



COUNCIL ON SCIENCE
AND TECHNOLOGY


Advancing
STEM Literacy
across Princeton
University and
Beyond

2019-
2020
Annual
Report



PRINCETON
UNIVERSITY

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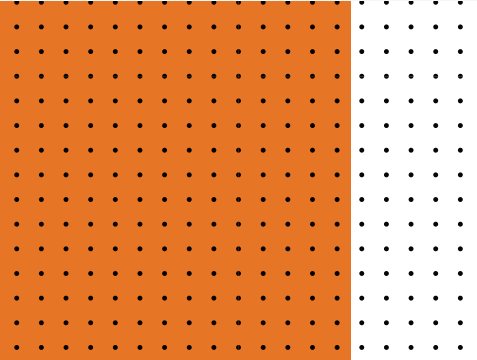


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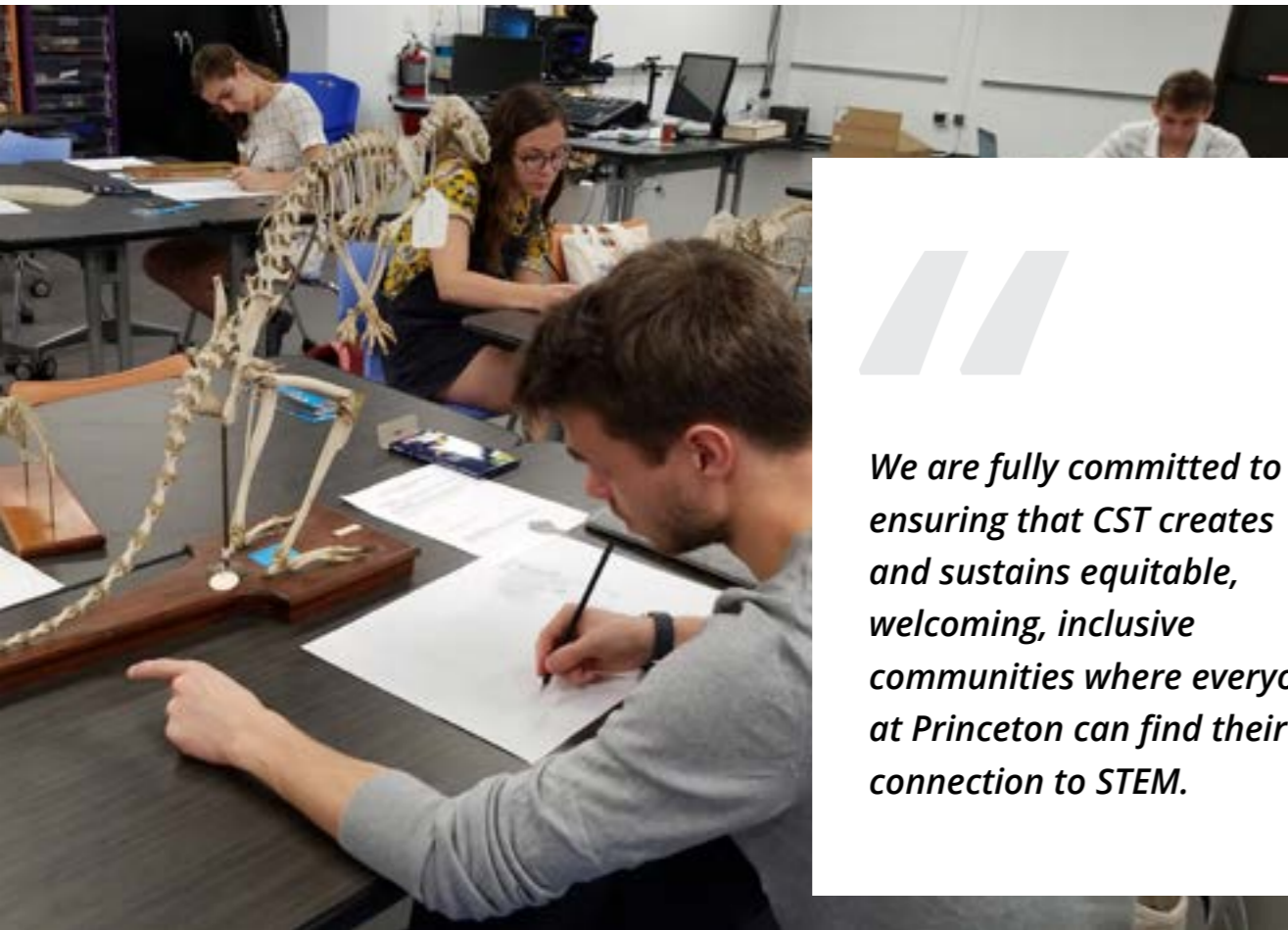
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Our Mission

The Council on Science and Technology (CST) is comprised of dedicated faculty and staff who work to advance STEM literacy across Princeton University and beyond. This worthy goal is achieved through rigorous course development, creative interdisciplinary programming, and robust educational research. By developing strong interdisciplinary collaborations, the CST seeks to ensure that all members of the Princeton University community—regardless of their background, experience, or discipline—can engage with, appreciate, and apply science in their everyday lives, in their careers, and in society.



We are fully committed to ensuring that CST creates and sustains equitable, welcoming, inclusive communities where everyone at Princeton can find their connection to STEM.

Message from the CST Directors

Dear Friends,

To say that the 2019-2020 academic year was like no other is certainly an understatement. For the CST, what began as a year of new beginnings including a renovation of our StudioLab, the hiring of a new Executive Director, and the launch of several new initiatives, took an unprecedented turn when the COVID-19 pandemic took hold and changed the shape of teaching and learning at Princeton and beyond. The CST responded to the challenges and opportunities of online teaching by providing personalized technical support in STEM pedagogy and education research to colleagues across the University. In addition, to maintain connectedness and build community among students during this challenging time, we implemented several novel online events ranging from a weekly “radLab,” where students and others share their STEM-related passions, to a student-requested webinar on alternative paths to academia...and even a whimsical, virtual Rube Goldberg challenge! Along with the formation of our inaugural Student Advisory Board, we’re particularly proud to have employed a record number of students at the CST over the last year, providing meaningful learning and research opportunities, even during the summer when such experiences were relatively limited. And through it all, we continued to support the development of rigorous and engaging STEM and STEM-adjacent courses that appeal to a wide variety of learners while also providing a record level of funding to faculty innovators through our Annual Call for Proposals.

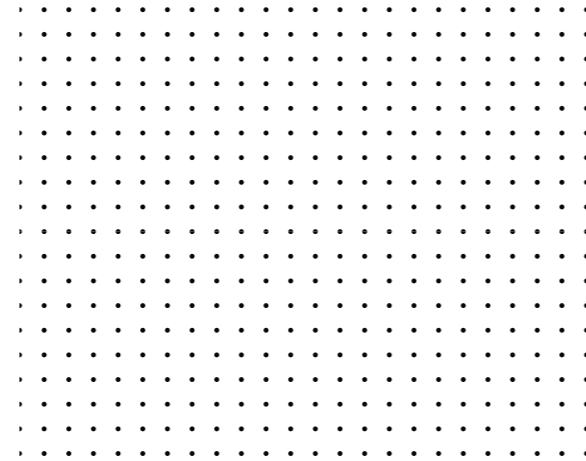
Of course, the murder of George Floyd last May and the ensuing rise of the Black Lives Matter movement still continues to shape our work. We pledged to move beyond talking about systemic racism to affirmatively working to dismantle it. Over the past several months, we have educated ourselves through readings and other media, examined inequities in STEM and STEM education, and developed an ambitious agenda of initiatives that include diversifying STEM course readings and cases, enhancing STEM advising and mentoring for students of color, and expanding programs that affirm anti-racist policies and practices. We are fully committed to ensuring that CST creates and sustains equitable, welcoming, inclusive communities where everyone at Princeton can find their connection to STEM.

At the time of this writing, we’re eagerly anticipating our rescheduled Living at the Intersection Symposium (LIS) 2020, which was originally set to take place last spring. The event, now virtual, brings together a broad array of experts to examine the intersection of STEM and the arts, humanities, and social sciences. We believe our theme of “Truth and Evidence” is particularly relevant this year and supports a vision of scientific literacy that promotes empowerment in societal discourse and informed personal and societal decision making. Other exciting highlights in the coming year include a CST-funded 3-D Print-by-Mail program, loaning innovative technology kits to students in order to experience the “StudioLab at Home,” and an array of new and continuing teaching and learning initiatives. We look forward to having you join us, virtually or in person, no matter what surprises the coming year may bring.

Sami Kahn
Executive Director

Naomi Leonard
Director

Who We Are



SAMI KAHN
EXECUTIVE DIRECTOR

NAOMI LEONARD
DIRECTOR



CATHERINE RIIHIMAKI
ASSOCIATE DIRECTOR,
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PAUL DURST
ASSISTANT DIRECTOR,
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D. PILLIS
ASSISTANT DIRECTOR,
STUDIOLAB INITIATIVES

PENELOPE GEORGES
ASSISTANT DIRECTOR, STEM
EDUCATION



BRENDAN BYRNE
STUDIOLAB ARTISTIC/
TECHNICAL MANAGER

JOSEPH CAPIZZI
PROGRAM MANAGER

KATHY GALVIN
EVENT COORDINATOR



CST Affiliates

Comprised of graduate and undergraduate students and staff, our affiliates staff the StudioLab and design and lead student training and programming.



Executive Committee

Faculty generously support the mission of the CST as members of our Executive Committee.



Student Advisory Board

The Student Advisory Board (SAB) meets periodically to provide advice and assistance as we advance our mission.



What We Do

Teaching and Learning

The Council on Science and Technology (CST) engages in a wide range of activities and services to support teaching and learning at Princeton. From consulting with faculty on the development of rigorous, interdisciplinary courses that appeal to learners with varied interests to ensuring that general education courses designated as “SEN/SEL” advance recognized STEM learning goals, the CST applies and investigates research-based practices in STEM curriculum design and pedagogy to promote equity and excellence in STEM at Princeton and beyond.

Course Offerings

The CST offers and supports innovative, interdisciplinary courses that appeal to a variety of student interests.



STC 204 / MUS 204
Musical Instruments, Sound, Perception, and Creativity



STC / EGR / MUS 209
Transformations in Engineering and the Arts



STC / HIS / MOL / HUM 297
Transformative Questions in Biology



FRS 174
The Science and Art of Mapping the World

Course Support

SEN/SEL Designations

The CST grants SEN and SEL (science and engineering lab/non-lab, formerly STN and STN) designations to science and engineering courses that are particularly appropriate for students concentrating in the arts, humanities, and social sciences. CST’s Professional Specialists work with faculty to ensure that these courses are both scientifically rigorous and engaging.

During the 2019-2020 academic year, the CST provided SEL/SEN review and facilitation for 12 courses.

Educational Research and Grants

The Council engages in a robust agenda of educational research and grant-funded projects designed to enhance our understanding of STEM teaching and learning. The Council welcomes partners from across the University and beyond to join us in these endeavors. Some of the research projects with which the CST engaged during 2019-2020 were:

- Evaluation of new EGR course sequence at Princeton’s School of Engineering & Applied Science.
- A study on STEM educational outcomes and the transition to online education under COVID-19.
- Development of a literature review on special needs and talents in science learning for a leading research handbook.



CST Course Spotlight

THR/STC 210 Storytelling with Technology for Performance, a joint initiative of the Lewis Center for the Arts and the CST, brings together students from a wide array of concentrations to explore analog and digital technologies for creating performance-based projects. Taught by David Bengali and Andrea Lauer and held in the CST’s StudioLab, THR/STC 210 can fulfill either a QR or LA distribution requirement. In Fall 2019, students engaged in a variety of experiences, from extracting DNA and designing circuits for wearable technologies, to 3D printing props for their final projects!



Musician, composer, and software engineer Christopher Tignor gave a lecture and demo of his amazing generative compositions in the StudioLab for the Storytelling with Technology for Performance class. His clever use of auto-tune creates multiple narratives that demonstrate the power of human-computer interaction.

What We Do

Opportunities

The Council on Science and Technology offers several opportunities that develop, enhance, and/or recognize faculty and student interests and efforts. Faculty and student funding, student fellowships and internships, and the Gregory T. Pope Prize for science writing all attest to the CST's deep commitment to promoting STEM literacy for all by promoting innovation, leadership, and risk taking in STEM education, communication, and collaboration, often by transcending traditional disciplinary boundaries.

Faculty Opportunities

Faculty Funding

The Council on Science and Technology funded proposals for courses and co-curricular activities that supported CST's mission of advancing science, technology, engineering, and mathematics (STEM) literacy across Princeton University and beyond.



Nearly **\$200,000** was awarded to fund **20 faculty projects** across a spectrum of disciplines in 2019-2020.

The average award through our Annual Call for Proposals and other faculty funding was over **\$9,000**.

CST provided **nearly \$17,000** to support recipients of The 250th Anniversary Fund for Innovation in Undergraduate Education.

Faculty Funding Spotlights



Iterating the Genera Brain

CST funding covered the expense of the prototype fabrication and assembly of multiple projects for Jeff Snyder, Director of Electronic Music and the Princeton Laptop Orchestra. Funds were used for a new circuitboard revision (rev3) for the Iterating the Genera Brain project, an ARM-based microcontroller platform for embedded audio design that allows the instrument created in his lab to produce their own synthesis, rather than using an external computer.

Funds were also used towards the revision on the design of the Electrobass, an electronic instrument inspired by the bass guitar performance interface as well as firmware for the Vocodec voice processor. COVID-19 delayed the debut of the new Vocodec planned for the April 2020 PLOrk concert.



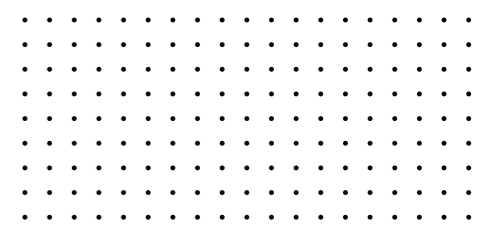
Summer Robotic Architecture Workshop

The CST was proud to sponsor V. Mitch McEwen and the Summer Robotic Architecture Workshop (RAW) 2020. With the Director of Research and Development at Zahner, two School of Architecture graduate students collaborated on industry-partnered student teaching (remotely) during the COVID pandemic. Princeton graduate students from both engineering and architecture programs participated in the workshop using small digital fabrication machines that were sent to their homes, thereby transforming their kitchens/living rooms/dorms into mini factories.

Black Mirror: Race, Technology, and Justice

In fall 2020 Ruha Benjamin taught a new course, Black Mirror: Race, Technology, and Justice, with support from the CST. In this course, students explored a range of discriminatory designs that encode inequity: by explicitly amplifying racial hierarchies, by ignoring but thereby replicating social divisions, or by aiming to fix racial bias but ultimately doing quite the opposite. Black Mirror guided participants into the world of biased bots, altruistic algorithms, and their many entanglements, and provided conceptual tools to decode tech promises with historically and sociologically informed skepticism.





Student Opportunities

The CST provides a range of opportunities and experiences for students and student organizations. During 2019-2020, we increased our SAFE funding allocations and employment opportunities to support students during COVID-19 and also initiated the Student Advisory Board (SAB).

Student Funding

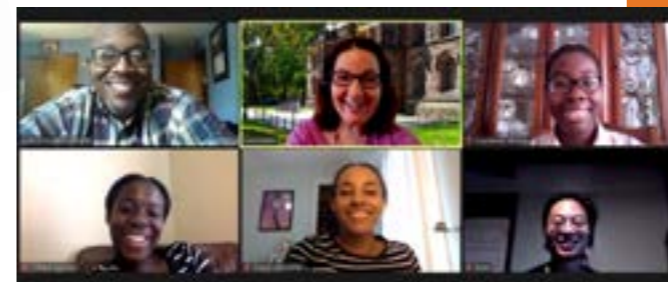
The CST provides funding for student organizations and student projects that align with the CST's mission.



The CST funded Princeton's Rocketry Club's wish list of essential supplies for personal rocketry/STEM-related projects and casual endeavors in the Summer of 2020. Examples of requested items are personal soldering iron kits, a continuous writing pencil (perfect for drafting/design sketches), a wireless mouse to help with CAD, Arduino components, and aerospace/engineering-related games.



In 2019-2020,
25
students and student organizations
were funded
\$10,985.



Student Advisory Board (SAB)

2019-2020 marked the inaugural year for our Student Advisory Board.



Internships

The CST provided employment and internship opportunities for 9 students in 2019-2020. Students led StudioLab events and trainings, designed and implemented CST social media campaigns, conducted research alongside CST staff, and even designed this annual report!

Gregory T. Pope Prize

The Gregory T. Pope '80 Prize for Science Writing is granted to a senior who has shown a keen interest in science and demonstrated an outstanding ability to communicate that enthusiasm to a wide audience through journalism.

The recipient of the 2020 Pope Prize for Science Writing was Ben Weissenbach '20. His piece entitled "Traveling Treeline" was a captivating read that exemplifies the combination of scientific communication and storytelling envisioned by this award.



The CST was proud to sponsor the Princeton Rocketry Club (PRC) Watch Party of the July 30th NASA's Perseverance rover launch to Mars out of Cape Canaveral, Florida. To celebrate, the Princeton Rocketry Club (PRC) hosted a Zoom watch party for the campus community to provide students with the opportunity to watch the launch with fellow space enthusiasts. There were mini rounds of Perseverance-related trivia, and Mars 2020 raffle prizes funded by CST.

Events

The Council on Science and Technology hosts a broad range of multifaceted events related to STEM, many of which explore intersections with other disciplines.

Anthony B. Evin Lecture

The Evin Lectures were established with a gift from Anthony B. Evin '62 to promote a broader and deeper understanding of the critical roles of science, technology, engineering and mathematics (STEM) in all aspects of human endeavor. Since 1991, the Council on Science and Technology has invited luminaries in the fields of STEM and science communication to explore topics of interest to a broad audience.



From Silent Spring to Silent Night: A Tale of Toads and Men

Tyrone Hayes, UC Berkeley, Professor of Integrative Biology

Turning a childhood love of frogs into a battle with one of the largest pesticide companies is some people's dream, others' nightmare, and Dr. Tyrone Hayes' reality. He told his life story as a distinguished speaker in CST's Evin Lecture series on February 11, weaving together humor about such topics as the number of photographs of frog gonads he would be showing, somberness about the findings of damage to testes of male individuals across multiple species that were exposed to the pesticide atrazine, and defiance in the face of personal and professional attacks by the atrazine manufacturers. His ultimate message was about how important it has been to connect his animal studies back to human impacts, especially on farmworkers, who are predominantly Latinx, and how that work is made more meaningful because it is done by people of color who have been disproportionately impacted by pollution.

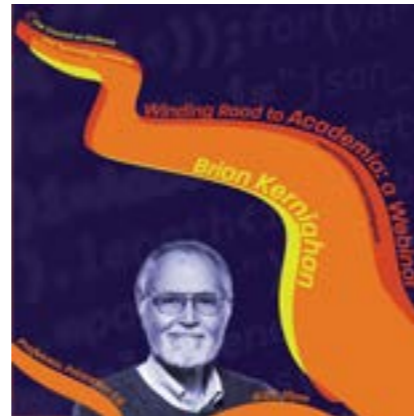


Events

Webinar: The Winding Road to Academia

The traditional path to a faculty position in the sciences is relatively straightforward.

Undergraduate studies lead to graduate school and a PhD, postdoctoral work, and eventually a professorship. The Winding Road to Academia is a series of conversations with those who took a different route to becoming a professor. Our first conversation, hosted by CST Assistant Director, Paul Durst in June 2020, was with Professor Brian Kernighan, who worked at Bell Laboratories for 30 years before joining Princeton's Department of Computer Science in 2000.



Women In Stem Panel

In September 2019, incoming freshmen learned about the numerous opportunities at Princeton University by hearing from a few of the many accomplished women in our STEM departments. Hosted by CST Executive Director, Sami Kahn, the faculty, students, and researchers on the panel shared their journeys, discussed their career trajectories and provided tips for students interested in pursuing STEM careers.



Nature, Art and the Subjectivity of Color

CST Associate Director Catherine Riihimaki led this panel with the Princeton University Art Museum in October 2019, with an overview of the driving questions: How and why is color produced in nature, how have various cultures made direct use of these natural colors in art, and how do humans depict the colorful natural world in illustrations and other artwork? This panel, featuring faculty and museum curators highlighted the elusiveness and joy of defining and understanding color.



Rube Goldberg Challenge

In June 2020, The CST invited the Princeton University community to use their restless imaginations to create absurd and wonderfully clever contraptions with common household objects and everyday items that would foster positivity during the current global pandemic. With over 20 participants, including undergrads, grad students, faculty, and staff, submissions were quirky, creative, and provided a spark of joy during quarantine. Five teams won various prizes including a drone, drawing tablet, 3D printer, or vinyl cutter for their great work.

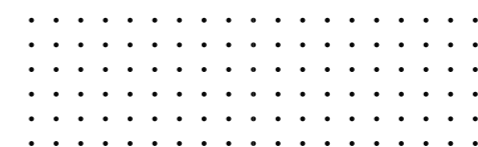


Hack the Drag

Hack the Drag (designed in collaboration with the LGBTQ center) is a weekend-long hackathon during spring break with the aim of providing a safe space for culturally relevant STEM-making and teaching through wearable electronics and drag. Participants are guided through design iteration, circuit-making, and presentation. Participants show off the final product in a drag show. (Cancelled due to COVID)

Science and Art at the Bottom of the World

In this two-part virtual workshop hosted by CST Associate Director Catherine Riihimaki, Dr. John Higgins (Princeton Geosciences) and artists Ian van Coller and Todd Anderson, discussed their experiences working in Antarctica and beyond, mixing science and art together to create powerful projects. The first session was an exploration of their collaboration. The second session was a broader discussion of how workshop participants can further their own science and/or art projects.



StudioLab

The StudioLab offers all Princeton community members a welcoming, beginner-friendly environment for exploring the arts and sciences through hands-on experience with rapid prototyping tools like 3D printers and advanced digital technologies like motion capture. In addition to the lab's regular open hours in which students, staff, and faculty are free to experiment and create.

1. i3 Hackathon

The i3 Hackathon was an opportunity for students to transcend physical boundaries through digital creation. The event was open to all students in the Princeton community and designed to be accessible to all participants, regardless of background, experience, or discipline. Over 40 participants explored creative prompts and formed ten teams to ideate, iterate, and innovate projects of their choosing.

2. Student Clubs

The StudioLab is happy to have the Princeton Robotics, Rocketry, Droid Team, and Maker's Collective Clubs call StudioLab their home, and to support the Princeton Radio Control Club (PRCC).

3. The Science of Food Preservation

In our Science of Food Preservation StudioLab Café in November 2019, over 50 attendees learned about the microbiology of pickling from graduate student Robbie LeDesma (MOL). Attendees were able to develop their own recipes using brine, herbs, and spices to prepare cucumbers and green beans for fermentation in their own take-home jars.

4. Soldering and Snow Globes

StudioLab Café Coordinator, Cynthia Vu '21 led the "Learn how to Solder: Make a Light-up Snowglobe" Café. Students were instructed on basic soldering techniques in order to create a circuit using a battery, a switch, and a small LED light to light up a small jar. Students used mini holiday trees, glitter, paint and more to decorate their snow globes.

5. Fabrication Equipment Training

Cynthia Vu '21 leads a workshop introducing students to using Illustrator with the StudioLab's vinyl cutter.

6. Wycinanki Paper Cutting

Wycinanki is a traditional Polish folk art, created by cutting or layering colorful paper into intricate patterns. Folding and unfolding problems in mathematics have been evident since the 1500s and are studied as Geometric Folding Algorithms. Popular designs include geometric patterns and scenes from rural farm life. These crafts were initially popular decorations for country homes in the mid-nineteenth century and have grown in popularity to be a universally recognized symbol of Polish culture. Participants learned the history of the Wycinanki, the math associated with geometric folding and had fun creating their own designs.

7. Science Communication

Catherine Riihimaki shared her insights and expertise of effective science communication via her collaboration on the new Princeton podcast "All for Earth". Students, staff and other attendees of the workshop were also treated to a tour of the Broadcast center.

8. Graduate Student Mixer in the StudioLab

Over 100 graduate students attended a mixer in the StudioLab in October 2019. During this event, which was co-sponsored by the Graduate Student Government, students had the opportunity to learn about StudioLab courses, tools, and resources, and hear about ways that graduate students can engage with the CST.

9. radLabs

radLab is a new virtual workshop series held weekly for sharing totally rad projects, ideas, and experiences. Undergrads, graduate students, and staff host their own workshops on passion projects they love. Organized by CST StudioLab Artistic/Technical Manager, Brendan Byrne, radLab events broadcast live on YouTube from the #radlab Slack Group.



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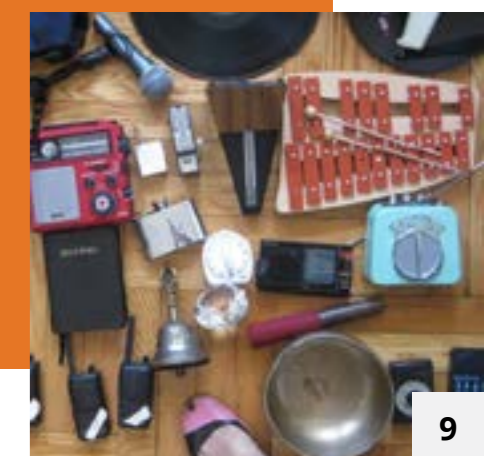
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Other 2019-20 Initiatives

Website Redesign

After nearly a year of effort, we are proud to have launched our cleaner, clearer and more vibrant CST website. We worked closely with Princeton's Web Design Services to ensure accessibility and implementation of best practices in web design, and we hope that this effort shows.

StudioLab Renovation

The StudioLab underwent a renovation during the summer of 2019. The renovation enhanced safety and usability in the space, including the creation of a dedicated rapid prototyping room.

McGraw Center and Online Teaching

Sami Kahn, Paul Durst, and Catherine Riihimaki participated in several working groups – coordinated by the McGraw Center for Teaching and Learning – during Summer 2020 to help faculty prepare for online teaching during the Fall 2020 semester. The groups were organized by types of teaching (e.g., labs, seminars, large-enrollment courses) and disciplines (e.g., Electrical Engineering). The discussions generally included 10-20 faculty sharing their teaching plans and concerns, followed by open discussion between the participants and CST and McGraw facilitators.

Cross-Listed Courses

The CST added two new cross-listed courses during 2019-2020:
CLA 247 / HUM 249 / STC 247 - The Science of Roman History
VIS 209 / ANT 281 / ARC 215 / STC 207 - Reality R&D: Designing Speculative Futures

Student Employment

The CST increased student employment to support students during COVID-19 via internships, research and StudioLab programming.

Looking Ahead to 2020-21

Teaching, Learning and Programming

- Ongoing teaching/course support and novel collaborations
- Conducting and supporting research on best practices
- StudioLab – [3-D Print-by-Mail](#), technology loaning program including [Raspberry Pi Kits](#) and Immersive Media Kits
- Programming – [Annual/biennial events done virtually](#), unique low-stakes programming/community building
- Graduate School Collaborations – GradFutures webinars and UAFs
- [Opportunities for Faculty and Students](#)

Equity and Inclusion

- Diversifying STEM course readings/cases/examples
- Enhancing STEM advising/mentoring for students of color
- Meeting with student organizations for needs assessments
- Inclusive programming (e.g., Hack the Drag, Women in STEM, etc.)
- Ongoing professional development on anti-racism/anti-bias in concert with campus-wide partners

CST as a Global Leader in STEM for All

- Summer working summit on STEM literacy for all college students, regardless of major concentration, background, or experience
- Research and scholarship on best practices, including interdisciplinary/transdisciplinary teaching
- Deeper, ongoing relationships with Princeton University collaborators (e.g., named initiatives, funding + commitment, etc.)
- Highlighting the rich history of the CST on our redesigned website

Living at the Intersection (LIS) Biennial Conference

The Living at the Intersection Symposium (LIS) explores the intersection of STEM with the arts, humanities, and social sciences. This biennial conference invites scholars, artists, scientists, writers, students...all of whom have an interest in interdisciplinary exploration, collaboration, and discourse. The LIS 2020 (postponed from April to October 2020 due to COVID-19) will examine the topic of "Truth and Evidence."

We Believe

STEM literacy, defined as the ability to **recognize, apply, and appreciate STEM in one's everyday life and in society**, is a key component of a quality liberal arts education.

People are multifaceted and should have opportunities to explore many disciplinary interests.

The insights and influences brought by **a diverse community strengthens all disciplines**.

A quality **STEM education requires innovation and risk-taking** that supports the free exchange of ideas and taps a variety of inquiry methods.

We value **evidence-based decision making** in our work, both in the form of implementing rigorous, research-based STEM approaches in our courses and in using education research to guide our programmatic efforts.



CST Executive Committee

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