

Article

Holding Complexity: Lessons from Team-Teaching an Interdisciplinary Collegiate Course on Urban Sustainability

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Abstract: Lead instructors discuss the structure, opportunities, and pedagogical challenges of an interdisciplinary team-taught course on urban sustainability involving seven professors from six departments across four of George Washington University's schools over five years. The teaching team prioritized presenting and exploring diverse perspectives on urban sustainability, seeing a key learning objective of this course in students (1) learning to make links between disciplines; (2) having opportunities to reflect, disagree, share, and develop their own perspectives; and (3) developing a life-long engagement and openness with ideas and learning. This is challenging for many students. To promote student learning and engagement in the class, we utilize active-learning and cooperative discussion techniques, and see these as times that the class reaches "interdisciplinarity". We employ place-based pedagogical approaches, focusing the class on the case-study (and students' adopted hometown) of Washington D.C., finding that a "layering" of perspectives on a single city helps students see disciplinary similarities and differences more clearly. For those considering a large-team interdisciplinary course, we stress the importance of a lead instructor for coordination—both conceptually and administratively—and adequate institutional support for this unique and challenging endeavor.

Keywords: urban sustainability; interdisciplinary teaching; team-teaching; place-based learning; cooperative discussion; Think-Pair-Share

1. Introduction

Sustainability education has helped motivate university leaders to think beyond traditional boundaries and see the value in interdisciplinary approaches involving collaboration between experts from two or more academic disciplines (Jabareen 2012). Interdisciplinary teaching requires novel skill sets for teachers and learners alike, as it presents challenges and opportunities for learning (Letterman and Dugan 2004; Feng 2012). In the spring of 2016, seven faculty at George Washington University (GWU) launched a team-taught undergraduate course titled "The Sustainable City". The course is innovative in several ways. First, it represents an extreme of interdisciplinarity, in that it is taught by not just two faculty but a team of seven. Second, the course is constructed such that a different mix of faculty collaborate and share teaching responsibilities each class period (rather than dividing up weeks in a semester). Third, the course utilizes cooperative discussion strategies and place-based learning (in our "hometown" of Washington D.C.) to focus discussions of urban sustainability and help students engage and hold the conceptual complexity explored in this interdisciplinary course.

Urban Sustainability itself is a broad and challenging concept. As such, Li and colleagues note, it may fail "to inspire actionable and effective actions; to teach urban sustainability is an even more daunting task, which requires drastic changes to conventional pedagogical structures and processes"

(Li et al. 2018). Our own experiences, over the five years “The Sustainable City” has been taught supports this assertion. Now, more than 200 students have taken the class, and the faculty team has learned much about the theory and practice of team-teaching. We have learned from each other and from other educators in the process of iteratively redeveloping, piloting and reevaluating elements of the course syllabus and teaching approaches.

The purpose of this self-reflective essay is to share our experiences with interdisciplinary team-teaching in “The Sustainable City”. We recognize that the benefits and challenges we have encountered in our teaching, so far, may prove to be specific to our university culture, the resources available, or unique to the way this course was designed. Our goal is not to comprehensively evaluate the challenges and obstacles of team-teaching broadly or to propose there is a “right” way to team-teach sustainability. Instead, we use an ethnographic approach to document the challenges and rewards we have experienced and contribute to the rapidly growing literature on interdisciplinary team-teaching and sustainability education.

One purpose of this essay is to enhance the discussion about the intersection of these two topics: ways in which team-teaching can contribute to sustainability education. Despite inherent challenges, we have found team-teaching to be a highly valuable method to explore the complexities of sustainability and to challenge students to consider the perspectives of multiple disciplines in a more nuanced fashion. Indeed, we have found, like Feng (2012) and others discussing interdisciplinary learning, that the most important value of our course is not students “learning” components of sustainability. Instead, we prioritize students’ learning to make links between disciplines, having opportunities to reflect, disagree, share, and develop their own perspectives, and modeling a life-long engagement and openness with ideas and learning. In supporting these aims—which we shorthand as “holding complexity”—we have found that a team approach lends itself well to what we see as the most important learning outcomes of this course.

The paper begins with a brief literature review and discussion of methodology. We then situate the development of the course within the broader academic program for Sustainability at GWU. The next section discusses the design and development of the course. Finally, we explore the challenges of teaching urban sustainability, and to team-teaching this course more specifically.

2. Literature Review and Methodology

The literature on team-teaching has developed robustly over the last decade, fueled in part by reforms and opportunities in higher education that have allowed co-teaching to become more common (see, for example, Colburn et al. 2012; Dugan and Letterman 2008; Lee 2013; Money and Coughlan 2016). Scholars have called for changes in current teaching practice to emphasize interdisciplinary perspectives and focus on critical problem solving, experiential learning, collaboration, and personal empowerment (Davis 1995; Burns 2013). Recently, scholars have examined team-teaching in sustainability courses (see, for example, Burns 2013; Michelsen 2013; Coops et al. 2015; Levintova and Mueller 2015).

Collaborative teaching is a broad term that encompasses approaches that differ in the extent to which each instructor contributes in the creation and delivery of content and/or engages with students (Friend and Cook 2010, pp. 168–75). In “The Sustainable City”, we primarily follow the team-teaching model, where each instructor contributes equally, and in which instructors trade off or “tag-team” at specific signals or content breaks within each class period. Conderman views this type of team-teaching as the prized “goal” of co-teaching endeavors (Conderman 2011, p. 27). For this discussion, we use Davis (1995) description of a teaching team as “all arrangements that include two or more faculty in some level of collaboration in the planning and delivery of a course” (Davis 1995, p. 8). The literature on team-teaching suggests several best practices (Eisen 2000), including how to design interdisciplinary courses, of particular relevance to us (Rives-East and Lima 2013).

More recently, sustainability has offered opportunities to engage in team-teaching. Team-teaching, particularly in sustainability courses, has a host of benefits. Wilson and colleagues (2019) discuss the ways team-teaching can “act as an agent of change” (Wilson et al. 2019). Coops and colleagues discuss

how sustainability reveals the benefits and challenges of a university-wide initiative for sustainability education (Coops et al. 2015). Walsh and Davis note that complex issues in sustainability, such as climate change and ecosystem degradation, along with instabilities and inequalities necessitate an increasingly interdisciplinary approach to sustainability (Walsh and Davis 2017). They found that team-taught interdisciplinary first-year courses can significantly raise student awareness of the complex, multifaceted nature of sustainability. The course provided a powerful opportunity for students to witness theories in action, to grapple with divisive and controversial issues, and to engage in the global conversation on living sustainably.

Yet, there are still many unanswered questions regarding the best practices in team-teaching sustainability. For example, Shibley (2006) has noted that team-teaching requires negotiating pedagogical differences, a challenge we experienced most acutely in developing course expectations and assessing student learning. Metzger noted communication and organization challenges, which we also identified (Metzger 2015).

Methodology

This paper is a critical reflection essay that uses an ethnographic approach to document the challenges and rewards of team-teaching in sustainability. Brookfield suggests that critical reflections are part of becoming a critically reflective teacher (Brookfield 2017). The authors were members of the leadership team that created GWU's Sustainability program and the Sustainability Minor in 2012 (Benton-Short served as Faculty Chair of the Faculty Committee on Sustainability and later as Interim Director of the Sustainability Program, and Advisor for the Sustainability Minor; Keeley serves as member of the Faculty Committee on Sustainability, and was part of the core team that developed the Sustainability Minor). We draw on this experience to set a larger context for how the team-taught course is intended to contribute to the broader Sustainability program learning outcomes. In addition, both authors were members of the initial teaching team that conceptualized and designed "The Sustainable City". We have each taught the class annually since 2016, and alternately have lead the teaching team's efforts as lead instructor of the course. These experiences also inform our discussion of the course objectives, evaluation of pedagogical approaches, and course challenges.

We also draw generally from the feedback we have received from students over the years. We have gained general perspectives about the student experience in this course through informal discussions with students about their classroom experiences, insight shared between the teaching team members from student questions and comments, and impressions gleaned from several years of volunteer and anonymous student course evaluations. At GWU, student evaluations are completed online (all answers are typed), and these are compiled and released to faculty by the Office of Survey Research and Analysis with no identifying information and only after grades have been submitted. While we include in this paper several salient student comments from these course evaluations that particularly informed our teaching, a systematic review of these responses is beyond our scope. After multiple discussions with GWU's Office of Human Research and Office of Survey Research and Analysis, we conclude that that no IRB was required to include limited anonymous student feedback in this publication reflecting on teaching effectiveness.

3. The Context: Sustainability Education at George Washington University

Several aspects of GWU's approach to sustainability set the pedagogical context for the development of "The Sustainable City" course. Colleges and universities have utilized a variety of approaches to support and advance sustainability education (Vincent et al. 2013). Some schools create unique, stand-alone sustainability degrees or schools (Arizona State, for example). Others create an institute or center dedicated to sustainability education (such as Columbia University). In an effort to make sustainability belong to all schools, GWU deliberately chose to not place it within any one school (Benton-Short and Merrigan 2015). Instead, the Academic Program in Sustainability is housed in the Office of the Provost. The appeal of this approach was that it might coordinate and make

coherent existing sustainability-related efforts across campus, while keeping these offerings in place across the university. GWU's approach to sustainability is a less common one; in 2012, only 37% of examined higher education institutions sustainability programs administratively spanned schools or units (Vincent et al. 2013). In our experience, the decision to situate the Academic Program in Sustainability in the Provost Office has provided benefits (including our own ability to teach a class with professors in six departments and four schools) and drawbacks (including administrative challenges, which we discuss later in this paper).

GWU faculty began by creating an undergraduate sustainability minor, with the intention to develop other undergraduate degrees and graduate degrees over the long term. The committee of some two dozen faculty members (from numerous departments and representing all the schools), then, considered the courses that would create the new sustainability minor, which would be open to all students. While minor components include a selection of sustainability-centric existing courses from across the university and a capstone experience, the committee recommended that GWU create a set of "signature" team-taught classes that would expose students to the ways in which different disciplines problem solve around sustainability.

Team-teaching is often an important element universities undertake as they seek to integrate sustainability into the curriculum (Davison 2012). Interdisciplinary teaching is, of course, not new, and there are many studies that identify a variety of positive outcomes of interdisciplinary team-teaching (Anderson and Speck 1998; Murata 2002). Courses that are team-taught generate multiple perspectives on the same issues, leading to dynamic and engaging discussions with faculty and students. For these reasons, we were excited to make interdisciplinary teaching the centerpiece of sustainability education at GWU.

The committee recommended moving beyond conventional concepts of team-teaching (for example, a pair of faculty co-teaching a class, or "dividing" teaching responsibilities, with each professor teaching different units over the course of the semester) and embraced the team-taught model that would include multiple faculty, representing different disciplines and schools. The idea was novel at GWU at the time, although it is consistent with recommendations in emerging contemporaneous literature (see Conderman 2011).

The first team-taught course GWU created was "Introduction to Sustainability", a required course for the minor. This course features faculty from the Law School, School of Public Health, College of Professional Studies, and several from Arts and Sciences. Two years after launching the team-taught "Introduction of Sustainability", two additional featured team-taught classes "The Sustainable City" and "The Sustainable Plate" were developed in response to positive student feedback to this innovative teaching approach to sustainability.

It is through these signature team-taught classes that the interdisciplinary component of sustainability is articulated and demonstrated within the minor, with the goal of exposing students to multiple perspectives on sustainability conceptualization and practice. As a result, from the time of its inception, the Sustainability Minor was seen as innovative at GWU as it represents the university's first effort to build upon, and test, its vision for interdisciplinary collaboration in teaching and research (Benton-Short and Merrigan 2015).

4. The Sustainable City: Course Design and Development

The Director of the Academic Program in Sustainability and the Sustainability Minor Director recruited seven faculty members with expertise in urban sustainability to develop a new course on Sustainable Cities. Initially, it was thought that only a subset of those faculty would be interested in actually teaching the course, but all seven were enthusiastic about participating in this team-teaching experiment. Table 1 shows the different disciplines represented.

Table 1. Disciplines represented by the seven faculty member teaching team.

Disciplines Represented
Geography (2 faculty)
History
Sociology
Real Estate Management
Engineering Management and Systems Engineering
Epidemiology

What stands out the most from the first meeting of this group of scholars is that we shared no consensus on even a working definition of sustainability! Thus, with this initial discussion, each faculty's own interdisciplinary learning process began. In the brainstorming phase, we each wrote down on notecards five or more individual topics that we felt represented crucial aspects of urban sustainability and which we would be interested in presenting to the class. We then pinned them to the wall, and read over each other's topical interest areas. There was considerable and lively discussion as we sorted these topics around in an attempt to discover areas of synergy around topics that we could all agree should be in the course.

This process quickly made us realize that the course could not be a comprehensive survey of urban sustainability. There was far too much to cover, and too little consensus on what was essential, something that several scholars have also noted (Godfrey 2010; Li et al. 2018). In addition, there were already other courses that examined urban sustainability (albeit from the perspective of a single discipline). Instead, the team was drawn to the idea of diving more deeply into topics which could bring together several faculty perspectives and areas of expertise. In developing our syllabus, we chose to group faculty who could share perspectives on the same topic area in one class period. In this way, we could focus the class on disciplinary comparisons and contrasts.

4.1. Incorporating the Local into the Course: Place-Based Learning and Digging Deep

In designing the course, the faculty team decided early on that our prioritization of an interdisciplinary exploration of urban sustainability and the attendant challenges these present to students required us to find a focus for the class to better highlight interconnections, and simply hold some things constant within the course. We ultimately agreed that focusing on one city might accomplish this goal. Our own city of Washington D.C. was a logical focus; nearly all the faculty had at least some research projects or other professional relationships in the city. Additionally, as the adopted "hometown" of our students, everyone has some connections and interest with this case study city.

We debated the shortcomings of a focus on a single city. Among these, this course does not focus on challenges of and solutions for cities in the developing world, mega cities, and even other US cities smaller in size, or experiencing distinct challenges like disinvestment from deindustrialization. We acknowledge that because of this choice, some topics central to urban sustainability are deemphasized or absent in our version of "Urban Sustainability". At the same time, we all recognize that any semester-long course cannot cover all issues within the myriad of urban contexts.

However, we believe that focusing our efforts on Washington D.C. provides our students unique advantages that outweigh these shortcomings. At the most basic level, the city of Washington D.C. is a constant for our students. Even as students hear from a professor with a distinctive lecture style, who raises new perspectives and uses different disciplinary jargon, they can fall back on a growing familiarity of neighborhoods, communities, and organizations within Washington D.C. We hope that this "layering" of perspectives on a single case study helps students see disciplinary similarities and differences more clearly.

However, we see further benefits to focusing student learning around their adopted "hometown". Place-based learning is a pedagogical approach that focuses on the incorporation of local knowledge about places and issues into the curriculum to enhance student engagement—both with the topic at

hand and their community (Gruenewald 2003). Each semester, we bring guest speakers in to class, including place managers and community activists which ground our more abstract or theoretical discussions in “real life”. We have also required students to attend sustainability-related community events occurring in the city over the course of the semester. Students reflect on these experiential learning opportunities in written responses, but often recall these experiences during class discussions, more broadly sharing insight and connections with classmates.

Recently, we began including a walking tour—using a neighborhood experiencing rapid gentrification as a “living laboratory”—in order to give all students a preview of key themes to come and to ground these themes in a specific place which we can refer to throughout the semester. This has been particularly effective at helping students decode aspects of the political economy and social injustice that are visible in the landscape (Mitchell 2008). Of course, there is a rich literature that examines the impacts of action-oriented experiences such as field trips that encourage reflection, critical analysis and synthesis on communicating urban sustainability principles (Bell et al. 2016; Tarrant et al. 2014, pp. 145–46).

Our results in these efforts have been mixed. Many D.C. connections in our class are vibrant, and a new Photo Essay final project that encourages the students to apply class concepts in the city was very successful. Yet, in practice, even very well meaning professors are busy people, and not all members of our group have been able to take the time to substantially develop local case studies in the ways that we first hoped. To be fair, for some topics, local data (and particularly comparative, neighborhood-level data) are unavailable. Additionally, the course has evolved significantly over the four years it has been taught, and perhaps we need to consider other ways to assist this group to fully redevelop the course intentionally as a semester-long D.C. case study. This might involve providing small extra summer stipends to professors to develop this case study and attendant partnerships in the city, or funds dedicated to hire graduate students to collect existing data, create maps, and continually update these. The authors still believe that a focus on D.C. (or a neighborhood or another case-study area) is a great advantage in a complex, interdisciplinary course like this one.

4.2. Course Learning Objectives

The process of creating the learning objectives, course syllabus, and assessment strategies for the class was yet another exercise in interdisciplinary learning for the teaching team. For instance, in developing the syllabus, we were reminded that historians care about chronology. In order to best leverage our historian and convey the temporal evolution of urban challenges in Washington D.C. to our students, we needed to consider sustainability themes best highlighted in different centuries of D.C. history and order these chronologically over the semester.

Our experiences have been in agreement with the findings of Borg et al. (2012), who found discipline-bound differences and teaching traditions are a challenge to holistic, sustainability-based curriculum. Indeed, our challenges with developing course-appropriate readings and assessment strategies have been significant enough that this is explored more fully in a following section. In the end, we developed course learning outcomes that were broad, rather than specific (with the exception of the last outcome). The course learning objectives underscore the priority the faculty place on embracing interdisciplinarity within the course (Table 2). Our focus on place-based learning—the use of Washington D.C. as a case study—to enhance students’ understanding of urban sustainability is also apparent.

Table 2. Learning Outcomes for “The Sustainable City”.

Learning Outcomes	
(1)	Explain range and complexity in both theory and practice of urban sustainability
(2)	Know and describe the ways in which cities approach sustainability and appreciate the controversy and debate that revolves around these issues
(3)	Understand the complexity of urban sustainability in terms of economic development, environment, and equity both in history and today
(4)	Articulate and analyze the problems of and solutions to uneven and inequitable development
(5)	Appreciate the interdisciplinary nature of sustainability and how different disciplines contribute to sustainability solutions
(6)	Identify and explain how Washington, D.C. reflects (now and in various periods) uneven, inequitable, and unsustainable development

4.3. Course Constraints

A number of constraining factors—relevant to team-teaching this class within the structures at GWU—have greatly shaped this course. The faculty that team-teach the Sustainable Cities class each receive a small stipend (about \$2000) for their effort. This class is considered a “teaching overage”; as such, it does not count toward one’s teaching load, and is largely unrecognized by home departments. Yet, the amount of time it takes to participate in a team-taught class is not necessarily significantly less than to teach a class individually. Our efforts are reported in our annual reports, and count toward the total numbers of students that each faculty teaches in the year. Thus, to ease the time burden on participating instructors who are already teaching a full complement of classes, we chose to have the class meet just one day a week, during an elongated 150-min time block.

To date, the Academic Program in Sustainability does not yet have sufficient funds to allow us to hire a teaching assistant with full tuition and salary. By raising the enrollment cap to 50 students, we have funds to hire a graduate student as a grader, responsible for grading response papers and quizzes. This is less than ideal; the faculty team would prefer to have a fully-funded graduate teaching assistant in order to teach discussion sections. (Our desire for a fully-funded teaching assistant has only grown over the years that we have taught this class. This is because the value that we place on discussion as a way to process the various, sometimes conflicting, ideas generated in a course that features multiple faculty. Further, a graduate teaching assistant could help provide additional assistance to students outside of class and another consistent voice week-to-week).

Finally, the course is open to all undergraduate students at the university, and has no prerequisites. For this reason, we developed this course conceptualizing it as a second-year course, wanting to engage students early in their academic careers. In practice, however, we find that there is tremendous diversity in students taking the class. Our students are first-semester freshman and graduating seniors; have a wide variety of majors representing most of the GWU’s schools; some have already taken the interdisciplinary, team-taught “Introduction to Sustainability” or other sustainability or urbanism classes while others have not. Well less than half of students are declared sustainability minors.

4.4. Course Structure

All of these approaches, goals, and constraints created the format of a typical class day. The lead instructor starts class with announcements, followed by a debriefing of readings, discussion of upcoming assignments, or quiz administration. Then, we dive into the day’s topical focus with two 40 min “units” (often lectures, sometimes discussions or activities) each led by a different professor. The last 20–30 min of class are then reserved for a synthetic class discussion led by those two professors. Throughout the semester, we intentionally mix up the pairings so that different professors have the opportunity to share a course period and explore interdisciplinary topics over the course of the semester. In addition, we share coordination of several special activities during the semester, such as field trips,

interactive role-play or policy analysis activities, and guest speaker panels. Finally, we begin and end each semester with discussions which involve the entire team of faculty—first to introduce the course, and again at the end of the semester to summarize key concepts and learning outcomes.

In previous course iterations, we sometimes had three “units”/professors in one class, however, that class format left little time for discussion at the end of class. We have found that setting aside time for discussion allows the faculty and students to better connect to course themes, and to reconcile differing opinions on issues discussed earlier in the class. We see this as crucial to interdisciplinary, and it has truly become the highlight of the class period.

Indeed, we work to frame the entire class as an interdisciplinary celebration of the different perspectives that our diverse students (in addition to the faculty) bring to the topic of sustainability. Allotting time for discussion is an important approach moving us towards this goal. We utilize cooperative discussion strategies to engage students as they discuss readings or consider responses to questions posed in lecture. We have had great success asking student groups to formulate questions for the faculty as a way to launch our discussions. Specifically, we have become firm believers in the cooperative learning approach “Think-Pair-Share”, a popular discussion strategy which has been the subject of significant research (see, for example, [Kaddoura 2013](#); [Prah 2017](#)).

Briefly, the “Think-Pair-Share” classroom strategy works in three phases. A question is posed to the class. First, students are asked to briefly “Think” and consider their own answer to the question. Students then “Pair” with a neighboring student compare answers, and “reach a consensus, pick the most convincing response, generate many responses, etc.” depending on the instructor’s prompt ([Lom 2012](#)). Finally, after students have shared in a small group for a few minutes, we commence with a full class discussion in which groups “Share” their thinking with the rest of the class. (In practice, we modify this, sometimes skipping the “think” step, and have actually found that slightly larger groups like triads or quads work better in some ways, bringing students with different backgrounds together for small group discussion).

[Lom \(2012\)](#) reported multiple benefits of the “Think-Pair-Share” discussion strategy, including communicating the expectation and providing space such that all students will engage and thus reach a deeper understanding of a topic. Given the interdisciplinary nature of this class and our focus on appreciating difference, we particularly value several outcomes of this technique most important to our class. Specifically, we find this strategy helps students consider multiple answers and perspectives through a talking-listening process before trying to reach a “correct” solution—a finding also highlighted by [Lom \(2012\)](#). In this way, we have found “Think-Pair-Share” to be an essential course component, one that helps our students think broadly, analyze complex material, and appreciate diverse perspectives.

We have found interactive classroom activities to be another effective strategy to engage students in course material and to consider sustainability from different perspectives. Our Public Health Professor created an activity for the class utilizing socioeconomic and public health data for Washington D.C.’s eight Wards (neighborhoods). Students analyze real-world data; consider health, amenity, and access disparities across the city; and consider how policy priorities differ spatially and for different populations. However, creating this kind of specialized activity—with data which must be regularly updated—is quite time consuming for faculty.

For several years, we have successfully integrated the disaster scenario “Extreme Event” developed by the National Academy of Sciences into our class (<https://labx.org/extreme-event/>). Extreme Event is a role-playing game that gives students a taste of what it takes to build community response and resilience in the face of disaster. Players work together to make decisions and solve problems during an engaging, fast-paced disaster simulation. Student feedback suggests that this is a highly effective activity that helps students to better understand the complex decision making that goes on during a disaster and reinforces interdisciplinary cooperation and problem solving. This is consistent with [Sipos et al.](#), who note that this type of engagement can help achieve transformative sustainability learning ([Sipos et al. 2008](#)).

5. The Challenges of Teaching the Sustainable City

As rewarding as it has been to design and develop this team-taught course, it has not been without challenges. In this section, we examine several of these—some of which have been evident since course development, others which have emerged over time. Many of these challenges resonate with those described in the literature. However, we hope that highlighting some of the challenges we have wrestled with might inform the approaches of others and contribute more broadly to discussions of sustainability and interdisciplinary education.

5.1. Challenges: Holding Conceptual Complexity

Team-teaching is an opportunity to engage in a thoughtful and often on-going discussion about how we define sustainability, how we teach sustainability, and what each faculty member believes is essential for students to learn. After five years, the faculty team still does not agree on a definition of sustainability (and we have learned that this is OK). Sustainability as a concept is inherently complex and multifaceted (Misiaszek 2017). The reality is that the teaching team has come to value that conceptual complexity. For that reason, in some lectures, we have purposely organized the course around conflicting definitions—of equity, for example. Each year, we intentionally feature two faculty who engage in a lively and sometimes discordant discussion about what equity means within their discipline and their own research. We have learned to clearly and repeatedly tell students that our understandings of the problems and solutions at hand are strengthened by listening to all of these perspectives.

We have also experienced that the diversity of ideas and lenses presented in “The Sustainable City” was very appreciated by our students. Student comments along these lines include: “Hearing multiple perspectives on the same topic was awesome”, and “getting a holistic view of the topic and hearing different opinions was the best part of the class structure” and “learning from so many different perspectives allowed me to form my own opinion about urban sustainability”. These are also findings of Walsh and Davis, who note that team-taught interdisciplinary first-year courses can significantly raise student awareness of the complex, multifaceted nature of sustainability (Walsh and Davis 2017).

Yet, it is clear that holding this conceptual complexity, and making sense of diverse opinions and scholarly disagreements were not entirely comfortable for all students. Many of the issues in sustainability, such as climate change and ecosystem degradation, necessitate increased interdisciplinary teaching, but this can be a challenge for students (Walsh and Davis 2017). Students have expressed it is a challenge to adjust to the teaching approaches of multiple lecturers within one class period. This is in part due to different terminologies and perspectives, but also extends to diverse presentation styles and uses of texts and presentation software. As one student succinctly stated: “adapting to different teaching styles is difficult”. Other students—even those who enjoyed the class overall—were struck by observing and participating in scholarly disagreement. One student expressed discomfort with what s/he saw as “clashing opinions” yet another “loved the sometimes direct contrast in practical visions of sustainability”. One student response is particularly illustrative of the ways in which a team-taught class challenges students:

“The best parts of this class were also what was most challenging: I felt like Professor X and Professor Y demonstrated clear contradictions between which forms of management/governance is best. This was challenging because I left feeling like I hadn’t found all the answers. This was good because I know have a realistic understanding of twenty-first century development pros and cons”.

We believe that many of the students who struggle with contradictory opinions and interpretations around sustainability are first- or second-year students, who may have less experience with a pedagogic approach that incorporates academic dialog. Troublingly, we received some student feedback from students who interpreted our scholarly disagreements as “fighting”, including one student who wrote “some of the discussions turned into the professors arguing”. (For the record, together, the authors

have attended every class and we have never seen any behavior we would characterize as fighting. Provocative questions and polite scholarly disagreements, certainly).

The faculty team has had many discussions about the difficulty and discomfort some students have with the complexity and diverse perspectives presented in our class. We have concluded that becoming comfortable with this discomfort—we call it “holding conceptual complexity”—is an important area of intellectual growth for students in this unique class, and that presenting a “unified” perspective is a disservice to our students. Indeed, building a culture of meaningful academic discourse seems a particularly valuable course goal at this cultural moment (even beyond topical understandings of sustainability). For all these reasons, we decided not to try to “unify” diverging perspectives for students, but instead to find ways to let students productively wrestle with this aspect of understanding an interdisciplinary subject such as sustainability.

Along these lines, the faculty do continue to genuinely engage each other with questions—out of curiosity, on terminology, to make connections apparent for students, or to play devil’s advocate—but we try to remember to keep the pace and tone of the conversation accessible to students. Sometimes this means providing some context as to why you are asking a question, other times, we hold the question until break or after class and then decide if some parts of the conversation that unfolds can or should be “reenacted” for the students, or if instead it remains a conversation among the faculty as it moves us too far away from our learning objectives for the day. These decisions are generally made together with the lead instructor, who we have learned has a particularly vital role finding the balance and making connections that help students embrace the conceptual complexity of this class.

Although the students perceive diverse perspectives in the classroom, ironically, many of the faculty team report that our positions are becoming more similar over time as we have developed a deeper and more nuanced perception of sustainability than we once had. In part, we believe that the process of teaching this class together has influenced each of us faculty in unexpected ways.

For example, on the first day of semester, the faculty team engages the class in a discussion about what s/he considers the essential definitions of sustainability, and selects one or two of the most pressing issues U.S. cities currently face. Each faculty team member speaks for about 10 min on this, then condenses their ideas into a “hashtag” written on the board in front of class. Hashtags have included #equity, #health, #walkability, #integrated, #contingent etc. For the first three years of teaching, those discussions—along with associated hashtags—remained pretty static.

However, in the last two years, faculty have changed their definitions or critical issues, borrowing (stealing?) hashtags from other team members. The Sociology professor who typically used #equity took instead #health, in part because of a recent study underlining major health inequities in Washington D.C. The Public Health professor who often used #health then instead chose #walkability because of the major implications of walkability on health, obesity, and sustainability more generally. That left the professor who normally chooses #walkability to suggest #holistic (the hashtag “belonging” to one of the authors!) Of course, this is a spontaneous exercise, no hashtags are proprietary, and we were all left bemused. Yet, this highlights the ways in which the experience of team-teaching over a longer-term both stimulates and influences our own perspectives, and points to how interdisciplinarity continually modifies our own disciplines as well.

5.2. *Challenges: A Cohesive Set of Readings*

Identifying and agreeing on readings appropriate for this class has been another particular challenge for the faculty team. Likewise, at some points, understanding and keeping up with the reading has been a problem for our students. As we developed the course in 2015, it became clear that there was no single text book that examined the topic of urban sustainability in a multi-disciplinary manner that reflected our expertise and the perspectives we intended to bring to the class. The obvious answer to us was that each professor would identify disciplinarily-relevant readings for their own part of each lecture.

However, we found this to be problematic for several reasons. The first problem was the sheer number of readings, as many professors assigned multiple readings, and two (or in the first year, three!) professors would lecture each class day. Students struggled with the volume of reading. The second problem with the reading was content. Many students were overwhelmed by the disciplinary diversity of readings, the new terminology, the different perspectives and tones. Then, as is always the case, different professors expected different kinds of reading—some close reads and others skimming—but this was not effectively communicated to students. In our experience, students who found the quantity and diversity of readings too challenging did not fully engage with the material.

We tried to address this challenge in several ways. First, we instituted reading responses (which guided students to answer a short set of questions that highlighted the most important ideas). Second, we tried dramatically reducing the number of readings, so that students could focus on a smaller, selected, number of texts. Third, we strongly encouraged each of the faculty to incorporate their own readings into lecture and discussion, using this time to process key terms and ideas, and explicitly make connections between readings and the lecture.

A fourth strategy was to assign the Washington D.C. Sustainability plan as the “course text-book” and assigned sections of the document in each week as they were relevant. This was a strategy we hoped would strengthen connections to the city as a case study in the class. (Students did generally respond positively to this reading, and one noted that it helped them “see sustainability in the real world”). However, it further contributed to a reading load that was already problematic, and we found that while some professors readily incorporated this reading into their class time, others did not. Our implementation of these “fixes” was admittedly inconsistent, and ultimately, a majority of the faculty felt that too many students were disserved by this approach to class readings.

In 2019, two members of the team published a book *Urban Sustainability in the US: Cities Take Action* largely in response to the challenge the team had faced over five years in trying to find a textbook for the class. We ultimately decided to use this as the course text book as a way to provide unity to diverse ideas and perspectives and as a “safety net” for students struggling with lecture material. We have experienced several advantages in having a topically broad text written in one voice. We believe that this approach gives each student a similar basis of understanding to bring to our class time together. Fewer students appear to be struggling with the material with this “safety net” in place. Student feedback seems to confirm that selecting one textbook as a primary reading has helped. Student comments along these lines include: “the book helped give me an overall understanding of sustainability”, “enhanced lectures and put lectures into context”, “supplemented what we learned in lecture”, and “provided valuable content and background information”.

Several of our team members resisted the adoption of a single text, concerned that it would be difficult to highlight disciplinary differences to students with a text written in one voice. To address this concern, we still incorporate a few additional readings. In some ways, the text book was liberating as well, in that faculty no longer needed to introduce basic terms and concepts like equity, combined sewers, bus rapid transit or zero waste in their lectures. We encourage each faculty member to use their own lecture time to introduce their own disciplinary terms, techniques, and perspectives. In this way, a common text book allows faculty to spend more time discussing higher-level concepts and perspectives from a disciplinary perspective. We hope to see faculty develop more bridges and connections with the text—including critical ones—as we move forward with its use.

5.3. Challenges: Assessments

Assessing the effectiveness of our teaching approaches and of student learning has been an ongoing challenge for at three distinct reasons. One set of challenges revolves around the multiple disciplines represented in our teaching team. Shibley (2006) has noted that team-teaching can require negotiating pedagogical differences, something we have experienced as well, including in the development of assessments of student learning. It was quickly clear that—even at a theoretical level—there exists disciplinary disagreements about how student learning can or should be assessed. These differences

exist at many levels and include the kinds of questions and tools that can be used and even the types of “knowing” that students should demonstrate. At a more practical level, there is not one tool (i.e., an easy-to-grade quiz of multiple choice questions) suitable for the very different material presented by each professor or in each reading. In addition, while the development of some assessments are a true team effort, in the rush of the semester, the lead instructor is often in the position of creating and grading assignments outside of her own area of expertise.

Second, grading efficiency is a key concern. As discussed earlier, this class is taught as a teaching overage for everyone involved. We need assessment strategies that are straightforward to grade. This is especially the case because at least some grading is outsourced to a graduate student grader hired to assist with course logistics.

Our third challenge has been adjusting not only our pedagogical approaches, but our expectations of student learning. For instance, several members of our teaching team do not regularly teach undergraduates, and certainly not undergraduates with little to no background in their fields (or of a necessary prerequisite, like higher-level math). This initial challenge has largely abated with experience. However, all of our faculty quickly discovered that a challenge of a class covering this breadth of material is that many students lacked the depth of understanding to tackle the kind of meaningful broad-scoped final project we had first developed. This challenge will be discussed in more depth below, but in short, we have found that students in this class require much more focus and structure than we first assumed to apply class concepts and produce a satisfactory project.

5.3.1. Reading Responses

Perhaps our most universally appreciated assessment approach has been reading responses. Students respond to a series of several prompts generating a written response to readings in advance of each class. As discussed above, readings for the class have evolved dramatically over the years. In every iteration, reading responses have been essential, though for different reasons. Initially, when each professor assigned several short readings in advance of his or her lecture, prompts for the reading responses were designed to help students identify main points and ideas within readings that were challenging to them because of the different disciplines, writing styles, and terminologies present. Once we assigned a text book for the class, the reading response prompts took on a new role. Currently, prompts are designed to make sure that all students have a basis of understanding in a topical area—a common “jumping off place”—and also encourage students to find unifying themes and ideas across topical areas and between the book and lectures. In all cases, reading response exercises have been helpful in assuring that students come to class having actually read and preparing all students (and especially shier students) for discussion in class.

5.3.2. Quizzes

Although students do not seem to appreciate them, we continue to rely on frequent short quizzes about six times throughout the semester as a relatively easy way to assess student learning, provide feedback to students on their standing in the class, and keep students coming prepared to class having done the reading. The structure of the quizzes is generally a mix of multiple choice and short answer questions which the students complete in the first 15 min of class. However, material—particularly for some of the disciplines—is more concept-driven and difficult to simplify into multiple choice questions. As a result, we often end up creating more than one correct answer to multiple choice questions, and the students do hate those!

5.3.3. Final Project

Perhaps the course element in which we have most learned from failure was the final project for the course. Now in our fifth iteration of the class, we have utilized three very different final projects—all of which initially seemed like interesting, sound pedagogical approaches. Our final iteration seems like a strong option and benefitted from lessons learned in the first two approaches.

In the first years, the final assignment challenged students to work in groups, each exploring a topical section of the Washington D.C. Sustainability Plan (such as water, health, or green space). Each group was to undertake more in-depth research on a local problem-area presented in their section, utilizing academic literature and governmental publications, and identifying possible best practices from other cities. We suggested that they consider the “3-E’s of sustainability”, incorporate perspectives from several disciplines, and visit multiple faculty to advise their efforts (although we suspect they did not). They presented their final projects on the last day of class and answered questions from the audience which included all faculty. In that process, we realized that students did not have the depth of knowledge to make these evaluations without much more structure, guidance, and more advising than we were able to provide in this setting. This assessment method also included all the normal challenges of managing and grading assignments which involve group work.

The next final assessment iteration—developed in response to the problems noted above—was a more traditional final take home exam which students completed individually. The faculty team worked together to develop eight overarching, multidisciplinary questions which required students to synthesize material from readings, lectures, discussions and other class activities in their answers. Students were asked to select four questions to answer, utilizing class notes and readings (and citing these) in their 500-word responses. While we were pleased with the rigor of the work students submitted, this assignment was particularly hard to grade at the rush of the end of the semester, even when the work was divided between several professors.

The current version of the final project consists of a series of short, 250-word essays based on a visual such as a map, graph, or photograph. This project was developed as a version of the previous take home exam but is intended to get students out into our “living laboratory”—the city of Washington D.C.—especially as we deliberately connect the class more closely to this case study. We developed ten topical “prompts” covering key issues addressed throughout the semester such as gentrification, climate change, water quality, mixed-use development, etc. In response to each prompt, students must take a picture, make a map or find a historical document that illustrates a sustainability challenge in D.C. relating to each prompt. Thus, students spend the second half of the semester thinking about class themes and ideas as they travel through and engage with the city, and at the same time, they have latitude in finding connections and pursuing topic areas that are of personal interest. Like the take-home final exam, students are required to synthesize lecture notes and readings and to utilize other information sources including academic literature and governmental publications in short essays discussing their chosen images. We found this approach to be engaging and demanding for the students, and interesting and easily-gradable for the faculty. We plan to continue using this final assessment project for the foreseeable future.

5.4. Challenges: The Administrative Burden

Although the class has always been taught by seven professors listed as equals in the course bulletin, one lead instructor takes on administrative responsibilities for the course and is the coordinator of ideas and faculty, primary point of contact for students, leads grading efforts and supervises our graduate student grading assistant. That person receives about double the compensation of other team members, though it truth, each of us who have taken on the lead instructor role has found it to be more time consuming than a normal class that we teach individually. Because of the centrality of this position to the function of this course, we quickly outline below some of the administrative responsibilities and challenges related to the lead instructor role. We hope to help others considering this approach and to urge institutions valuing this teaching strategy to better support and compensate lead instructors in these course configurations.

5.4.1. Holding Complexity

Our lead instructor is the only faculty member who attends every class section. (Others are invited to join in, even on days that they are not lecturing, and sometimes do). Therefore, the lead instructor is

the only faculty member with a comprehensive understanding of the topics that have been covered and of what the students have learned. In this way, the lead instructor is the only professor with the overarching knowledge of the class necessary to bind together individual lectures, assignments, exercises and readings and provide the “conceptual glue” to help students contextualize materials and perspectives and hold class together for students.

For this reason, during each class, it is the role of the lead instructor to make connections to previous readings and lectures as well as overarching class themes. In practice, the lead instructor has a heavy hand on the generation of reading response prompts—especially those that encourage students to find unifying themes and ideas between topical areas and between the book and lectures—since the lead instructor is perhaps the only one who knows what those might be. Similarly, the lead instructor guides the creation of discussion questions that shape this vital portion of the class as well as all assessment strategies, as she is the person best situated to understand what is fair to expect students to know from across readings and lectures as we develop quizzes. (In these ways, responsibilities of the lead instructor resonate with other roles of the lead instructor, including “herding cats” below).

In all these ways, presenting and holding conceptual complexity in a way that is accessible and engaging to students is a challenge and a major responsibility of the lead instructor. It is certainly a heavy lift, which is one reason that the faculty team has been disappointed that GWU cannot or will not provide a fully-funded graduate teaching assistant to better support students and therefore, faculty in this role.

5.4.2. First Point of Contact for Struggling Students and Those Really Interested in the Class

We found the lead instructor to be essential from the student perspective in other ways as well. A number of students we have spoken with—even those who very much enjoyed the experience—still consider this one of their most challenging classes at college. There are several reasons for this, many related to the interdisciplinary nature of the class and which have previously been discussed. However, to summarize: first, listening to and taking notes from such a wide variety of professors is challenging. For instance, some professors talk fast and move quickly through lecture slides but make them available later; others do not use power point, preferring to develop an oral narrative for the students. Second, students are certain to be exposed to ideas and perspectives that are new to them, which challenge ideas and lenses they have been taught to use, and which may be uncomfortable. Finally, and perhaps most fundamentally—this is not a course that presents a clear “answer” that is unequivocally right. Students cannot memorize an approach or narrative and regurgitate it for the final. As a class that calls upon students to learn to appreciate the complexity of sustainability challenges and ways forward, students need a comfortable point of conceptual contact for questions.

Along similar lines, we have found that many students in the class are passionate about sustainability or cities or both and cannot get enough of the material. Just as some students need extra support, our most engaged and precocious students are eager to talk with faculty about the topic, get input on other courses they might be interested in or consider internship or career opportunities along these lines. The lead faculty member is a point person for these inquiries as well.

5.4.3. Herding Cats

“Managing academics is, like herding cats, either impossible or pointless” (McCormack et al. 2014). This broadly-used phrase highlights the challenges of leading and uniting collections of independent people. Since, as Garrett and Davies (2010) highlight, “most academics and researchers like to exercise as much independence as possible in their professional lives”, our challenge of “holding complexity” can be seen from a managerial perspective as well.

Despite the many benefits, we have seen first-hand many administrative challenges that come from working in and coordinating a team of seven faculty. The lead instructor faces all the typical administrative issues of running a class—but many of these are exacerbated because the lead instructor is not the sole person to institute needed changes. While many of these challenges are highlighted

by others reflecting on team-teaching experiences (see, for example, [Letterman and Dugan 2004](#); [Plank 2011](#); [Feng 2012](#)), we have not found discussions oriented to the experiences of large teaching teams who co-teach in the manner described here.

Coordinating schedules (including changing travel schedules), lecture topics and other course logistics—as well as engaging in foundational theoretical and pedagogical issues—has proven unexpectedly arduous. It is more difficult to pivot the course if something is not working, or to quickly incorporate a new idea that connects to current events when engaging in large team-teaching. For instance, we have witnessed multiple instances of professors utilizing news of the day or a recently released governmental report to spontaneously shift or reframe the focus of their classroom unit. In a normal course, this can be a highly effective teaching strategy to “freshen up” a topic to engage students, demonstrate topical relevance and extend academic discussion beyond the classroom, modeling a culture of lifelong learning. However, in a delicately balanced class, in which collaborative effort is necessary to set up discussion topics and connect overarching class themes, sudden changes can challenge the course’s connective, conceptual “glue” and further problematize the conceptual complexity we are already balancing for our students.

In a further complication, each year we have taught the class, we have instituted a major change—often associated with assessments (quizzes, tests and final projects)—but also with changing readings and associated reading prompts. This translates into the need to revise lectures, assignments, assessment questions and grading rubrics—not always easy adjustments for already busy faculty. For the lead instructor, new changes can mean constant follow up with the faculty team to keep everyone informed and generate new reading response prompts, discussion questions and quizzes on a weekly basis.

While each of our faculty members is engaged in the topic of urban sustainability and are committed teachers, they are not superhuman. While we often have exciting ideas of ways to improve the class, many of us have not yet fully integrated these as we are balancing this class commitment with other teaching, research, service and life responsibilities.

5.4.4. University Logistical Challenges

The lead instructor handles a variety of organizational and clerical responsibilities as well, ranging from managing course software through interviewing and hiring a TA. Since this course (like our university’s other team-taught Sustainability courses) is not offered through a specific department, but instead is a special course offered through the Provost’s Office, many routine, mundane issues that might normally be handled by departmental administrative staff are challenging. One example is making sure that everyone is officially listed as a faculty member with the registrar, so they automatically have access to online course materials and that course information is reported in our annual reporting software. Other examples include making sure that department chairs are aware of their faculty’s extra teaching and service load, assuring that everyone receives their teaching overage payment, processing honoraria for guest speakers, and making sure the course is actually scheduled and has a room that meets our needs.

6. Conclusions: Lessons Learned

Wilson and colleagues conclude that team-teaching can be a transformative experience, leading to an improved course curriculum; new pedagogies, competencies and innovation; as well as a more positive attitude towards teaching and towards yourself as an instructor ([Wilson et al. 2019](#)). Our experience certainly reinforces this idea. The scholarship on team-teaching—particularly in sustainability courses—adds to our understanding of effective teaching strategies. Teaching urban sustainability is a significant challenge; team-teaching this class with a large, interdisciplinary group of faculty brings additional challenges. However, the benefits are numerous and, we have found, certainly worth the challenges. Some lessons we have learned are simply typical of good pedagogy,

however, we list them below in order to add to the growing discussion around making interdisciplinary, team-teaching even more effective:

1. Prioritize participation of faculty with a longer-term interest in teaching the course from inception, which allows for development of synergies over time. Expect growing pains, but as the course is repeated, faculty gain a better sense of what each other will discuss and assign, and this can lead to improved coordination and better discussions.
2. Class discussions are critical and are the point in the class at which we reach true “interdisciplinary”. Given students’ discomfort in participating in discussion, the variety of student backgrounds, and the complexity of the topics at hand, we have great success with cooperative discussion strategies such as the “think, pair and share” model in which students discuss answers in small groups before reporting back to the class or moving on to whole-class discussions. Consider this and other active-learning strategies to engage students with the complexity of the material.
3. Encourage the faculty team to consider points of synergy that will lead to a fruitful discussion of disciplinary comparisons and contrasts throughout the semester. This requires faculty to have a good sense in advance of what each other will discuss in class and of themes and ideas from other class days as well. For students to appreciate the diverse perspectives presented, they often need these explicit connection points and comparisons to make sense of and hold the complexity with which they are presented.
4. Appoint and adequately pay a lead instructor who is the point person for “holding complexity”, “herding cats”, administration, grading, and student needs, as this is a time-consuming role. The time invested in this role can be considerably more than teaching a typical class.
5. Include a graduate teaching assistant to lead discussion sections or otherwise assist with the course. Discussion sections would really assist student learning, although finding a graduate student confident and competent to lead these discussions might be challenging. We have taught a class of 50 students without discussion sections and still greatly appreciate the help of a graduate assistant with grading.
6. Find a focus to help ground students and discussions amidst all the interdisciplinary perspectives raised. Having a case study city—in our case, the adopted “hometown” of our students—is an effective way to layer learning, and hold some things constant amidst so much difference and complexity. A local case study leverages the many advantages of place-based learning for students as well.
7. Consider a textbook as a “safety net” for students and as another way to help provide a common base-point for all.
8. Make students write their responses to reading prompts to help students prepare for lectures and be ready to participate in discussion. Prompts can guide students through readings from diverse disciplines or train students to compare and contrast perspectives from different sources.
9. Carefully consider final projects, since the interdisciplinary work that students do is a heavy lift. Without very specific parameters (such as specification of reference sources) analysis was questionable.
10. Finally, find ways to hold complexity for students. Team-taught courses that stress interdisciplinarity are not straightforward. Students may struggle to grasp the complexity of sustainability, especially in classes that do not provide clear answers to pressing questions. They may worry about the conflicting nature of interdisciplinary perspectives and approaches. Instructors should work to minimize confusion, but to also leverage interdisciplinary differences as a highly effective teaching strategy. We call this “holding complexity”.

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