

CONSIDERING CONTEXT

D. Kilgore, C.J. Atman, K. Yasuhara, T. Barker, A. Morozov • Center for the Advancement of Engineering Education

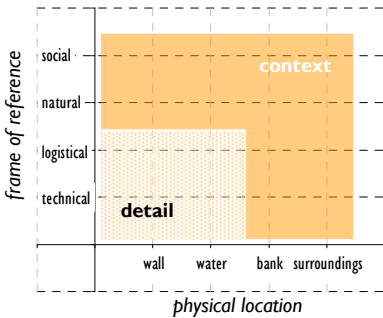
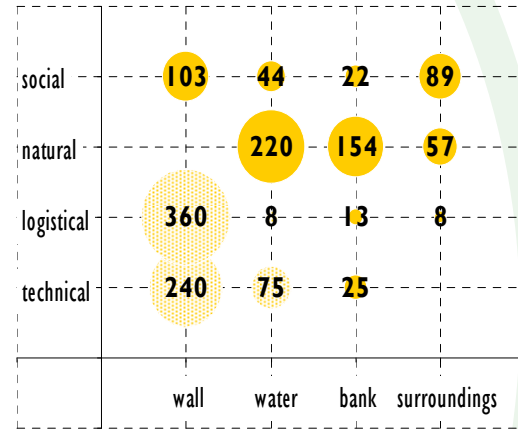
High-quality engineering design requires understanding how the resulting engineered artifact interacts with society, the natural environment, and other aspects of context. This study examined how first-year engineering undergraduates approached two engineering design tasks. We focused on how much students considered contextual factors during problem scoping, a critical part of the

design process. As part of a larger, longitudinal study, we collected data from 160 students at four U.S. institutions. Students varied in their consideration of each design task's context, and women's responses were more likely to be context-oriented than men's. Overall, context orientation was positively correlated between the two design tasks, despite

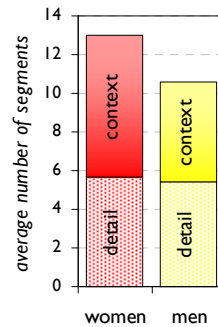
differences in data collection and analysis methods. Having found that beginning engineering students in this sample, particularly women, are sensitive to important contextual factors, we suggest that efforts to broaden participation in engineering should consider legitimizing and fostering context-oriented approaches to engineering earlier in the curriculum.

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?

124 participants took up to 10 minutes to write their answers to the Midwest floods question. Transcribed responses were segmented into distinct "thought units," each expressing one discrete idea. Average response length was about 11 segments.

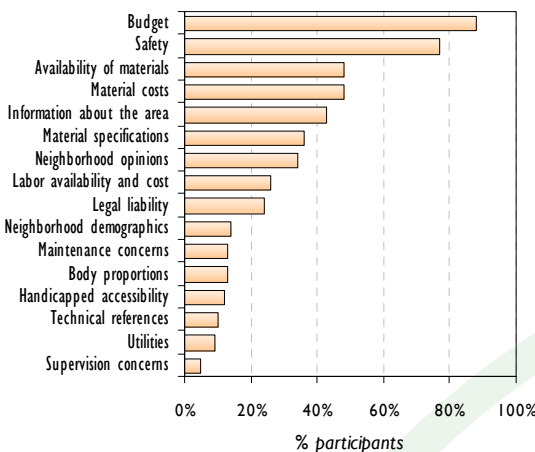


Each segment was coded in two dimensions, physical location and frame of reference, with four codes for each.



Women averaged more context segments than men ($p < 0.01$).

All together, the participants' segments distributed across the coding space as shown. Disc area is proportional to the number of segments coded with the corresponding location-frame code pair.



Each bar shows the percentage of participants who included the corresponding kind of information as one of their five "most likely needed" selections.

You have been asked to design a playground. You have a limited amount of time and resources to gather information for your design. 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...

THE PICTURE FROM THE FIRST YEAR...

Problem scoping

- Women: similar attention to detail and greater attention to context
- Men: more emphasis on detailed design factors than on contextual factors

Information gathering

- Women: more emphasis on context of solution, such as handicapped accessibility, neighborhood demographics, and information about the area
- Men: more emphasis on details of solution, such as budget, materials, labor

Gender differences in selection frequency were significant for six items ($p < 0.05$).

