Task and Compositional Factors in Individual and Group Problem Solving

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Overview

- **Part 1. What Do We Mean by Teams?**
  - **Background on Teams and Teamwork**

- **Part 2. Experiments on Task and Compositional Factors**
  - **2.1. Attitudinal and Cognitive Factors (Trust and Confidence in Expertise)**
  - **2.2. Behavioral and Cognitive Factors (Information Sharing and Information Search)**
  - **2.3. Behavioral and Cognitive Factors (Interpersonal Processes and Group IQ)**

- **Part 3. Steps for Roadmaps**
  - **3.1. Steps for Implementation Roadmap**
  - **3.2. Steps for Research Roadmap**

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- **<u>Characteristics of Teams</u>**
  - **Multiple <u>information sources</u> and intensive <u>communication</u>**
  - **<u>Task-relevant knowledge</u> with meaningful task <u>interdependencies</u>**
  - **<u>Affective</u> and <u>attitudinal</u> factors influence <u>group dynamics</u>**
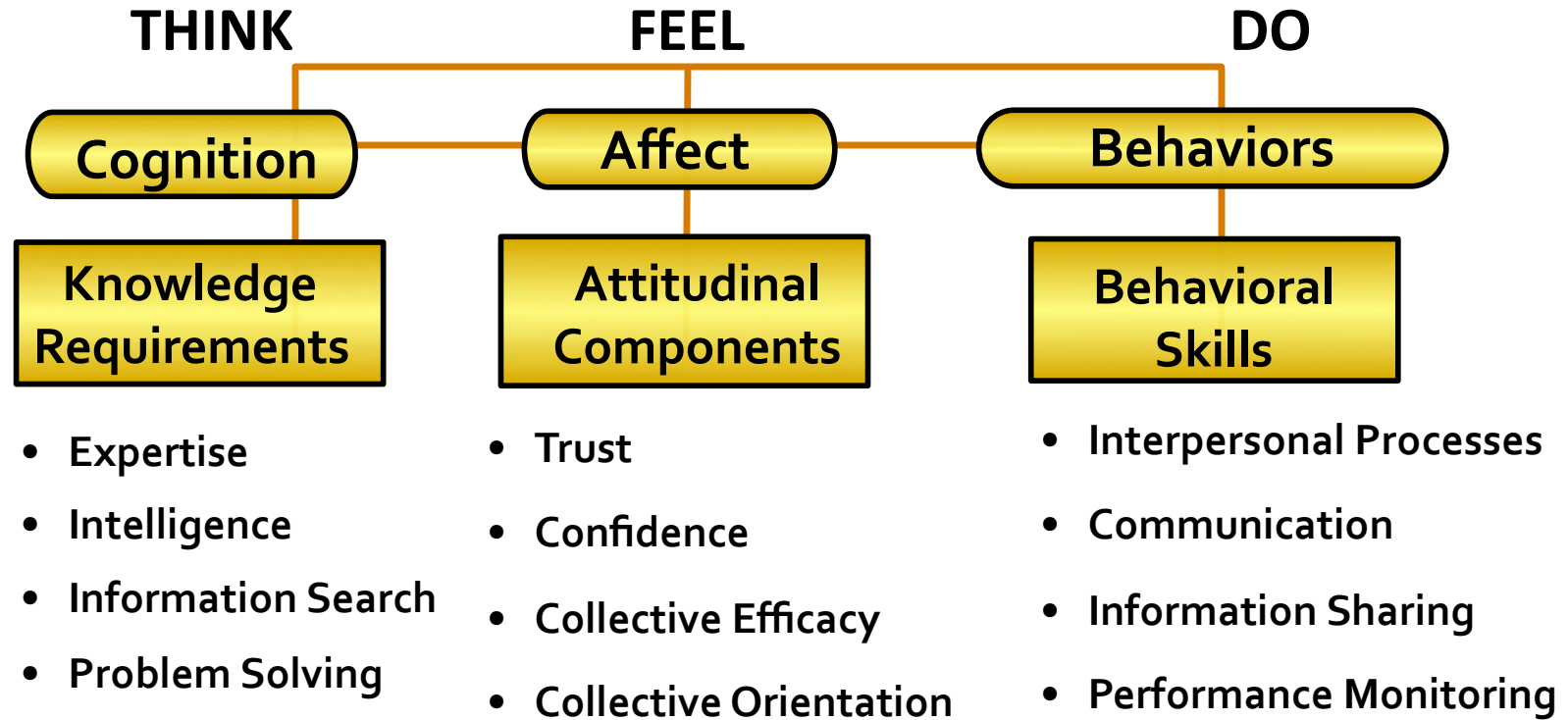 - **<u>Coordination</u> among members with <u>specialized roles</u>**

- Teamwork <u>inside and outside of STEM</u>
  - *Both bring people together to achieve objective(s) that an individual could not achieve and do so while maintaining partially overlapping knowledge*

1. What do we mean by "teams"
Background on Teams and Teamwork

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THINK	FEEL	DO
Cognition	**Affect**	**Behaviors**
Knowledge Requirements	**Attitudinal Components**	**Behavioral Skills**

- Expertise
- Intelligence
- Information Search
- Problem Solving

- Trust
- Confidence
- Collective Efficacy
- Collective Orientation

- Interpersonal Processes
- Communication
- Information Sharing
- Performance Monitoring

Overview

Melissa Thomas-Hunt and Katherine W. Phillips (2004). When what you know is not enough: Expertise and gender dynamics in task groups. *Personality and Social Psychology Bulletin*, *30(12)*, 1585-1598.

- **Group Problem Solving Challenge**: Identification of Expertise
    - **Expertise often difficult to identify** in organizational groups
        - Problem when working on intellectual tasks where **solution is not demonstrable**
    - **Sharing expert knowledge difficult** (Wittenbaum et al., 1999)
        - Often entails expressing **dissenting perspectives** in the group
        - May require others to **abandon their initial ideas**

- **Gender Challenge**: Trust and Confidence in **"male-typed task"**
    - Problem of **pre-conceived performance expectations**
        - Both male and female group members often hold **lower performance expectations for women** (Meeker & Weitzel-O'Neil, 1977)
        - **Female leaders** often receive **lower performance evaluations** even when controlling for style (Eagly et al. 1992).

Melissa Thomas-Hunt and Katherine W. Phillips (2004). When what you know is not enough: Expertise and gender dynamics in task groups. *Personality and Social Psychology Bulletin, 30(12), 1585-1598.*

- Results: **Expertise and Gender Dynamics**
  - Groups **less able** to harness the **knowledge possessed by female experts**
    - **Women perceived** as **less expert**, were less influential, and **felt less confident** about impact on group.
    - Possession of expert knowledge more beneficial for men than for women.

- STEM Roadmap Implications: **Self-fulfilling Prophecies**
  - Men and women assess women's contributions in ways consistent with previously held **gender expectations**.
  - Divergence of expert opinions **negatively affects the confidence of female experts**
  - **Diminished confidence** of female experts may lead them to **censor their contributions**
  - Attenuation in contribution may cause them to be labeled as less knowledgeable, **diminishing ability to influence group**
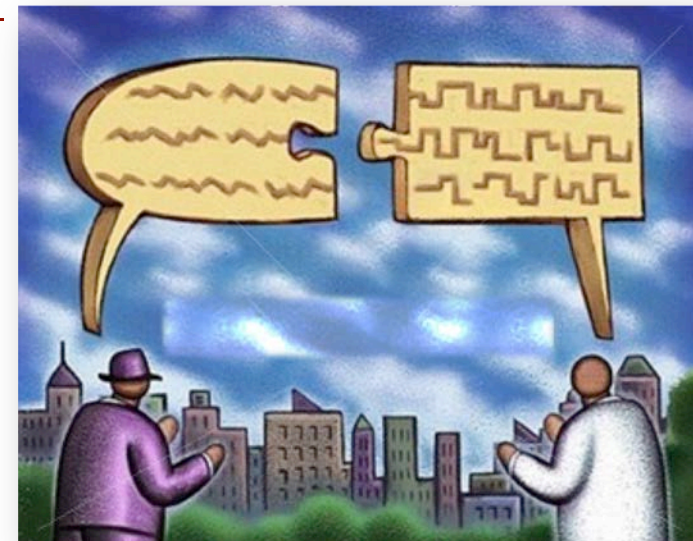
Petru Lucian Curşeu. (2011). Need for cognition and active information search in small student groups, *Learning and Individual Differences, 21(4)*, 415-418.

- **Group Problem Solving Challenge**: <u>Information Sharing and Information Search</u>
  - Groups do not often discuss <u>**unique information**</u> (DeChurch & Mesmer-Magnus, 2009)
    - Dynamics suggest that groups prefer to <u>**discuss what they have in common**</u>
  - Groups do <u>**not always actively seek out information**</u> (Curşeu et al., 2010)
    - Often prefer <u>**solution generation over task exploration**</u> (Fiore & Schooler, 2004)
    - May require others to <u>**abandon their initial ideas**</u>
  - <u>**Need for Cognition**</u> (NFC) is an <u>**idiosyncratic predisposition to engage in search**</u>

- **Gender Challenge**: Information Sharing/Search May Require <u>**Crossing Social Boundaries**</u>
  - Mixed gender groups more likely to <u>**hold unique information**</u>
  - <u>**Clique**</u> formation may <u>**inhibit search**</u> and sharing

Petru Lucian Curşeu. (2011). Need for cognition and active information search in small student groups, *Learning and Individual Differences, 21(4), 415-418.*

- Results: Individual Differences in Groups and Information Search – NFC as Moderator

  - Group members with **high NFC seek more** advice in task related issues

  - **Pattern** of information exchange **stronger for different gender social interaction**

- STEM Roadmap Implications: **Attend to both Intra- and Inter-individual differences**

  - People high in NFC actively search for information to a higher extent

  - Results particularly strong for cross gender social interactions

  - People scoring high on NFC better able to **bridge the gender barrier** that often blocks communication in small groups.

  - Group members who **actively search for information by crossing social group** boundaries may play the role of **information integrators within groups**

Anita Williams Woolley, Christopher F. Chabris, Alexander Pentland, Nada Hashmi, and Thomas W. Malone. (2010). Evidence for a Collective Intelligence Factor in the Performance of Human Groups. *Science, 330(6004)*, 686-688.

- **Group Problem Solving Challenge**: **Effects of IQ on Group Performance**
  - Teams increasingly contributing to production of knowledge (Wuchty et al., 2007)
  - Can a measure of **group level IQ** help diagnose performance differences

- **Gender Challenge**: **Group Process** as Related to **Gender** Composition of Teams
  - **Cooperative behavior** (constructive group process) **more prevalent in females**
 - **Interpersonal communication enhanced in females**

Anita Williams Woolley, Christopher F. Chabris, Alexander Pentland, Nada Hashmi, and Thomas W. Malone. (2010). **Evidence for a Collective Intelligence Factor in the Performance of Human Groups.** *Science, 330(6004)*, 686-688.

- Results: **Collective IQ and Gender**
  - Teams that had members with **higher IQs didn't earn much higher scores**
  - **Proportion of women** in a group is strongly related to the **collective intelligence**
  - Results related to **higher levels of social sensitivity** exhibited by women (ability to read nonverbal cues and make accurate inferences about what others are feeling or thinking)
  - Results also related to greater **equality in conversational turn-taking**

- STEM Roadmap Implications: **Importance of Interpersonal Processes** (Teamwork Skills)
  - **Groups need to be trained to be responsive** to one another
  - Groups need to be **trained in cooperative behavior** to make best use of member knowledge and skills
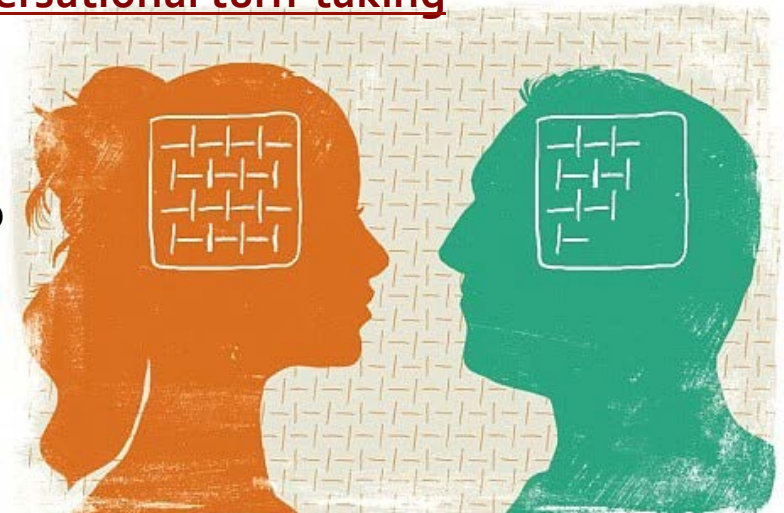
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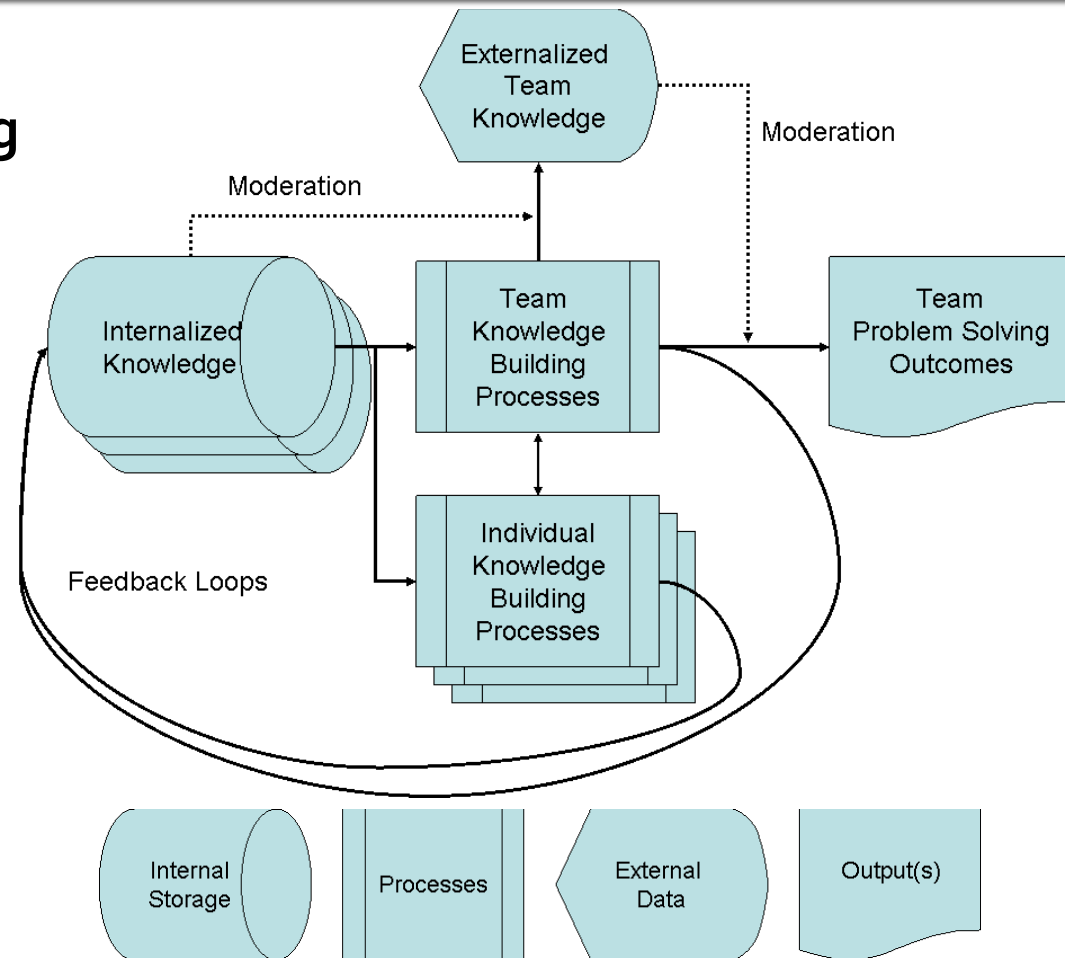
Need for Replications and Extensions

- Findings on **group composition** and **performance equivocal**
  - **Bear, J. B. & Woolley, A. W. (2011). The role of gender in team collaboration and performance.** *Interdisciplinary Science Reviews, 36(2),* 146-153.
  - Meta-analyses show no effects or slightly negative effects for gender heterogeneity.
    - Effects of gender diversity on team performance might depend upon moderators like **task difficulty** (Bowers et al. 2000), **team type** (Stewart 2006), **faultlines** (Lau and Murnighan 1998; Pearsall et al. 2008), and **demographic diversity** (Pelled et al. 1999).
  - Context Effects
    - In **male-dominated professions**, where women in minority, **gender diversity** is likely to have more **negative effects**.
    - Critical to understanding **gender diversity in STEM**
- **Generalizability** for international populations
  - **Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world?** *Behavioral and Brain Sciences, 33(2-3),* 61-83
  - Majority of **behavioral science** based upon non-representative sample of global population (**Western, Educated, Industrialized, Rich, and Democratic** aka "WEIRD").
  - Cross-cultural research finds that **WEIRD subjects are outliers** on variety of factors – from basic perception to fairness and cooperation.

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- **Theoretical Model of Collaborative Problem Solving**
  - *Multi-level in that it encompasses individual and team level factors*
  - *Addresses internalized and externalized cognitive functions*
  - *Incorporates temporal characteristics to examine problem solving phases through which group moves*

Fiore, S. M., Rosen, M. A., Smith-Jentsch, K. A., Salas, E., Letsky, M. & Warner, N. (2010). Toward an Understanding of Macrocognition in Teams: Predicting Processes in Complex Collaborative Contexts. *Human Factors*, 52, 2, 203-224.

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