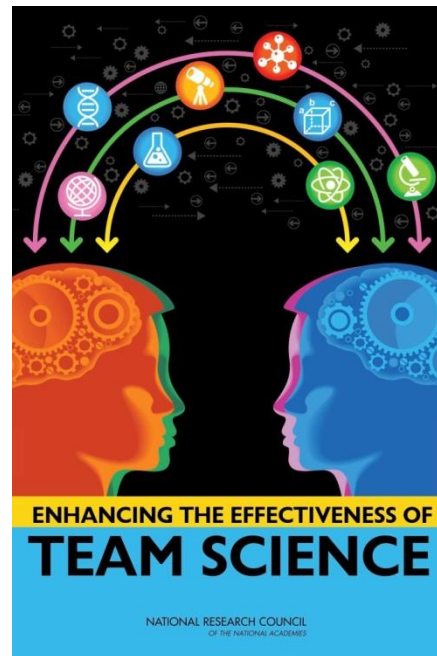


Enhancing the Effectiveness of Team Science

(National Research Council, 2015)

Study sponsored by the National Science Foundation and Elsevier



Nancy J. Cooke
Arizona State University
APLU ANNUAL MEETING
November 15, 2015

Committee Charge

Conduct a **consensus study** on the science of team science to recommend opportunities to enhance the effectiveness of collaborative research in science teams, research centers, and institutes... Explore:

- How **individual factors** influence team dynamics, effectiveness and productivity
- Factors at **team/center/institute** level influencing effectiveness
- Different **management approaches and leadership styles** that influence effectiveness
- How **tenure and promotion policies** acknowledge academic researchers who join teams
- Organizational** factors that influence effectiveness of science teams (e.g., human resource policies, cyber infrastructure)
- Organizational structures, policies and practices** to promote effective teams

Study Committee

- **NANCY J. COOKE (Chair)**, Arizona State University
- **ROGER D. BLANDFORD (NAS)**, Stanford University
- **JONATHON N. CUMMINGS**, Duke University
- **STEPHEN M. FIORE**, University of Central Florida
- **KARA L. HALL**, National Cancer Institute
- **JAMES S. JACKSON (IOM)**, University of Michigan
- **JOHN L. KING**, University of Michigan
- **STEVEN W. J. KOZLOWSKI**, Michigan State University
- **JUDITH S. OLSON**, University of California, Irvine
- **JEREMY A. SABLOFF (NAS)**, Santa Fe Institute
- **DANIEL S. STOKOLS**, University of California, Irvine
- **BRIAN UZZI**, Northwestern University
- **HANNAH VALANTINE**, National Institutes of Health

- **MARGARET L. HILTON**, *Study Director*
- **TINA WINTERS**, *Associate Program Officer*

Why Team Science?

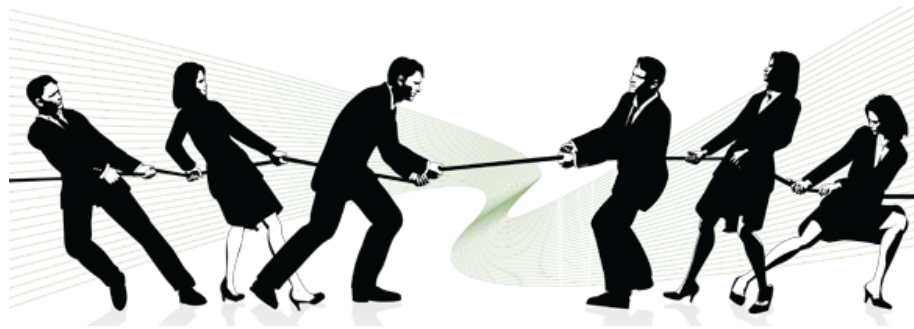


- Solving complex modern problems requires a team
- Team Science has been shown to
 - Have large impact (Wuchty, et al., 2007; Uzzi, et al., 2013)
 - Demonstrate high levels of innovation (Uzzi, 2013)
 - Increase productivity (Hall, et al., 2012)
 - Have a broad reach/uptake (Stipelman, et al, 2014)

Defining Key Terms

- ***Team science*** – collaborative, interdependent research by more than one individual
- ***Science team*** - Two to 10 individuals who conduct team science
- ***Larger group*** - More than 10 individuals who conduct team science
- ***Team effectiveness*** – A team's capacity to achieve its goals and objectives

Key Features that Create Challenges for Team Science



- Large membership diversity
- Deep knowledge integration
- Sometimes large size
- Goal misalignment with other teams
- Permeable boundaries
- Geographic dispersion
- High task interdependence

Improving Team Effectiveness

Conclusion: Strong body of research conducted over decades demonstrates **team processes related to team effectiveness**. Interventions that foster positive team processes offer most **promising route to enhance team effectiveness**.

Interventions in 3 Areas:

- Team Composition
- Team Development
- Team Leadership



Team Effectiveness

Composing the Team

Conclusion: Research in non-science contexts finds that **team composition influences team effectiveness**; relationship depends on **complexity** of the task, degree of **interdependence**, and **team familiarity**. **Task-relevant diversity** is critical and has a positive influence on team effectiveness.



Conclusion: **Task analytic methods** developed in non-science contexts and **research networking tools** developed in science contexts allow practitioners to **consider team composition systematically**.

Team Composition: Recommendation

Team science leaders and others involved in assembling science teams and larger groups should:

- **Consider using** task analytic methods that identify necessary **knowledge, skills, and attitudes**
 - *Use methods to match task-related diversity among team or group members with project needs*
- **Consider applying** tools such as **research networking systems** designed to **facilitate assembly** of science teams
- **Partner** with researchers **to evaluate and refine** these tools and task analytic methods

Team Professional Development

Conclusion: *Research in contexts outside of science has demonstrated that several types of **team professional development interventions improve team processes and outcomes.***



Team Professional Dev: Recommendation

Team-training researchers, universities, and science team leaders should **partner to translate, extend, and evaluate the promising training strategies**, shown to improve the effectiveness of teams in other contexts, to **create professional development opportunities for science teams.**

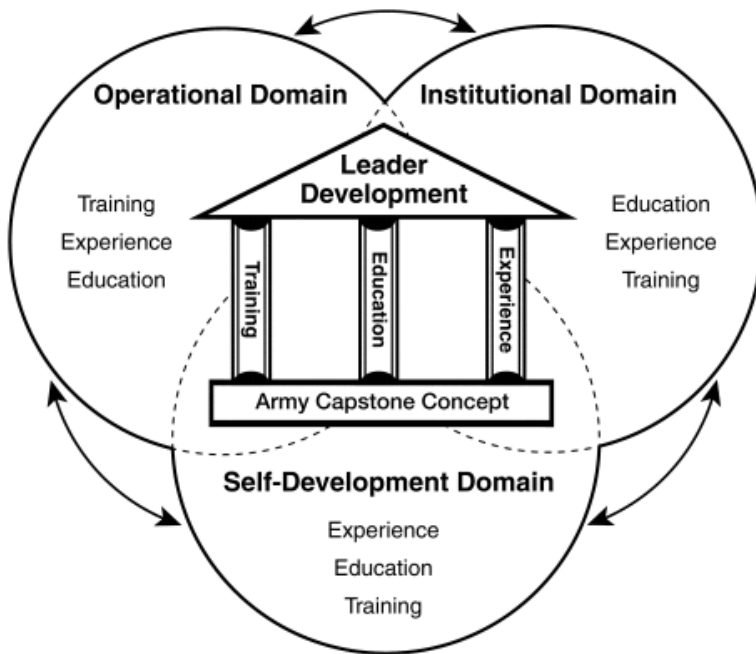
Leadership

Conclusion: *Fifty years of research on team and **organizational leadership in contexts** other than science provides a **robust foundation of evidence to guide** professional development for leaders of science teams and larger groups.*



Leadership: Recommendation

Researchers, universities, and team science leaders should **partner to translate and extend the leadership literature** to create and evaluate science leadership development opportunities for team science leaders and funding agency program officers.



Challenges of Virtual Collaboration

Conclusion: Research on **geographically dispersed science teams** and groups has found that **communicating** and **developing trust** are **more challenging** relative to face-to-face teams and groups.

- **Limitations** of virtual collaboration **may not be obvious** to members and leaders of the team or group.



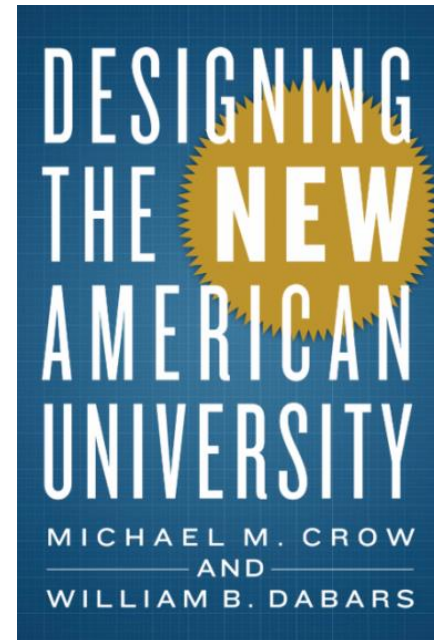
Virtual Collaboration: Recommendation

Leaders of geographically dispersed science teams should:

- **Utilize activities** validated to help participants **develop shared knowledge** (e.g., common vocabulary)
- Consider task assignments within semi-independent units at each location to **reduce the burden of constant electronic communication.**

Research Universities

Conclusion: *Universities have launched new efforts to promote interdisciplinary team science (e.g., creating research centers and institutes), but **the impact** of these initiatives on the amount and quality of team science **has not been systematically evaluated.***



Reward Structures

Conclusion: *University promotion and tenure review policies typically do not provide **comprehensive, clearly articulated criteria** for evaluating **individual contributions to team-based research.***

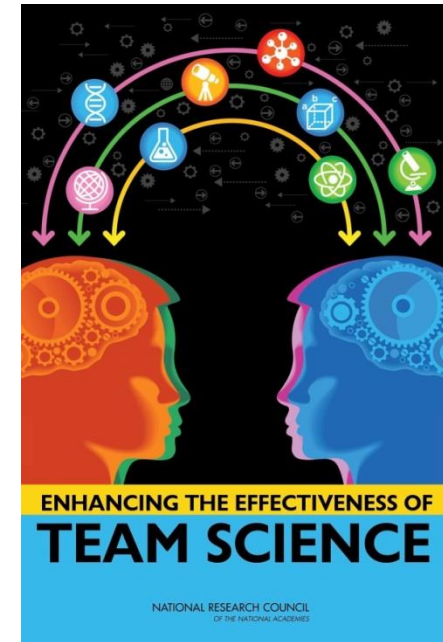
*The extent to which researchers are rewarded for team-based research **varies widely** across and within universities.*

*Where team-based research is not rewarded, **young faculty may be discouraged** from joining those projects.*



Conclusions

- There is a rich and robust science of teams that can be extended to improve team science effectiveness
- The science points to interventions through:
 - Assembling teams
 - Providing professional development and education opportunities and
 - Leadership development opportunities
- Other interventions can improve:
 - Virtual collaboration
 - Promotion and tenure credit for team-based work



Report also includes recommendations for funding agencies and future research

Report Available

<http://www.nap.edu/catalog/19007/enhancing-the-effectiveness-of-team-science>

