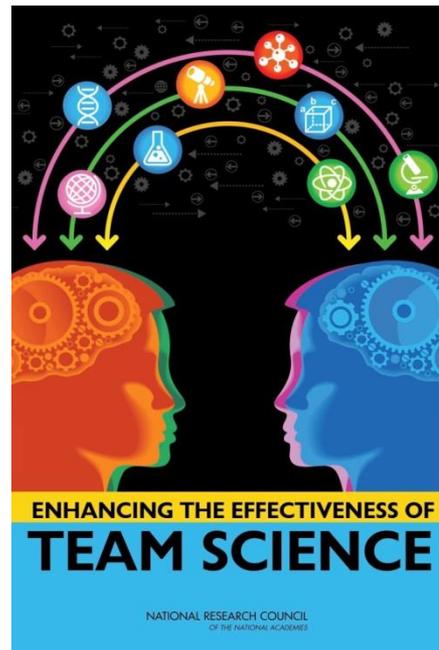


Enhancing the Effectiveness of Team Science

(National Research Council, 2015)

Study sponsored by the National Science Foundation and Elsevier



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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
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- **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?

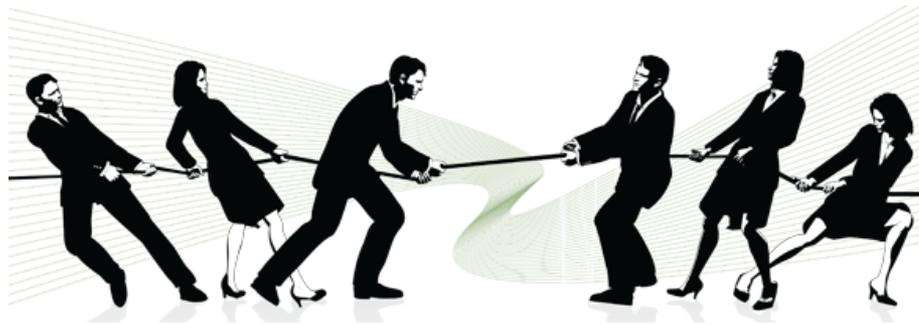


- Solving complex modern problems requires a team
- Team Science has been shown to
 - Have large impact (Wuchty, et al., 2007; Uzzi, et al., 2013)
 - Demonstrate high levels of innovation (Uzzi, 2013)
 - Increase productivity (Hall, et al., 2012)
 - Have a broad reach/uptake (Stipelman, et al, 2014)

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.**

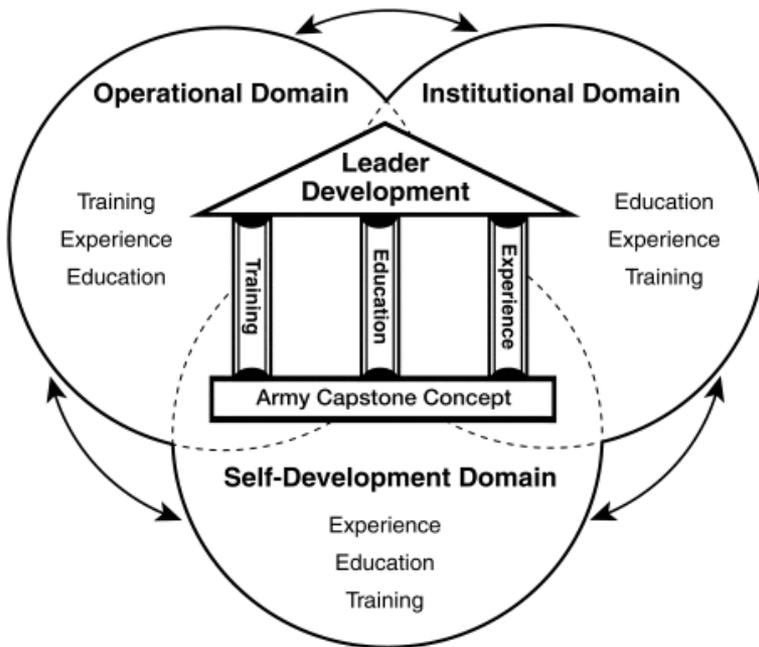
Leadership

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.



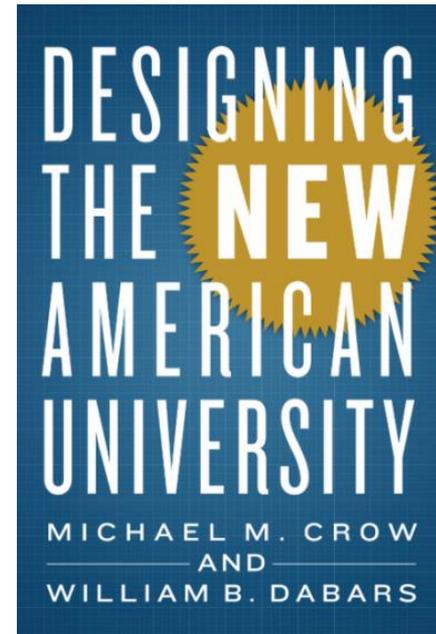
Virtual Collaboration: Recommendation

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.***

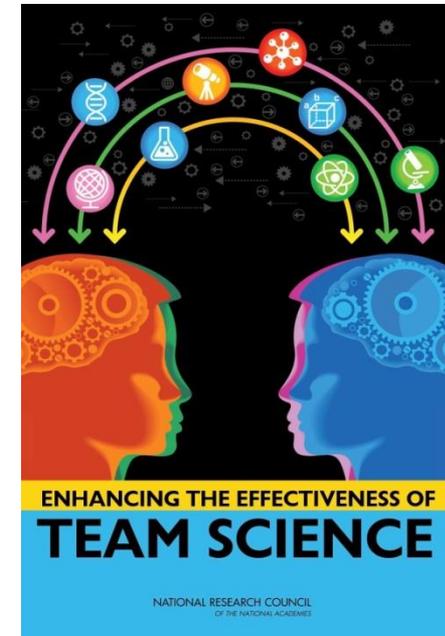
*The extent to which researchers are rewarded for team-based research **varies widely** across and within universities.*

*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>

