

*An Interdisciplinary Approach to Promote Innovation and Creativity
in the Field of Sustainability*

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Abstract

To create a transformative connection among science, technology, engineering, and mathematics (STEM) disciplines, Southern University (SU) uses an interdisciplinary approach to promote innovation and creativity in the field of sustainability. An undergraduate concentration in sustainability has been developed and the Bachelor Degree in Sustainability is expected to be completed and approved. The Sustainability Research Experience in China program was created and implemented since the summer semester 2011. The program provided students and their faculty mentors the opportunity to obtain a global perspective on sustainability research in the areas of sustainable materials, energy, technology, climate change, ecosystem and natural resources. SU has reviewed the current institutional internationalization activities and developed a set of global learning and engagement goals and objectives. SU has formed an internationalization leadership team suited to accomplishment of the institutional goals. In respond to the Louisiana Workforce Investment for a Stronger Economy (WISE), SU has developed a SU WISE that appropriately linked teaching and learning to positively impact the workforce development. The SU WISE includes a Center for Smart Composite Materials Modeling and Manufacturing, and a Bioenergy Research and Development Platform. The SU WISE integrates academics, research, and business partnering in a more functional manner with overall objectives that promote greater faculty and student experiential engagement and greater economic development. Through these teaching and learning innovations, SU enhanced the curricular and promoted sustainability teaching and learning, broadened international engagement in education and research, advanced internationalization, and contributed to STEM workforce development.

Keywords: Sustainability, interdisciplinary, internationalization, workforce development, curricular enhancement.

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Introduction

Sustainability is a complex subject which must be addressed by multiple disciplines. An interdisciplinary program in Sustainability will promote interdisciplinary academic engagement of students and faculty. To foster this engagement among disciplines in sustainability, Southern University (SU) has implemented a National Science Foundation funded HBCU-UP ACE Implementation Project and an USDA NIFA funded capacity building project. The first step toward is to establish a Sustainability Program and an academic concentration area in Sustainability. The program and the concentration would allow students of several majors to gain general knowledge of the concepts of sustainability as well as specific knowledge of topics of sustainability relative to their major field.

Goal and Objectives

The major goal of the projects is to create a transformative connection between STEM disciplines, research and development, and international engagement using an interdisciplinary approach to promote innovation and creativity in the field of sustainability. To achieve the project objectives on increasing interdisciplinary academic and research engagement of students and faculty, the projects carried out the primary activities such as development of interdisciplinary bachelor's programs in sustainability; study abroad opportunities and programs; and research engagement and STEM workforce development.

Interdisciplinary Approach

According to the National Academy of Sciences (NAS, 2004 and 2005), "Increasingly, the most significant new scientific and engineering advances...cut across several disciplines." NAS also reports that, students are strongly attracted to interdisciplinary courses, especially those of societal relevance. One NAS report cites the example of Stanford University which increased student interest and improved STEM graduation rates with implementation of an interdisciplinary program. The benefits of interdisciplinary education have been reported to include enhancing students' knowledge, attitudes, skills and beliefs, in particular on understanding of professional roles, flexibility, problem-solving, and inquiry. NAS also reports that lessons learned from industry and national laboratories provide strong evidence that interdisciplinary partnerships benefit research effectiveness and promote diversity.

As the Nation and the State make strides towards meeting goals for a vibrant economy, competitive workforce, and a cleaner environment, SU is actively engaged in these endeavors. Consistent with the Nation's and the State's focus on stimulating economic growth, SU has laid the foundation for cutting-edge research and innovation in multi-disciplinary areas that can impact existing and emerging industries in sustainable development. SU has embraced The "NEW" Decade: New Community, New Economy, and New Energy & Environment as a model for the emerging frontier in sustainability and to further solidify integration of academics, research and experiential learning for alignment with the Louisiana Board of Regents Master Plan (Louisiana Board of Regents, 2009 and 2010) and the Louisiana Science & Technology plan (Louisiana Department of Economic Development, 2009).

The topics of alternative energy solutions and environmental sustainability have gained popularity in higher education with the advent of the “Green Collar” job. Many universities have incorporated aspects of sustainability into their curricula. A small number of degree programs have been initiated in the related field of Renewable Energy. The SU project team is working to create the first program in sustainability at a Historically Black University. Students in many colleges at SU may opt to take classes to fulfill the requirements for a concentration in Sustainability. The concentration is intended to offer students interested in sustainability and related concepts an orientation to the principles of sustainability and their applications and context within their major. Education in sustainability offers inter-disciplinary flexibility reflecting the multi-faceted nature of sustainability. Sustainability potentially draws together all disciplines of the University, especially Engineering, Architecture & Technology, Mathematics, Physical Science, Agricultural Science, Social Science, and Business.

Sustainability Curriculum Creation and Enhancement

A concentration in sustainability has been developed and is currently moving through the university approval process. The first course, titled “Principles of Sustainability” towards the concentration in sustainability was approved through the University’s academic affairs, applicable curriculum committees, and by the University in May 2012. The class was taught each summer since 2012, in conjunction with the study abroad research experience program.

A new rubric has been set up to identify existing courses within each department that can be used as electives to fulfill the requirement for the interdisciplinary Sustainability concentration. All students opting for the concentration are required to take the Principles of Sustainability course. The additional three courses (9 credits) should be selected from a list of approved electives, dependent on major and the department. Elective courses all have approved level of content relevant to concepts of Sustainability. A subset of courses has been pre-evaluated and is delineated by each college. To provide more options, Departments and Programs have been encouraged to develop Sustainability modules for inclusion in elective courses. Students are strongly recommended to obtain academic advisement within their Home Department to select courses which simultaneously meet the student's major curriculum requirements, where possible.

International Engagement

The Sustainability Research Experience (SRE) in China Program has been created and conducted in the summer semesters since 2011. There were 21 students supported by the program in the 2012-13 academic year - almost double the number of participants in the 2010-11 academic year. There are six faculty members, representing six university departments mentoring students as of the summer 2013 term. The program provided SU students and their faculty mentors the opportunity to obtain a global perspective on sustainability research in the areas of sustainable materials, energy, technology, climate change, ecosystem and natural resources. The experience took place over a five-month period with two-month preparation and training workshops on research, results dissemination, and Chinese culture, history and customs. This was followed by students studying at various institutions in China

for a month as part of an effort to increase student and faculty engagement and to establish an international dual degree program in sustainability. While conducting research in China, students also learned about sustainable practices as well as attend cultural events and visit Chinese historical sites. Students were encouraged to explore the differences that existed between the United States and China from the academic, social and business perspectives. Following the return to campus, students, together with their faculty mentors and Chinese colleagues, spent another two months working on research project reports and disseminating their findings through their reports and formal presentations.

Another key success indicator associated with increased academic and research engagement is the number of conferences attended and the number of presentations made by SU students and faculty mentors in participating program departments. Of the 21 students currently participating in the program, seven students (33%) have attended and presented at a professional conference in the past year, an increase by 30% over the previous year.

Southern University has developed a new partnership with the American Council on Education (ACE) to participate in the ACE's Internationalization Laboratory - a prestige invitational learning community that jointly promote and achieve comprehensive internationalization. SU has reviewed the current institutional internationalization activities and developed a set of global learning and engagement goals and objectives. SU has formed an internationalization leadership team suited to accomplishment of the institutional goals. These activities have broadened and deepened SU internationalization.

Research Enhancement and STEM Workforce Development

In respond to the Louisiana Workforce Investment for a Stronger Economy (WISE, Louisiana Board of Regents, 2010), SU has developed a workforce investment and development plan (SU WISE) that appropriately linked the research productivity to positively impact the workforce development. To promote research, scholarly, educational and creative activities, as well as services supporting faculty in their search for business and governmental sector partners, The SU WISE integrates academics, research, and business partnering in a more functional manner with overall objectives that promote greater faculty and student experiential engagement and greater economic development.

The SU WISE includes 1. Center for Smart Composite Materials Modeling and Manufacturing. The vision of this center is to propel SU to a nationally competitive position in smart composite materials research and education, with the goal of creating and advancing knowledge and developing enabling technology in smart composite materials and structures that supports smart composite materials synthesis, characterization, modeling, simulation, processing and manufacturing. 2. Bioenergy Research and Development Platform to address the clean technology and energy needs in Louisiana. Specifically, the research focuses on using alternative sustainable non-food and non-feed feedstocks in Louisiana to develop biofuels. SU has built capacity in bioenergy and biofuel development through a multidisciplinary bioenergy research and development initiative in collaboration with the other state universities, E-fuel Corporation, USDA Forest Service, and

USDA National Institute of Food and Agriculture. 3. Research Opportunity Funds to provide researchers with start-up seed money, travel to granting agencies, organization of workshop and conferences, bridge funds for potential activities/projects that will enhance the research priority areas.

Conclusion

The project outcomes include the advancement of the role of Southern University in aggressively addressing national and global priorities that nurture sustainable materials, energy, technology, and environment to meet the growing demands of economic, business and social sectors in a global marketplace. Sustainability education has strengthened the University and its academic units while enhancing the ability to perform its mission. Students have benefited from exposure to education in sustainability, and are more competent in emerging areas and thus more attractive to potential employers.

Faculty members have benefited from increased interaction fostering opportunities for research and educational collaboration. The establishment of the interdisciplinary sustainability program has 1) resulted in increased enrollment at SU, 2) developed in students traits desirable to employers and graduate programs, 3) enhanced students' knowledge, attitudes, beliefs; and problem-solving skills, 3) allowed SU graduates to be more competitive in corresponding career pathways, and 4) enhances research capacity and production of SU faculty while taking the University to the next level of research by obtaining contracts and producing patents. Significant advantage has been achieved with little to no up-front financial obligation to the University. The projects has poised the University to make the larger steps towards transforming education at SU and in the State and the Nation.

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