

Using Scenario-Based Design Activities to Explore Sociotechnical Thinking in Engineering Professionals

A Master's Thesis Defense in Mechanical Engineering
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Sociotechnical thinking is the ability to recognize the interconnectedness of both technical and non-technical dimensions such as environmental, economic, social, cultural, and political factors. Although traditional engineering curriculum often emphasizes technical knowledge and skills, research suggests that engineering work is inherently sociotechnical. While sociotechnical thinking is a critical engineering skill, relatively little is understood about the nature of that thinking or the different aspects comprised within it. To that end, this study addresses the following research question: *What sociotechnical factors do engineering professionals consider in a collaborative scenario-based design activity?* To answer this question, we conducted a qualitative study of engineering professionals from a wide range of experience levels and backgrounds. We created scenario-based design tasks that encouraged participants to examine the interplay between technical and non-technical factors. In groups of 2-3, participants collaborated to complete one of these tasks over a period of approximately 45 minutes. We used a combination of deductive and inductive coding to characterize the different factors discussed by participants with a focus on the breadth of factors they identified as salient. Analysis of the transcripts revealed nine distinct sociotechnical factors spanning technical and non-technical dimensions including consideration of relevant stakeholders, the broader context, and practical constraints. We also explored how participants connected these factors using simultaneous coding and code co-occurrence. Findings highlight both the wide range of factors that professionals identified as well as the ways these factors overlap and intersect within design discussions. Identifying these different factors from engineering professionals offers insight into how educators might integrate sociotechnical topics into engineering curricula in ways that align more closely with engineering practice.

Industrial Factors related to the practical means of building and maintaining the solution	Human Factors Factors related to how humans perceive, react, and are affected by the solution	Technology Factors related to the functional design and performance of the solution
Solution Lifecycle Factors related to how the solution changes with time	Natural Environment Factors related to all non-human made aspects of the context	Financial Factors related to monetary aspects of the solution
Infrastructure Factors of or related to the built (human-made) environment	Institutional Factors related to the large groups that make up the social and political structure of the solution's context	Protection/Damage Factors related to safeguarding of the solution from human harm

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