



Reflecting on Transdisciplinary Team Science Training

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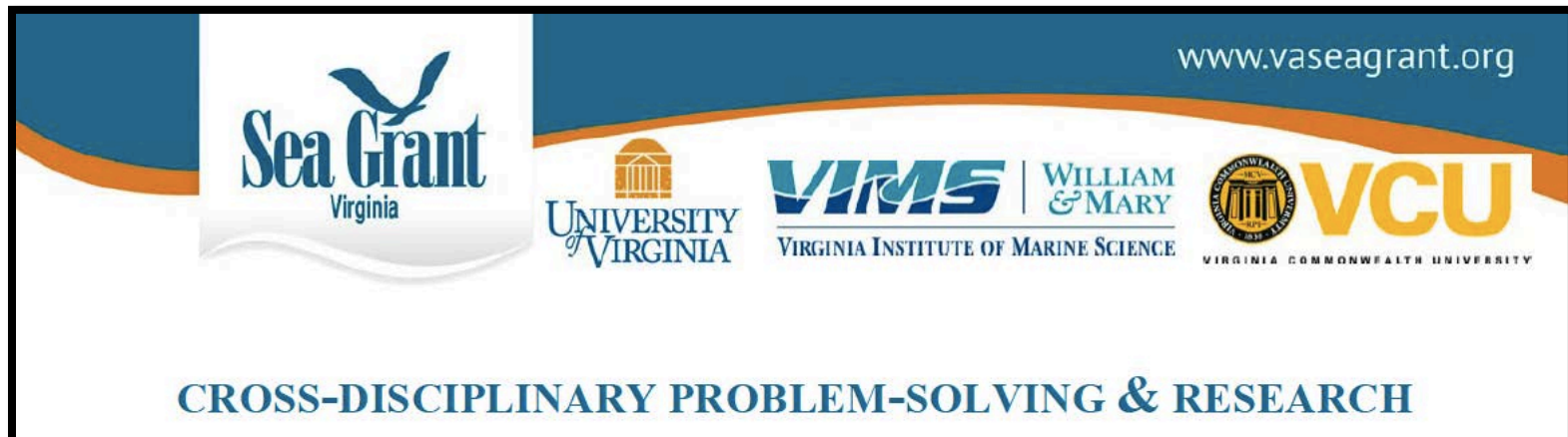
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Overview

- Part 1. Part I. SciTS Challenges: Education and Learning for Team Science
- Part 2. Training Transdisciplinary Team Science Competencies
- Part 3. Reflecting on Team Science as Complex Collaborative Problem Solving





Part I. SciTS Challenges

Education and Learning for Team Science

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)

Part I. SciTS Challenge

Education and Learning for Team Science

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



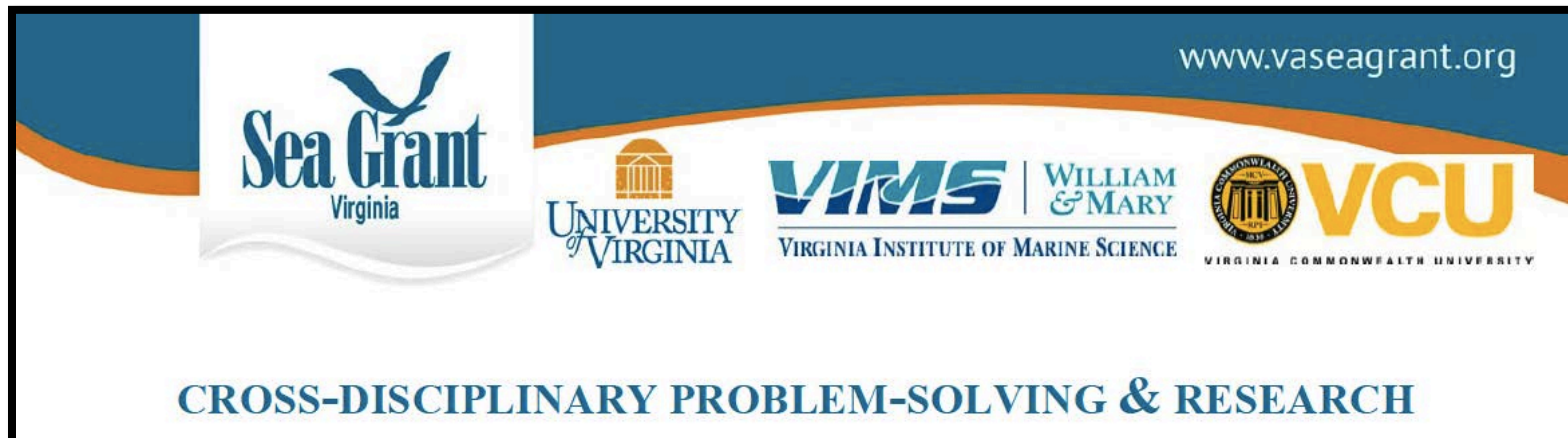
Part I. SciTS Challenge

Education and Learning for Team Science

		<i>Relation to TASK</i>	
		Specific	Generic
<i>Relation to TEAM</i>	Specific	<i>CONTEXT DRIVEN</i> <ul style="list-style-type: none"> • Knowledge – <i>Team objectives and resources</i> • Skills – <i>Particular analyses</i> • Attitudes - <i>Collective efficacy</i> 	<i>TEAM CONTINGENT</i> <ul style="list-style-type: none"> • Knowledge – <i>Teammate characteristics</i> • Skills – <i>Providing teammate guidance</i> • Attitudes – <i>Team cohesion</i>
	Generic	<i>TASK CONTINGENT</i> <ul style="list-style-type: none"> • Knowledge – <i>Procedures for task accomplishment</i> • Skills – <i>Problem analysis</i> • Attitudes – <i>Trust in technology</i> 	<i>TRANSPORTABLE</i> <ul style="list-style-type: none"> • Knowledge – <i>Understanding group dynamics</i> • Skills – <i>Communication and assertiveness</i> • Attitudes – <i>Interdisciplinary appreciation</i>

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Part 2. SciTS Challenge

Training Team Science Competencies



Funding

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

Part 2. SciTS Challenge

Training Team Science Competencies

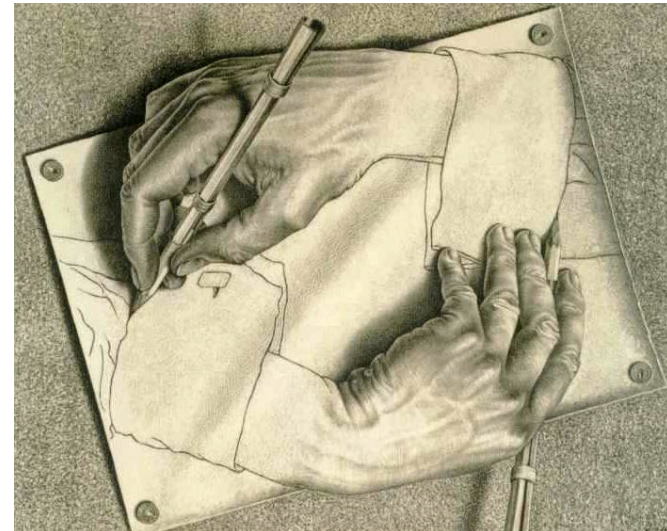
Potential Training Methods for Science Teams

- *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

Gabelica, C., Fiore, S. M., Van den Bossche, P., Segers, M., & Gijssels, W. (2016). Establishing team knowledge coordination from a learning perspective. *Human Performance*, 29(1), 33-52.



Part 2. SciTS Challenge

Training Team Science Competencies



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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:

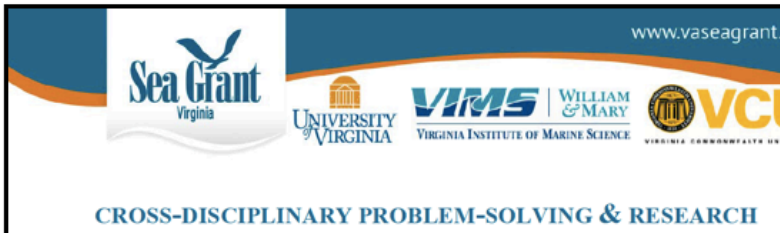
- How to effectively work on teams of scientist from multiple disciplines.
- Latest science-based communication and leadership techniques for effective teamwork.
- How to employ adaptive practices that ensure team science success.
- How to integrate diverse disciplinary perspectives to address a real 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
- Part 6. Scientific Problem Solving in the 21st Century



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*



Part 2. SciTS Challenge

Training Team Science Competencies

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

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COMMUNICATE

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

ADAPT

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

RELATE

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

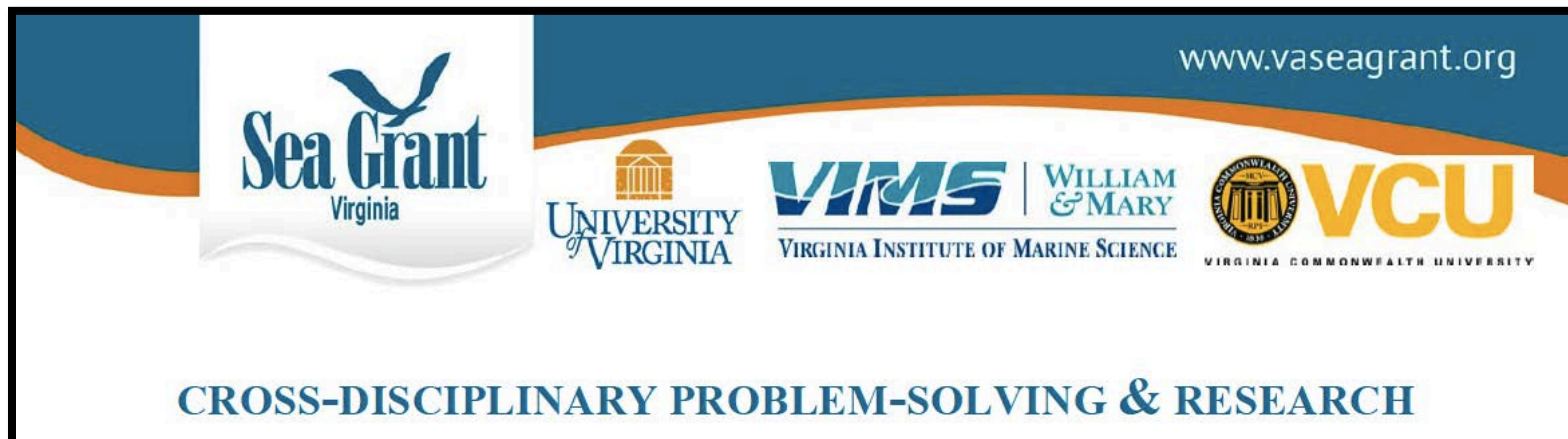
EDUCATE

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

O'Neill, T. A., Deacon, A., Gibbard, K., Larson, N., Hoffart, G., Smith, J., & Donia, B. L. M. (2018). Team dynamics feedback for post-secondary student learning teams. *Assessment & Evaluation in Higher Education*, 43(4), 571-585.

Overview

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Part 3. Reflecting on Team Science

SciTS and Complex Collaborative Problem Solving



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Creating a Visualization of Your Conceptual Framework: Instructions

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])



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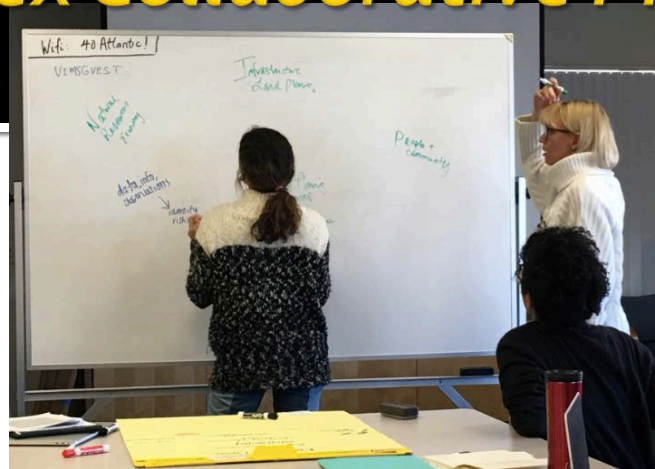
Creating a Visualization of Your Conceptual Framework: Instructions

Resilience Case – Cape Charles, Virginia

In advance of the workshop, please:

- On a single, large piece of flipchart paper, draw an image, diagram, graph, chart or other visualization of your conceptual framework for resilience in Cape Charles
 - Do this from your disciplinary perspective
 - Think about what factors might explain Cape Charles' resilience to climate change impacts
 - Think about what factors or strategies might enhance Cape Charles' resilience
- Bring the flipchart paper with your visualization for your team's meeting at the workshop
- At the meeting, you will post your conceptual framework on the wall and explain it to other members.
- In smaller sub-groups
 - You will be asked to compare frameworks
 - You will try to develop an integrated, shared conceptual framework

Part 3. Reflecting on Team Science SciTS and Complex Collaborative Problem Solving



In Collaboration With



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.

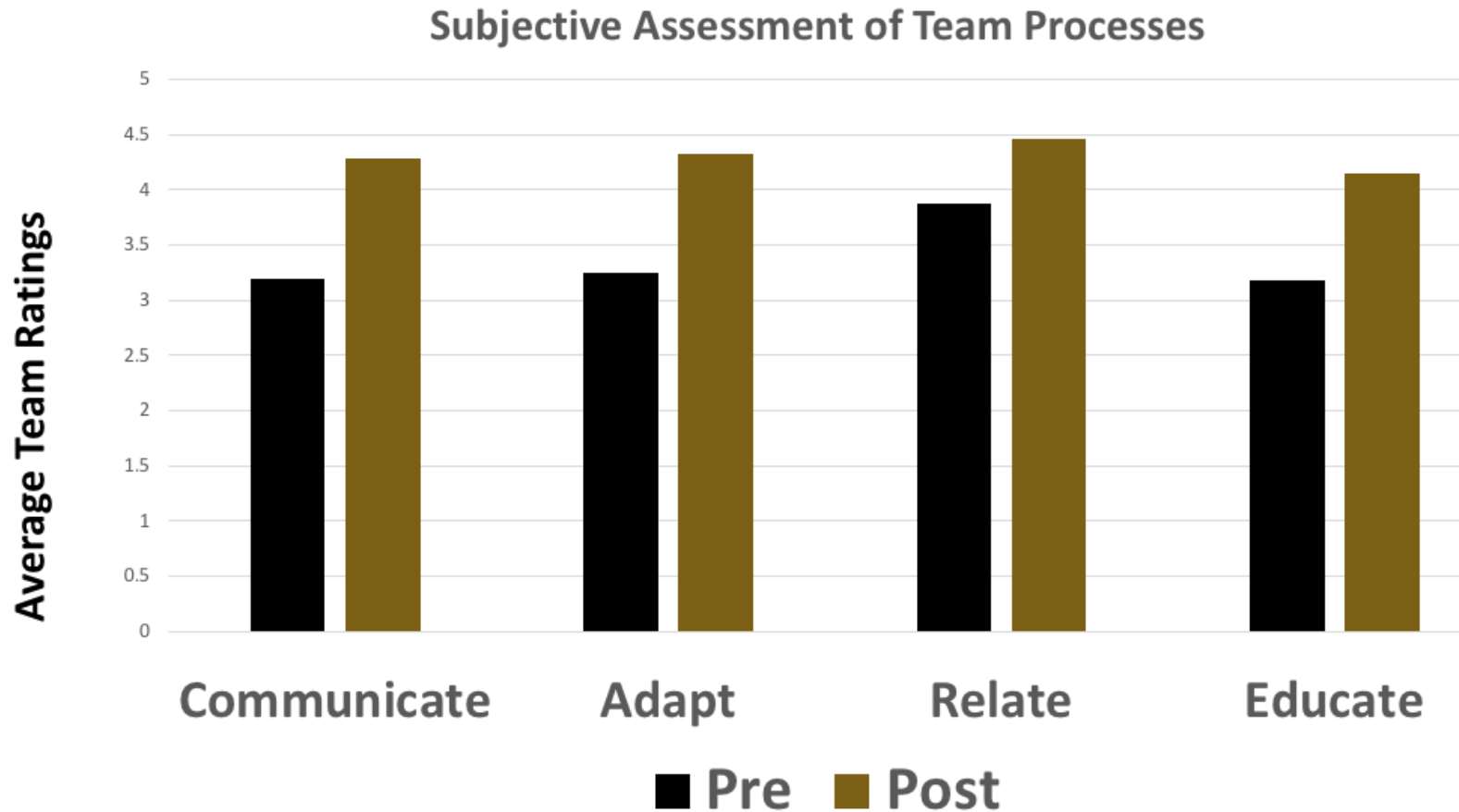
DIMENSION	ACTION STEPS: List steps and actions that your team will take to improve each dimension
<p>Cooperative Conflict Management: Approaching conflict and incompatibilities such that win-win solutions are sought. Conflict is viewed as a chance to learn and make quality improvements, and members work through different viewpoints with mutual respect.</p>	<p>More aware of other peoples opinions. Create a process to handle conflict in the future and differing opinions.</p>
<p>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.</p>	<p>Having the discussion of who does what prior to go forward with tasks. Having clearly defined roles and responsibilities may help us acheive our goals.</p>
<p>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.</p>	<p>Build in time to discuss counter arguments, maybe intentionally. Develop clear steps, an agenda, milestones, etc. to guide us.</p>

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.

DIMENSION	ACTION STEPS: List steps and actions that your team will take to improve each dimension
<p>Contribution Equity: Agreement in the adequacy of each member's contribution to the team effort and objectives.</p>	<p>Define clear and equitable roles. Foster open communication about role expectation and keeping each other accountable.</p>
<p>Healthy, Fact-driven Conflict: The team freely and openly debates the merits of different perspectives, views, and opinions on an intellectual level.</p>	<p>When making decisions, give every member will to state their point of view and reasoning.</p>
<p>Lack of Personal Conflict: The team atmosphere is free of interpersonal tensions, friction, animosity, and personality clashes.</p>	<p>Remind each other and the team of the importance of individual expertise.</p>
<p>Trust: Extent to which team members perceive and have confidence in the integrity, reliability, and overall trustworthiness of members within their workgroup</p>	<p>Continue to promote openness and acknowledge each others differences in experience.</p>

Part 3. Reflecting on Team Science

SciTS and Complex Collaborative Problem Solving



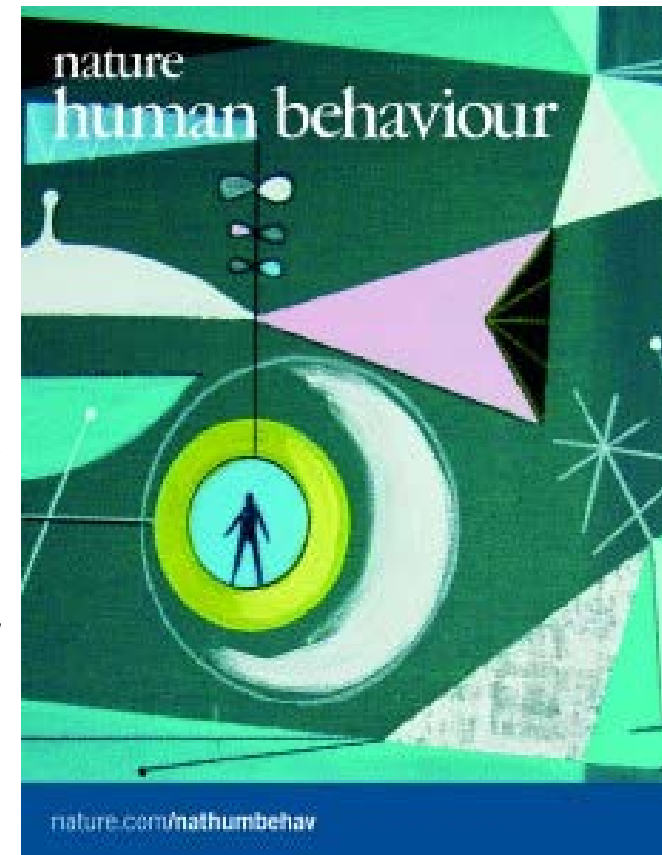
Part 3. Reflecting on Team Science

SciTS and Complex Collaborative Problem Solving

Collaborative Problem Solving Education for the 21st Century Workforce

Stephen M. Fiore¹, Arthur Graesser², Samuel Greiff³
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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.



- Fiore, S.M., Graesser, A., & Greiff, S. (2018). Collaborative Problem Solving Education for the 21st Century Workforce. *Nature Human Behavior*, 2, 367-369. doi:10.1038/s41562-018-0363-y
- Graesser, A. C., Fiore, S. M., Greiff, S., Andrews-Todd, J., Foltz, P. W., & Hesse, F. W. (2018). Advancing the science of collaborative problem solving. *Psychological Science in the Public Interest*, 19(2), 59-92.

Part 3. Reflecting on Team Science

SciTS and Complex Collaborative Problem Solving

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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