Supplemental Material

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(Revised) Supplemental Materials
Supplemental Tables 1 & 2; Appendices A-C

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Title of Manuscript: **Engaging Students Around the Complex Socioscientific Issue of Sustainability: Affordances and Tensions of Faculty Working Across Disciplines to Develop Transdisciplinary Curriculum**

Supplemental Table 1

Pseudonym	Discipline	Institutions A	B	C
Leaders				
Robin	Science	X		
Jamie	Science	X		
Jordan	Business	X		
Alex	Environmental Studies		X	
Sidney	Social Entrepreneurship		X	
Casey	Business/Economics			X
Tracy	Science			X
Faculty				
Jodi	Chemistry	X		
Peyton	Information/Communication	X		
Leslie	Economics	X		
Jackson	Science	X		
Madison	Engineering		X	
Kelly	Economics		X	
Drew	Entrepreneurship/Business		X	
Shannon	Biology		X	
Lee	Economics			X
Bailey	Business			X
Logan	Sociology/Anthropology			X
Lynn	Geology			X

Supplemental Table 1. Pseudonym, Disciplines and Institutions of Leaders and Faculty

Supplemental Table 2

Activities	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
Project leader interviews (n=7)		X										
Faculty pre-interviews (n=12)			X									
Faculty post interviews (n=11)												X
Project leaders planning meetings (n=6)	X		X		X		X		X		X	
Faculty pre-workshop sessions (n=3)	X				X		X					
5-day curriculum development workshop								X				

Supplemental Table 2. Description of Activities, Data Collected, and Timeline

Appendix A

Interview protocol for project leaders

1. I'd like to know more about your position at [name of institution] AND on the project. Specifically:
    1. Briefly describe your role and responsibilities in your current position at your institution.
    2. Can you tell me about YOUR role and responsibilities on the grant, including in comparison to others?
3. The Project has the following three goals: 1) curriculum development, which is to produce, implement, improve and disseminate novel transdisciplinary curriculum modules focused on sustainability problems that can be used in a wide variety of STEM and business courses, 2) faculty perspectives, which is to build capacity to create and implement sustainability curriculum and instruction by changing the perspectives and norms of faculty around transdisciplinary work and collaborations, and 3) student learning, develop measures to assess student learning and demonstrate improved student learning outcomes.
    1. What affordances or constraints regarding these goals might individual faculty encounter?
    2. What affordances or constraints regarding these goals might departments/programs encounter?
    3. What affordances or constraints regarding these goals might your institution encounter?
    4. What affordances or constraints regarding these goals might you encounter in your position?
4. Do faculty targeted by this Project at your institution interact/work regularly with others concerning issues of teaching and learning? [if yes], Please provide details regarding
    1. Who? in the same discipline/department/program or others?
    2. How typical are these interactions?
    3. What encourages or discourages these interactions?
    4. In what ways do you anticipate the project influencing these interactions in any way?
5. Describe the general climate [beliefs, attitudes, outlook] at your institution, or relevant programs/departments (to the grant) concerning teaching innovation and teaching improvement work?
    1. To what extent are faculty expected/encouraged to create their own curriculum? Transdisciplinary curriculum?
    2. Create curriculum with others? Transdisciplinary curriculum?
    3. Assess the efficacy of their curriculum and instruction, and make changes accordingly?

        4.   Given a-c, what do you think the Project might help change or support?

6. What might a meaningful curriculum that emanates from this project look like, that could meet the project's learning goals for students?

7. What does a successful faculty work group look like, that has the potential to create this meaningful curriculum?

8. We know that faculty may struggle to work across disciplines to create curriculum. We also know that faculty struggle to create curriculum that is truly transdisciplinary.

        1.   What challenges do YOU think the faculty YOU will work with will have with respect to these things?

        2.   Tell me how this project may overcome some of these challenges?

9. In what ways might this project change the way your organization operates or sustains the changes that are made?

10. Do you foresee any issues related to working across institutions?

Appendix B

Pre-interview protocol for faculty:
1. I'd like to know more about your position at [name of institution]. Specifically:
    a. What is your official title?
    b. Briefly describe your role and responsibilities in your current position.
    c. What disciplines have you taught previously or that you are teaching now? How many years have you taught at this institution or others?
2. I'd like to hear about your engagement with the "sustainability curriculum" project. Specifically:
    a. What motivates you to participate in this project? [probe re Promotion & Tenure and other "rewards"]
    b. What expectations do you have for how this project will impact you or your work/responsibilities?
3. Please describe any teaching experiences you have had that involve you teaching content that spans different disciplines, including with other educators?
    a. What disciplines did this span?
    b. How did disciplines interact, meaning what did the curriculum/instruction look like for students and for the educators?
    c. Who is involved?
    d. What benefits have you noted?
    e. What challenges have you noted?
4. This "sustainability curriculum" project has three (3) major goals related to faculty perspectives, curriculum development, and student learning. I will briefly paraphrase each goal and then ask you some questions related to each one of them. Specifically:
    a. One goal is related to curriculum development, which is to produce, implement, improve and disseminate novel trans (or cross) disciplinary curriculum modules focused on sustainability problems that can be used in a wide variety of STEM and business courses. [Ask i, ii, iii questions]
    b. The second goal is related to faculty perspectives, which is to build capacity to create and implement sustainability curriculum and instruction by changing the perspectives (attitudes) and norms (practices) of faculty around trans (or cross) disciplinary work and collaborations. [Ask i, ii, iii questions]
    c. The third goal is related to student learning, which is to develop measures to assess student learning and demonstrate improved student learning outcomes. [Ask i, ii, iii questions]
        i. What opportunities or challenges might faculty encounter in achieving these goals?
        ii. What opportunities or challenges might you encounter in your teaching towards achieving these goals?

        iii.   What opportunities or challenges might your department/ university encounter in achieving these goals?

5. Can you briefly describe or tell me about how you plan for a unit or module or topic in a course...how do design/decide on what/how to teach when a unit or module or topic in a course?
6. Please describe your typical assessment strategies for assessing student learning? To what extent do the results of your student assessment impact your future teaching?
7. Is there anything else you would like to comment on or talk about?

Post interview protocol for faculty:
Questions:

1. What benefits, if any, have you realized being part of this project?
2. Describe any challenges you have experienced in being part of this project?
3. If not addressed in #1 or #2, probe for any changes to:
   a. developing transdisciplinary curriculum concerning sustainability
   b. perspectives (attitudes) and norms (practices) of faculty around trans (or cross) disciplinary work and collaborations
   c. assessing student learning
4. Of the benefits and challenges you have identified, is there anything more related to the summer workshop? Or the LLCs?
5. Has this experience changed what and how you teach related to sustainability? If so, in what ways/how?
6. Has, or will developing the TD curriculum module change how you teach? If so, in what ways? (if needed elaborate on instructional methods, curriculum order, etc)?
7. Have you implemented the common exercise or gathered any data yet regarding associated student learning? If so, what did you learn, if anything? If not, what are your thoughts about the "finished" module that you received from the leaders?
8. What, if anything, would you like to see changed or done differently in this project moving forward, or others like it that bring faculty across disciplines together to develop TD curriculum?
9. What haven't I asked you about that you think would be important to know about your experience if I was coaching other faculty considering doing this?

Appendix C

Codes and Definitions

Achieving Project Goals: The Sustainability Curriculum project intends to develop and implement transdisciplinary curriculum around issues of sustainability, to be used in a wide variety of STEM and business courses, via collaborative work of interdisciplinary faculty, namely those from science and business disciplines. Interdisciplinary faculty will be brought together via various activities (local learning communities) to work on creating, implementing, and eventually testing/revising the curriculum they create, towards an improved curriculum.

Challenges to Faculty: Challenges that faculty may encounter in working to create, develop, implement, and assess transdisciplinary curriculum

Challenges to Organization (structures): This code includes any challenges to departmental or organizational structures. This could include policies, procedures, practices, norms, or attempts to maintain the status quo

Opportunities for Faculty: This includes any opportunities that the project may offer to faculty towards creating, developing, or implementing sustainability curriculum modules

Opportunities for the Organization: This includes any opportunity that this project provides to the organization that is considered a positive development.

Assessment of Student Learning: This code is related to any statement about assessing student learning or assessment of course/program or institutional goals related to accreditation or other external pressures. This can also mean assessing learning within the module.

Benefits for Students: This code is tied to any mention of benefits for students related to the project. This can include among other things, improved critical thinking skills, ability to see multiple perspectives, career development and more preparations for future jobs. Aspirational goals for students are also included with such things as making the world a better place.

Climate (beliefs, attitudes): This code involves any mention of the climate, which includes beliefs and attitudes at the institution. This also includes mentions of culture, which includes practices or long held norms

Faculty Collaborations: This code includes references to faculty working in a collaborative way with other faculty either within their discipline or across disciplines. This can include encouraging collaborations or issues that discourage collaborations.

Perceived Goals of the Project: This code includes the project goals that PIs perceive this project is trying to accomplish. These goals may or may not align with the stated goals in the grant proposal or may reflect the PIs interpretation of those goals.

Perceived Role of PIs of Project: This code is based on a question that asked the PIs to describe their roles and responsibilities related to the project.

Policy, Procedures, and Practices: Any policy, procedures, practices that are related to the project, this could include tenure and promotion, changing reward structures, etc...

Resources and Budget Issues: Any mention of how this project might impact budget or resource allocation in any way, either during or after the grant to sustain the work.

Affordances: This code is used for any mention of what the environment offers the individual or group

Curriculum Development (transdisciplinary): This code refers to any reference to creating or developing curriculum and can include any discipline

Disciplines (subject): This code refers to the person or discipline (e.g. STEM disciplines, business, social science or others)

Pedagogical Practices: This code refers to any mention of teaching or students related to developing the curriculum

Tensions: This code refers to any contradictions or tensions that might exist within or between individuals and groups.

Virtual Environment (tools): This code relates to any reference to the virtual environment especially as it relates to Zoom conferencing platform, Slack messaging platform, google docs, SERC website, or other tools broadly that exist online. (e.g. websites, resources, documents)

Wicked Problem: Any reference to the wicked problem, particularly as it relates to cross disciplinary communication or coordination