Engineering, Ethics & Society: Effective Teams and Leadership

- Log on to UCLA_WIFI
- Go to https://onlinepoll.ucla.edu
- Wait for further instructions

Dr. Gershon Weltman

Engineering 183EW, UCLA SEAS

Lecture 4

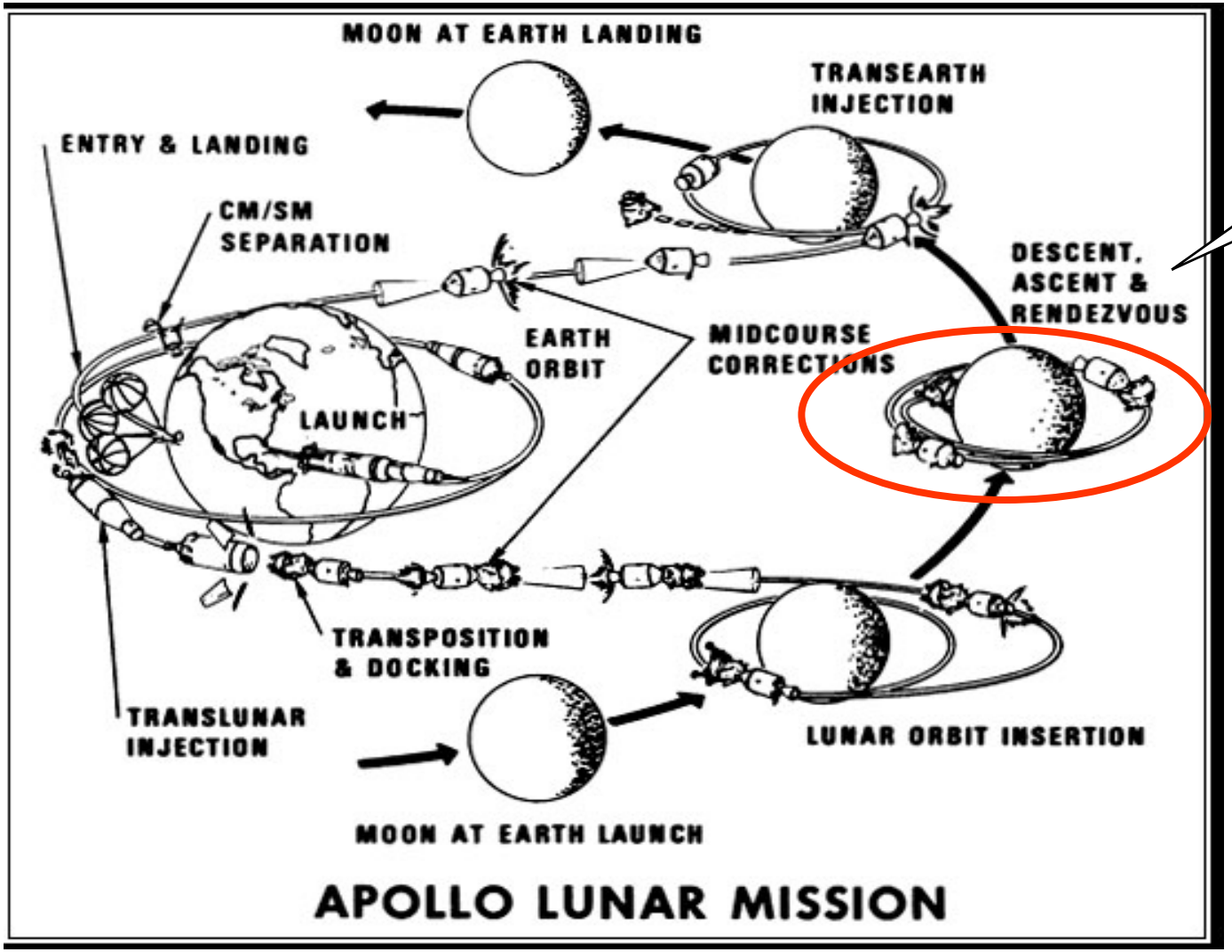
Lecture Contents

- Projects and teams
- Importance of social factors in engineering
- A sample team problem
- Key factors affecting team performance
- Diversity and team success
- Diversity climate at HSSEAS
- Team methodological skills

In Memoriam: Dr. Joseph Miller

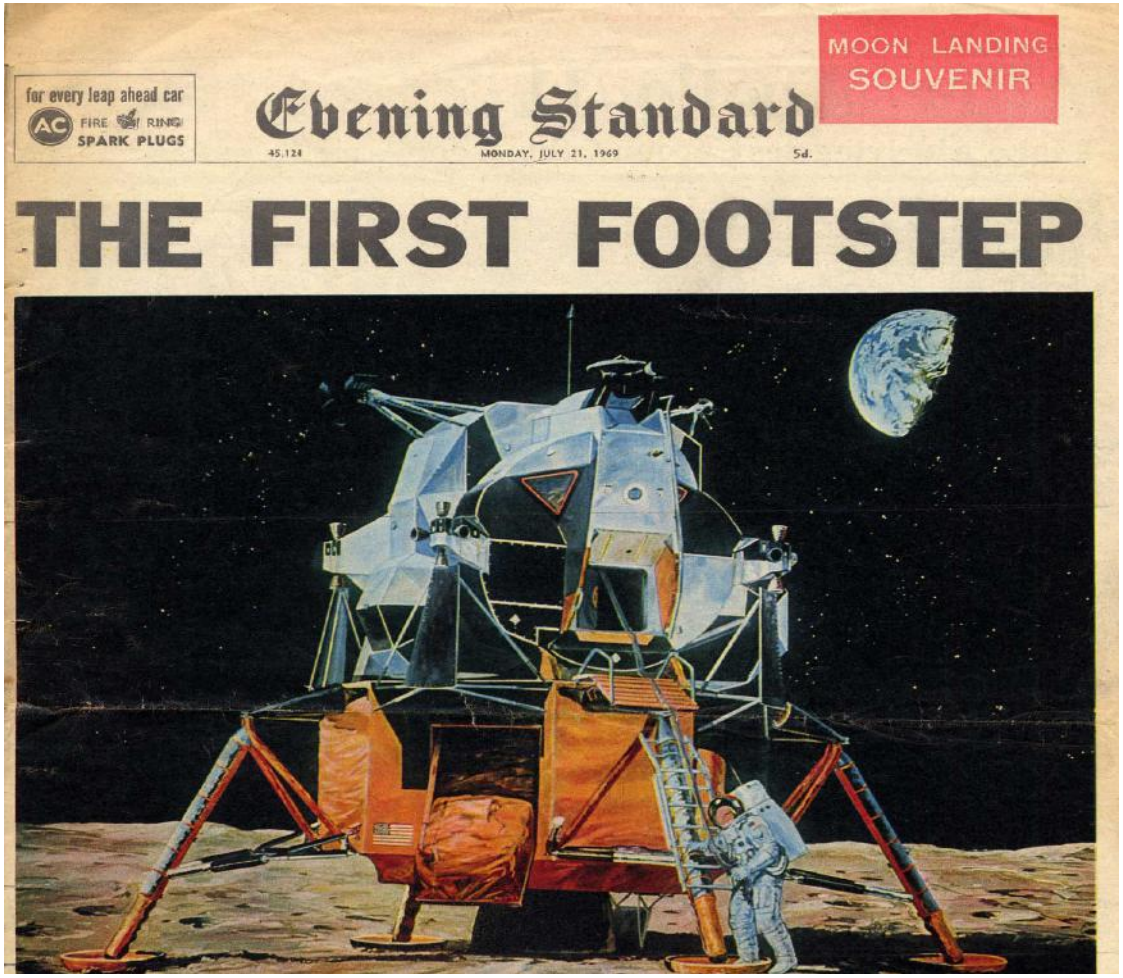
Dr. Browne's and my good friend Dr. Joseph Miller contributed much of the original material for the Teams and Projects lectures. He was killed in a bicycle accident about 14 years ago. This has a special significance here, as I will explain in the next lecture.

The Moon Landing Mission



Dr. Miller's contribution

The Apollo Lunar Module (ALM)



Successful ALM *descent and ascent* depended on the Lunar Decent Engine

Lunar Descent Engine[1] Teams

Teams for Design, Development, Manufacturing, Assembly, Test
- Head End Assembly
- Thrust Chamber Assembly
- Full Engine Assembly

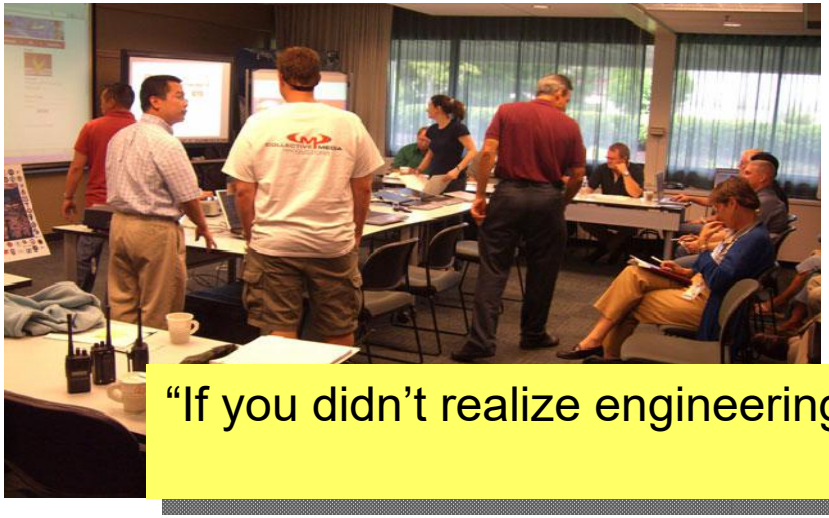
Teams for Project Management:
Systems Engineering, Tasking, Scheduling
Monitoring, Control
Subcontracts, Special Problems

600 People: A Team of Teams

Teams for Facilities:
- Reactant Storage and Delivery
- Thrust Stands, Vacuum Chambers
- Controls, Instrumentation, Data
- Test Operations, Site Services

[1]Developed at Space Technology Laboratories of TRW

Engineering is Fundamentally Social



- Broad Relationship with Society
  - Business
  - Welfare
  - Public Works
  - Infrastructure
  - Information
  - Communication
  - Entertainment
  - Art
- People-Centered Technology
  - *Externally* in its response to critical societal needs and constraints
  - *Internally* in the social dimensions of engineering team processes

"If you didn't realize engineering is a social discipline, you should know it now."
Dr. Joseph Miller

Engineering as a Team Sport

- Teams compete for:
  - Acquisition of contracts and projects
  - Internal resources – funding and personnel
  - Product marketing and sales
- Teams are rewarded and penalized
  - Some win, some lose
  - Rewards of winning are real and substantial
    - Employment and salary
    - Career path and contributions
  - Losing is not disastrous, but generally less beneficial
- Winning depends on:
  - Taskwork skills: Technical capabilities
  - Teamwork skills: Methodological and *social* factors

Top Executives Depend on Social Skills

- *Top Level Executives competencies* according to 300 high technology organizations

- Source:

  Bennett, F. Lawrence, "The Management of Engineering: Human, Quality, Organizational, Legal, and Ethical Aspects of Professional Practice: New York, John Wiley & Sons, 1996

Essential Skills

- Communication - 84%
- Organizational - 75%
- Team Building - 72%
- Leadership - 68%
- Coping - 59%
- Technological - 46%

Project Managers Need Social Skills as Well

- *Management Position* competency requirements at several levels of engineering projects

- Source:

  Shtub, Avraham et al, "Project Management: Engineering, Technology and Implementation," Englewood Cliffs, NJ, Prentice Hall, 1994

Essential Skills

1. Leadership
2. Interpersonal Skills
3. Communication
4. Decision Making
5. Negotiation and Conflict Resolution

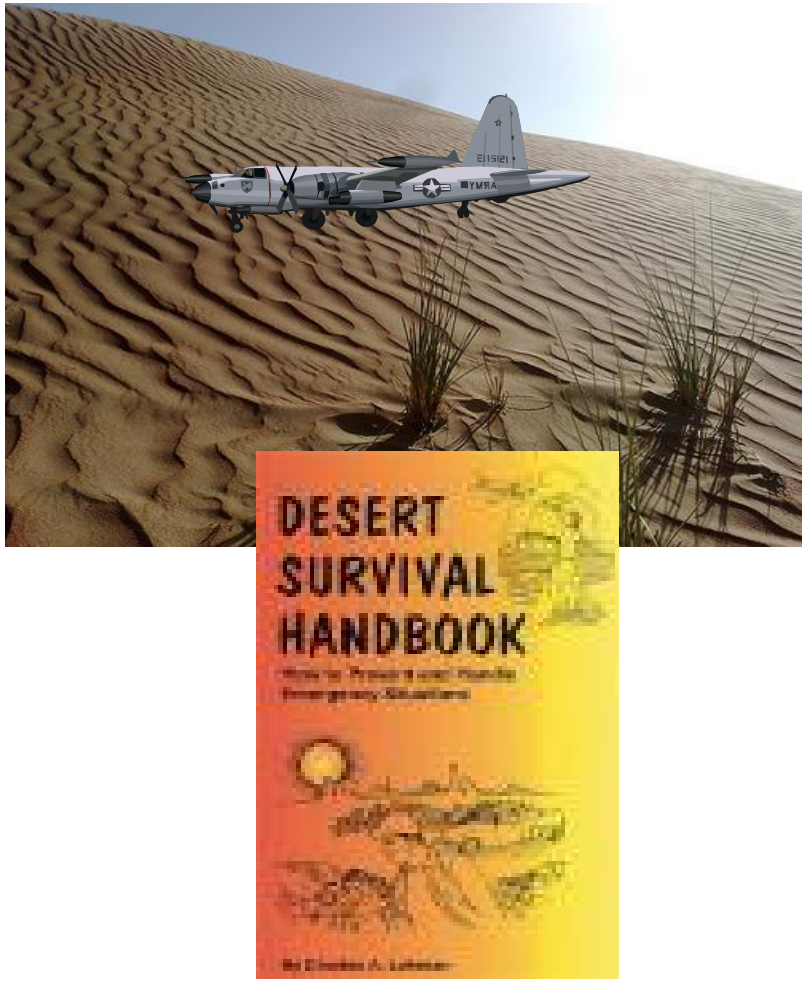
Teamwork Exercise: The Desert Survival Game

- The Situation

  Business plane down in the desert with all passengers OK
- The Problem

  Rank 15 available objects in order of their importance
- The Score

  Summed differences from expert ranking
- Analysis of Score by:
  - Individuals
  - Teams
  - Populations



The Expert Solution

1. **Cosmetic Mirror -** **Powerful daytime signaling device**
2. **Top Coat -** **Thermal insulation adds to survival time**
3. **Water -** **Immediate clear headedness**
4. **Flashlight -** **Nighttime signaling**
5. **Parachute -** **Shade and signaling**
6. **Jackknife -** **Rigging shelter, cutting cactus**
7. **Plastic Raincoat -** **Solar still for cactus (if know how)**
8. **Sunglasses -** **Eye protection**
9. **Pistol -** **Signaling (but dangerous to have around)**
10. **Compress Kit -** **Dehydration limits usefulness**
11. **Compass -** **Possibly signaling, may suggest walking out**
12. **Air Map -** **Toilet paper or fuel for fire**
13. **Animal Book -** **More toilet paper**
14. **Vodka -** **Fire starter/disinfectant/celebration**
15. **Salt Tablets -** **Dangerous during dehydration**

Solution reflects an expert knowledge of survival in hot desert environments

Typical Team Score Summary

	Spring 2012	Fall 2012	Winter 2013
Range	10 - 90	34 - 84	26 - 87
Median	60.0	63.0	60.0
Mean	58.8	59.8	60.4

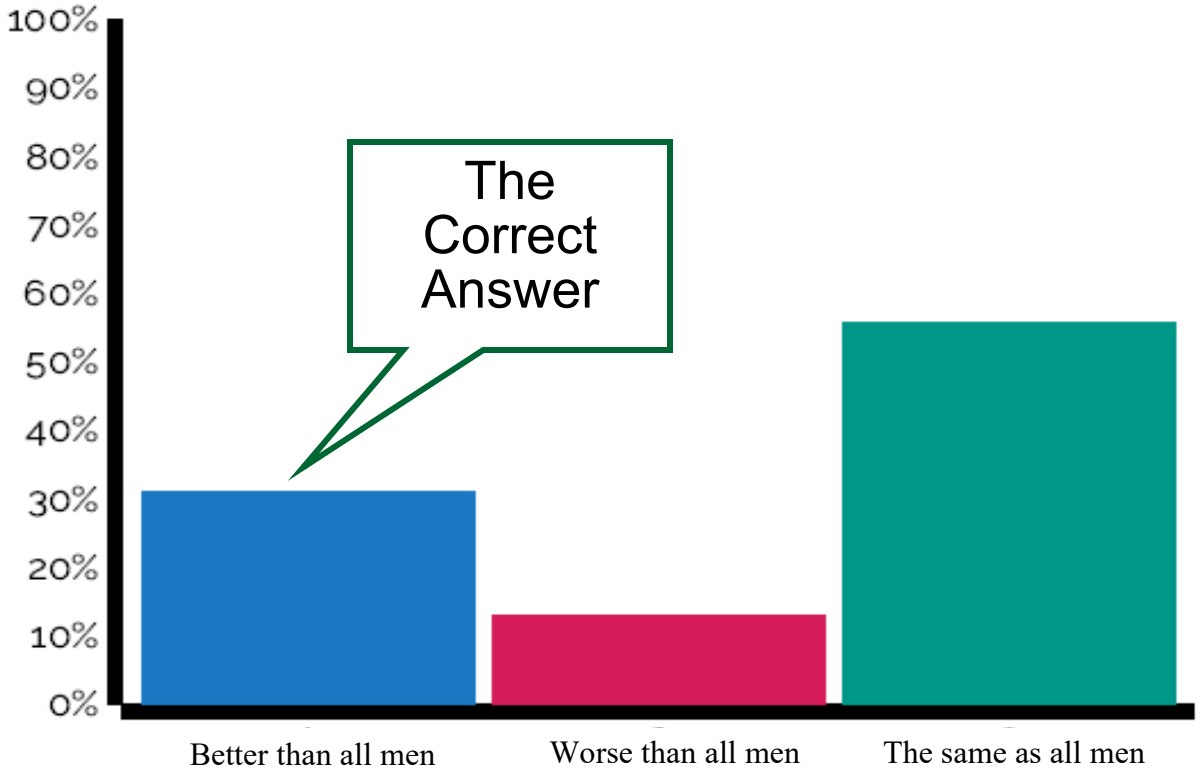
Team Score Comparisons

	Average Historical	Average Engr 183EW
Populations		
College Students	60	58 – 64.5
Junior High School Students	Better	
Senior Executives	Better	
Men and Women		

- Log in to UCLA_WIFI or UCLA_WEB
- Go to **https://onlinepoll.ucla.edu**
- Search for **Engr183EW–Survival**
- **Password - 1234**
- Answer the 2 multiple choice questions
- Hit “SUBMIT”
- Finish in 3-5 minutes

Onlinepoll Results

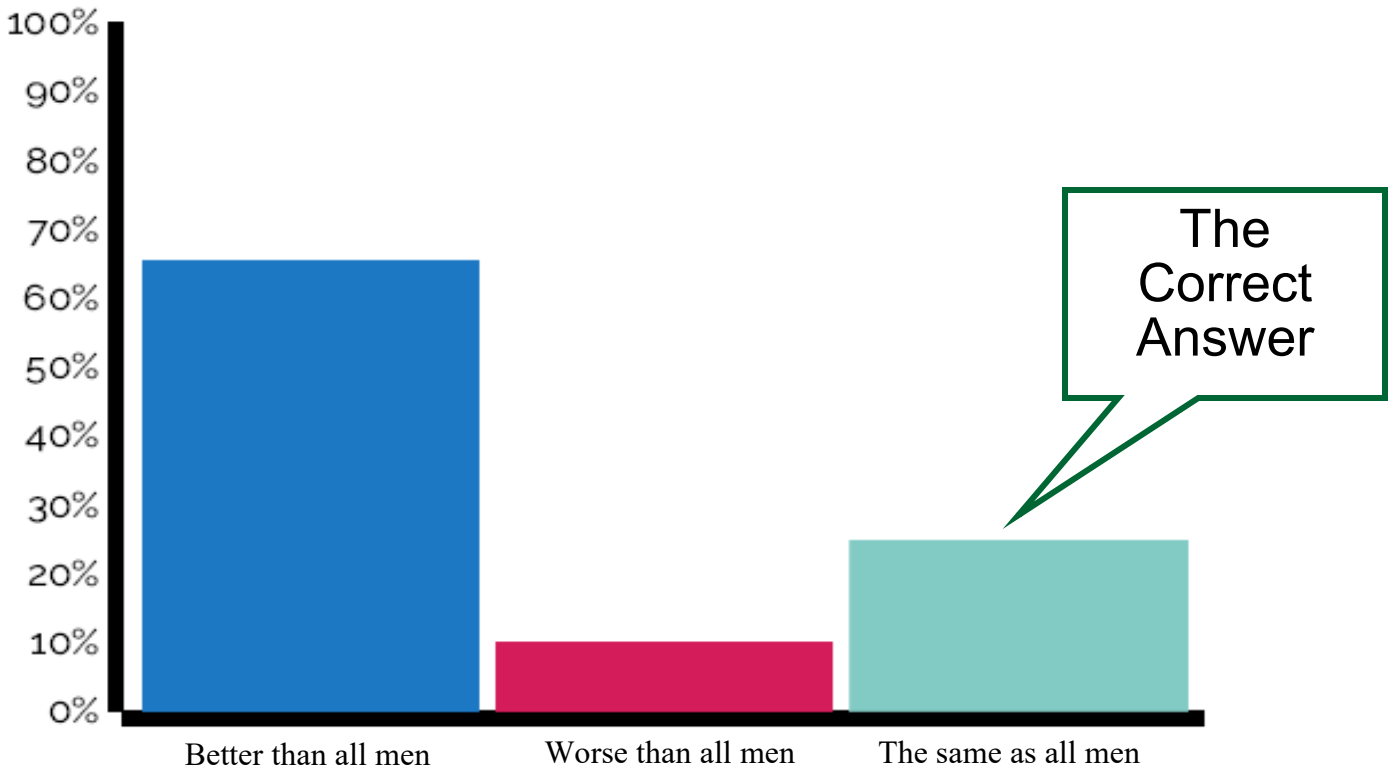
If the survival team is composed of ALL women; the team will do:



Previous studies showed that all-women teams did better than all-men teams.
These poll results, where ~90% of the respondents said 'better' or 'the same,'
may reflect a new acceptance of women as standard members of engineering teams.

Onlinepoll Results

If the survival team is MIXED men and women; the team will do:



Studies show that mixed teams will historically do about the same as all-men teams. One conclusion is that the women's contributions were not making it into the mixed teams before. This may not be as true today – we can hope so.

Team Score Comparisons

	Average Historical	Average Engr 183EW
■ Populations		
❑ College Students	60	58 – 64.5
❑ Junior High School Students	Better	
❑ Senior Executives	Better	
❑ Men and Women	Depends	

- Individuals vs. Teams:
  - Which is better?
  - What does it mean?
- What Leads to Team Success?
  - *Technical Skills – Knowledge of the domain*
  - *Methodological Skills* -- Working together as a team
  - *Social Skills* – Interpersonal factors at the team level

Many Factors Affect Team Performance…

- Ability
- Achievement
- Achievement Motivation
- Aggregated individual characteristics
- Attitude Similarity
- Cognitive Ability
- Creativity
- Dependability
- Familiarity
- Flexibility
- Goal striving
- Heterogeneity (Diversity)
- rewards)
- History of rewards (i.e., competitive vs. cooperative)
- Homogeneity
- Interpersonal KSA*
- Knowledge distribution
- Membership change/membership stability/team familiarity
- Openness to experience
- Perception of coworker task compensation
- Preference for group work
- Prior experience
- Prior performance
- Self -efficacy
- Self -Management KSA*
- Status
- Team Size

*Knowledge, Skills and Abilities

Source: Eduardo Salas and Marvin Cohen, Perceptronics Solutions, 2007

…but Three are Essential

1. *Communication*
2. *Leadership*
3. *Emotional Intelligence*

These are the qualities of members and leaders that contribute most directly to the success of an engineering team, and of an entire enterprise.

Communication Skills

- Exchanging
  - Presenting - effective use of language, ability to speak presentably, writing skills, skills of persuasion.
  - Listening - paying attention, inquiring, clarifying,, summarizing, reflecting, not thinking about something else, not interrupting,

Active Listening

1. ***Really listen*** **to the person who is speaking**
   Listen with the goal of understanding what the person is telling you, whether you agree with what they say or not.
2. ***Do not interrupt*** **with your own thoughts**
   Keep your focus on the speaker, not yourself. Avoid saying things like, “Oh, that happened to me too,”
3. ***Show signs*** **you’re really listening**
   Nod or acknowledge what they’re saying by using words such as: “yes,” “okay,” “go on,” or “really?”
4. **When they are finished, *summarize* what they said**
   Provide a brief summary of what the person just said including any feelings they shared. This provides proof that you heard the person and also calms their nervous system.
5. **End by asking, “*Did I get that right*?”**
   This question lets the speaker know that you really want to understand what they’re saying. It also gives the speaker a chance to clarify anything.

From Darlene Mininni, PhD, MPH; UCLA Training and Development

Communication Skills

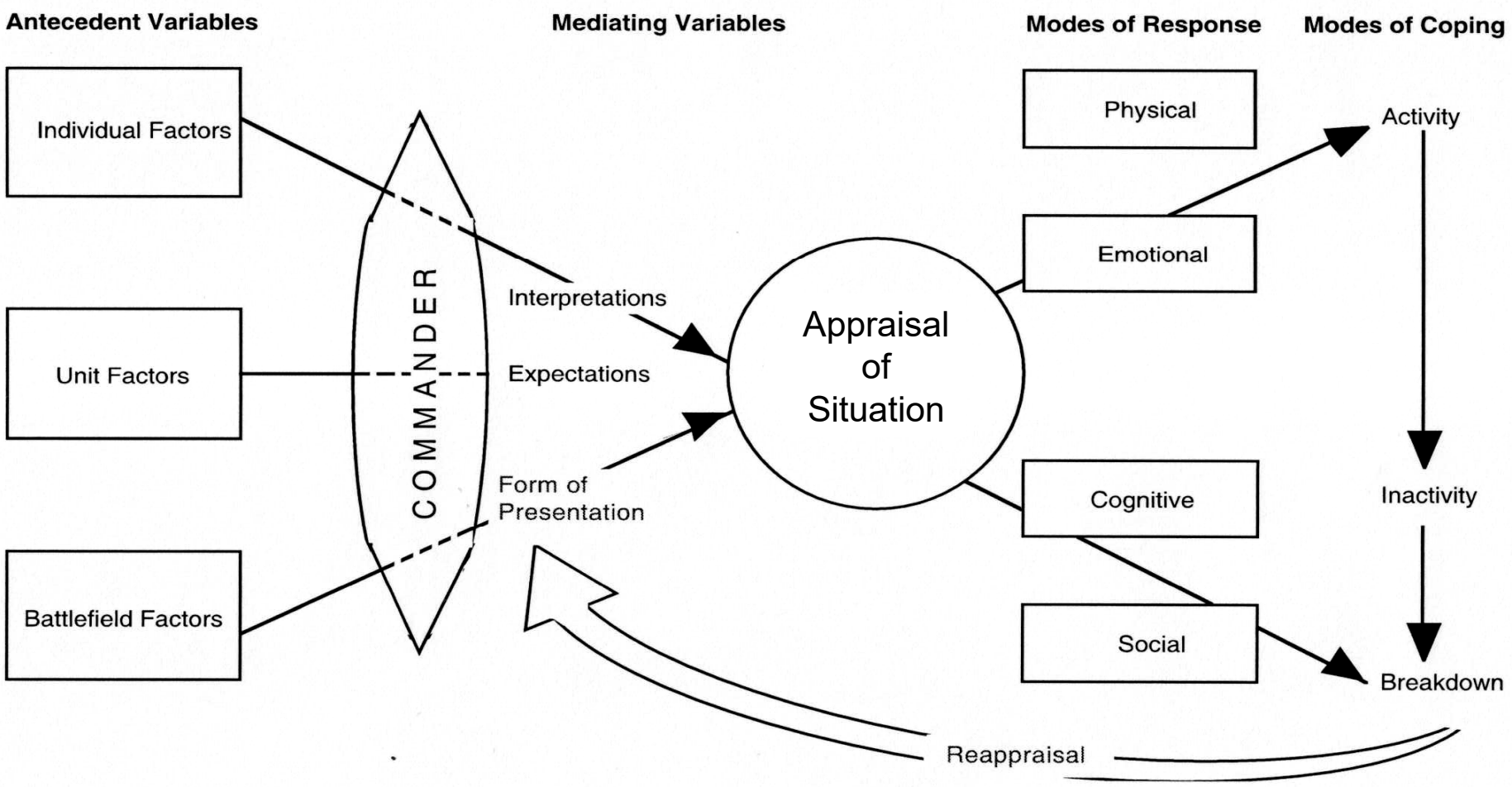
- Exchanging
  - Presenting - effective use of language, ability to speak presentably, writing skills, skills of persuasion.
  - Listening - paying attention, inquiring, clarifying,, summarizing, reflecting, not thinking about something else, not interrupting.
- Supporting
  - Assuming others' opinions are useful, pointing out positive aspects, creating opportunities for others to speak, building on others' ideas,
  - Being open, friendly, empathetic, motivating, not controlling, not criticizing, not using negative body language.
- Differing
  - Dealing with intra-team conflicts. Arguing constructively.
  - Not retreating or changing positions just to avoid confrontation.
- Participating
  - Standing firm, not withdrawing or deferring to more aggressive members
  - Involving others, giving all an equal chance, not letting one or two dominate

Good Leadership Facilitates Team Success

- Good Leaders Enable Other to:
  - Make their Contribution
  - Realize their Potential
  - Achieve Satisfaction from their Work
- Leaders' Roles Can Include:
  - Acting as Servant to Team
  - Executing Covenants vs. Contracts
  - Providing Motivation
  - *Defining Reality*

Source: *Max DePree "Leadership is an Art", Bantam Doubleday Dell, New York, 1989*

The Leader as Lens



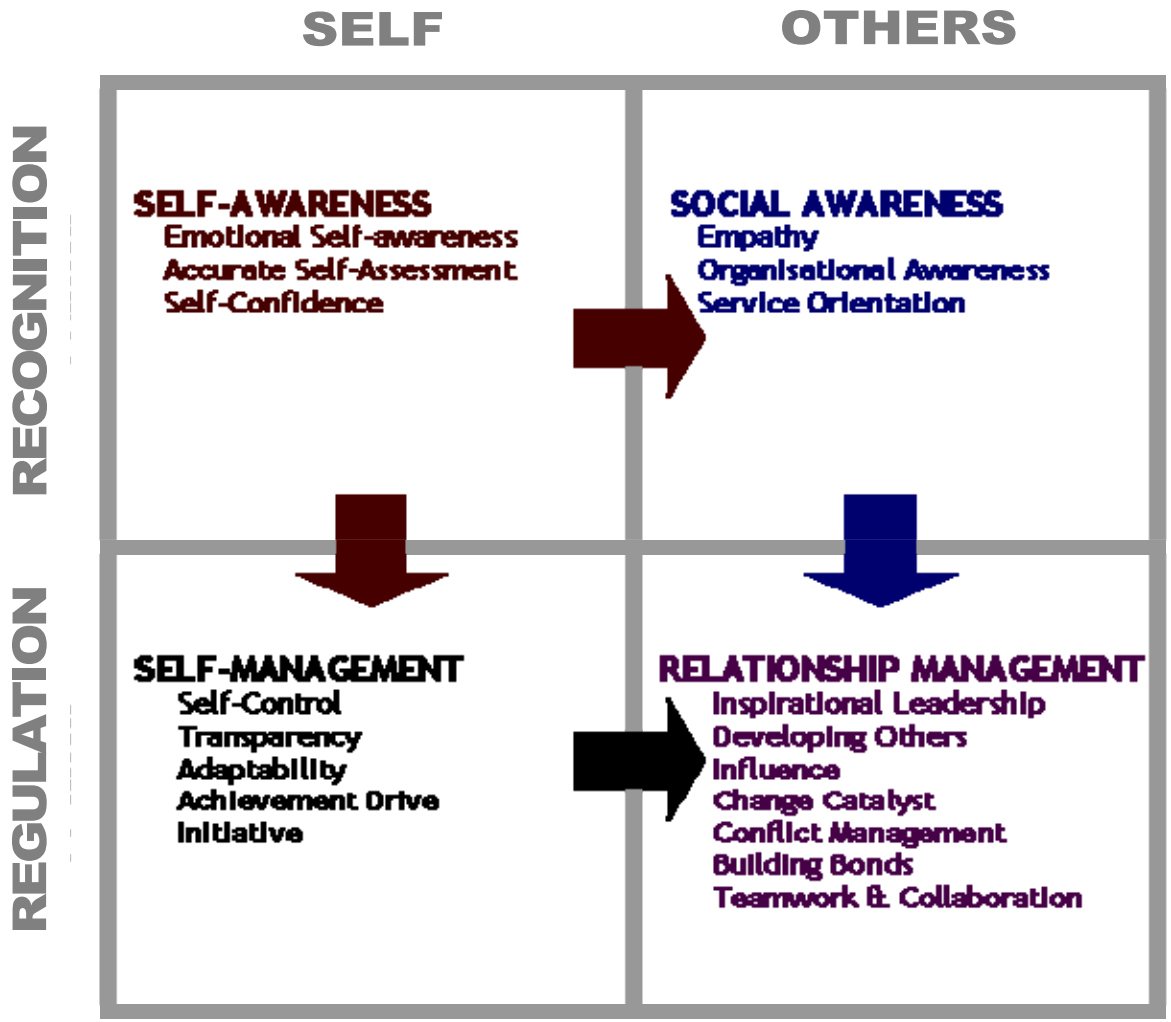
*Reuven Gal, Ph.D. and Franklin Jones, M.D, (1995). A Psychological Model of Combat Stress. In War Psychiatry, US Office of the Surgeon General, Washington, DC

Good Leadership Requires Emotional Intelligence

- **Self-Awareness** — Ability to recognize your own moods, emotions and drives; ***and to understand your effect on other people***
- **Self-Regulation** — Control of impulses and emotions, thinking before acting
- **Motivation** — Imparting meaning beyond money or status
- **Empathy** — Understanding others' emotional makeup, skill in treating others accordingly
- **Socialization** — Managing relationships, building networks, finding common ground/rapport

Source: D. Goleman, *What Makes a Leader,* Harvard Business Review, Nov-Dec, 1998

Goleman Emotional Intelligence Paradigm



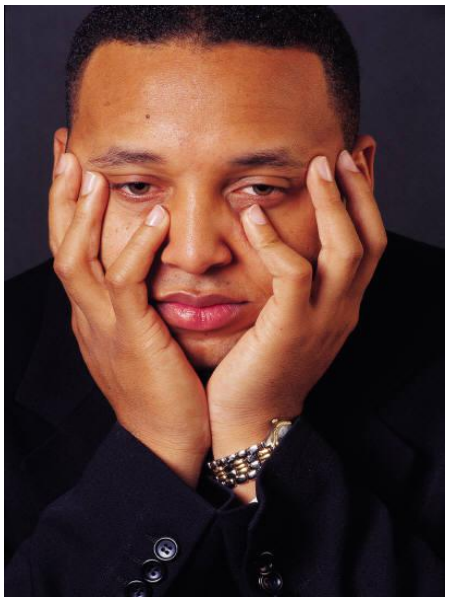
See http://www.danielgoleman.info/topics/emotional-intelligence/

Emotional Intelligence and Outcomes

- "Our research shows an incontrovertible link between an executive's emotional maturity and his or her (business) performance. Simply put, the research showed that "good guys" – that is, emotionally intelligent men and women – generally finish first."
- "High levels of emotional intelligence create climates in which information sharing, trust, risk-taking and learning flourish. Low levels of emotional intelligence create climates rife with fear and anxiety."

*Daniel Goleman, Richard Boyatizis and Annie McKee, Harvard Business Review, Dec 2001

The Leader's Emotions Count Heavily



- "We found that of all the elements affecting (business) performance, the importance of the *leader's mood and its attendant behaviors* are most surprising."
- "To be more specific, the leader's mood *is quite literally contagious*, spreading quickly and inexorably throughout the (organization).
- "A leader needs to make sure that not only is she regularly in an optimistic, authentic, high-energy mood, but also that through her *chosen actions*, her followers feel and act that way, too"

*Daniel Goleman, Richard Boyatizis and Annie McKee, Harvard Business Review, Dec 2001

Six Additional Factors are Also Important

1. *Communication*
2. *Leadership*
3. *Emotional Intelligence*
4. Team Orientation
5. Adaptability
6. Motivation
7. Trust
8. Feedback
9. Diversity

Source: Eduardo Salas and Marvin Cohen, Perceptronics Solutions, 2007

Diversity and Team Success

Research[1] has shown that team diversity:

- Improves Active Thinking

  Diversity promotes positive changes in *creativity, active thinking processes, intellectual engagement and motivation, and learning skills*.

- Improves Critical Thinking

  Diversity in work groups increases *tolerance of ambiguity, and the ability to recognize flaws in potential actions*.

- Improves Management Skills

  Managers who are effective with a diverse staff are more likely to succeed in a workforce driven by new worldwide demographics

[1]Prof. Sylvia Hurtado, Director of UCLA's Higher Education Research Institute (HERI)

Diversity in a Engineering Enterprise

Diversity relates to various forms of individual characteristics including:

- *Race and/or ethnicity*
- *Economic background*
- *Sex and/or gender*
- *Sexual orientation*
- *Religion*
- *Certain disabilities*

Political affiliation is usually not included. Should it be?

Diversity Emphasis at UCLA

The College of Letters and Science:

- Requires one course from a faculty-approved list of Diversity Courses
- Diversity Courses teach academic views of diversity and its effects
- Rationale for “Diversity Knowledge”
  - Global society is increasingly diverse, complex and interrelated
  - Students must have the ability to understand the perspectives of others with differing views, background and experiences
  - Enhance individual development as well as campus climate

The HS School of Engineering and Applied Science:

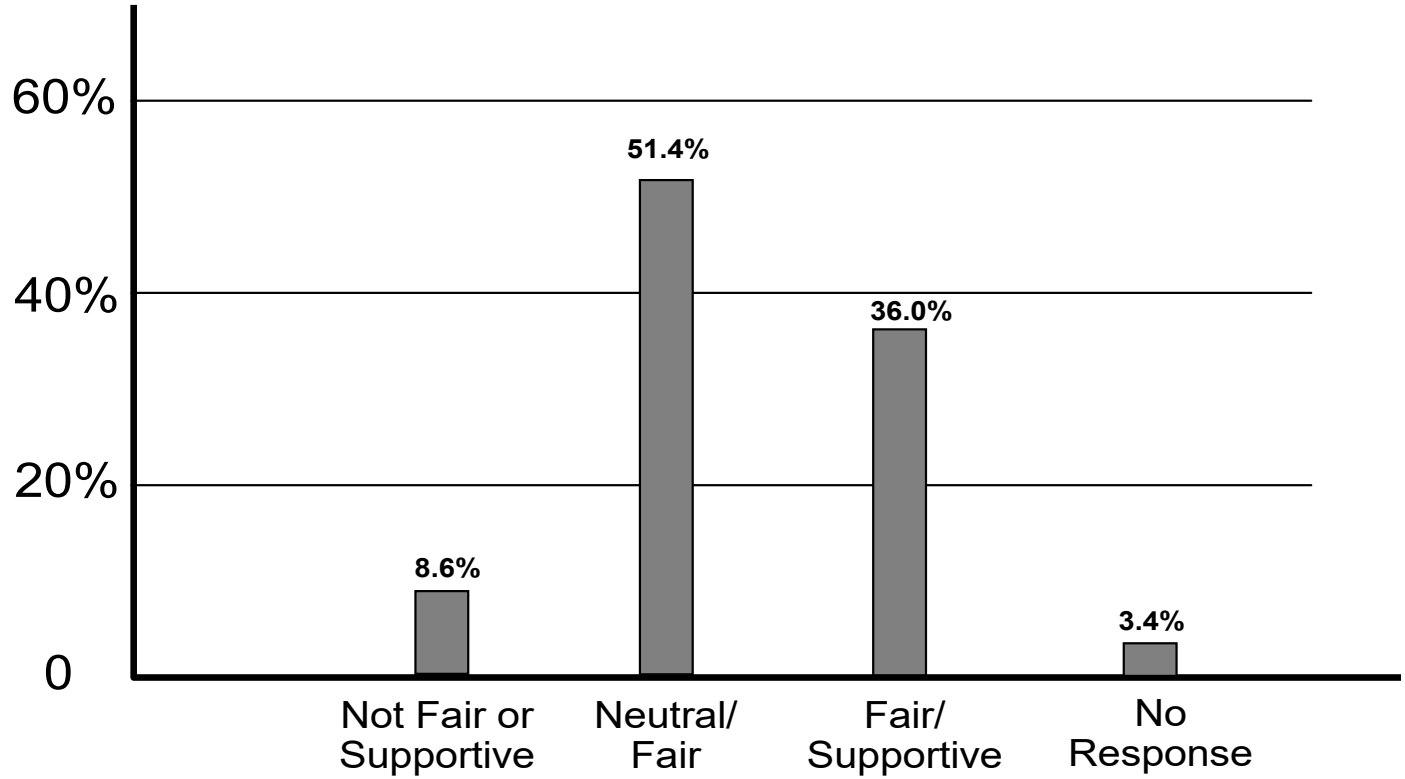
- Is not bound by the Letter and Science requirement
- But likewise sees the value of Diversity Knowledge
- Wants to incorporate Diversity Knowledge into curriculum and practice
- Formed a Diversity Committee in 2016 to inform and advise the Deans

HSSEAS Diversity Committee Objectives

- Prepare engineering students *to be effective as leaders* in today's diverse working environments
- Teach engineering students *how best to manage diversity* in project teams
- Show engineering instructors *opportunities to incorporate* diversity knowledge in courses
- Encourage engineering students and instructors *to promote effective diversity* in school and at work

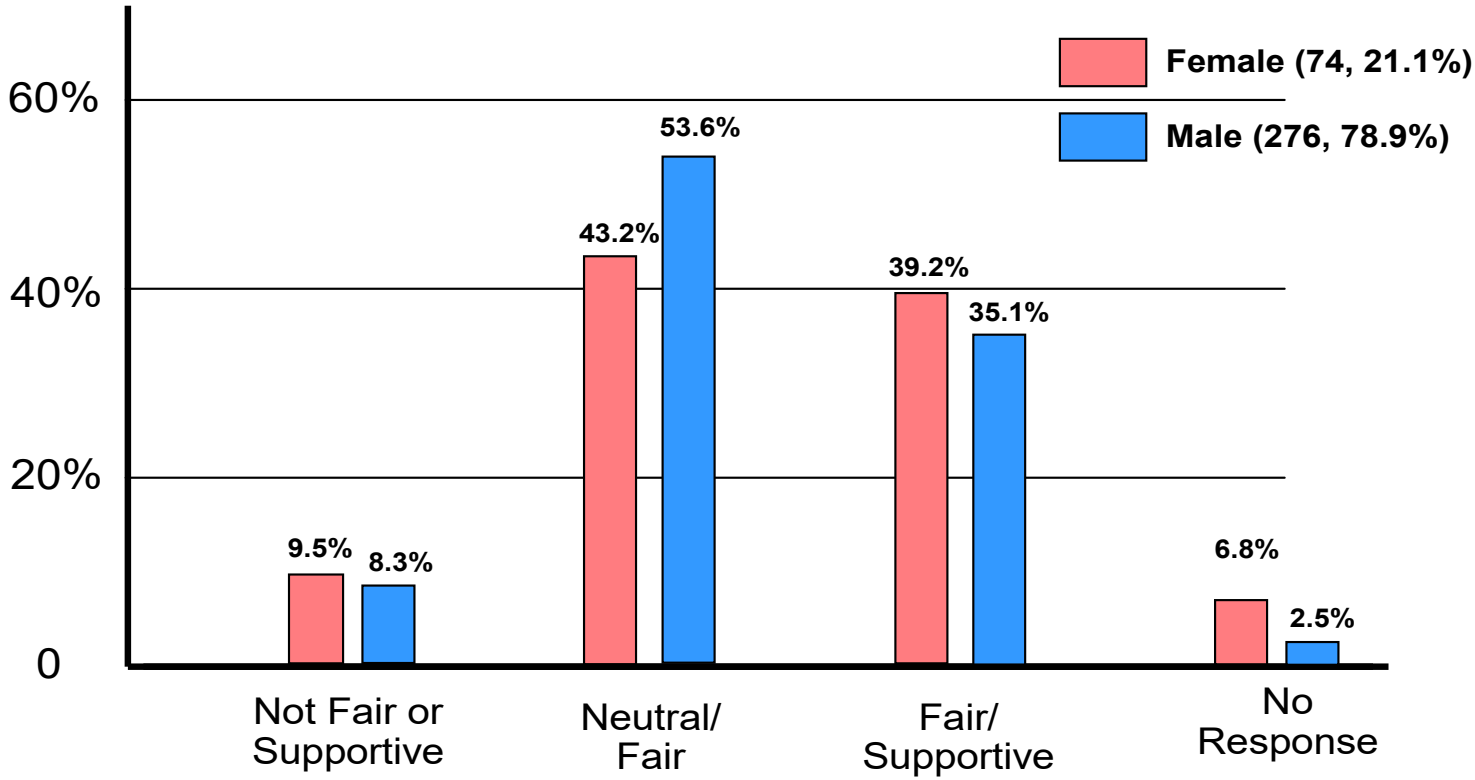
Engr 183EW gave us a chance to help accomplish these objectives, and we started the committee's work with a student survey. The SEAS survey included 350 autobiographies from Winter 2016 and Spring 2016 quarters

Diversity Climate at HSSEAS: All Students[1]



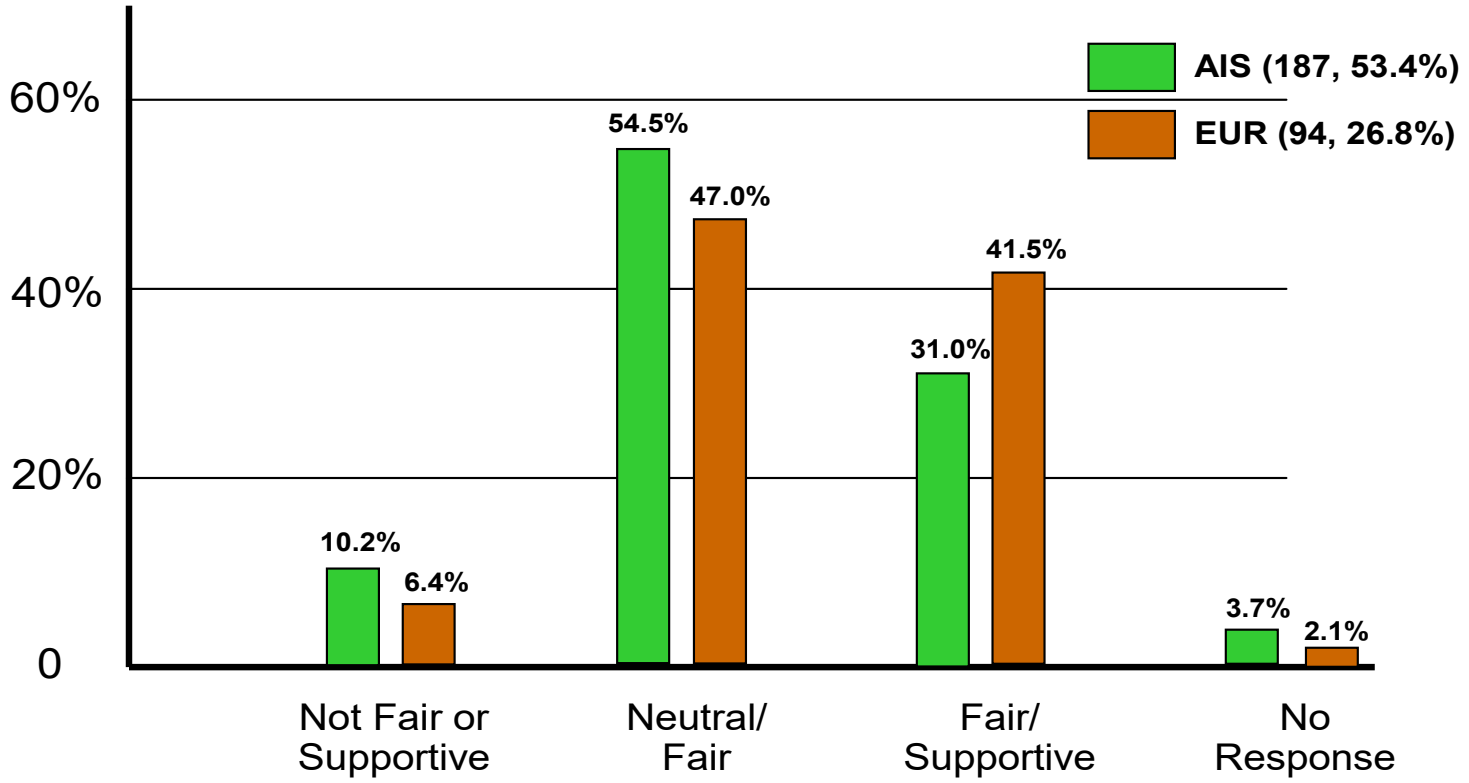
87% of students felt that the SEAS climate is neutral/fair or fair/supportive,

Diversity Climate by Gender



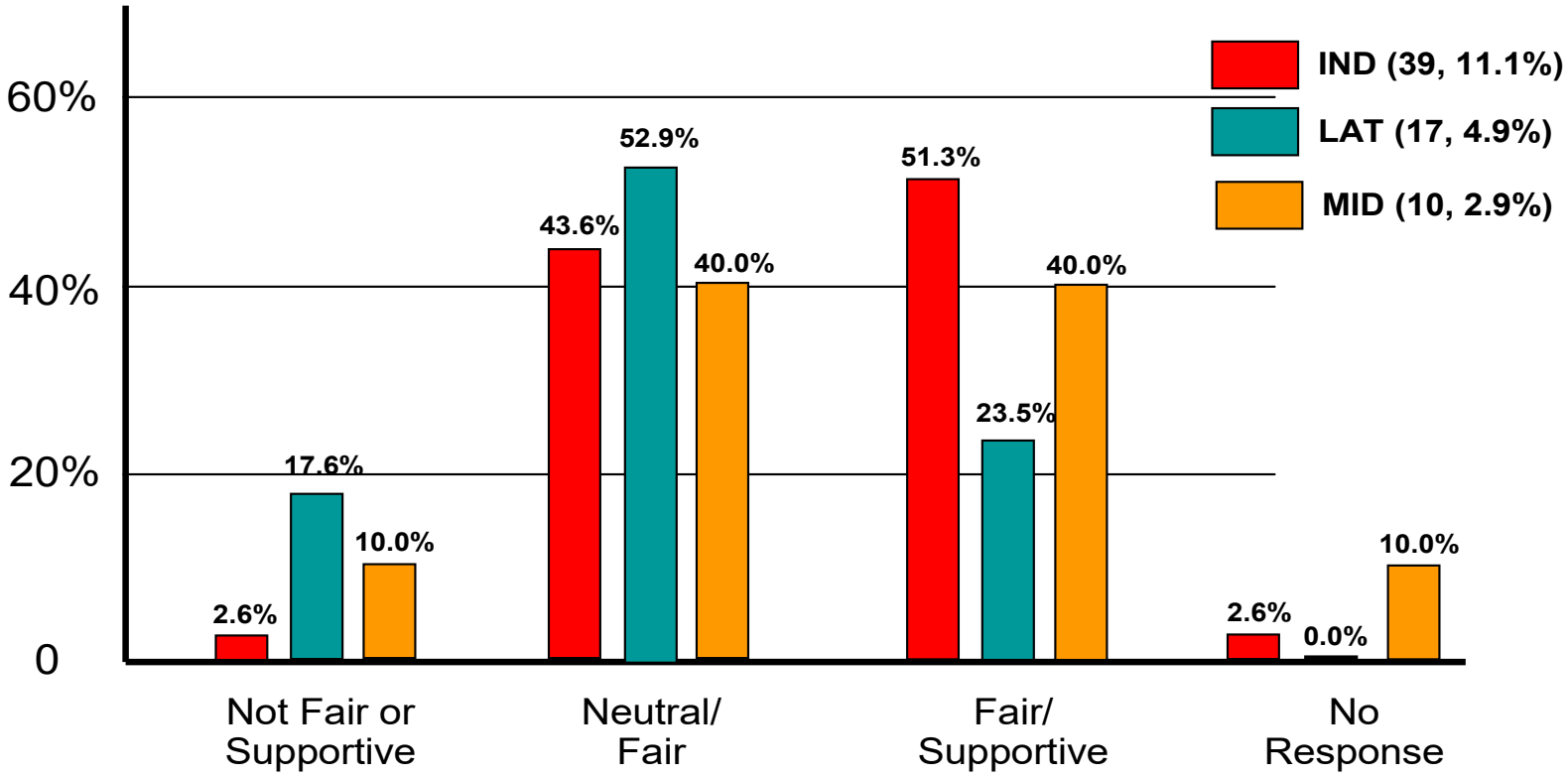
The overall ranking was much the same for female and male students,

Diversity Climate by Most Represented Ethnicities



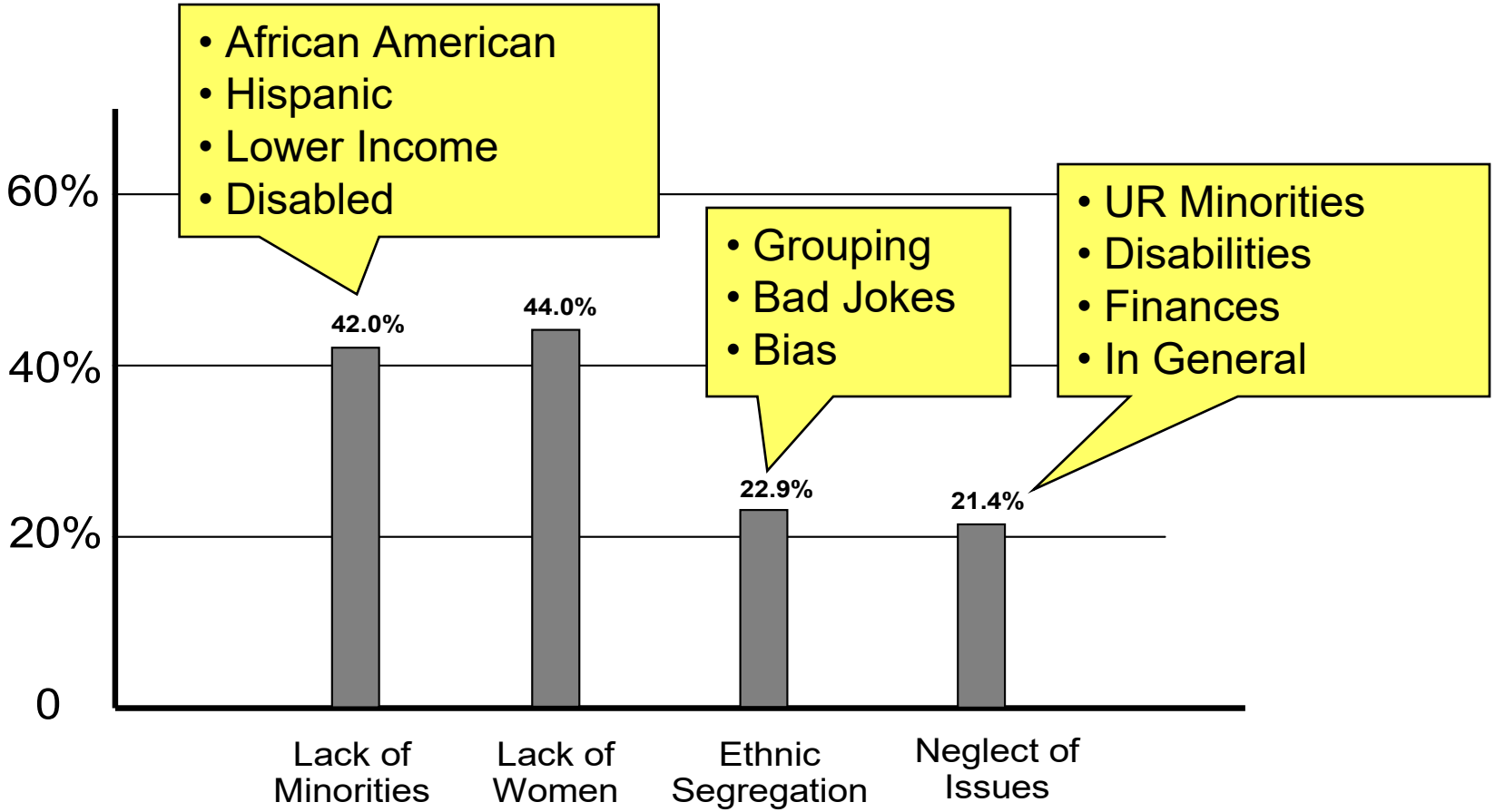
The rankings were also about the same for the most represented ethnic groups,

Diversity Climate by Less Represented Ethnicities



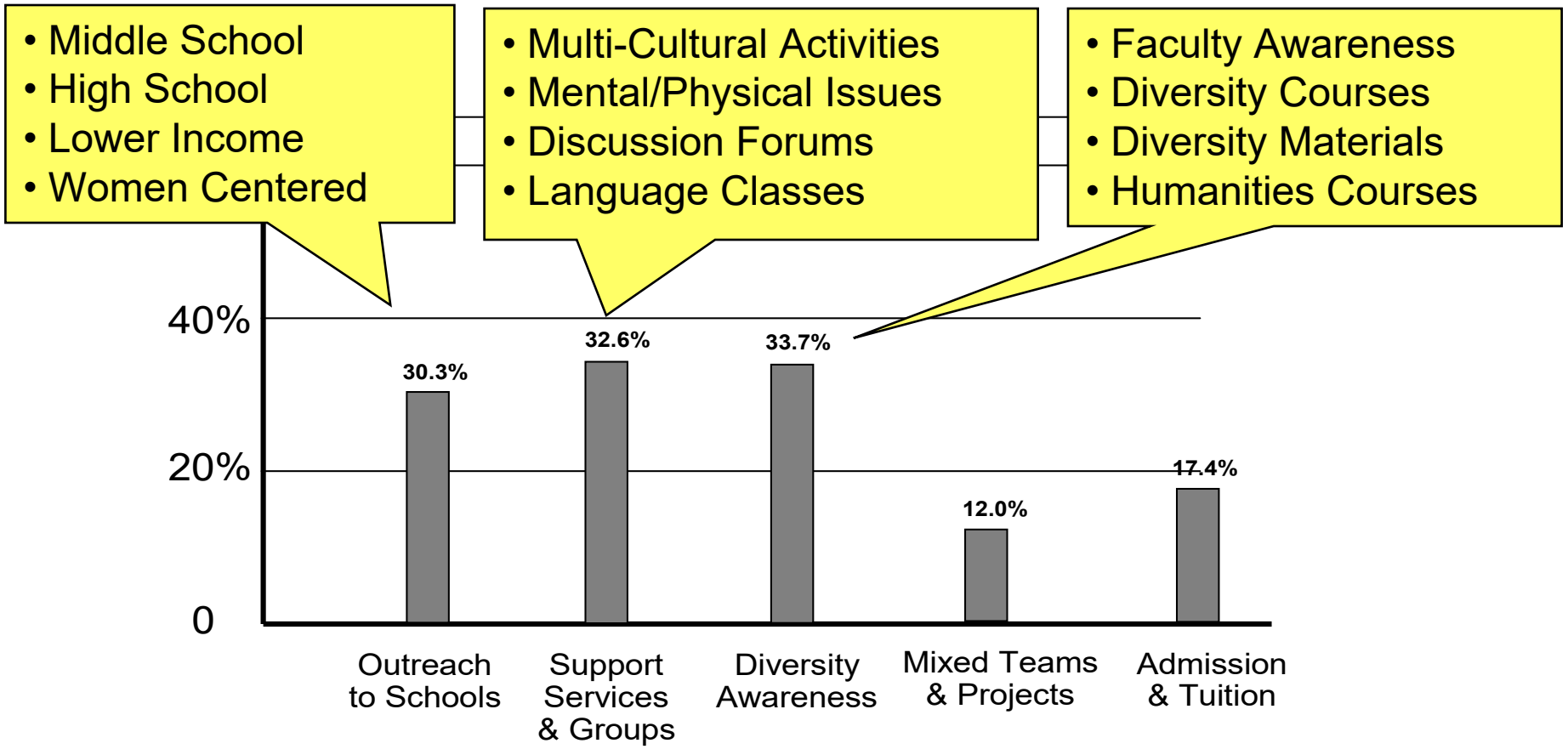
The rankings differed somewhat for the less represented ethnic groups, with divergent ratings for “not fair” or “fair/supportive” and lower ratings for “neutral/fair”

Diversity Issues, All Students



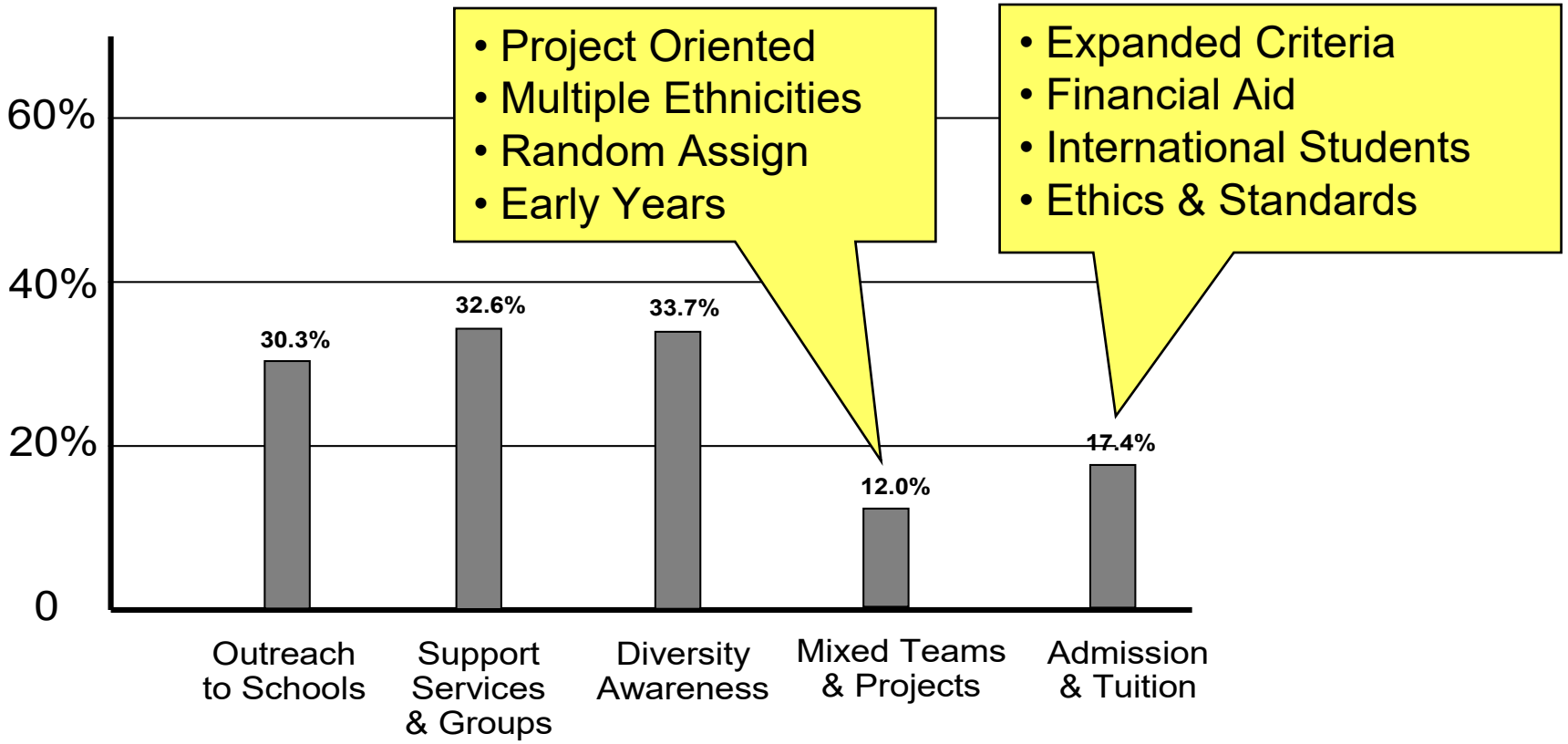
The outstanding issue were the small proportion of under represented minorities and of women; other issues are ethnic isolation and neglect of issues by SEAS

Improvement Suggestions, All Students



The leading suggestions for improvement involved early contact with minority and female students, support once they're here, and courses or modules in SEAS.

Improvement Suggestions II, All Students



The leading suggestions for improvement involved early contact with minority and female students, support once they're here, and courses or modules in SEAS.

Initial Conclusions from Student Survey

- Overall Fair/Supportive Climate at HSSEAS
- Significant room for improvement, and credible suggestions on how to do so
- Relative uniformity across categories, with some gender and ethnic differences
- Conclusion: “Thinking like engineers” rather than by gender or ethnic identity

It is important to remember that the survey looked at only two observed dimensions of diversity – gender and ethnicity. There are many more dimensions – e.g. nationality, economic status, disability, sexual orientation, politics, etc. – that must be considered in today’s increasingly diverse engineering teams.

Critical Diversity Problem Areas

- **Competency Proving** -- Women and members of minority groups repeatedly have to demonstrate that they are technically qualified and capable of holding the position they occupy.
- **Failure to Differentiate** - A member of a minority group is:
  1. Assumed to be a representative for all that group.
  2. Mistaken for another person of that group.
- **Sexual Innuendo**. A teammate's request for technical assistance or collaboration is taken as a romantic advance or a suggestion that he or she would like a date or more.
- **Micro-Aggression**. An action or remark, typically made in the form of a compliment, often without knowledge that it is offensive to the individual because it is insensitive or actually demeaning.

Common Micro-Aggressions

Examples of Micro-aggressive Remarks

- You're very different from all the other _____s.
- You speak very good English for a _____.
- You're very good in Math for a _____.
- As a _____, what do you think about it?
- You must have gotten this position because you're a _____.
- Where are you from?

The ability to recognize, understand and avoid micro-aggressions requires a combination of social knowledge and personal empathy.

Racist Micro-Aggressions

Examples of Racist Micro-aggressive Remarks

- What I said/did is not racist.
- Are you sure that is how they meant it? Are you sure that is what they said? Are you sure that is what happened?
- I never dated a _____ person. Our babies would look so cute.
- You are so exotic.
- I am not a racist, I have a _____ friend.
- People say the N-word all the time! They say it in music lyrics and in movies!

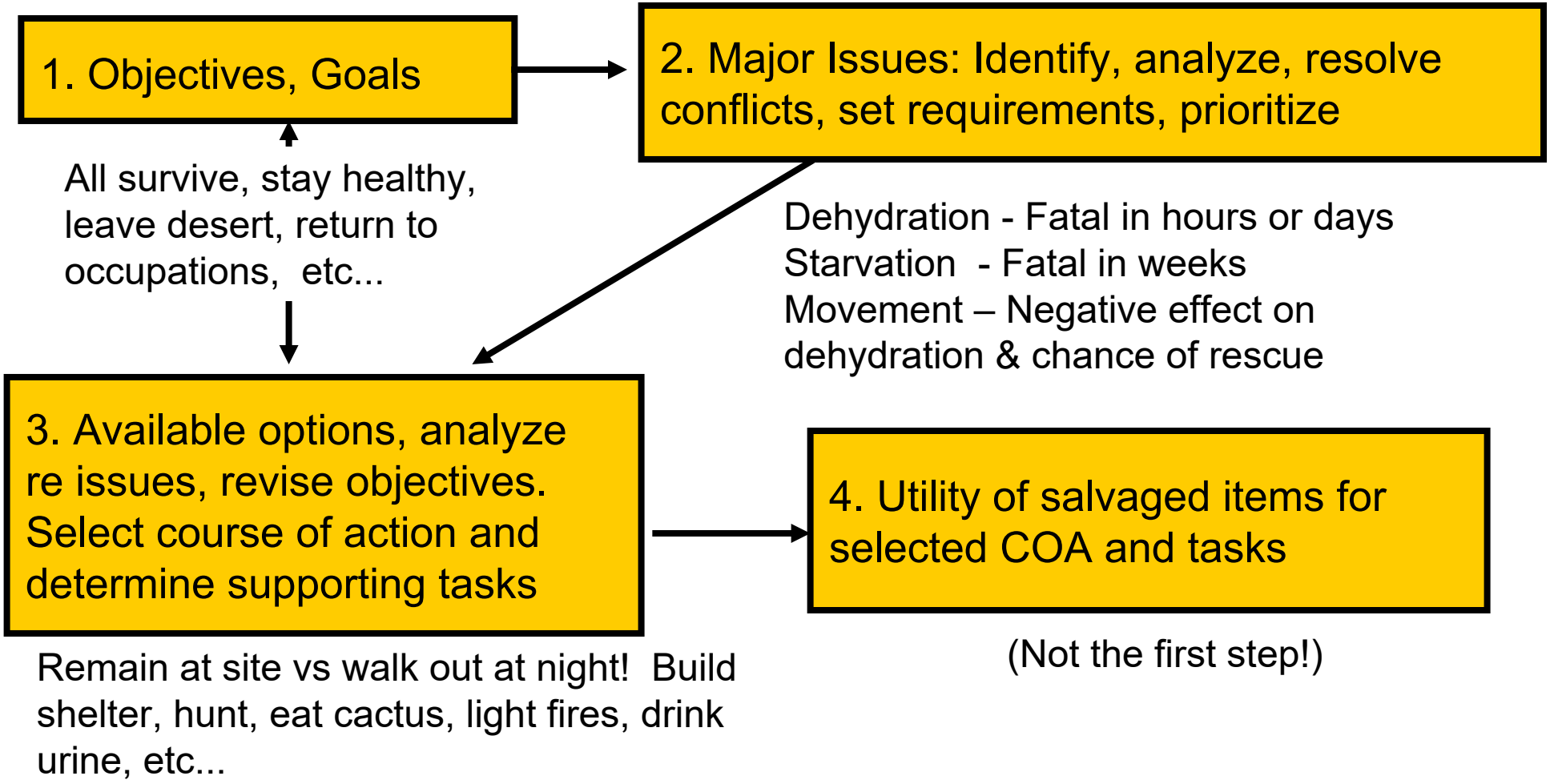
Ono Mergen posted these examples on June 16, 2020 as part of her article "Seemingly harmless racist phrases to avoid around your BIPOC friends"

Team Methodological Skills

- Establishing a Process
  - Sequence and logic. Deciding on the methodology. Differentiating facts and assumptions. Recognizing unknowns and acting to address them.
  - Defining objectives, final product, time available, time distribution
  - Objectives. Goals, issues, requirements, prioritization, tasks
- Analyzing the Situation
  - Keeping facts and assumptions separate, assessing uncertainties, not allowing opinions to pass as facts
  - Not pursuing actions prior to discussing goals and constraints
- Developing Alternative Courses of Action
  - Taking time to identify, discussing and analyze relative merits, considering both benefits and costs or adverse consequences
  - Not focusing early on one strategy or dismissing alternatives prematurely
- Making the Decision
  - Criteria, logic, analysis, form of decision
  - Minimum cost vs highest value; least adverse vs best consequences

Desert Survival – A Methodological Approach

First discuss and agree on the process for addressing the problem



The 10 Commandments of Team Ethics

1. *Respect* your teammates' knowledge and expertise
2. *Listen to* and seriously consider teammates' opinions
3. *Share* your knowledge and ideas
4. *Help* others to achieve their potential
5. *Acknowledge* others' accomplishments
6. *Emphasize 'We'* instead of 'You' or 'I'
7. *Defend* (reasonably) the team when challenged
8. *Benefit from diversity* of background and experience
9. *Avoid* discomforting or offending team members
10. *Treat your teammates as you would wish to be treated; do not treat them as you would not want to be treated.*

In Summary

- Engineering is a *team-based technical and social activity*
  - Technical issues: Complex problems, multiple possible solutions
  - Social issues: Teamwork, interpersonal factors, ethical considerations
- Team Success = *Technical Skills* + *Social Skills*
  - Social skill set includes leadership, communication, motivation, adaptation, negotiation, decision making
  - Good leadership using emotional intelligence is highly beneficial
  - These skills can be learned and practiced
- Social skills will affect one's professional advancement
  - As a team member on engineering projects
  - As a leader of engineering teams and/or organizations
  - As a contributing citizen of America and/or The World