AN UPDATE ON THE SCIENCE OF TEAM SCIENCE

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Northwestern University

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Interdisciplinary and Interprofessional Teaching, Research and Practice
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Volume of scientific knowledge has increased over time, making it increasingly difficult to have deep expertise in all needed areas.

Solving complex problems (e.g., global warming, poverty, cancer) requires integration of specialized knowledge bases. Needs collaboration with more people from different specialties.

Emerging “science of team science” reflects insights to facilitate multi-, inter-, and transdisciplinary scientific progress.

Siloed Science
Research increasingly done in teams

Over the last 50 years, the proportion of social science publications authored by teams (vs. solo authorship) has more than doubled.

Research increasingly done in teams

Over the last 50 years, the # of authors on a team has increased significantly (and consistently across disciplines)

Structure & Composition of Successful Teams

Shaded graphs indicate significantly correlated variables at the 95% confidence level.

The rise in multi-university collaboration. By comparing the incidence of papers produced by different authorship structures, we see that the share of multi-university collaborations strongly increases from 1975 to 2005. This rise is especially strong in SE (A) and SS (B), whereas it appears weakly in AH (C), in which collaboration of any kind is rare.
The impact advantage

Between-school collaboration publications tend to be higher impact than single school or solo author publications.

The impact advantage

Risks associated with team science

Cummings & Kiesler (2007) 491 NSF funded collaborations.
Result: Having more universities involved in a collaboration associated with having fewer project outcomes (patents, awards, and publications)

High Risk.
But why?

Inverse relation between # of universities and project outcomes is mediated by the # of coordinating activities: division of responsibilities, project management tool (e.g. Basecamp), shared papers, student exchanges; in-person meetings - Issue: $$$$$

**Allen’s Law:** collaboration effectiveness declines when co-workers >30 m apart

Facilitates Interdisciplinary Team Science

- **Regular interactions focused on science** (Cummings & Kiesler, 2005; Rowe, 2008; Stokols et al., 2005)

- **Common language/constructs** (Maasen et al., 2006; Rosenfield & Kessel, 2008)
  
  Stephen Crowley, Idaho Toolbox – Scientific worldviews, scales, habits

- **Mutual respect among scientists** (Rowe, 2008; Stokols et al., 2005)

- **Cultural norms, institutional leadership, & funding that support interdisciplinary TS** (Cohen & Siegel, 2005; Gray, 2008; Klein, 2005; NAS, 2004; Rowe, 2008; Rosenfield & Kessel, 2008; Seaman, 2008; Sellers et al., 2006; Zerhouni, 2006)

Courtesy of Jacob Kraemer Tebes, Yale University Psychiatry
SciTS isn’t One Size Fits All

Collaboration Readiness Scale:

e.g. item 1: “There is so much work to be done within my field that I feel it is important to focus my research efforts with others in my own discipline.”
(uni-disciplinary research orientation item)

e.g., item 2: “Although I was trained in a particular discipline, I devote much of my time to understanding other disciplines in order to inform my research.”
(inter/trans-disciplinary item)


Also Facilitates Interdisciplinary TS

- **Training programs in team science** (Morgan et al., 2003; Nash et al., 2003; Sellers et al., 2006)

- **Mentoring in interdisciplinary team science** (Meaney, 2008; Seaman, 2008)

Courtesy of Jacob Kraemer Tebes, Yale University Psychiatry
The TeamScience.Net Goal

- Create, evaluate, and disseminate, new durable, readily accessible on-line learning resources to enhance team-based research.

- Tools designed to address the needs of a wide and diverse audience, in an engaging, even entertaining way
eLearning

**Why?** E-learning offers:

1) easy, free, access by a wide audience
2) convenient scheduling for busy researchers
3) adult learning principles: active exploration, interactive problem-solving, ask experts, experiment & make mistakes in safe environment.
   - known to facilitate deeper learning & retention
4) complements classroom learning (when available)

**How?** With the help of award winning NogginLabs, Inc.
Access the modules and download interactive activities from http://teamscicence.net

We have developed and launched four, interactive learning modules on http://teamscicence.net:
What resources are available:

A Suite of 4 e-Learning Modules

1. The Science of Team Science  Instructional (key findings)

2. Team Science Research Process in Behavioral Science

3. Team Science Research Process in Basic Medical Science

4. Team Science Research Process in Clinical Medical Science
What resources are available:

A Suite of 4 e-Learning Modules

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Experiential Learning (role playing)
Module 1: The Science of Team Science

Click a topic to get started.

TEAM SCIENCE 101  INCENTIVES AND CHALLENGES  ASSEMBLING A TEAM  MANAGING A TEAM  EVALUATING TEAM PERFORMANCE

ALL TOPICS

Please take the post-assessment by clicking the appropriate button below.

Take Self-Assessment
Module 1

Viewing only the 37 videos & 6 animations/activities in the "Team Science 101" category.
Module 1

Viewing only the 19 videos & 3 animations / activities on “Incentives & Challenges”
Module 1

Is conflict bad for a team?

Howard Gadlin answering a question on conflict

Some forms of conflict can actually improve the team.

Related Questions

Mouse over the squares below to view questions you also might find of interest.
Informational Activities

Module 1

According to bibliometric data, has collaboration been increasing or decreasing?

Research looks at what bibliometric data indicates about the amount of collaborations that are currently occurring in scientific fields.


Choose a graph with the line that represents the linear slope of co-authorship. Once you’re satisfied with your choice, click Submit. If you prefer not to guess, simply click Skip to continue.


Related Questions

Mouse over the squares below to view questions you might also find of interest.
Modules 2-4: Experiential learning / Role playing
Move through a series of real-world exercises

Module 2

Behavioral Team Science Wing

Identifying the Funding Opportunity

Click each funding opportunity to view additional information. Then, click **choose** to select the funding opportunity best suited for the research your team would like to conduct. (Remember, you can view your Dossier at any time for a refresher on project specifics.)

- **NATIONAL INSTITUTES OF HEALTH**
  - NIH P01: Program Project Grant

- **NSF**
  - Collaborative NSF Grant

- **W. M. Keck Foundation**
  - W. M. Keck Foundation Grant

**Collaborative NSF Grant**

NSF does not normally support research with disease- or health-related goals, including work on the etiology, diagnosis or treatment of physical or mental disease, abnormality, or malfunction in human beings or animals. Animal models of diseases or the development or testing of drugs or other procedures for their treatment also are not eligible for support.

However, research in bioengineering, with diagnosis- or treatment-related goals, that applies engineering principles to problems in biology and medicine while advancing engineering knowledge is eligible for...
Allocate funds to a team project’s budget

Module 3

Biomedical Team Science Wing

Drafting Budget

You worked with the PI to allocate reasonable amounts of the $22.5 million dollar maximum available funding to create this draft budget.

Click on the highlighted portions in the draft budget to view guidelines and best practices for this stage in proposal development.

Additional budget information is available in the Learn More button on this screen.

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And practice dealing with team conflicts

Module 3

Facilitating Communication

As a Research Development Officer, facilitating collaboration among the team is crucial. How can you facilitate collaboration effectively?

Talk to PI and other collaborators:
- Have the team set up standing, hour-long weekly meetings
- The RDO sets these meeting agendas in partnership with the PI

Be aware of warning signs such as missed meetings and frequent schedule difficulties:
- If members are regularly missing meetings and scheduling other things, talk with the PI about available options and possibly have a discussion with the collaborator(s) directly to ask about continued involvement. Being proactive will pay off.

Click the Next button to return to the room.
Learn strategies for evaluating the project

Module 2

To begin, select the glowing object in this room.
Then find out how much you’ve learned

Pre-Assessment

Team Science Wing

Self-assessed Skills

Instructions: Please select the number to the right of each item that best describes your level of confidence.

<table>
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<th>How confident are you in your ability to...</th>
<th>Not At All Confident</th>
<th>Very Confident</th>
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<td>assemble and manage a cross-disciplinary research team?</td>
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<td>find an appropriate funding opportunity for a cross-disciplinary research project?</td>
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<td>head off conflict on a cross-disciplinary research team?</td>
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<td>find help mediating conflicts when collaborating with colleagues in different departments or institutions?</td>
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<td>set up and employ the right communication methods at the right times with cross-disciplinary team members?</td>
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<td>evaluate the success of a collaboration midway through a cross-disciplinary project?</td>
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Modules 1-4

Continue
Reviewing key features // teamscience.net

- Open access (i.e., free) thanks to our funders
- Self-testing at the beginning and end of each module
- Self-pacing / stop & save /
  - exploration (e.g., the “learn more” feature)
  - estimated 45-60 minutes to complete each module
- A library of resources for researchers and instructors
  - articles, team building tools, & syllabi

We hope you’ll use & enjoy them!
Thank you to:

The Coalesce Team:
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Holly Falk-Krzesinski
NogginLabs, Inc.

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Gary Olson
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For more information see: www.teamsscience.net or contact Bonnie.Spring@northwestern.edu