SLAM
Symposium on Learning Analytics at Michigan

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THE EFFECT OF SKEWED GENDER COMPOSITION ON STUDENT PARTICIPATION IN UNDERGRADUATE ENGINEERING PROJECT TEAMS

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Student group projects are common in engineering and other fields.

Small groups develop a project and present it using PowerPoint at the end of the term.

Students value presentation experience, but they may be vulnerable to stereotyping processes.
Social science research findings

- Men show assertive, and women affiliative speech in mixed gender groups.
- Women in science and engineering are vulnerable to stereotype threat, and are likely to experience minority status or solo status.
- These can lead to impaired performance and lowered motivation and self-efficacy in science and engineering among women.
Gendered Roles

- Do men adopt more technical roles than women in engineering group project presentations?
- If so, what are the implications for learning?
  - People “learn by teaching”
  - Academic self-efficacy develops through active participation
- Can gender differences in passive/active role adoption lead to gender differences in learning? What can we do about it?
Research Initiation Grant in Engineering Education (NSF-RIGEE)

- Part 1a: Archived videotaped presentations
- Part 1b: Survey data
- Part 2: Focus Groups
- Part 3: Laboratory Experiment
Part 1: Analysis of Videotaped Footage

- Engineering 100: Introduction to Engineering
  (FALL 2008 - WINTER 2011)

- Group project presentations are routinely videotaped for archives
<table>
<thead>
<tr>
<th>Team Composition</th>
<th>Analysis Categories</th>
<th>Teams</th>
<th>Women</th>
<th>Men</th>
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<tbody>
<tr>
<td>All Women</td>
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<tr>
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<td>70</td>
<td>19</td>
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<tr>
<td>Two Men</td>
<td>Dominated</td>
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<td>227</td>
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<tr>
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<tr>
<td>Totals</td>
<td></td>
<td>421</td>
<td>469</td>
<td>1470</td>
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</tbody>
</table>

☐ N = 739 in today’s presentation
Part 1: Analysis of Videotaped Footage

- Two independent judges scored each group’s presentation on
  - Roles adopted by each student, technical vs. non-technical
    - Technical: Detailed description of design solution, technical specifications, calculations, analyses
    - Non-Technical: Title slide or final slide, introduction, summary or recap
  - Speaking time ratio (actual/expected time)
  - Number of audience questions answered

- Analyzed with ANOVA: 2(student gender) X 3(group composition), or with MANOVA
Technical vs. Non-Technical Role Adopted by Student Gender

2-way interaction, $F(1, 732) = 16.70, p < .001$

- Technical (p<.001)
- Non-Technical (p<.05)
Speaking Time Ratio by Student Gender

Main effect of gender, F(1, 720) = 5.88, p < .03
Number of Audience Questions Answered by Group Composition

2-way interaction, $F(1, 731) = 6.66, p < .001$
Part 2: Focus Groups

- Fall 2011, conducted by ADVANCE staff
- 9 same-gender groups, 36 students total
- Enrolled in ENGIN 100 in a previous term and completed a group project presentation

Sample discussion questions

- How many men and women were on your team?
- What are your perceptions of the kinds of roles male and female students adopt in group project presentations? Why would they adopt these roles?
- What are the most important parts of the presentation in your view?
Focus Groups (9 groups, 36 students)  
Fall 2011

- All Women: 3%
- Solo Male: 3%
- Two Women: 24%
- Solo Women: 30%
- All Men: 40%
Focus Groups: Emerging themes

- Students strive for fairness in determining roles, but...
  - Tech roles given to perceived “experts” (men)
  - Roles conform to stereotype, but perceived as self-selected (not pressured into it)
- Some reports of stereotyping in group dynamics
  - Organizational roles typically fall to women
  - Women seen as less competent by men
  - Groups with only one female reportedly did not work well ("she was quiet and did what she was told")
- Women saw the intro/summary roles as insubstantial and considered “boring” by audience
Emerging themes, cont.

- Students recognize that presenting the project/teaching others helps them master the material.
- Students recognize the importance of team member diversity.
  - Encourage mixed gender groups, discourage solo female/solo male groups.
- Support a zero-tolerance policy on discrimination.
Future Plans

- Next steps include a thorough statistical analysis of the recently acquired (Fall 2011) video, survey, and ancillary data (grades, etc.)
- Lab experiment testing interventions (Fall 2012)
  - Role intervention
    - No instruction about roles (control)
    - Assigned to roles
    - Prepare for any role
  - Explicit “zero tolerance” policy
  - Other strategies may emerge from data
Conclusions (so far)

- Men take on more active roles than women in student group project presentations
- Gender stereotypes may play a role
  - Men stereotyped as experts compared to women
  - Women stereotyped as supporters
  - Corroborated with focus group results
- Students realize the implications for learning
  - Master the material by explaining it to others
  - Recognize benefit of diversity in engineering
Thanks!

- NSF-RIGEE Program
- UM ADVANCE
  - Abby Stewart, Janet Malley, Keith Rainwater, Chelsea Goforth
- College of Engineering
- UM individuals and organizations who value research on diversity and learning