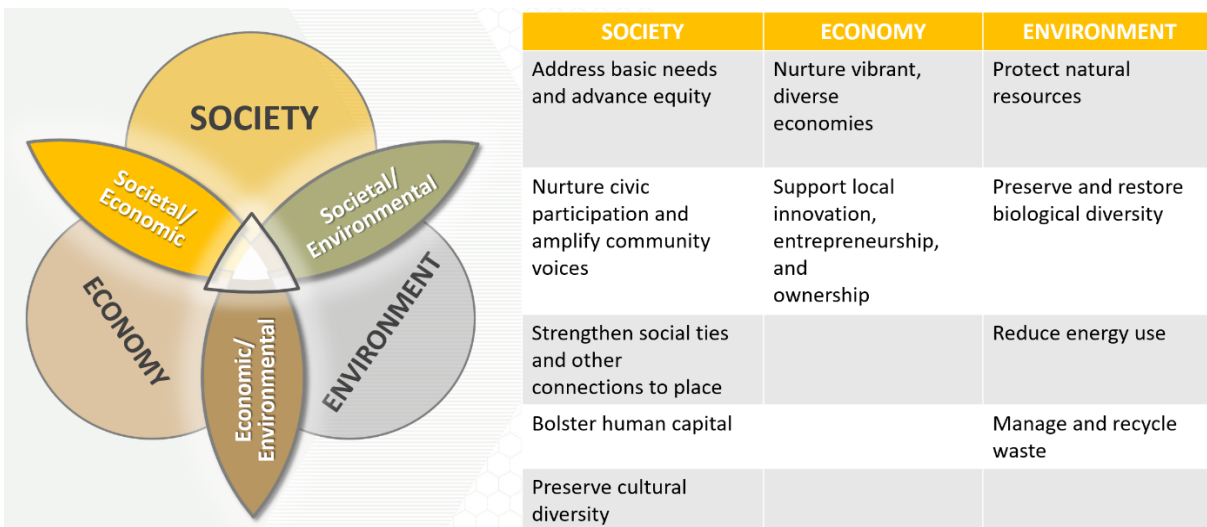


Snapshots of Transdisciplinary Teaching for Sustainable Communities at Georgia Tech

By Jennifer Hirsch and Ruthie Yow
Center for Serve-Learn-Sustain

Dr. Wayne Clough, President Emeritus of the Georgia Institute of Technology, is known for saying: “The only thing harder than interdisciplinary research is interdisciplinary teaching.” But the Institute’s Strategic Plan calls for us to prepare students to “develop innovative and socially responsible solutions” – so we need to figure this out. In fact, today’s most pressing global challenges, like sustainability, have been characterized as wicked problems – problems that require solutions that transcend disciplinary knowledge altogether and thus can only be addressed through *transdisciplinary* approaches. Increasingly, there are calls within academia for transdisciplinary work, defined nicely by Marie Grice as having two traits – one within academia and one connecting academia to the real world: “one is boundary crossing, the need to break away from traditional discipline specialization, the other the urge to transgress the gap between theory and practice” (2014:151).

At Georgia Tech, the Center for [Serve-Learn-Sustain \(SLS\)](#) has been experimenting with developing and implementing transdisciplinary models for teaching. Launched in January 2016, SLS works with all six colleges at Tech – Engineering, Liberal Arts, Computing, Business, Design, and Sciences – to integrate lessons and real-world learning about “creating sustainable communities” into undergraduate programs and courses. In keeping with most technological institutes of higher education, students’ undergraduate education programs at Georgia Tech are, for the most part, very focused and siloed, going deep into their chosen majors, with little attention to breadth including the broader goal of developing global citizens. SLS aims to begin to address this gap and prepare students to use their disciplinary expertise, and other knowledge and skills that they learn at Georgia Tech, to work collaboratively with diverse stakeholders on sustainability challenges. We approach sustainability as a holistic system uniting environment, economy, and society. We focus especially on the “society” part of sustainability - often referred to as “social sustainability” - and within this area, on equity and justice as key to creating



*Model adapted in part from Jeffrey C. Bridger and A.E. Luloff, “Toward an interactional approach to sustainable community development,” *Journal of Rural Studies* 15 (1999): 377-387

SLS’s Sustainability Model and approach to “creating sustainable communities”

sustainable communities that benefit both people and nature. (Read more about our approach [here](#).)

Partnerships with faculty and schools in the Ivan Allen College of Liberal Arts, as well as with community and government organizations in Atlanta, have been key to this work. In the remainder of this short essay, we share four snapshots of these partnerships, as our response to the question, “How do we teach humanities subjects differently because of our science- and technology-oriented student populations?” Together, they demonstrate the variety of strategies that we are piloting to help students at our technological institute graduate with a strong understanding of how technology is both impacted by, and impacts, social context – and of the ways in which they, as civically-minded technology specialists, can push technology to create a more just, equitable, and sustainable world for all.

Snapshot #1: Linked Courses iGniTe Summer Program on Equitable and Sustainable Development

SLS’s Linked Courses Program links together existing courses from different disciplines – and preferably different colleges – during the course of one semester, under the umbrella of one of three of SLS’s Priority Issue areas: Green Infrastructure, Community Health, and Equitable and Sustainable Development. The program aims to help students understand the issue from multiple disciplinary perspectives and within real-world contexts. In each of their courses, faculty introduce a common intellectual framework that was developed jointly by faculty from multiple disciplines, with input from community partners. They also bring their students to joint workshops and partner activities hosted by SLS, on and off campus. Finally, they engage their students in real-world projects with community or government partners. During fall and spring semester programs, students work on different aspects of the same or related projects. During the summer program, students engage in smaller projects in their separate courses.

To engage students in sustainable communities work from the get-go, SLS prioritizes working with first year students. The two programs we partner with most in this regard are the [Writing and Communication Program](#), which runs the English courses taken by most first year students, and the [iGniTe First Year Summer Launch Program](#), for incoming students starting Tech in the summer term. SLS’s iGniTe Linked Courses Program on Equitable and Sustainable Development brings these two programs together. Each summer, the program offers two SLS-affiliated English courses plus two liberal arts courses, usually from History and Sociology (HSoC) and from Literature, Media and Communication (LMC). To date, the program has focused on the Atlanta BeltLine as a major real-world project that demonstrates the complexities of built infrastructure that simultaneously benefits people, the economy, and nature.

Faculty from Liberal Arts – and especially HSoC and LMC – have been key contributors to the Linked Courses Program in two ways. First, their focus on writing and on reflection helps students connect what they are learning in the classroom, including theory and methods, to real world practice. For example, one English instructor had her students do public-facing writing and shared that in their final assignments, students mentioned that interactions with community partners led to deeper understandings of how to write for specific audiences. Similarly, another English instructor said that his course evaluations revealed that students were able to connect their work around poetry to real-world issues. Second, faculty members have contributed their expertise on equity, to the conceptual frameworks and other materials shared with all instructors,

as well as to the community activities, such as the BeltLine tour. For example, in Summer 2018, Professor Joycelyn Wilson from LMC gave a guest lecture in two courses on what hip-hop has to say about development in Atlanta. In Summers 2018 and 2019, Professor Allen Hyde from HSoC contributed stories and lessons learned from his oral history work in the Grove Park community (see [blog post](#)) to the BeltLine tours that served as the opening activities for the summer program, bringing additional content and context to the stories and lessons shared by partners from West Atlanta and from Atlanta BeltLine Inc.



Professor Allen Hyde from History and Sociology talks about equity challenges during an iGniTe tour of the Atlanta BeltLine, Summer 2018 (Photo courtesy of SLS)

Initial assessment of the program suggests that these contributions significantly help students identify relationships among ecological, social, and economic systems - which is the primary student learning outcome for the program. For example, one student wrote, “[Touring the Westside BeltLine] aligned with the key concept of how infrastructure development can impact different communities in different ways. As a Computer Science major, this relates to how I need to consider not only the software I am developing and who I’m developing it for but also who could be further impacted by it. Processing data can take into account economic impacts, and in some cases environmental impacts can be simulated, but CS doesn’t have inherent tools for understanding the social effects of what has been done and what can be done.” This quote suggests that the program’s focus on equity and real-world learning is helping students discover the limits of their own disciplinary approaches – another key component of transdisciplinary learning.

Snapshot #2: Sustainable Cities Minor

The [Sustainable Cities Minor](#) is a collaboration between its host school, [City and Regional Planning](#), and SLS. After a modification of the minor approved by the Institute last year to align it more closely with SLS’s approach to sustainable communities education, students must now take at least one of the five required courses outside of City and Regional Planning. Many of the course options come from disciplines that are often left out of Planning and Sustainability-related programs, such as HSoC, LMC, Computer Science, Biological Sciences, and Modern Languages.

[Modern Languages](#) (ML) courses have been the most surprising and least understood contribution to the Minor. Their inclusion builds on a strong partnership between SLS and ML, which has developed a strong specialization in sustainability in different parts of the world, connecting society, economy, and environment and helping students understand the key role that culture plays in creating sustainable places. This is demonstrated through the fact that of

SLS's 10 affiliated [Study Abroad Programs](#), six are run by ML faculty. The chair of ML, Anna Stenport, conducts sustainability research in the Arctic (see [this article](#) about her recent work) and in 2018, received a \$2.25 million grant from the U.S. Department of Education to start, together with Georgia State University, the [Atlanta Global Studies Center](#) (AGSC), which has a strong sustainability focus. Along with SLS, AGSC is working on research, education, and action related to the United Nations Sustainable Development Goals at Georgia Tech and in our region.



Students volunteer at Sierra Nevada Limpia in Granada as part of Dr. Kelly Comfort's Serve-Learn-Sustain in Spain program, Spring 2018.
(Photo courtesy of Kelly Comfort)

The [“Serve-Learn-Sustain in Spain” Study Abroad Program](#) is included in the minor and provides a good example of the ways in which ML courses and programs take a transdisciplinary approach to sustainability education. The language courses themselves take “creating sustainable communities” as a key theme, and the program also includes courses on Social, Cultural, and Linguistic Diversity and Economic and Environmental Sustainability. Through a partnership with local service-learning organizations focused on sustainability, students take part in community projects, cultural and linguistic immersion activities, and roundtable discussions with community partners, and field-based needs-assessment projects, to learn how to integrate themselves into the local culture, understand the diverse communities in which they serve, and gain intercultural competence and place-based

perspective in addressing challenges.

Snapshot #3: SLS Affiliated Courses and Projects

Through the [SLS Affiliated Courses Program](#), faculty from all six colleges offer approximately 160 courses per year that teach students about “creating sustainable communities” from the perspective of their disciplines or course topics. SLS staff work closely with a subset of faculty who are interested in redesigning their courses to more deeply incorporate different parts of SLS's approach to sustainable communities education, such as our focus on society/equity. Here are a few examples of how courses and projects - from Engineering, Sciences, and Computing, ranging from sophomore to senior levels – have evolved as a result of incorporating community partnerships.

CHBE 2120: Numerical Methods in Chemical Engineering

This is a required course for the Chemical Engineering major. On the SLS website, Professor Andrew Medford describes the course, and the ways in which it relates to sustainable communities, as follows: “Many engineering problems require the use of advanced numerical methods for finding solutions to systems of linear, nonlinear, and differential equations, optimizing functions, and analyzing data. The general objectives of this course are to develop skills in properly defining and setting up chemical engineering problems and learning numerical methods that can be used to solve these problems. For this reason, this

course provides a foundation of techniques that can be used to solve practical and complex engineering problems. The course project and assignments will focus on examples related to fertilizer production and the food-energy-water nexus. This will include an Aspen project to model the Haber-Bosch process; and the economics module will explore the implications of high capital processes on equitable access to resources.”

Since Fall 2017, after participating in an SLS Fellows Program on Energy Systems for Sustainable Communities, Professor Medford has been working to integrate guest lectures from outside partners and a variety of small assignments into his course, primarily related to the environmental and economic aspects of sustainability. Then, in Fall 2019, he worked with SLS to incorporate some work with a local community organization, the [West Atlanta Watershed Alliance](#) (WAWA). Education Director Darryl Haddock was invited to give a guest lecture on the work that WAWA does to improve the watershed; the ways that work advances WAWA’s larger goals related to engaging the local community in sustainable development; and the importance of community-based organizations in advocating for environmental justice in historically marginalized neighborhoods. Drawing on this lecture, a group of students then worked on a project for WAWA analyzing water quality data. All the students in the course were also invited to participate in WAWA’s annual River Rendezvous to do stream-testing with WAWA and its partners on-site at Proctor Creek. (Learn more about River Rendezvous through [this blog post](#), written by a Georgia Tech student who participated in 2017).

EAS 4221: Environmental Geochemistry Lab

On the SLS website, Professor Jennifer Glass from the School of Earth and Atmospheric Science describes the Environmental Geochemistry Lab as follows: “Geochemical processes are central to a variety of environmental issues, including the distribution of CO₂ on Earth, water quality and the transformation and storage of inorganic and organic contaminants from human activity.” In Fall 2017, Dr. Glass worked with SLS to connect the lab work with real-world projects and partners. In her words, her goals were: 1) inclusion of local partners for water quality testing of a local stream; 2) integration of historical knowledge about the creek and adjacent neighborhood by our neighborhood partner; 3) emphasis on practical, real-world environmental challenges that can be solved by simple changes to water chemistry; and 4) modification of the final project from a standard term paper to a more engaging video-blog for communication of an environmental geochemistry topic to non-scientists.



Students conduct stream testing with partners from the West Atlanta Watershed Alliance, Fall 2017 (Photo courtesy of SLS)

The lab now works with WAWA, residents of West Atlanta, and the outreach professionals of the U.S. Fish and Wildlife Service to provide assistance with stream-testing in the local Proctor Creek watershed and, in the process, help students begin to develop the technical and collaborative skills that are core to science communication. One student commented on course impact: “I had never experienced a lab where it felt like the topics we were learning might make a difference to people we had met. The ability to get the story of the community from someone who had lived in the area, and had seen all the contamination, brought home the importance of what we were learning. At the end of the lab, we had the opportunity to present our findings to the community and saw first-hand how scientific language can either engage community members or distance them from the science.”

Senior Design Project in Industrial and Systems Engineering (ISyE)

For two years now, SLS has been working with the ISyE Senior Design Program to recruit and help coordinate projects with community and government partners that will simultaneously help students apply their industrial engineering skills while also advancing a real-world project related to “creating sustainable communities.” One example of these projects is “Boys & Girls Club Transportation Savings,” carried out in Fall 2019. For this project, the Boys & Girls Clubs of Metro Atlanta (BGCMA) requested an ISyE capstone partner to assess and recommend improvements in its system for transporting students from school to their after-school programs. Their primary interest was reducing the high cost of fuel without increasing the amount of time students spent in transit; cost savings could then be repurposed for programming that supports student wellness and academic development. Based on advising from subject matter experts outside of ISyE, provided by SLS – including an SLS staff member and a doctoral student specializing in environmental, climate, and energy economics - the student team expanded its research and analysis to examine the associated health impacts of diesel emissions and options for switching to alternative types of transportation. Using an equity lens, they researched health disparities that affect communities that send their children to BGCMA for after-school programming and integrated health considerations, including exacerbation of asthma symptoms, into their analysis and recommendations. (Read about SLS’s model for working with Capstone and Senior/Junior Design projects [here](#).)

Snapshot #4: Living Building Challenge – Equity Petal

Since 2016, SLS has been leading the equity portion of one of the campus’ most high-profile projects: the design, construction, and opening of a new educational building being built according to the guidelines of the [Living Building Challenge](#), a program of [The International Living Future Institute](#). The challenge focuses on seven imperatives, presented as petals – Energy, Water, Materials, Place, Equity, Health & Happiness, and Beauty. Opening for classes in January 2019, Georgia Tech’s newest building, [The Kendeda Building for Innovative Sustainable Design](#), is on track to become the most environmentally advanced education and research building in the Southeast.

The [Equity Petal](#) in its current iteration aims “to transform developments to foster a true, inclusive sense of community that is just and equitable regardless of an individual’s background, age, class, race, gender or sexual orientation.” Through an Equity Petal Work Group bringing together faculty, staff, and students from the Diversity office and all six colleges, we have been pushing the Equity Petal in new and deeper directions, resulting in a

series of white papers recommending equity actions regarding design and construction, programming and staffing, and courses and teaching. The overall goal is to ensure that the building advances an equitable culture, both on and off campus, through teaching, research, and action.



Living Building Equity Champions Lucy Kates and Angelica Acevedo show off a handmade interactive board made by Kates demonstrating the difference between equality and equity during an Equity Petal Building Tour. The tour was part of a workshop on equity and sustainability conducted with The International Living Future Institute and the NAACP in Fall 2019. (Photo courtesy of SLS)

Georgia Tech’s most successful Equity Petal program to date is the [Living Building Equity Champions \(LBECs\) program](#), proposed and run by the Diversity, Equity and Inclusion office. LBECs are Georgia Tech students who learn about the Living Building Challenge, the Kendeda Building, the Equity Petal, and more broadly about equity as a key piece of sustainability, and then engage other students – especially students from underrepresented populations – in the building.

The Equity Petal Work Group has now transitioned into an ongoing undergraduate action research course called “Building for Equity and Sustainability” (read about it [here](#)). The course is co-led by staff and faculty from SLS and Diversity, Equity, and Inclusion (both anthropologists); Philosophy; and Civil and Environmental Engineering. It aims to establish clearer and deeper definitions and understandings of “equity” in relation to sustainability and especially sustainable buildings and infrastructure; to advance equity work in the new building and Georgia Tech’s surrounding communities; and to deepen the equity components of sustainable building rating systems (e.g., LEED), through SLS’s partnerships with ILFI and the [NAACP’s Centering Equity in the Sustainable Building Sector](#) initiative.

Works Cited

Grice, M., (2014), “Epistemic beliefs and knowledge creation among upper-secondary students in transdisciplinary education for sustainable development.” *Nordidactica – Journal of Humanities and Social Science Education*, 2014:1, pp. 146-169.