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Overview

- Part 2. Training Transdisciplinary Team Science Competencies
- Part 3. Reflecting on Team Science as Complex Collaborative Problem Solving
SciTS CHALLENGE – Understand that science teams need to know how to engage in both taskwork and teamwork (Fiore et al., 2015; Fiore, 2008)

- **TASKwork** refers to what needs to be accomplished to meet goals and complete objectives
  - This is the scientific “work” of science teams
    - Understanding the relevant theory and constructs
    - Developing studies and executing appropriate methods
    - Conducting analyses and interpreting results and writing up findings
- **TEAMwork** refers to the attitudinal, behavioral, and cognitive factors required to function effectively as part of an interdependent team
  - Attitudinal – Affect arising from working with teammates (trust)
  - Behavioral – Skills supporting interacting with teammates (communication)
  - Cognitive - Knowledge associated with teammates (roles, responsibilities)
NRC Report Identified Competencies Deficit – Researchers do not necessarily have the TEAM competencies for collaboration

Task Competencies

• **TASK SPECIFIC** competencies important within particular task
• **TASK GENERIC** competencies are those necessary across task situations

Team Competencies

• **TEAM SPECIFIC** competencies are more directly related to teams and include knowledge of the abilities held by team members
• **TEAM GENERIC** competencies are those necessary regardless of the context or the setting

## Part I. SciTS Challenge

### Education and Learning for Team Science

<table>
<thead>
<tr>
<th>Relation to TEAM</th>
<th>Specific</th>
<th>Generic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relation to TASK</strong></td>
<td><strong>CONTEXT DRIVEN</strong></td>
<td><strong>TEAM CONTINGENT</strong></td>
</tr>
</tbody>
</table>
| **Specific** | • Knowledge – *Team objectives and resources*  
• Skills – *Particular analyses*  
• Attitudes - *Collective efficacy* | • Knowledge – *Teammate characteristics*  
• Skills – *Providing teammate guidance*  
• Attitudes – *Team cohesion* |
| **Generic** | **TASK CONTINGENT** | **TRANSPORTABLE** |
| | • Knowledge – *Procedures for task accomplishment*  
• Skills – *Problem analysis*  
• Attitudes – *Trust in technology* | • Knowledge – *Understanding group dynamics*  
• Skills – *Communication and assertiveness*  
• Attitudes – *Interdisciplinary appreciation* |

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Part 2. SciTS Challenge

Training Team Science Competencies

NSF-wide

Innovations in Graduate Education (IGE) Program

NRT-IGE: Team Science Training for Coastal Ocean & Estuarine STEM Graduate Students * #1735301 * Troy Hartley PI and Linda Schaffner Co-PI * College of William & Mary Virginia Institute of Marine Science
Potential Training Methods for Science Teams

- **Promising approaches developed for teams outside science**
- Example of what we’d call “TRANSPORTABLE competencies”

Team Reflexivity Training (e.g., Gabelica et al., 2016)

- Train **self-regulation and self-efficacy** in support of collaboration
- Requires members **reflect on performance and objectives** met and not
- **Reflect on strategies** used or group processes engaged
- Members **speculate performance** improvement
- Reflections prompted by series of questions for team discussion

RECRUITING GRADUATE STUDENTS FOR PROFESSIONAL DEVELOPMENT IN COLLABORATIVE RESEARCH

Multiple Disciplines Conducting Team Science to Enhance Coastal Resilience to Climate Adaptation

What you will learn:

- How to effectively work on teams of scientist from multiple disciplines.
- Latest science-based communication and leadership techniques for effective teamwork.
- How to employ adaptive practices that ensure team science success.
- How to integrate diverse disciplinary perspectives to address a real work challenge – enhancing resilience to climate change.
Part 2. SciTS Challenge

Training Team Science Competencies

Team Science 101

- Part 1. Background on Teams and Teamwork
- Part 2. Understanding Science of Team Science
- Part 3. Understanding Teamwork “in” Team Science
- Part 4. Science as Collaborative Problem Solving
- Part 5. Team Reflection to Support Collaborative Problem Solving

Team Science 102

- Part I. Team Science 102
  - Interdisciplinary Research as Complex Collaborative Problem Solving
- Part II. Putting the Team in Science
  - Understanding Science of Team Science
- Part III. Cultivating Understanding and Reflection in Science Teams
  - Educating Beyond Just Scientific Taskwork
- Part IV. Leading Transdisciplinary Science Teams
  - Understanding Teamwork Basics to Share Leadership
Team Reflection – 2 Main Components

1. Reflecting on and interpreting accomplishments
2. Preparing for future action

- Thinking together and communicating about previous accomplishments and planning future action leads to:
  - Development of **better strategies**
  - Better communication within the team
  - Learning from mistakes
  - Better understanding of the problem
  - Performance improvement
Part 2. SciTS Challenge
Training Team Science Competencies

Overview

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### Resilience Case – Cape Charles, Virginia

- Resilience can mean different things to different disciplines.
- Generally, and in our case, we are interested in climate resilience
  - *Capacity for a socio-ecological system or coupled human-natural system to absorb stresses and maintain function in the face of climate change-driven external stresses, and to adapt, reorganize, and evolve into a state that leaves it better prepared for future climate change impacts.*
- Climate resilience of a socio-ecological systems is multi-faceted with many disciplines contributing to studying, understanding and explaining resilience.
- We are bounding the socio-ecological system geographically by the Town of Cape Charles, Virginia.

In advance of the workshop, please:
- Briefly review the two background documents on resilience in the Town of Cape Charles, (i.e., *Resilience Adaptation Feasibility Tool (RAFT) Scorecard, Town of Cape Charles, June 2017*; and *Planning for Resilience on the Eastern Shore... May 2015. [Selected Chapters]*)
Part 3. Reflecting on Team Science
SciTS and Complex Collaborative Problem Solving
Instructions: As a team, please complete the following reflection activity. Use the "Team Health" report provided to understand what your team-level response is for each dimension. Be very specific with your action steps.

<table>
<thead>
<tr>
<th>DIMENSION</th>
<th>ACTION STEPS: List steps and actions that your team will take to improve each dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooperative Conflict Management</td>
<td>More aware of other peoples opinions. Create a process to handle conflict in the future and differing opinions.</td>
</tr>
<tr>
<td>Role Clarity:</td>
<td>Having the discussion of who does what prior to go forward with tasks. Having clearly defined roles and responsibilities may help us achieve our goals.</td>
</tr>
<tr>
<td>Strategy Formulation &amp; Planning</td>
<td>Build in time to discuss counter arguments, maybe intentionally. Develop clear steps, an agenda, milestones, etc. to guide us.</td>
</tr>
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<td>Contribution Equity:</td>
<td>Define clear and equitable roles. Foster open communication about role expectation and keeping each other accountable.</td>
</tr>
<tr>
<td>Healthy, Fact-driven Conflict:</td>
<td>When making decisions, give every member will to state their point of view and reasoning.</td>
</tr>
<tr>
<td>Lack of Personal Conflict:</td>
<td>Remind each other and the team of the importance of individual expertise.</td>
</tr>
<tr>
<td>Trust:</td>
<td>Continue to promote openness and acknowledge each others differences in experience.</td>
</tr>
</tbody>
</table>
Part 3. Reflecting on Team Science
SciTS and Complex Collaborative Problem Solving

Subjective Assessment of Team Processes

Average Team Ratings

Communicate  Adapt  Relate  Educate

Pre  Post
Collaborative Problem Solving Education for the 21st Century Workforce

Stephen M. Fiore¹, Arthur Graesser², Samuel Greiff³
University of Central Florida¹, University of Memphis², University of Luxembourg³

The complex research, policy, and industrial challenges of the 21st Century require collaborative problem solving. Assessments suggest that, globally, many graduates lack necessary competencies. There is a pressing need, therefore, to improve and expand teaching of CPS in our education systems.

Scientific Genius in New Guises

*Scientific ecosystem requires we understand new forms of genius arising during team science.*

- Genius can arise from a member who *instinctively optimizes* the group’s *complementary expertise* to elicit a ground-breaking discovery.
- More radically, genius may now be an *emergent phenomenon* – an ideal combination of knowledge and process can create a form of *collective genius*.
- *Must recognize and encourage this new form of team science competency.*

Thank You!

Questions or Comments?

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