The Early Work Experiences of Recent Graduates in Engineering.

Russell F. Korte, *University of Illinois Urbana-Champaign*
Sheri D. Sheppard, *Stanford University*
William C. Jordan, *Collaborative Research Lab, Stanford University*

Grant No. ESI-0227558

American Society for Engineering Education Conference, June 22-25, 2008

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.

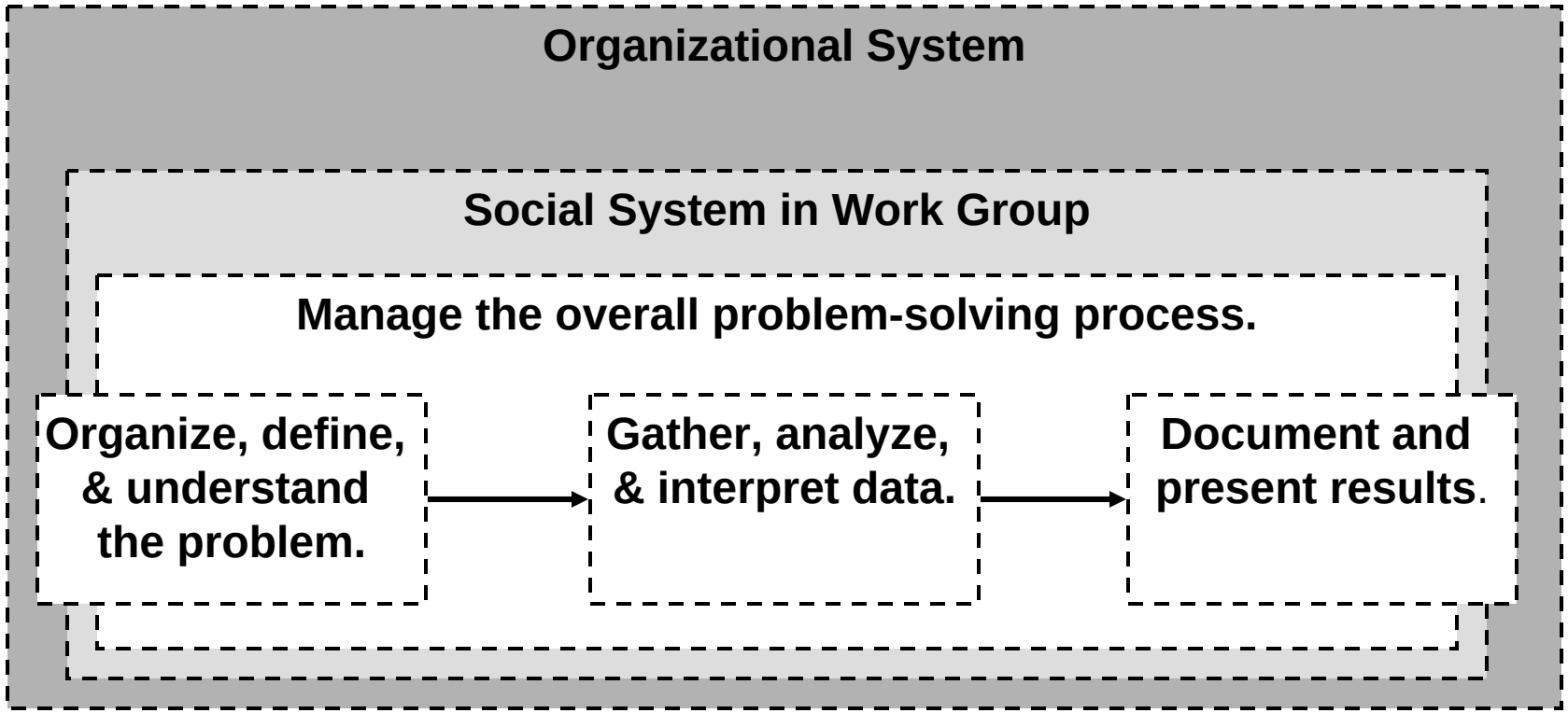
,

Summary of Work Experiences

Categories of Work Experiences	Work Experiences
Problem-Solving Process	▪Organize, define, & understand the problem ▪Gather, analyze, & interpret data ▪Document and present results ▪Manage the overall problem-solving process
Working within the Group (social system)	▪Develop relationships with others ▪Learn from others ▪Collaborate with others ▪Influence others
Working within the Organizational System	▪Learn the 'big picture' ▪Understand non-engineering priorities and decisions ▪Work through cultural and systems procedures
Managing Individual Effort	▪Gain experience to increase expertise ▪Become intimately familiar with job and data ▪Effectively manage efforts to exceed objectives ▪Contribute value to the organization

,

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.

,