Discovering the necessary skills, knowledge, and experiences for training the next generation of interdisciplinary, solutions-driven researchers
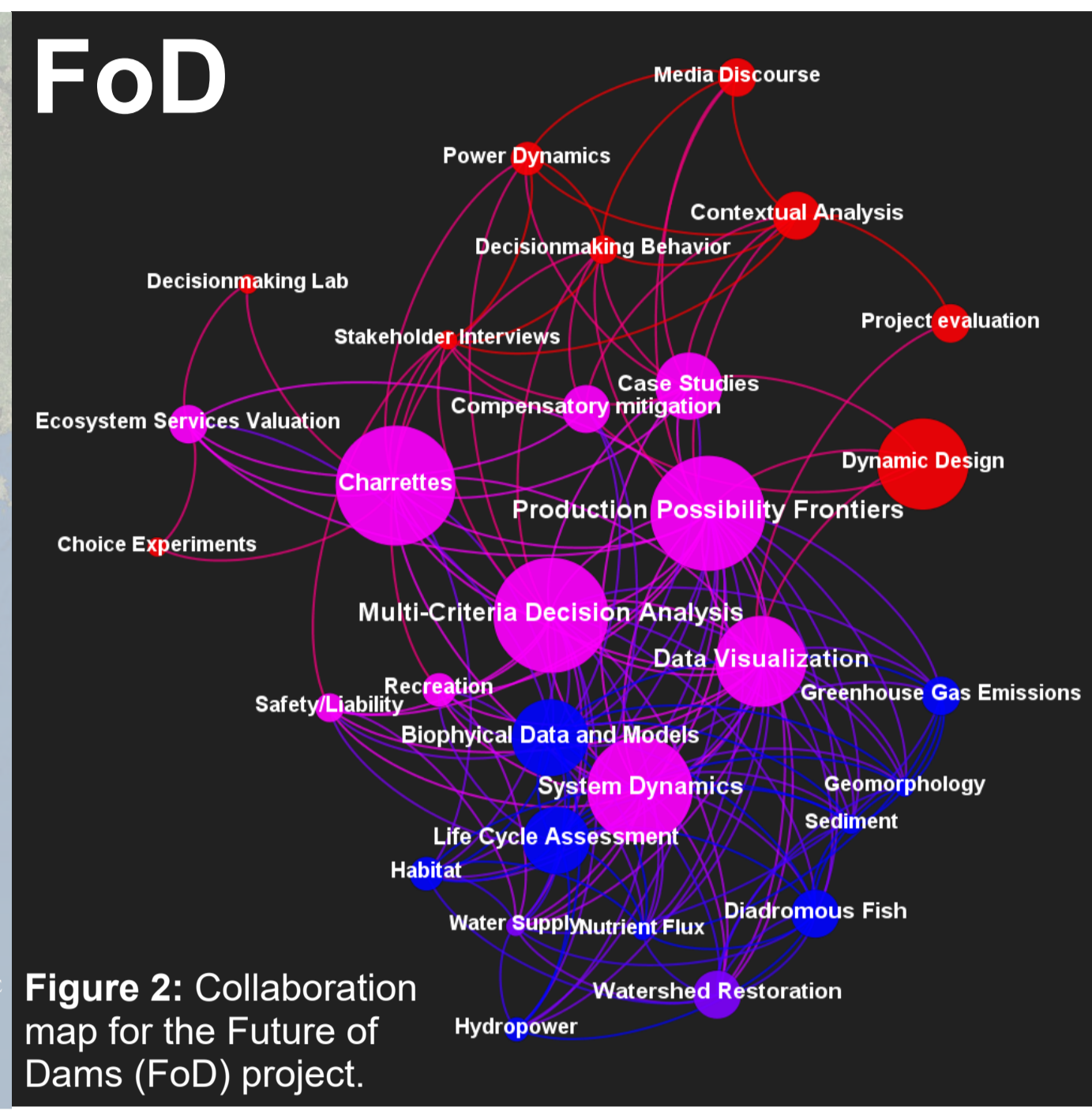
Sam G. Roy[1,2]; Simone Pereira de Souza[3]; Bridie McGreavy[1,4]; Caroline Gottchalk Druschke[5], David Hart[1], Kevin Gardner[3]

[1] Sen. George J. Mitchell Ctr. for Sustainability Solutions, Univ. Maine
[2] Sch. Earth & Climate Sci., Univ. Maine
[3] College of Engineering & Phys. Sci., Univ. New Hampshire
[4] Dept. Comm. & Journ., Univ. Maine
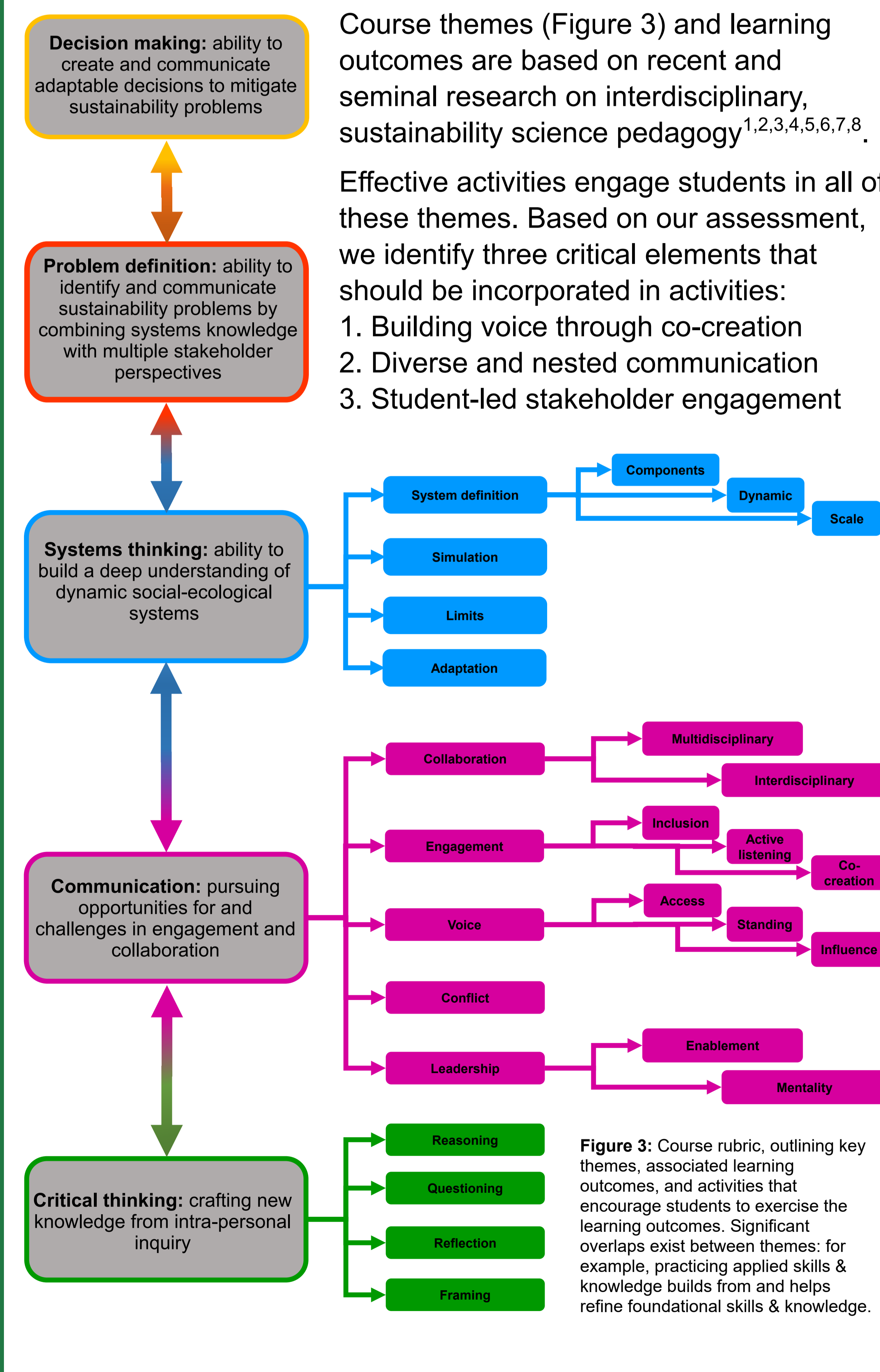[5] Dept. Natural Resources Sci., Univ. Rhode Island

Introduction

The need to train early-career sustainability researchers who are stakeholder-engaged, interdisciplinary, and solutions-driven has never been greater than now. Educators in Maine, New Hampshire, and Rhode Island have collaborated with students to design a multi-university course to meet this challenge. Here we focus on the basic course structure and primary activities critical for building student research capacity.

Figure 1: locations of students and other course collaborators.

FoD

Figure 2: Collaboration map for the Future of Dams (FoD) project.

All students are research members in The Future of Dams (FoD) project (Figure 1, 2). Viewing dams as social-ecological systems, FoD seeks to help stakeholders balance complex trade offs involved in decision making.
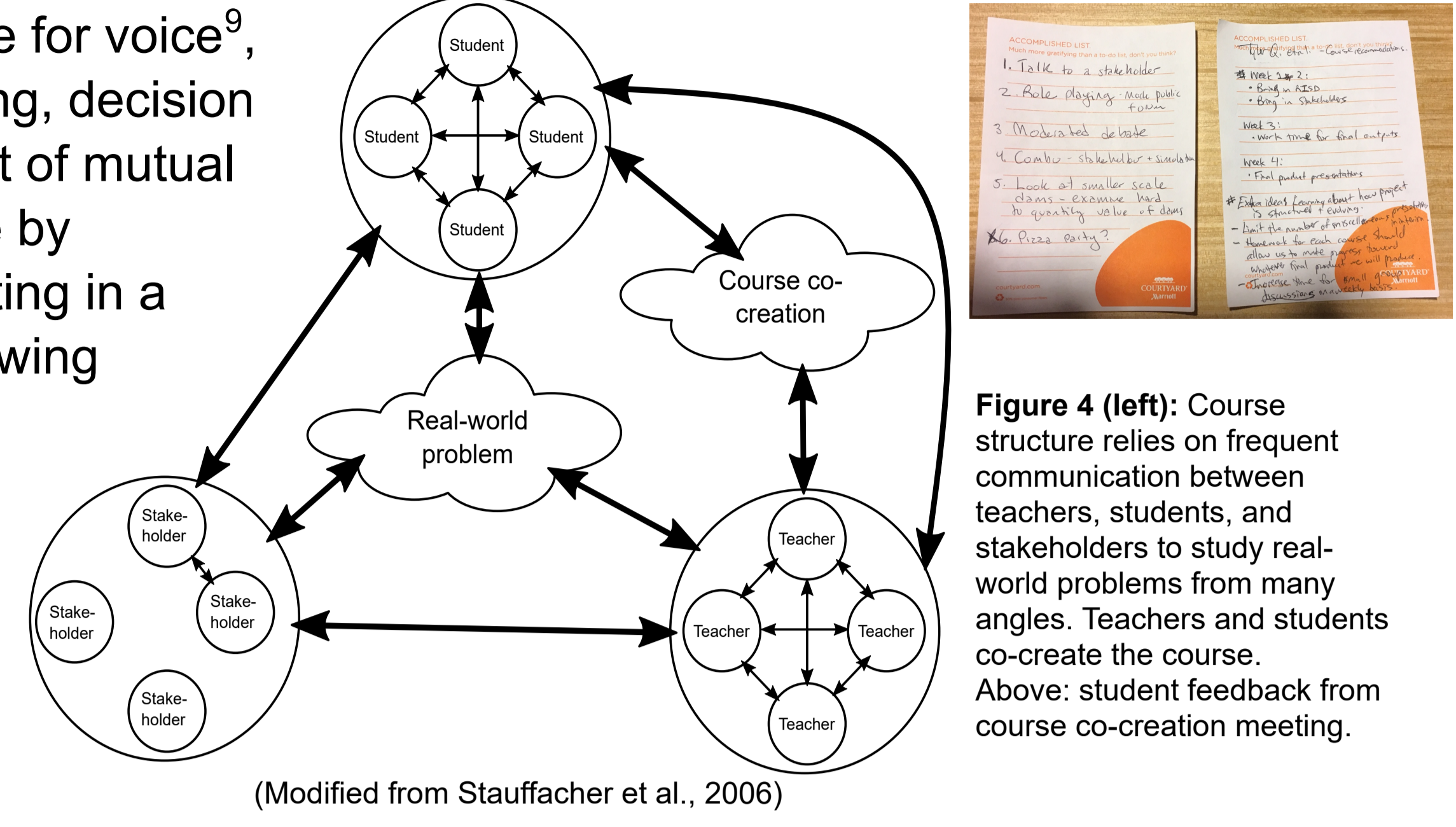
Linking themes, activities

Course themes (Figure 3) and learning outcomes are based on recent and seminal research on interdisciplinary, sustainability science pedagogy[1,2,3,4,5,6,7,8].

Effective activities engage students in all of these themes. Based on our assessment, we identify three critical elements that should be incorporated in activities:
1. Building voice through co-creation
2. Diverse and nested communication
3. Student-led stakeholder engagement

Decision making: ability to create and communicate adaptable decisions to mitigate sustainability problems

Problem definition: ability to identify and communicate sustainability problems by combining systems knowledge with multiple stakeholder perspectives

Systems thinking: ability to build a deep understanding of dynamic social-ecological systems

Communication: pursuing opportunities for and challenges in engagement and collaboration

Critical thinking: crafting new knowledge from intra-personal inquiry

Figure 3: Course rubric, outlining key themes, associated learning outcomes, and activities that encourage students to exercise the learning outcomes. Significant overlaps exist between themes: for example, practicing applied skills & knowledge builds from and helps refine foundational skills & knowledge.

Building voice through co-creation

The course instructors focused on creating a space for voice[9], which we understand as a space for shared learning, decision making, and dynamic interaction in an environment of mutual respect. Course co-creation (Figure 4) builds voice by establishing an open forum for collaboration, resulting in a greater sense of meaning for the course and a growing respect shared between educators and students.

"I found multiple new collaborators, and I was able to make measurable progress on both my own research and the research of my collaborative partners."

Figure 4 (left): Course structure relies on frequent communication between teachers, students, and stakeholders to study real-world problems from many angles. Teachers and students co-create the course. Above: student feedback from course co-creation meeting.

(Modified from Stauffacher et al., 2006)

Diverse and nested communication

"I see more than ever the importance of taking into account perspectives from as many knowledge backgrounds as possible."

Interdisciplinary collaboration is fostered by a rich diversity of expertise (Figure 6) shared across groups of differing size (Figure 7, 8).
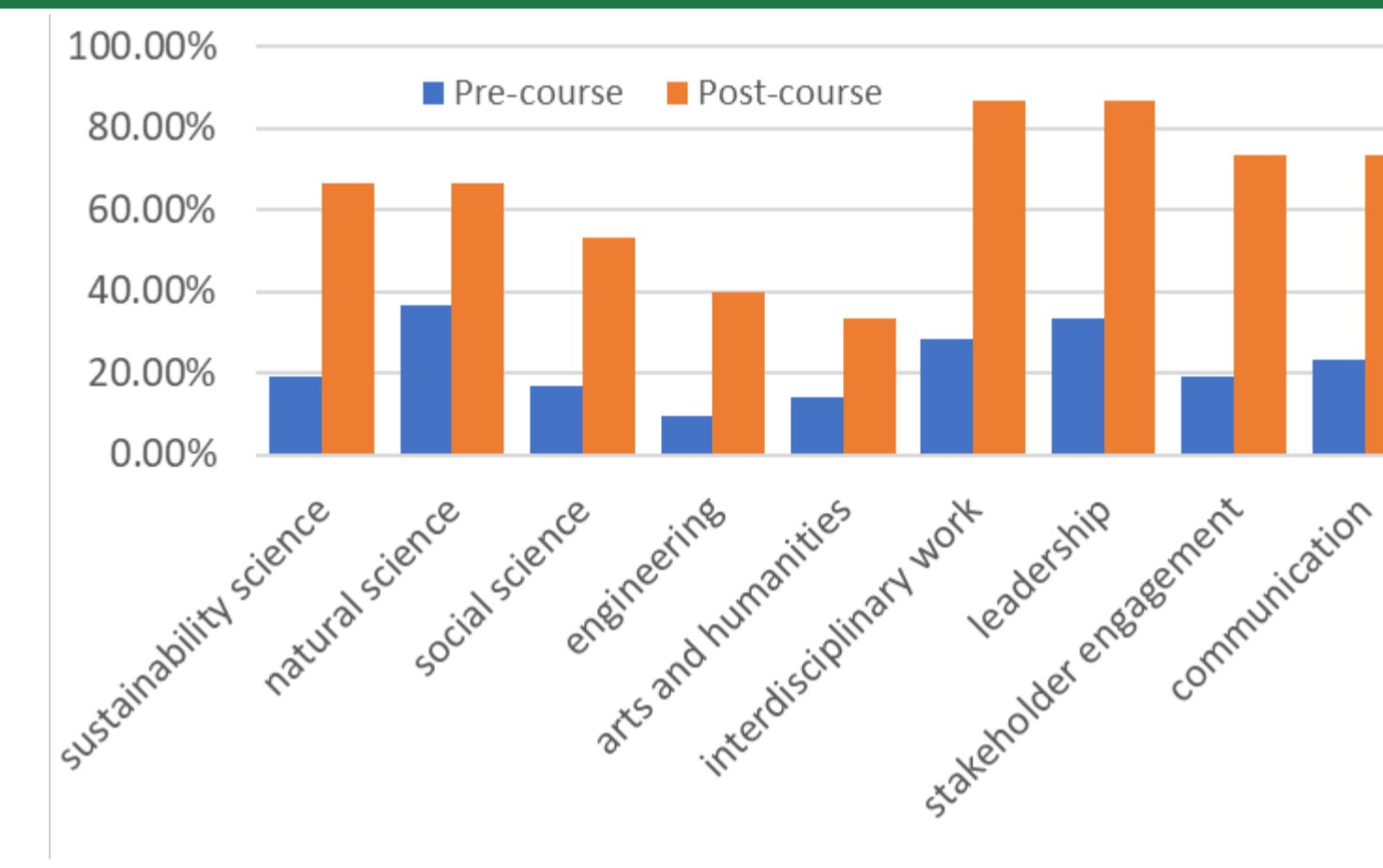

Figure 6: Student pre-course and post-course confidence levels in key interdisciplinary sustainability research topics.
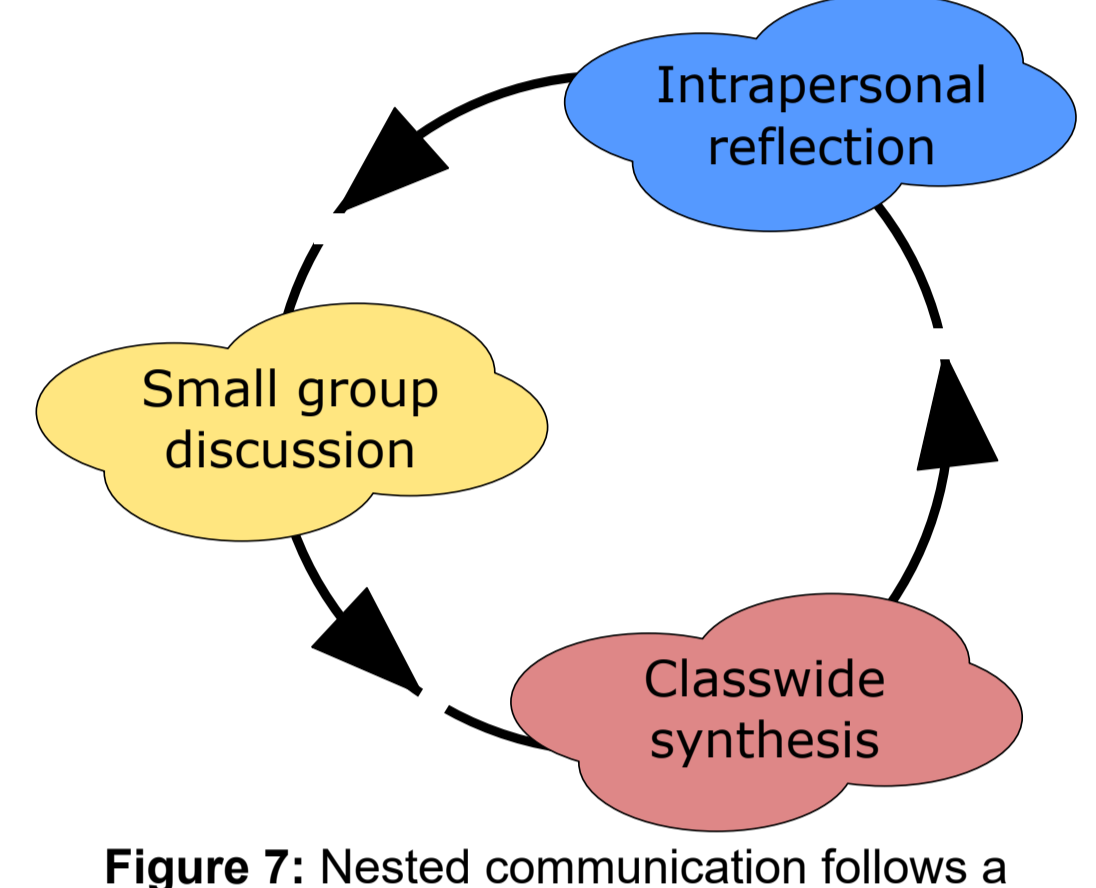
Figure 7: Nested communication follows a cyclical "think-pair-share" approach.

Figure 8: Different scales and themes of communication. Top row: groups of 2-5 meet for the day's discussion (photo credit: Tyler Quiring). Bottom left: classwide videoconferenced discussions to report out from the smaller groups and encourage a larger scale discussion of the material. Bottom right: discussions continue outside of class (photo credit: Sarah Vogel).

Student-led stakeholder engagement

"Stakeholders can play a role in making sure that researchers are crafting usable knowledge, making sure that the decisions being considered are equitable, ensuring that the research process is holistic, and holding researchers accountable for the information they produce. The role of stakeholders in sustainability science is a critical one!"

"The stakeholder interviews were so eye-opening for me, I really appreciated having them come in and answer our questions. It 'humanized' some of the perspectives I couldn't quite wrap my head around."

Core stakeholder engagement activities:
1. Developing reports based on case studies and stakeholder interviews/forums
2. Collaboratively organizing and hosting interviews with stakeholders who played decisionmaking roles.
3. Post-interview critical reflections (Figure 9)
4. Negotiation roleplay simulations

Figure 9: Changes in perceptions of stakeholder engagement, as reflected in word cloud of student essays before (left) and after (right) course. For example, "Stakeholder" goes from 12th to 4th most used term.

Conclusions

- Communication is recognized by students as a critical skill for interdisciplinary research.
- Course co-creation strengthens ties between students, educators, and stakeholders.
- Student-led stakeholder engagement engages students in all sustainability research course themes.
- These course elements are relevant for a wide variety of "real-world" sustainability problems.

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