

Women in engineering: Interests, perspectives, confidence ...and experiences

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Center for the Advancement of Engineering Education
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Center for the Advancement of Engineering Education

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- ▶ **CAEE team members at WEPAN:** Deborah Kilgore, Sherry Woods, Ken Yasuhara

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Acknowledgements

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Academic Pathways Study

Sheri Sheppard, Lead

- ▶ Large-scale, multi-method study of undergraduate engineering students
- ▶ 3 cohorts of engineering student participants
- ▶ Multiple groups of early-career engineers
- ▶ Additional analysis of national survey data

Research on the engineering learning experience *from the student perspective*

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Sampling of APS findings

Large variation in student pathways...

- ▶ Reasons for choosing engineering
- ▶ Choosing to stay to go
- ▶ Navigation through curriculum
- ▶ Experience by gender
- ▶ Acquisition of engineering knowledge & skills
- ▶ Preparation for "the real world"

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Two parts of APS

- ▶ **APPLES₂ Survey**

Sheri Sheppard, Lead

- Cross-sectional (class standing)
- 4,266 students at 21 engineering colleges

- ▶ **Engineering Thinking & Doing (ETD)**

Cindy Atman, Lead

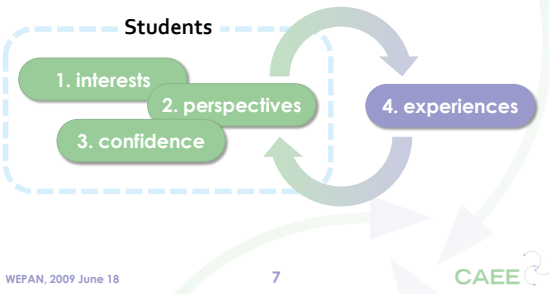
- Multi-method, longitudinal study
- Approx. 160 students at four campuses
- Conceptions of engineering and design
- Performance on engineering design tasks

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How do women's interests, perspectives, and confidence interact with their engineering education experiences?

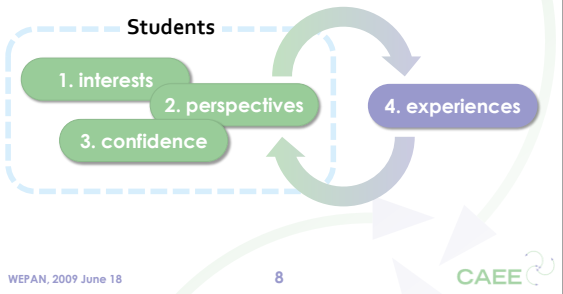


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How do women's interests, perspectives, and confidence interact with their engineering education experiences?



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1. Diverse interests APPLES2

- 1
- 2
- 3

- ▶ Extracurricular activities, engineering and non-engineering
 - Women tend to participate more than men do in both kinds of activities (first and senior years).***
 - Women tend to place greater importance on non-engineering extracurricular activities than men do (seniors).**

*** $p < 0.001$, ** $p < 0.01$

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2. Diverse perspectives ...on engineering skills APPLES2

- 1
- 2
- 3

- ▶ As seniors, women tend to place greater importance on professional and interpersonal skills than men do.***
 - Leadership
 - Performing in teams
 - Communication
 - Public speaking
 - ...

More about this in the confidence section

*** $p < 0.001$

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2. Diverse perspectives ...on design problems

- 1
- 2
- 3

- ▶ Considering context when approaching engineering design problems ETD
 - Selecting information for playground design
 - Closed-ended survey question
 - Years 1 and 4
 - Factors considered for "Midwest floods" design task
 - 10-minute, paper-and-pencil design task
 - Years 1 and 3

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Playground design question ETD

- 1
- 2
- 3

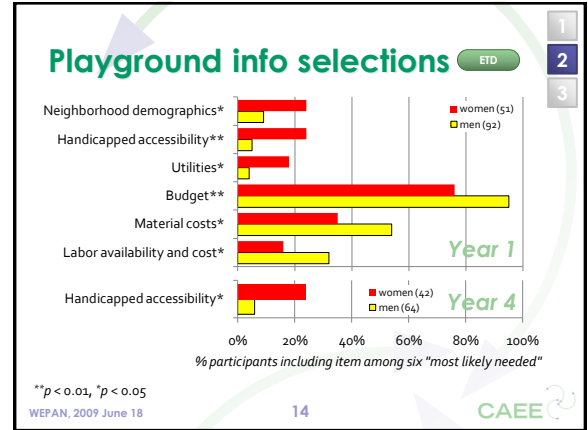
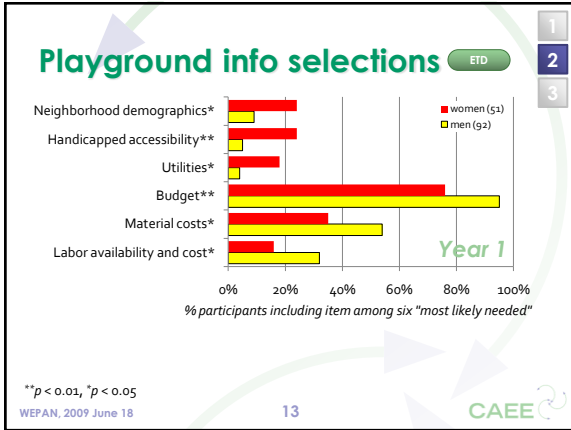
"You have been asked to design a playground...From the following list, please put a check mark next to the FIVE kinds of information you would MOST LIKELY NEED as you work on your design:

- | | |
|--|--|
| <input type="checkbox"/> Availability of materials | <input type="checkbox"/> Material costs |
| <input type="checkbox"/> Body proportions | <input type="checkbox"/> Material specifications |
| <input type="checkbox"/> Budget | <input type="checkbox"/> Neighborhood demographics |
| <input type="checkbox"/> Handicapped accessibility | <input type="checkbox"/> Neighborhood opinions |
| <input type="checkbox"/> Information about the area | <input type="checkbox"/> Safety |
| <input type="checkbox"/> Labor availability and cost | <input type="checkbox"/> Supervision concerns |
| <input type="checkbox"/> Legal liability | <input type="checkbox"/> Technical references |
| <input type="checkbox"/> Maintenance concerns | <input type="checkbox"/> Utilities |

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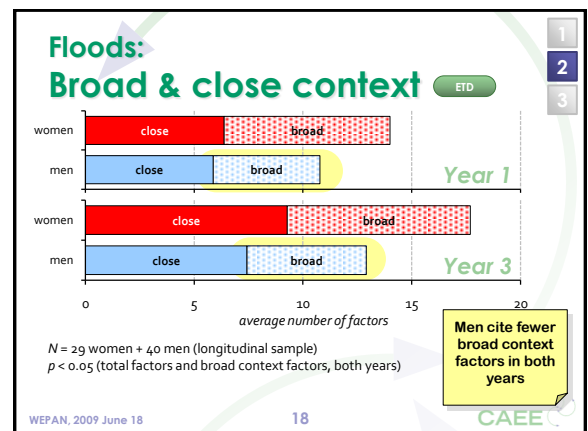
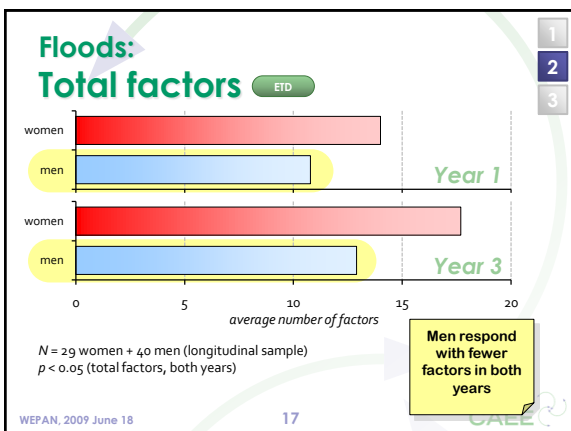
Midwest floods design task

ETD

"Over the summer the Midwest experienced massive flooding of the Mississippi River. What factors would you take into account in designing a retaining wall system for the Mississippi?"

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- ### Floods: Contextual factors
- ETD
- ▶ **Broad context factors**
 - "aesthetic appeal – is it going to draw local complaint?"
 - "the surrounding habitat – make sure little or no damage is done to the environment"
 - "would wall impact use of the river by industry?"
 - ▶ **Close context factors**
 - "cost of materials"
 - "check the budget available for the operation"
 - "how to contain the river water that has flooded out"
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3. Differences in confidence

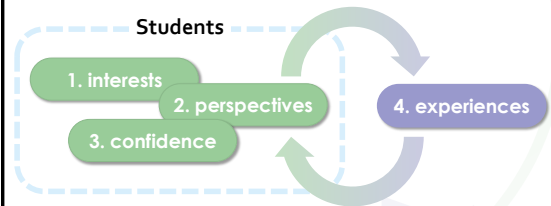
| | Confidence | Year(s) | |
|---------------------------------------|----------------|-------------|---------|
| Math & science ability | women < men** | Years 1 & 4 | APPLES2 |
| Open-ended problem-solving ability | women < men*** | Year 4 | APPLES2 |
| Specific design activities | women < men** | Year 2 | ETD |
| Professional and interpersonal skills | no difference | Years 1 & 4 | APPLES2 |

*** $p < 0.001$, ** $p < 0.01$
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How do women's interests, perspectives, and confidence interact with their engineering education experiences?



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4. Experiences

APPLES2

- ▶ As seniors, women tend to report experiencing more curricular overload,*** which is negatively correlated with...
 - Satisfaction with instructors
 - GPA
 - ▶ Women tend to report more pressure to balance social and academic life (seniors,*** first-years**).
- ** $p < 0.01$, *** $p < 0.001$

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Summary

- ▶ Women bring broader interests and perspectives to engineering
- ▶ ...but can be less confident in certain respects
- ▶ ...and report challenges with overload and balance.

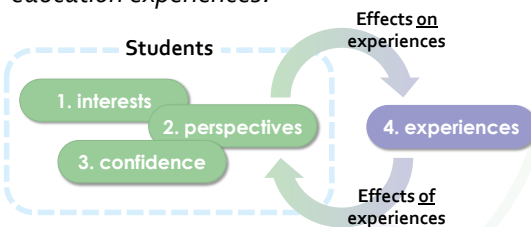
What kind of engineering education experiences can we provide in response?

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How do women's interests, perspectives, and confidence **interact** with their engineering education experiences?



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Implications?



- ▶ How might women's interests, perspectives, and confidence affect their experiences as engineering undergraduates?
- ▶ Conversely, how might their experiences affect their interests, perspectives, and confidence?

Consider your students' experiences, successful student support programs, other research...

Please share your thoughts on the provided discussion notes pages. They will be transcribed and published to the web anonymously, so please write legibly!

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Wrapping up

- ▶ Strength of the multi-method, multi-institution approach
- ▶ Instruments that can be used on your campus
- ▶ Variety of findings across many aspects of the student experience

We hope to hear more from you...

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to give us
your green
sheet!
Thanks!

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