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Fitting Ergonomics to the Engineers

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Ergonomics must be introduced to design projects as early as possible to be most effective. Benefits to early inclusion include increased ease and flexibility for design changes, reduced costs for redesigns or retrofits, and the introduction of more productive, healthy work systems from the beginning of their life-cycle. However, ergonomists need organizational support, particularly from design departments, to coordinate early introduction of ergonomics into design work. As a result, ergonomists must work with stakeholders in many other professional groups to achieve their objectives, one of which is engineers. Many ergonomists report difficulty engaging in engineering design stages. Ensuring engineers' goals are met, ergonomists can better integrate ergonomic considerations into the design process. To do this ergonomists need to understand the objectives, motivations, and working routines of engineers.

INSIGHTS: Engineers and Engineering Work

The following 10 TIPS from the research on engineering practice are recommended for ergonomists to consider for building better working collaborations with engineers. This non-exhaustive list of considerations and the resulting TIPS can help ergonomists working with engineers (or any other stakeholder group) develop an effective approach to integrating ergonomics into the design process.

Key Messages

10 Tips for Working with Engineers
1. Learn the "culture" in the engineering department.
2. Introduce human factors in a way that complements existing practices.
3. Acknowledge differences in perspective and use 'perspective-swapping' to help designers consider both human and technical aspects of a project.
4. Ensure management support and encouragement for engineers' ergonomics efforts and successes.
5. Connect to quality and productivity goals to win buy-in for ensuring ergonomics is included in design.
6. Help engineers understand how ergonomics helps control their legal liability as well as the gains offered by going beyond the legislative minimum.
7. Raise the profile of 'workplace design' and help establish company design standards and criteria.
8. Introduce ergonomic checkpoints to create accountability and ensure inclusion in the process.
9. Establish regular ergonomic feedback (on both successes and failures) for engineers.
10. Create organizational support for engineers when applying their ergonomics training.

1) Engineers are diverse: Engineers are a widely varied group. Within an engineering discipline their attitudes, priorities and working style may differ by level of experience, role in the organization, and the surrounding culture. Engineers may also display differing attitudes toward human factors between disciplines. TIPS: Take time to learn the "culture" in the engineering department(s). Find out day–to-day expectations, immediate priorities and long-term objectives. Try to appeal to these concerns when making a case for ergonomic aspects.

2) Engineers are open to ergonomics: Engineers report a generally positive attitude toward human factors inclusion and improvement. TIPS: Introduce human factors in a way engineers understand and that complements their roles, responsibilities and job requirements – emphasize positive outcomes in productivity and quality. Find ways to integrate human factors into everyday tasks and routines to ensure the right supports (tools, management support, access to experts, etc.) are in place.

3) Perspectives can clash: Design teams are multidisciplinary. Engineers tend to share a technical focus, while ergonomists are more socially focused. This can lead to conflict in design teams. TIPS: Deliberately alternating the design team focus between technical and social foci may be useful to consider all parts of the system and to help team members gain new perspectives. Note how engineers define design parameters and frame the problem in these terms.

4) Engineers are constraint-driven: Engineering designs must operate within existing technical, social and business systems and are therefore subject to financial, legal, contractual, political, social, and time constraints. Engineers will be wary of additional constraints on their work and additional work that does not fit into project timelines. TIP: Engage engineering managers in recognizing and rewarding those engineers who take the time needed to do good human factors work.

5) Numerous stakeholders: Engineering projects have many stakeholders to consider, each of these with different goals and objectives. Design is a series of compromises to find the most feasible solutions that will satisfy the majority of constraints.

TIP: Appeal to the strategic goals of each stakeholder group individually to show the various benefits of embedding ergonomics in their design requirements.

6) Engineers are highly accountable: Engineers may have legal liability in the event of a lawsuit or accident. Legislation can motivate engineers to include more human factors in their work. However, without an understanding of the systemic benefits of ergonomics, legal liability may only motivate some to work 'by the book'. TIP: Ergonomists should help engineers understand how ergonomics can limit their legal liability as well as the benefits of applying human factors beyond the minimum standard.

7) "Workplace design" is not managed: There appears to be a lack of recognition of "workplace design" as a specific process or activity within organizations; instead the focus usually surrounds "production system design." The lack of specified 'workplace design' is usually built into a company's organizational structure. TIPS: Ergonomists can work to increase awareness of how each system element contributes to a workplace. In addition to the recognition that workplaces are being designed, it may be valuable to facilitate the creation of workplace design criteria as a company standard.

8) No-"one" responsible for ergonomics: Workplace design is the result of many aggregated decisions made by various players and affected by policies at a wide level of organizational levels. Responsibility for ergonomics is distributed among many parties and thus weakened for each individual. TIPS: Pay particular attention to the effects of system elements interacting to avoid any emergent problems that may be impossible to foresee when looking at different system components independently. Ergonomic checks should be integrated into the project management cycles (for example, at each 'stage gate') or at regular intervals to ensure human factors is not neglected. Such process controls can act as 'feed-forward' to guide design activities.

9) Engineers lack feedback: Designers do not receive long-term feedback about their designs. With no short-term problems, the designer may never know about the long-term implications of their work or take part in solution building should problems – in productivity, quality or user wellbeing – arise. There is a lack of organizational learning from mistakes and it is difficult for designers to improve their work over time. Designers appearing to ignore systemic problems may simply be removed from that system in their work and unaware of the problem. TIPS: Establish formal feedback loops on ergonomics related measures to connect designers to their work. Provide positive feedback whenever progress in ergonomics is made.

10) Training alone is insufficient: Training engineers in ergonomics and creating awareness will not result in changed behaviour unless the application of the knowledge is encouraged and supported. TIP: Introduce organizational supports and approaches to ensure human factors knowledge is applied. Examples might include adding ergonomics in sign-off procedures, rewarding positive change, hiring ergonomics support personnel, or introducing tools and techniques for engineers.

Implications for the Prevention of MSD

MSD prevention starts with design decisions. Engaging with engineers early in design projects has many financial and worker health benefits. For success, ergonomists need to be aware of how to interact with engineers, support and align with engineering expectations, goals and work processes to maximize the application of ergonomics. Ergonomic change thus needs to be approached ergonomically. Doing so removes barriers to ergonomics, improves work design and reduces MSD risk.

Conclusion

Ergonomic change needs to be approached ergonomically. When introducing ergonomics to an organization, one is changing the jobs of engineers. Ergonomists must be sensitive to the work system surrounding design, removing barriers to ergonomics whenever possible and considering the abilities and limitations of those applying new methods and procedures. Ergonomists can better support the uptake and application of ergonomics in engineering departments and throughout organizations by understanding the competing demands on engineers, the organizational factors influencing engineering work, and the way health and safety issues are viewed by engineers.

Further Reading

Mekitiak, M., Nagdee, T., Wells, R., Zolfaghari, S., Theberge, N., Neumann, W.P. (2008). Demystifying Engineering: Implications for practicing ergonomists. Association of Canadian Ergonomists' (ACE) 39th Annual Conference, Ottawa, October 5.

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