The Early Work Experiences of Recent Graduates in Engineering.

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Introduction

• Employers reported new graduates adequate/well-prepared in science and technical skills (problem solving); inadequate in communication and teamwork skills (Lattuca, Terenzini, & Volkwein, 2006)

• Ongoing debate about relevance of current curricula, competencies, and attributes.

• Recent efforts to expand engineering criteria to include socially and design-based curricula.

• This paper focused on the engineering experiences of new engineers (17) in a workplace.
Research questions

• How do newly hired engineers learn the specific job requirements of the workplace?

• How do newly hired engineers practice engineering in the workplace?

• What are the factors affecting how newly hired engineers begin practicing engineering in the workplace?
Theoretical Frame

• Social cognitive theory—learning what to do; how and why in the social system of the workplace.

• Social exchange theory—ongoing interactions between people guided by rules (norms).

• Socialization—a critical period for learning requirements and expectations of work and forming enduring perceptions of work and profession.
Findings

• Engineering described as a problem-solving process.
• Problem-solving process embedded in and moderated by:
  – The social system of the work group.
  – The norms and systems of the organization.
  – Individual preferences.
Problem-solving process

• Gathering and manipulating data described as “real engineering work.”

• Process heavily based on communication and teamwork (social interaction and influence)
  – Organize, define, and understand problem.
  – Gather, analyze, and interpret data.
  – Document and present results.
  – Project manage process.
Social system of work group

• Managers and coworkers had certain expectations and a preferred way of doing things.

• New grads relied on coworkers to help interpret ambiguous processes and data: “Why are we doing this? What exactly is this doing?”

• Lack of documentation forced new grads to rely on coworkers for help. This help was based on the quality of relationships.
The Organizational System

- Learning the “big picture.” “. . . get oriented to the whole system, because the system is absolutely, ridiculously huge.”

- Understanding non-engineering priorities and decisions. “Okay, so a lot of things can’t change.”

- Working through cultural and systems procedures. “when people are sticklers for the process, you run into a lot of problems.”
Managing Individual Effort

• Desire to gain experience and increase expertise.
• Become intimately familiar with job.
• Meet and exceed objectives.
• Contribute value to the organization.
### Summary of Work Experiences

<table>
<thead>
<tr>
<th>Categories of Work Experiences</th>
<th>Work Experiences</th>
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<td>Problem-Solving Process</td>
<td>• Organize, define, &amp; understand the problem</td>
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<td>• Gather, analyze, &amp; interpret data</td>
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<td>• Document and present results</td>
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<td>• Manage the overall problem-solving process</td>
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<td>Working within the Group (social system)</td>
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<tr>
<td>Working within the Organizational System</td>
<td>• Learn the ‘big picture’</td>
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<td>• Understand non-engineering priorities and decisions</td>
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<td>• Work through cultural and systems procedures</td>
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<td>Managing Individual Effort</td>
<td>• Gain experience to increase expertise</td>
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<td></td>
<td>• Become intimately familiar with job and data</td>
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<td>• Effectively manage efforts to exceed objectives</td>
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<td>• Contribute value to the organization</td>
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Problem-solving process.

Organizational System

Social System in Work Group

Gather, analyze, & interpret data.

Document and present results.

Organize, define, & understand the problem.

Manage the overall problem-solving process.
Experiences in the workplace.

• Not doing “real engineering” work. “I don’t feel like I’ve had to actually do engineering.”

• Problems highly uncertain, ambiguous, complex. “in the real world, it’s a lot more difficult to model things. It’s just there’s a lot more variables involved and there’s the unsurety too of whether or not you’re modeling it right.”

• More practical, hands-on work. “there’s no mathematical formula you could use like you would in school to solve this kind of problem.”

• Work is socially and culturally embedded. “It’s a huge difference in how people perceive your data depending on how much they know.”
Conclusions

• Engineering problems often ill-structured: (Jonasson, Strobel, & Lee, 2006)
  – Multiple, often conflicting goals
  – Multiple solutions

• The problem-solving process embedded in legacy of local custom, social preferences, and organizational constraints.

• Most work involves communicating and collaborating with others.
Implications for Engineering Education

• Greater emphasis on ill-structured problems embedded in fickle social contexts.
  – Messy problems that change over time.
  – Multiple, conflicting goals, priorities, and interpretations.

• Increase use of problem-based learning and cooperative learning.
  – Maximize social cooperation, collaboration, and interdependence.
  – Quality of interactions and experiences is important.