SYMPOSIUM ON LEARNING ANALYTICS AT MICHIGAN

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

Team Composition	Analysis Categories	Teams	Women	Men
All Women		6	26	-
Solo Men	Female Dominated	19	70	19
Two Men		31	95	62
Gender Equal	Gender Equal	40	85	85
Two Women	Male Dominated	73	146	227
Solo Women		132	132	480
All Men		155	-	682
Totals		**421**	**469**	**1470**

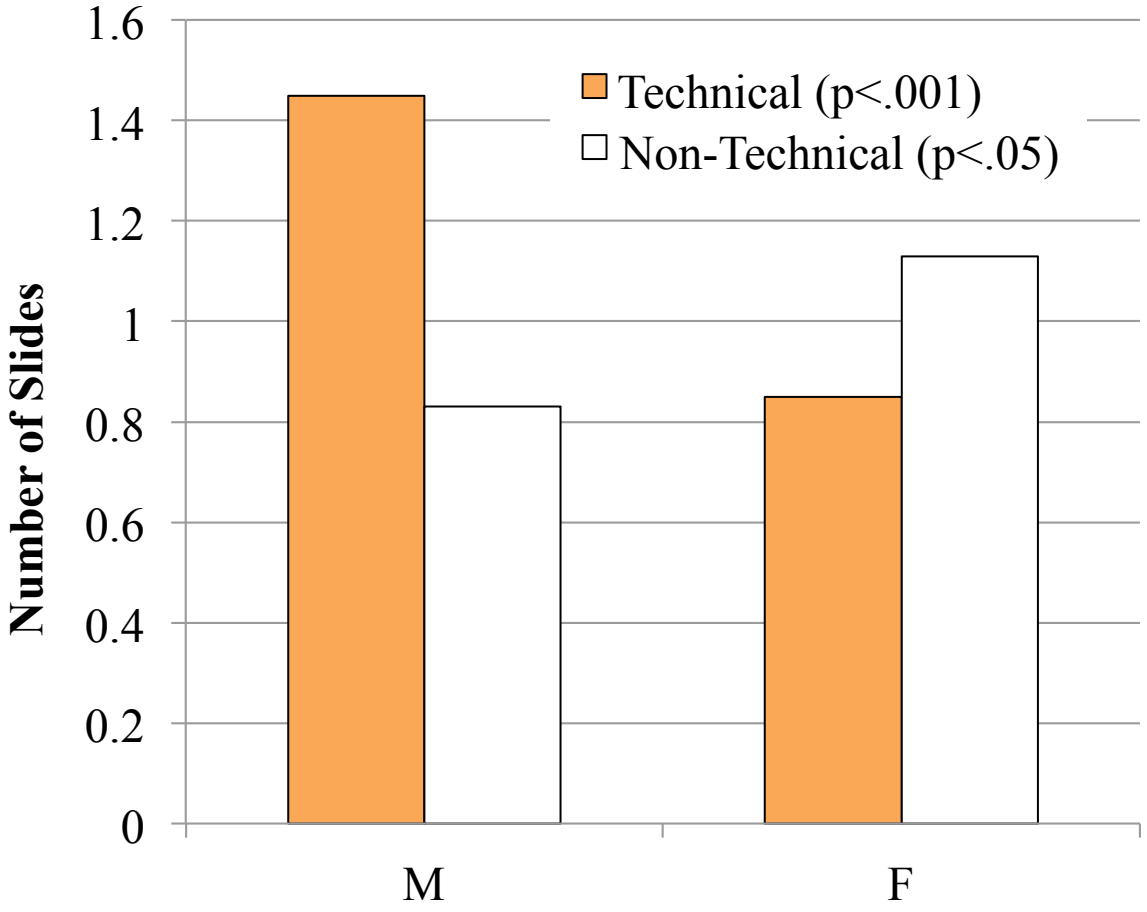
- N = 739 in today's presentation

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

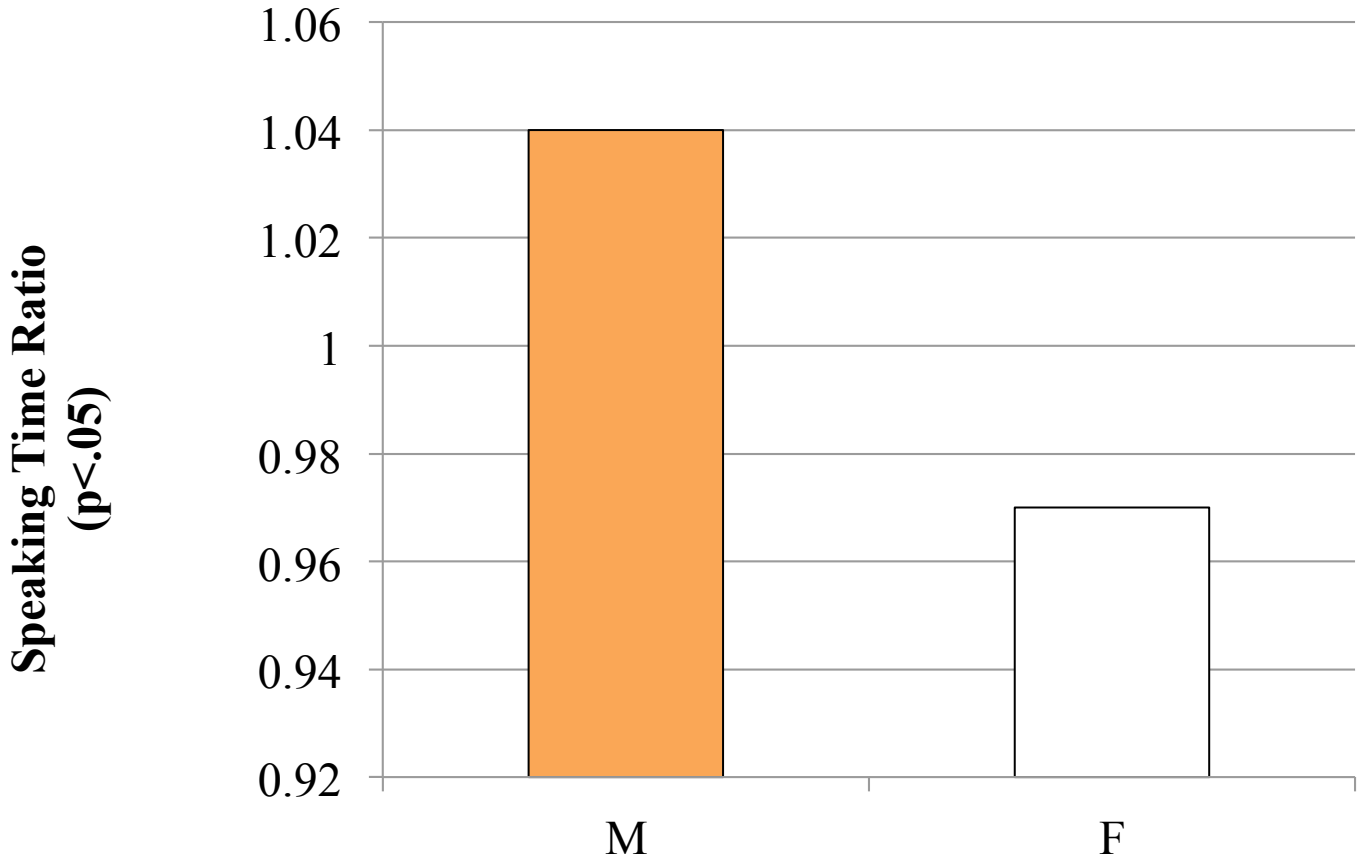
Technical vs. Non-Technical Role Adopted by Student Gender

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



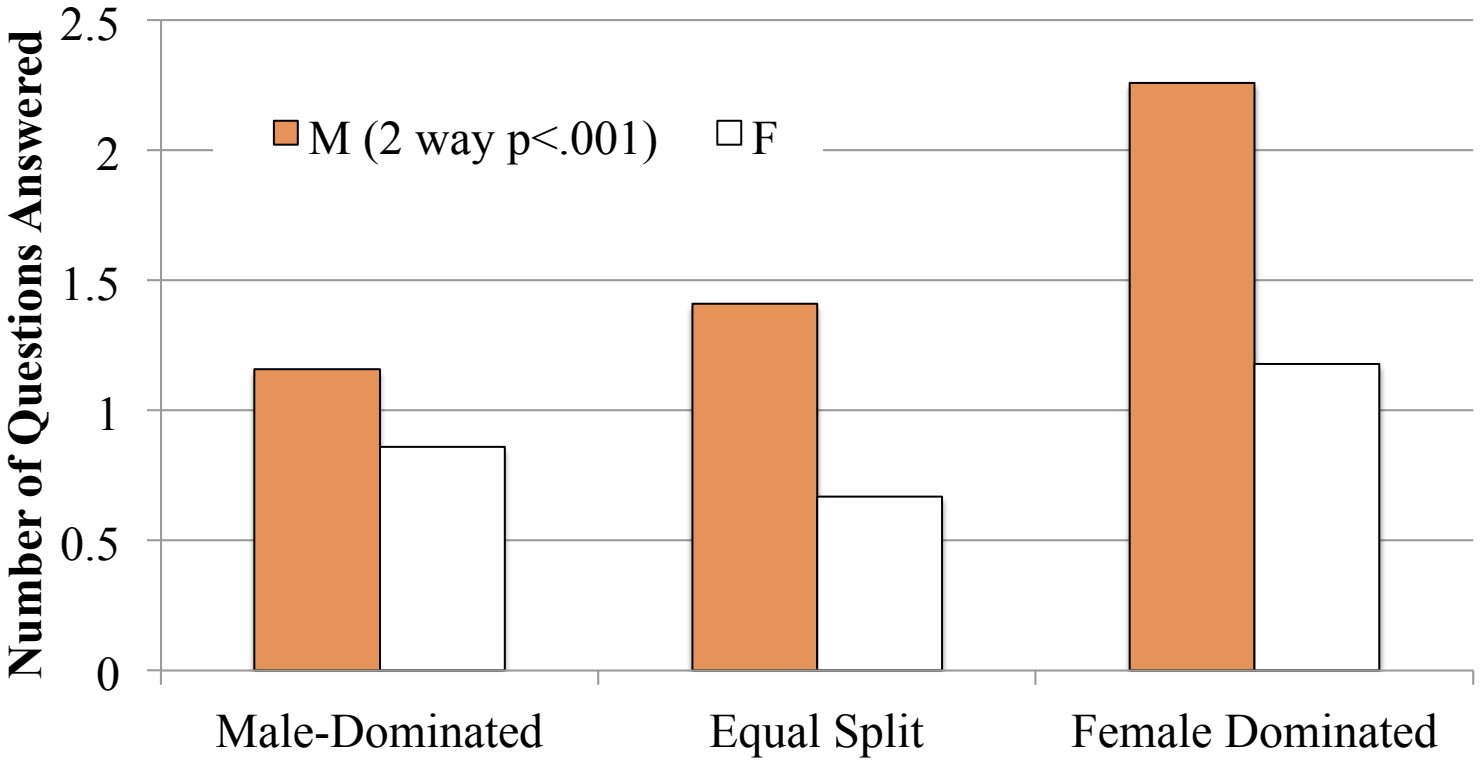
Speaking Time Ratio by Student Gender

Main effect of gender, $F(1, 720) = 5.88$, $p < .03$



Number of Audience Questions Answered by Group Composition

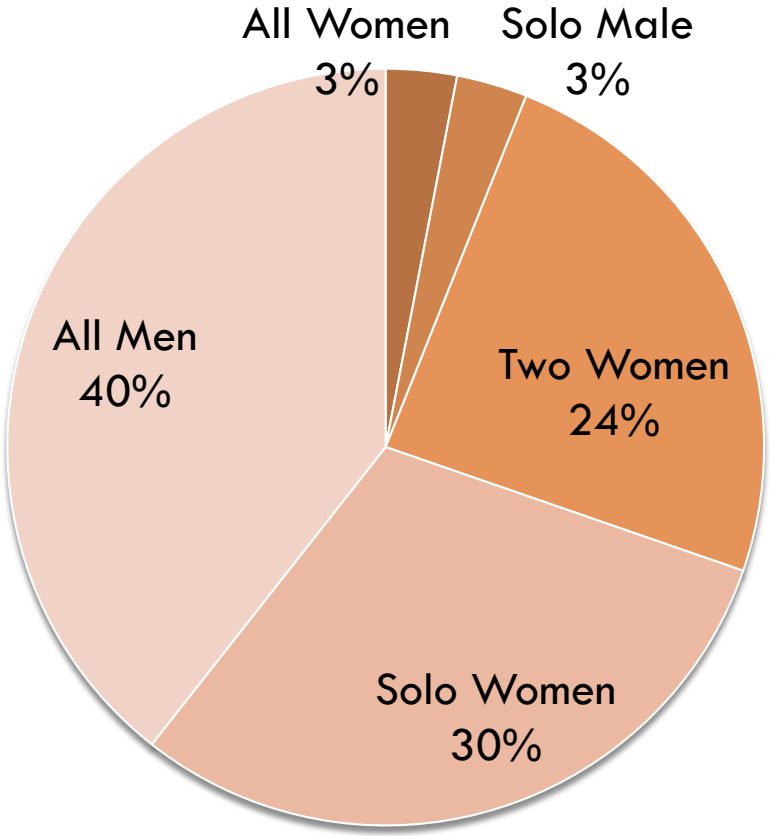
2-way interaction, $F(1, 731) = 6.66$, $p < .001$



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



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!

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