

Interdisciplinary Science Teamwork Skills

Kathleen E. Halvorsen¹ and Alex S. Mayer²

¹ Department of Social Sciences/School of Forest Resources and
Environmental Science

² Department of Civil and Environmental
Engineering/Department of Geological and Mining Sciences and
Engineering

Michigan Technological University

Interdisciplinary (ID) and Transdisciplinary (TD)

- ◆ Interdisciplinary science teams: include 2 out of 3 of categories – social and/or natural and/or engineering sciences.
- ◆ Transdisciplinary science teams: interdisciplinary + include non-scientists, such as agency managers, policy makers, community members, NGO staff

My background

- ♦ Many, mostly US National Science Foundation SEES (Science, Engineering, and Education for Sustainability) projects on water, bioenergy, climate change
- ♦ Highly interdisciplinary, international proposals and grants
- ♦ Teams of 3-40 social, natural, and engineering scientists with US\$ 300,000-4.8 million
- ♦ Taught international graduate class on ID science team skills, publishing about it, and have new IAI grant on ID teamwork
- ♦ Natural resource policy scientist

**Why do ID or TD science
work?**

ID and TD Team Science Advantages

- ◆ ID teams have broader expertise, better fit to study and solve complex environmental research problems
- ◆ Learning across disciplines
- ◆ We need to learn to do it well and teach our students to do it well
- ◆ Science agencies require it

Challenges!



- ♦ Managing ID science teams is very hard
- ♦ Managing TD science teams is even harder

**How are ID and TD
processes difficult?**

ID/TD Scientific Proposals: Common Problems

- ◆ Poor integration across disciplines and research questions
- ◆ Poor integration across products/outcomes
- ◆ Different disciplinary sections use different organizational methods
- ◆ Social scientists not treated as equals – added late, fewer \$, not seen as scientists, used just for “outreach” or “education,” but not for science

**Why is it so hard to do ID
and TD work?**

Scientific Research Teams = Small Work Groups

- ◆ Effective small work groups *MUST* have:
 - ◆ Shared language, concepts, values
 - ◆ Shared goals
 - ◆ Shared norms and roles
 - ◆ Shared identity with the group.

Creating effective small work groups is HARD!

- ◆ The more differences within the group, the harder it is to get:
 - ◆ Shared language, concepts, values
 - ◆ Shared goals
 - ◆ Shared norms and roles
 - ◆ Shared identity with the group.

ID group: Social, natural, and engineering scientists

- ◆ Shared language, concepts, values?
- ◆ Shared goals?
- ◆ Shared norms and roles?
- ◆ Shared identity with the group?

Social scientists?

- ◆ Language, concepts, values?
- ◆ Goals?
- ◆ Norms and roles?
- ◆ Identity with the group?

Natural scientists?

- ◆ Language, concepts, values?
- ◆ Goals?
- ◆ Norms and roles?
- ◆ Identity with the group?

TD group: Social, natural, and engineering scientists, policy makers, managers, NGO staff, community members...

- ◆ Shared language, concepts, values?
- ◆ Shared goals?
- ◆ Shared norms and roles?
- ◆ Shared identity with the group?

Interdisciplinarity = Heterogeneity

- ♦ Of knowledge,
- ♦ scientific norms (research questions v. hypotheses; experimental v. research design; credit),
- ♦ language (gradients v. variation),
- ♦ respect (unintended insults: soft v. hard science; science social science; STEM v. HASS);
- ♦ scale, etc.
- ♦ HETEROGENEOUS SMALL GROUP MANAGEMENT IS HARD!!!!

Best Practices

(from Halvorsen and Mayer 2014)

- ♦ **The development and management of a successful ID scientific team is hard.**
 - ♦ Be ready for frustration and challenges.
 - ♦ Have strategies to fix common ID and TD problems.
 - ♦ Be patient.

Best Practices

- ◆ Invest time in the development of team member and/or leader training in ID and TD team social interaction and task skills.

Best Practices

- ♦ **Choose team members carefully.**
 - ♦ Social skills are as important as scientific skills.
 - ♦ Choose people committed to good ID/TD work.
 - ♦ Some team members should have ID/TD experience.
 - ♦ ID and TD work can be easier for some disciplines, for instance, applied fields, environmental social sciences.

- ♦ **Including some people with strong relationships helps kick-start cohesion, identity, and commitment.**

Best Practices

- ♦ **Start meeting as a team early.**
 - ♦ The development of group cohesion and identity takes time but it is essential to success.
 - ♦ Plan for twice as much meeting and work time as for a unidisciplinary proposal or project.
 - ♦ Assign responsibilities, for instance, socioeconomic and natural scientific subteam leaders.
 - ♦ Plan to present across disciplines about scientific philosophies, concepts, research design, theory, and methods.

Best Practices

- ♦ **Smoothly functioning small groups require clear norms, roles, and expectations. Be careful to show respect across disciplines.**
 - ♦ Begin by discussing good and bad prior ID and TD experiences.
 - ♦ Agree on strategies to avoid common ID and TD problems.
 - ♦ Agree on rules to show respect, for example, never use terms like: “science and social science” or “hard and soft science.” Treat non-scientists as equals.

Best Practices

- ♦ **The creation of successful ID teams requires good leadership.** The team leader should:
 - ♦ Have experience in working in successful ID and TD teams.
 - ♦ Invest time in learning about other disciplines, for instance, there is no “Social Science” discipline, there ARE anthropologists, geographers, political scientists, etc. with different skills and approaches to scientific work.
 - ♦ Demonstrate respect across disciplines.

Best Practices

- ♦ **Successful teams have a shared purpose.**
 - ♦ You will have an idea of the scientific goals to start...
 - ♦ But people in different disciplines will probably have different goals.
 - ♦ Investing extra time in meeting and discussing goals and research designs and integration will help create success.

Best Practices

- ◆ **Include critical mass of scientists and team members of various types, avoid “tokens.”**
 - ◆ A 10 person TD team should not have just 1 social scientist, 1 policy maker and 8 natural scientists.

ID science team skills training

- ◆ August-December 2015: International graduate class in ID science team skills.
- ◆ November, 2015: International one week online training course in ID science team skills.

Gracias

