courses helps students feel like they also can succeed in course load
Role Models

➢ There is a very direct correlation between an increase in female engineering faculty and the number of female engineering students

➢ Many women felt the lack of support from professors, peers, advisors, and said they felt like they didn’t belong in engineering

➢ One way to make them feel welcomed is to introduce and connect them with other women who have succeeded in the male dominated field
Positive Trends

- Increased enrollment figures in undergraduate programs are also beginning to translate into an increased number of women engineers and women engineering faculty.

- Having female engineering faculty teach courses helps students feel like they can succeed in engineering courses.
Negative Trends

- Society has developed in a way that views women as inferior to men in Engineering and other STEM fields.
- Systemic obstacles include cultural influences and gender stereotyping at home, in school, peer pressure and images in the media.
- Women often times leave engineering because they don’t get same support and vote of confidence as men get.
- During tabling events, most WES only get to help set up event.
- It is important to keep WES’s confidence up because it leads to higher retention rates.
- Many WES feel like they are kept in shadow.
Results Of Negative Trends

- Many fear engineering courses would be too hard and would cause them to lose scholarship.
- Lead to issues that were diverting girls from entering engineering field.
- “leaky pipe syndrome’
- Fear declaring engineering as their major because of perception of it being male dominated.
How To Fix The Social Stigma

- Cannot allow male dominated industry to continue with negative disposition towards their female counterparts
- Women like seeing their efforts go towards making the world a better place
- “Don’t be the best woman engineer, be the best engineer, period”
How To Fix The Social Stigma

In order to provide the best opportunity for increasing the number of females to engineering and STEM fields, we need to break past today’s male dominated stereotype of the career.

A better understanding of the factors influencing the academic decisions and persistence of women and URM is necessary.
What Girls Want From A Career

- Females need to internalize the benefits of being an engineer
- WES not only want a job that benefits society and solves real-world problems, but also want to have fun
- They enjoy challenges and will work harder to break stereotypes
Women In The Workplace

- 40% of women who earned engineering degrees quit the profession or never entered the field

- Inadequate training, development and even hostility from peers and managers in the workplace were key factors
Women In The Workplace

- Women who stay in the field have supportive bosses and co-workers that have ‘transparent’ paths for advancement and a “work culture that supports work-life balance for all”

- Most companies don’t accommodate for work-life concerns
Women In The Workplace

The ‘flight risk’ for women occurs because of excessive workload without support, unclear expectations about work goals, and a career plateau with few advancement opportunities.

Women have to learn to be either ‘one of the guys’ to fit in, or blaze their own trail, which is very difficult.

Lack of advancement opportunities lie at the heart of women opting out and/or not leaning in.
Conclusion

- Girls need to be given a chance to explore careers outside of what traditional female roles are.
- Summer and afterschool programs is a great way to engage girls in a variety of hands-on activities by project-based learning at high schools.
- College summer programs designed for high school girls encourage them to pursue a career in engineering.
- Project-based learning demonstrates that projects increase girls' interest in science and engineering.
- Girls learn best when encouraged to construct their own knowledge of the world around them.
Thank you!