Welcome! If you consider yourself to be a researcher, please answer the six questions on a handout before the session begins. (Don’t worry about the other side!)
Teamwork Training for Graduate Students

Susan E. Cozzens

Georgia Institute of Technology

Council of Graduate Schools, December 6, 2019

We gratefully acknowledge the support of the National Science Foundation under Grant 1735017 under the Innovations in Graduate Education Program.
Our team

- Susan Cozzens
- Meltem Alemdar
- Angus Wilkinson
- Mary Lynn Realff
- Kata Dósa
- Chris Cappelli
Outline

• Motivation for the project
  • Science of Team Science
  • Why graduate students?
• The project
  • Graduate student focus groups
  • Scope, focus
  • Settings
  • Assessment
• The modules
Science of Team Science (SciTS)

- Team science = interdisciplinary collaborative research
  - Often problem driven
  - Brings complementary skills together
  - Integrates knowledge
  - Growing across all disciplines
- SciTS = research on team science
  - What are its dimensions?
  - What are its consequences for quality and careers?
  - What makes it work well or not?
- Field is institutionalizing
Why graduate students?

- Science of Team Science has not paid specific attention to their roles.
- Distinctive characteristics
  - Power relationship with PI/advisor
  - Many are international, first time in the U.S.
  - Perceived gap in expertise
  - Relationships within the team may be uncharted
  - Rolling team membership
Listening to graduate experiences

- Advisors/PIs and research groups
- Contributor roles
- Student leadership roles
- Frequently mentioned points of conflict:
  - Authorship
  - Data access
  - Equipment and space sharing

We turned these into scenarios to use in the modules.
The NSF-supported project

- Scope: STEM programs
- Focus: Transportable skills
- Settings
  - Workshop
  - Classroom
- Would like to move on to...
  - In situ teams
Assessment

- Pre-Post/Follow Up Graduate Student Surveys
  - Barriers to Team Science
  - Collaboration Readiness
  - Team Competency
  - Feedback/Satisfaction
- Focus Groups

Main messages:
- More research, please.
- Give us takeaways.
- Get us ready to talk to our advisors.

Curriculum development cycle for team science training materials.
## Preliminary Results

**Have you engaged in the following activities following your participation in the iCOGS team workshop?**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Agree (%)</th>
<th>Neutral (%)</th>
<th>Disagree (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conducted research in another interdisciplinary team.</td>
<td>85.7%</td>
<td>14.3%</td>
<td></td>
</tr>
<tr>
<td>Discussed interdisciplinary research with faculty at Georgia Tech.</td>
<td>85.7%</td>
<td>LU%</td>
<td></td>
</tr>
<tr>
<td>Successfully preserved team relationships when conflicts have arisen.</td>
<td>!:0.5%</td>
<td>9.5%</td>
<td></td>
</tr>
<tr>
<td>Constructed a plan for work on a team that enables team member’s to make unique contributions to the team.</td>
<td>81.0%</td>
<td>19.0%</td>
<td></td>
</tr>
<tr>
<td>Formulated solutions to communication challenges when they have arisen.</td>
<td>95.2%</td>
<td>4.8%</td>
<td></td>
</tr>
<tr>
<td>Constructed a plan to effectively address team conflicts.</td>
<td>66.7%</td>
<td>33.3%</td>
<td></td>
</tr>
<tr>
<td>Adapted your communication strategy when necessary in a team environment.</td>
<td>100.0%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Constructed a plan that integrates various patterns of behavior or to maximize team functioning.</td>
<td>61.9%</td>
<td>38.1%</td>
<td></td>
</tr>
</tbody>
</table>

**To what extent do you agree with each of the following statements?**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agree (%)</th>
<th>Neither (%)</th>
<th>Disagree (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working with researchers from other disciplines may have a positive influence on my own research.</td>
<td>80.0%</td>
<td>20.0%</td>
<td></td>
</tr>
<tr>
<td>I believe that my own expertise can help researchers in other fields improve their work.</td>
<td>61.9%</td>
<td>38.1%</td>
<td></td>
</tr>
<tr>
<td>I am able to navigate the environment of working on an interdisciplinary team.</td>
<td>57.1%</td>
<td>42.9%</td>
<td></td>
</tr>
<tr>
<td>I understand my own personal weaknesses that may inhibit effective team collaboration.</td>
<td>33.3%</td>
<td>57.1%</td>
<td>4.8%</td>
</tr>
<tr>
<td>I am comfortable collaborating with researchers in a diverse team environment.</td>
<td>57.1%</td>
<td>42.9%</td>
<td></td>
</tr>
</tbody>
</table>
Innovation and creativity

By the end of this module, you will be able to...

1. Identify factors that contribute to the growing prevalence and importance of interdisciplinary research teams
2. Describe the ways in which working in a team can either help or hinder idea generation
3. Describe the relationship between collaboration and team productivity over time
4. Acknowledge and identify some challenges researchers experience when working in an interdisciplinary team
Diversity for better teams

By the end of this module, you will be able to...

1. Reflect on what dimensions of diversity are salient to yourself and others
2. Explain the relationship between team diversity and team performance
3. Reflect on and articulate aspects of your patterns of thought/behavior on teams
4. Construct a plan to integrate all patterns of thought/behavior and maximize team functioning
Effective communication

• By the end of this module, you will be able to…

- Describe some possible ways communication challenges arise in interdisciplinary teams
- Analyze communication challenges in research teams
- Formulate solutions to communication challenges
- Identify language unique to your discipline that might be misunderstood outside the discipline
Leveraging and managing conflict

By the end of this module, you will be able to...

1. Choose appropriate conflict management strategies for a given conflict situation
2. Construct a plan to address a major conflict
3. Preserve working relationships during crucial conversations by employing empathetic listening
Materials available

- For the four modules
  - Slides
  - Student workbook
    - Includes takeaway tools
  - Facilitator guide
- Would love to collaborate on delivery of the workshop on your campus.
- Contact me to talk about a time to do this.
  - scozzens@gatech.edu
Thank you for your attention.

Susan Cozzens
scozzens@gatech.edu
Team Science Training for Graduate Education

Wayne T. McCormack, PhD

Distinguished Teaching Scholar & Professor, UF College of Medicine
TL1 Principal Investigator, UF Clinical & Translational Science Institute

mccormac@ufl.edu
Clinical & Translational Science
TL1 = Institutional training grant (like a T32) linked to CTSA
If we expect future researchers to work in teams, they should be trained in teams.

“TL1 Teams”

Supported by UF CTSA Awards TL1TR001428 and UL1TR001427
How can we best prepare new researchers to USE team science?

- Use the “Science of Team Science” in our training programs
  - We know a **LOT** about how research teams work
- Support for team training
  - *Didactic*: curriculum
  - *Practical*: give trainees experience with collaboration
Clinical & Translational Science PhD Co-Major

Year 1 – Fall
• Translational Research & Therapeutics: Bench, Bedside, Community, & Policy (3)
• Team Science (1)

Year 1 – Spring
• Responsible Conduct of Biomedical Research (1)

Year 2 – Fall
• CTS Journal Club (1)
• CTS Seminar (2)

At any time
Electives (6)
Experimental Design
Quantitative Skills
Professional Development
Didactic:
Team Science (GMS 6945)

- Intro to Team Science
- Preparing for Team Science
- Team Leadership
- Building a Research Team
- Writing a Collaboration Plan
- Managing Research Teams
- Conflict Management
- Team Monitoring
- Team Evaluation
Didactic & Practical: Team Science (GMS 6945)

- Intro to Team Science
- Preparing for Team Science
- Team Leadership
- Building a Research Team
- Writing a Collaboration Plan
- Managing Research Teams
- Conflict Management
- Team Monitoring
- Team Evaluation

Behavioral Self-Assessment (DISC)
Vision/Mission/Values
Collaboration Plan
Authorship Agreement
Team Dimensional Training
**Practical:**

**TL1 Teams**

- Two PhD and/or dual degree students in different PhD programs in different colleges
- Apply before dissertation proposal approved
- TL1 Co-Mentors
- Extent of collaboration
  - Team specific aim(s)
    - Overcome barrier to progress or expand scope
    - Synergy between individual projects
    - Level of interdependence
- Embed into individual dissertation research projects
Practical: TL1 Teams

- Information sessions
- Interest list
- Advice from trainees:
  - Talk to your mentor
  - Networking session
  - Elevator speeches
  - Strategic Doing workshop
TL1 Team Trainee Home Colleges

AGR = Agriculture & Life Sciences
ENG = Engineering
HHP = Health & Human Performance
JOU = Journalism & Communication
LAS = Liberal Arts & Sciences
MED = Medicine
NUR = Nursing
PHHP = Public Health & Health Professions
PHM = Pharmacy

Created with NodeXL (http://nodexl.codeplex.com)
Program Assessment

- Novel metrics
  - Modest gains in cross-disciplinary activities (CDCA) and perspective (ROS)
  - Significant increase in self-efficacy for clinical research (CRAI)

- Items from additional measures focusing on team skills are being tested

- Qualitative
  - Trainees value interdisciplinary interactions for new ways of thinking about experimental design and conduct, new skillsets, and methodological insight
Team Science Training for Graduate Education
A Coastal Resilience Challenge as a Framework for Graduate Student Team Science Training

CGS Winter Meeting
December 6, 2019
Project Leadership

Troy Hartley, PI, Virginia Sea Grant (Collaborative Governance in Marine Resource Management, Marine Policy, Professional Development for Graduate and Post-Graduate Students)

Linda Schaffner, Co-PI, Virginia Institute of Marine Science, William & Mary School of Marine Science (Marine Science, Graduate Education and Student Professional Development)

Karen McGlathery, Co-PI, University of Virginia (Marine Science, Environmental Change and Resilience)

Deborah DiazGranados, Co-Investigator, Virginia Commonwealth University (Organizational Science, Science of Team Science)

Steve Fiore, Co-investigator, University of Central Florida (Cognitive Science, Science of Team Science)

NSF NRT-IGE 1735301 Team Science Training for Coastal Ocean & Estuarine STEM Graduate Students
Grand Challenges of the Coastal Zone:
How do we prepare today’s graduate students to address them?

Rising Seas Are Flooding Norfolk Naval Base, and There’s No Plan to Fix It

The giant naval base in Virginia is under threat by rising seas and sinking land, but little is being done to hold back the tides.

By Nicholas Kusnetz
OCT 25, 2017

Source: Inside Climate News
Source: Google Earth
Source: NASA
Source: NOAA
Source: VIMS
Addressing today’s grand societal challenges [of the coastal zone] demands research and problem-solving that produces integrated breakthroughs and solutions that transcend individual disciplines.

New kinds of intellectual partnerships are needed (Schaffner et al. 2016)

...collaboration and communication skills are needed to pursue truly transformative science (Ciannelli et al. 2014)

Deeper levels of knowledge integration are needed
Levels of Knowledge Integration

**Multidisciplinary** - each discipline makes a separate, but additive contribution

**Interdisciplinary** – methods, data and perspectives from two or more disciplines are somewhat integrated

Aspects of knowledge integration:
- Defining a problem
- Shared methods

Adapted from: Ciannelli et al. 2014
Levels of Knowledge Integration

Transdisciplinary – teams transcend disciplinary boundaries, generate novel frameworks, theories, hypotheses, models and shared policy solutions

Collaborative intelligence, collective genius (Fiore 2013)

Project Goals

Design and test a team science professional development training program, following SciTS recommendations for increasing team effectiveness:

• introduce students to the science of team science, particularly the inter- and intrapersonal competencies needed for effective teamwork

• provide opportunities for students to develop and improve self-reflective and team-reflective practices and adaptive capabilities

• use real-world (authentic) resilience* challenges to motivate engagement and provide experience with process of knowledge integration

*Resilience is defined here as the ability of a system to absorb and adapt to changing conditions before shifting to a less desirable state.
Training Approach

Assemble diverse teams of graduate students and assign each a resilience case study “challenge”

Workshops (2), assignments, coaching and feedback to support:

- Mastery of basic team science concepts and ongoing development of self-reflective and team-reflective practices for better communication and collaboration
- Enhanced appreciation of the factors that facilitate deeper knowledge integration; through the development of a shared conceptual framework and a trans-disciplinary proposal addressing the resilience challenge

Team deliverables - final presentation, integrated proposal
Supporting Teamwork in Team Science

C: Communicate
Create a cooperative environment, ensure role clarity, and develop a clear course of action for teamwork.

A: Adapt
Coordinate efforts in response to changing task demands, monitor team members' progress, and provide backup.

R: Relate
Reduce interpersonal conflicts and arguments regarding how to accomplish work. Focus on building trust and a safe place for sharing.

E: Educate
Learn from other team members, and provide each other with constructive feedback.

Team CARE Model developed by Dr. Tom O’Neill at Individual and Team Performance Lab at the University of Calgary ITPmetrics.org
Supporting Teamwork in Team Science

**Communicate**

Cooperative Conflict Management
Approaching conflict and incompatibilities such that win-win solutions are sought. Conflict is viewed as a chance to learn and make quality improvements, and members work through different viewpoints with mutual respect.

Role Clarity
The existence of well-defined and understood roles within the team, demonstrated through the establishment and maintenance of clarity regarding responsibilities, goals, expectations, and relative authority of each role within the team.

Strategy Formulation & Planning
Developing overall strategies that guide team efforts, including the sequencing of planned work elements, evaluation of processes, and formulation of contingency plans.

**Subjective Assessment of Team Processes**

- **Communicate**
  - Pre: 4.1
  - Post: 4.7

- **Adapt**
  - Pre: 3.7
  - Post: 3.8

- **Relate**
  - Pre: 3.8
  - Post: 4.1

- **Educate**
  - Pre: 3.7
  - Post: 4.1
Team Reflection Prompts for Coaches

Example: Knowledge, Skills and Abilities

**Reflection Oriented Prompts**

- What did you do, or what did you see your teammates do, that you think helped them acquire new skills or knowledge to improve the team’s performance?
- What kinds of questions did you ask, or hear your teammates ask, that helped you better understand teammate tasks or roles?

**Future Oriented Prompts**

- To improve your collaboration competencies, how might you acquire new skills or knowledge to improve the team’s performance?
- To improve your collaboration competencies, how could you learn about other teammates’ tasks and roles?
Select Observations

Developing a shared conceptual framework and knowledge integration takes time.

Visualization is effective for moving team towards shared understanding.

Self-reflective and team-reflective assignments and coaching encouraged team discussion.

Self assessments → increases in “transportable competencies”

Teams stayed focused during workshops and were remarkably engaged outside of the workshops - possibly linked to focus on an authentic resilience challenge.

Teams were not necessarily good at navigating conflict – long discussions ensued, and some teams resorted to simplification of models when time became limiting.

A training framework for coaches (faculty, professional staff and others) would likely enhance the application of SciTS recommendations and best practices.
Approaches to Teamwork Training

Susan Cozzens, Georgia Institute of Technology
Wayne T. McCormack, University of Florida
Linda Schaffner, William & Mary
### Approaches to Teamwork Training

Collaborative, interdisciplinary, and cross-cultural research has significantly increased, but often students do not receive sufficient preparation in teamwork skill building. This session will feature examples of developing teamwork skills specifically for graduate students and that draw on the new “Science of Team Science.”

Speakers: Susan Cozzens, Professor Emerita, Georgia Institute of Technology
Wayne T. McCormack, Distinguished Teaching Scholar & Professor, University of Florida
Linda Schaffner, Professor and Associate Dean, Academic Studies, William & Mary

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<table>
<thead>
<tr>
<th>Please indicate (✓) how strongly you agree or disagree with each of the following statements:</th>
<th>Strongly Disagree (1)</th>
<th>Somewhat Disagree (2)</th>
<th>Neutral (3)</th>
<th>Somewhat Agree (4)</th>
<th>Strongly Agree (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I tend to be more productive working on my own research projects than working as a member of a collaborative research team.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2. There is so much work to be done within my field that it is important to focus my research efforts with others in my own discipline.</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. While working on a research project within my discipline, I sometimes feel it is important to seek the perspective of other disciplines when trying to answer particular parts of my research question.</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Although I rely primarily on knowledge from my primary field of interest, I usually work interactively with colleagues from other disciplines to address a research problem.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5. In my own work, I typically incorporate perspectives from disciplinary orientations that are different from my own.</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Although I was trained in a particular discipline, I devote much of my time to understanding other disciplines in order to inform my research.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Multidisciplinary: shares insights & perspectives with other fields, collaboration may be additive, complementary, independent, sequential

Interdisciplinary: collaboration is more interactive, combined, integrated

Transdisciplinary: transcends disciplinary perspectives, develops new methodologic or conceptual frameworks
Ten people turned in their results. The number of people with the highest score in each category is shown to the right.

**UNIDISCIPLINARY**: use of theories and methods from a single field

A

**CROSS DISCIPLINARY**: combines concepts & methods from multiple disciplines

A\&B tie

**Multidisciplinary**: shares insights & perspectives with other fields, collaboration may be additive, complementary, independent, sequential

B

**Interdisciplinary**: collaboration is more interactive, combined, integrated

C

**Transdisciplinary**: transcends disciplinary perspectives, develops new methodologic or conceptual frameworks

D
Approaches to Teamwork Training

Susan Cozzens, Georgia Institute of Technology
Wayne T. McCormack, University of Florida
Linda Schaffner, William & Mary

Thank you for your participation!