



National Science Foundation

Expanding Lifelong STEM Career Pathways in Sustainable Building Science Technology, Award #1406320

Project Activities and Impacts 2015-2016

## Project Goals

1. Design a Baccalaureate of Applied Science in Sustainable Building Science Technology based in building science, incorporates energy policy, and energy codes; and
2. Build and expand recruiting pipelines for future students and workers including minorities, women, veterans, and high school students.

## Project Activities

**OBJECTIVE 1 – Develop innovative bachelors of applied science (BAS) curriculum in sustainable building science technology (SBST).**

*1) Create a two-year SBST BAS curriculum that meets industry standards of excellence.*

In the second year of the grant, the emphasis was to complete the "build-out" of the remaining courses in the second year of the curriculum. The following courses had syllabi developed, textbooks selected, and websites created from July 2015 through March of 2016:

- SBST 315: Work Experience Practicum – 10 credits
- SBST 332: Building Energy Codes in Washington State – 3 credits
- SBST 421: Energy Policy – 3 credits
- SBST 431: Professional Communication – 4 credits
- SBST 432: Fiscal Management for Facility Managers – 3 credits
- SBST 489: Capstone – 1 credit

The growth of the program meant that two additional part time faculty were hired for various courses throughout the year; One of the adjuncts, Steve Abercrombie, has an extensive background in sustainability, and has now been designated as a regular part time faculty, and is working closely with Victoria Hardy, the Lead Faculty and Coordinator for the program in academic planning, course revisions, and securing living laboratories for field trips and speakers for the Saturday cohort meetings.

This year, New Buildings Institute (NBI) developed 4 online educational modules for our program: Introduction to Advanced Benchmarking; Portfolio Manager and FirstView; Practicum - from Building Data to Analysis; and Controls in Zero Net Energy Buildings. These modules deliver content/learning through a combination of slides, video, and practical exercises familiarizing students with Portfolio Manager, an energy tracking tool widely used, and

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FirstView, a reporting tool used in conjunction with Portfolio Manager, developed by NBI. Students who successfully complete the modules receive a certificate from NBI for FirstView Training. The Modules were piloted in spring quarter with full integration to come in next year's class.

*2) Develop internship standards and procedures, and recruit internships in all aspects of Sustainable Building Science Technology.*

The second year of the grant saw both important adjustments and enhancements for the Internship requirement in the core curriculum. Not surprisingly, due to the accessible nature of the program, many of the students who entered the degree program are already working. In the first two cohorts, only 5 of the 33 students who began in the fall 2015 quarter were not fully employed. The focus of the internships then became the development of sustainability projects within students' companies that could both meet the requirement and bring merit to the student. A good example of this tactic was a senior who pitched a project for her employer that involved calculating the waste that could be saved by switching from paper towels in the restrooms to hand dry blowers. Her analysis showed a savings of \$30,000 a year per building, and so not only was this tactic adopted by the company, but the student was promoted (and then she hired one of her cohort colleagues to replace her!).

A second example involved Seattle Central College, which had been selected by the District to implement a sub-metering program to improve energy efficiency. In this project, the first step was to identify over 600 pieces of mechanical equipment in the campus buildings that are part of the HVAC systems, and then detail their condition, use, and warranty status. Since this work could be done in the evenings and on weekends, we had multiple SBST students from both cohorts working on the project. It saved the campus thousands of dollars in consulting fees, and gave the SBST students a much appreciated view of the day-to-day operations of the campus physical plant. A third example involved one of the seniors who used her internship (with her employer's knowledge and support) to study for and pass her LEED GA exam. The employer even assigned a mentor from their staff who had passed the exam the previous year. With this new credential in hand, our student applied for and was selected to be the next Energy Star Manager for the City of Portland, Oregon. These adjustments continue to make the internship requirement in the core curriculum a good experience and productive for the students and their careers. Offering internship courses throughout the program continues to be a way for students to gain valuable real-world experience.

*3) Use of community learning laboratories*

In addition to the project for Seattle Central College, the SBST faculty continued to find opportunities in the community to visit learning laboratories where new technologies/methods and real-world meet. During the second year, the cohorts visited the Bullitt Center, the greenest office building in the world, and hosted a visit by the Director of Global Energy Management for Microsoft (who is now the Director of Global Facilities and Energy for Google) to discuss the Microsoft Global Energy Center. In addition, the cohorts spent time at the Smart Buildings Center in the Pacific Tower in Seattle. This unique facility houses a variety of programs that support sustainable practices in the built environments, both commercial and residential. To that

end, the highlight of the tour in the morning was the presentation by the manager of the Tool Lending Library. Within weeks, three of the students had borrowed tools (at no charge) for work-related projects. The day also included comprehensive presentations by the original chief engineer for the HVAC systems in the building and other lectures/activities.

For their Energy Analysis and Auditing class, juniors were tasked to create an energy management plan for a facility. Students worked with several types of facilities, gaining access to buildings/systems, interviewing staff, evaluating/analyzing, and finally recommending ECMs (energy conservation measures) for the following buildings: Symetra, a highrise in Bellevue, WA; Wells Fargo, a highrise in Seattle, WA; EMP (Experience Music Project), a museum in Seattle, WA; Egyptian Theater, a movie/performance theater in Seattle, WA; Building C, on the Georgetown Campus of South Seattle College. Our surrounding environment continues to be rich in learning opportunities.

### Changes in Curriculum

As of June 17, 2016, all the courses have been taught at least once, so the process of review has begun with student, faculty, staff, and the Technical Advisory Board's input. The first change in curriculum was to switch sequencing for SBST 432 Fiscal Management and SBST 331 Financing Energy Efficiency and Renewable Energy. That switch was approved through the Course Approval process at South Seattle College and is in place for the 2016-2017 academic year. Shifts were also made at that time to internship credits to keep the core curriculum load to 10 credits per quarter.

In addition, it was determined that SBST 321 Building Codes in Washington State and SBST 332 Building Energy Codes in Washington State contained significant duplication of materials which did not merit two courses. Much of the course content in SBST 332 was added to SBST 321; the credits remain the same for that quarter, and SBST 332 was stored with the possibility that it could be developed into an elective in the future. The 3 credits from SBST 332 will be added to SBST 489 Capstone, to bring that course in line with other College Capstone course offerings. This process is still underway, but provisional approval has been made by the Curriculum and Instruction Committee of the College, subject to a final review by the sub-committee on online and hybrid courses.

## **OBJECTIVE 2 - Recruit, retain and graduate students from industry, people of color, veterans, women and other career-changers.**

### **People of Color**

We have a specific focus on Native American tribes, specifically working with the Tulalip tribe, but also outreaching to the Lummi, Puyallup, Swinomish, Quinalt, and Snoqualmie tribes.

Activities have included:

- Worked with the Tribal Liaison Subcommittee of the Washington State Apprenticeship and Training Council.

- Expanded the connection of the Tulalip Pre-Apprenticeship Program with the Georgetown Branch of South Seattle Community College to enhance the curriculum for the program and link to SBST pathways
- Worked with the Tulalip TERO (Tribal Employment Rights Organization) pre-apprenticeship to build two “tiny houses” for homeless encampments in King County in order to better understand sustainability and how it applies to the issues of homelessness.

### **Veterans**

King County Community Services has been partnering with numerous organizations to identify potential candidates for the SBST program, including the King County Veteran’s Programs in Renton and Seattle, Wounded Warrior, Employment Security of WorkSource, and the Washington Department of Veteran’s Affairs.

This year, we focused on those transitioning out of the military at various events and fairs as well as on those seeking support services. Our partners helped create veteran-specific collateral about the program. South Seattle College now evaluates all military transcripts for veterans to identify related courses that could receive credit in the program.

### **Women**

The Apprenticeship and Non-traditional Employment for Women (ANEW) organization continues to market the SBST program to women through weekly information sessions, the ANEW website and Facebook pages, and emails through their listserv. In addition, they attended several events and staffed tables and/or made announcements as well as made direct contact with industry, including the Chicago Women in Trades Conference.

### **Use of Innovative models for Recruitment, Retention, and Completion**

*1) Arrange class schedules to enable working people to attend.*

- Develop a curriculum that provides at least: 30 credits online; a system to provide up to 10 credits for work-related experience; and at least 6 competency-based credits.

The second year of the grant program saw the successful implementation of a Prior Learning Assessment (PLA) process that resulted in the awarding of PLA credit in the SBST Program to thirteen of the seniors and six of the juniors (more may be applying for PLA credit in their senior year). The SBST courses that received the most applications for PLA Credit were SBST 315 Work Experience Practicum, which reflects the experienced backgrounds of the students, and SBST 325 Internship, as many of the students are already working in the industry. In addition, there were two successful applications for academic PLA credit, which were approved by the Academic Programs Division. Those credits were in art and communications. This process was not without its challenges; the College PLA Committee was developing the application forms and roadmap as we were submitting paperwork, and key personnel had not yet been identified to process applications through the Academic Programs Division. Once those hurdles were resolved, the process moved forward. The students are using the SBST 314 Portfolio course as the jumping off point to prepare their PLA applications. Once their Portfolio is complete, the next steps to apply for credit in areas where the student has either extensive work or life experience becomes much easier.

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Since the PLA process is also approved by the Washington State Board for Community and Technical Colleges, this also helped move the implementation along at the College level.

## 2) Cohort model

The cohort model continues to be a chief “attractor” for the program, combined with the hybrid teaching model (80% online and 20% face-to-face, one Saturday a month). The students support each other in a variety of ways, including travel to field trip sites, hiring from within the cohort, and general academic support. In addition, the successful implementation of PLA credit has been a significant factor in both retaining students (persistence), and moving students through the curriculum (completion). It has also been a great marketing tool in attracting veterans in particular and people from industry positions who have hit the “glass ceiling” and cannot advance without a Bachelor’s degree. To know that you may receive PLA credit for your prior work experience has been an important element in securing students for the second and third cohorts.

## Outreach

SSC faculty and staff have attended many events ranging from community festivals to organizational meetings to conferences to get the word out about the program. For 2015-2016, we attended 55 events reaching out to approximately 1,393 people.

## Enrollment Demographics

- Cohort 1 Headcount: 15 students
- Cohort 2 Headcount: 18 students
- Cumulative Headcount: 33
- Cohort 1 Persistence: 87%
- Cohort 2 Persistence: 89%
- Completions: 2
- Cohort 1 Veterans: 0%
- Cohort 2 Veterans: 22%
- Cumulative Veterans: 6%
- Cohort 1 Gender: 27% female; 73% male
- Cohort 2 Gender: 28% female; 72% male
- Cumulative Gender: 27% female; 72% male
- Cohort 1 Ethnicity: 27% non-white; 73% white (13% Asian, 7% Black or African-American, 7% Other Non-White)
- Cohort 2 Ethnicity: 28% non-white; 72% white (6% American Indian or Alaska Native, 6% Asian, 6% Black or African-American, 6% Hispanic or Latino, 6% Other Non-White)
- Cumulative Ethnicity: 27% non-white; 73% white (3% American Indian or Alaska Native, 9% Asian, 6% Black or African-American, 3% Hispanic or Latino, 6% Other Non-White)

## Articulations

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Originally, we had 1 articulation that was built into the development of the degree, and that was the Multi-Occupational Trades AAS-T (MOT) degree from South Seattle College. The MOT degree is available for journey-level trades people and includes awarding credit for apprenticeship hours and related supplemental instruction. In year 2, 12 different program articulations were developed with 9 different institutions, creating seamless entry from multiple points into the program.

### **STEM Summer Learning Opportunity**

In July 2016, we offered a professional development opportunity to high school and community college instructors. Teachers were in attendance for five days and learned about sustainability, energy/energy efficiency, building science, smart buildings, data and analytics. They learned about the Sustainable Building Science Technology degree and met students from the program. They experienced community learning laboratories, including the Smart Buildings Center, the Bullitt Center, and the campus of Fred Hutchinson Cancer Research Center.

Teachers were introduced to Project/Problem-Based Learning and were divided into groups. Each group worked on a deliverable that integrated the learnings from the week into curriculum that was appropriate for their classrooms, and they presented on their projects at the end of the week.

As a result, two high school teachers (science and math) and one community college instructor (physics/nanotech) worked on developing a 2-week summer course to be offered a week later (July 25 - August 5, 2016) to high school students at Cleveland High School in Seattle as part of their STEM Summer Learning Opportunities. Cleveland High School is an option Seattle Public School focused on STEM, project-based learning, and 1:1 technology with a student demographic of mostly Asian and Black/African-American students (only 5.6% of the students are white). They offer a variety of for-credit, 2-week long (40 hours/week) student learning opportunities in the summer, exposing students to varying workforce/industry topics in the form of experiential learning, project-based learning, and pathways/career exploration. This is currently in progress, and ten high school students are registered in the *Sustainability in the Built Environment: Energy, Water, Waste* session.

### **Impacts**

#### **Impact on the development of the principal discipline of the project**

The development of this bachelor's in applied science degree is groundbreaking curriculum made for the 21st century and beyond. While there are many related associate's degrees: HVAC, construction management, facilities management, etc., there are few, if any, technical bachelor's degrees focused on the new skills needed for managing our built environment into the future. Integrating soft skills such as teamwork, communication, and flexibility with facilities and asset management, sustainability, energy auditing and analysis, building science, whole systems thinking, data collection and analysis, and more creates a dynamic set of skills for students that are desperately needed in the workforce.

Developing an academic pathway for journey-level trades people to earn a bachelor's degree while considering their training and work experience as transferable is also groundbreaking.

Other impacts on pedagogy in particular include the continued work on field trips to community learning laboratories, those iconic buildings in the Seattle area that are working examples of the principles and theories being taught in the classes. This “teach one, see one” model of using actual field examples to support the course work has been a highlight of the program.

The hybrid/cohort model also continues to be an innovative teaching model, and a successful tool for both reaching the students and retaining them. In spring 2016, students came from as far south as Portland, Oregon and as far north as Oak Harbor, WA on Whidbey Island.

### **Impact on other disciplines**

Another deep impact that the development of the hybrid bachelor's of applied science (BAS) in sustainable building science technology has had on the Seattle Colleges District and other community colleges involved in the BAS movement across the country has been in the implementation of the Prior Learning Assessment (PLA) process, which can be used for any discipline. The PLA process includes considering prior learning outside of the traditional academic environment and awarding academic credit for it. This is important for adult students who may have years of working experience, but minimal academic experience comparatively.

In June, 2016, Victoria Hardy, lead faculty for the BAS in SBST and Mary Beans, lead faculty for the Professional Technical Education and Instruction program, another hybrid BAS degree at South Seattle College, were invited to present their experiences in PLA implementation at the **National Institute on the Assessment of Adult Learning** based at Thomas Edison State University. This national exposure was indicative of the good work that has been done in PLA implementation for both degree programs.

### **Impact on the development of human resources**

Offering a bachelor's degree in a unique field has created opportunities for many in the workforce who hit a "ceiling" in their careers due inadequate academic education, and is even making a difference for students in the program before completion.

### **Impact on physical resources that form infrastructure**

The confluence of new codes, regulations, and processes in terms of our built environment is creating a unique opportunity in the city of Seattle, and the students in the Sustainable Building Science Technology BAS degree are primed to make an impact. In the winter of 2016, Victoria Hardy, the lead faculty for the SBST, was tapped to serve on the Technical Working Group (TWG) to advise the City Office of Sustainability and the Environment on the implementation of the “tune-up” rules that all Seattle commercial buildings over 50,000sf will have to comply with in the coming decade. These rules will define how the building owners will demonstrate their compliance with the new energy codes that demand a percentage energy reduction over the next three decades. During this process, the TWG also defined the recommended qualifications for the “tune-up specialist” that could be hired by the building owners to conduct the required audits and make recommendations on how to achieve the energy efficiency goals. On the final list of qualified categories, the South Seattle College BAS in SBST was the only degree program in the region that was cited specifically as meeting the qualifications. The other categories included primarily industry credentials such as Certified Energy Manager (CEM), or

Professional Engineer (PE). Inclusion on this list was a definitive recognition of the value of the curriculum content in the discipline of sustainability and the built environment.

### **Impact on society beyond science and technology**

Building operations make up the bulk of our energy consumed in the U.S., and thus carbon output with the combustion of fossil fuels making up the majority of our energy production. As the biggest slice of the consumption pie, building operations also provides the biggest opportunity in terms of reductions and efficiencies. The institutions involved in this project are working to provide industry-relevant programs that graduate students who will work directly with facilities management, building science, energy efficiency, and conservation. This work has the direct and tangible effect of decreasing carbon emissions, which most scientists agree is essential to mitigating climate change effects.