PROJECT KALEIDOSCOPE
Teach. Lead. Know. *Differently.*

1818 R Street, NW
Washington, DC 20009
202.882.7439
pkal@aacu.org
www.aacu.org/pkal

A Letter to President Obama on Reforming STEM Higher Education Through Active Learning

President Barack Obama
The White House
1600 Pennsylvania Avenue, NW
Washington, DC 20500

October 19, 2016

Dear President Obama:

We applaud your commitment to improving STEM higher education for *all*. Indeed, if our nation is to remain a global leader, better strategies for increasing the number of competitively trained and liberally educated STEM graduates are warranted. Chief among these strategies is improving the quality of undergraduate STEM teaching, particularly through the implementation of active teaching strategies, including research-based instruction.

Remarkable progress has already been made toward a better understanding of the major tenets of active STEM teaching and learning. We now know, unequivocally, that these strategies not only increase STEM student retention and graduation for *all* students, but also impart the essential critical-thinking and problem-solving skills necessary for academic and professional success in STEM fields. Coupled with our understanding of the effectiveness of these strategies is our realization of the need for systemic approaches that mitigate institutional barriers, extend beyond localized classroom successes, and support individual STEM faculty in understanding and adopting active teaching strategies with fidelity.

We feel strongly that, in addition to institutions of higher education, STEM-related professional societies, like the Project Kaleidoscope of the Association of American Colleges and Universities, have an important role to play in addressing these challenges. For centuries, professional societies have served to establish accepted norms and traditions, as well as interpret and control the production of knowledge that shapes our classroom behaviors and determines pedagogical priorities. As leaders of STEM higher education reform, we are committed to contributing to your administration's priorities by: 1) cultivating common ways of knowing, understanding, and appreciating active teaching and learning within the STEM higher education

enterprise, and 2) developing a shared competence among STEM faculty members and administrators in valuing, implementing, and rigorously documenting the effectiveness of active learning strategies in all institution types.

To that end, each of our organizations and institutions is committed to engaging in one or more of the following steps to improving STEM higher education through active undergraduate STEM teaching and learning by:

- Investing in STEM faculty professional development
- Encouraging and supporting STEM faculty in adopting active learning strategies that are appropriate within their own institutional contexts
- Meaningfully incorporating cultural responsiveness into active learning strategies
- Encouraging institutional change efforts that will lead to comprehensive changes in STEM teaching behaviors
- Investing in faculty reward systems that acknowledge contributions to advancing active undergraduate STEM teaching and learning
- Broadly disseminating research findings and/or lessons learned from a wide range of institution types
- Publicly showcasing and promoting active learning innovations and successes on our campuses, at our regional meetings and national conferences, and on our websites

Thank you for your leadership and commitment to reforming STEM higher education. We look forward to working with you and your administration on this important effort.

Sincerely,

Agnes Scott College
Albany State University
Albright College
American Association of Physics Teachers
American University
Aquinas College
Armstrong State University
Association of American Colleges & Universities
Auburn University
Augustana College
Bahir Dar University
Baptist Health Madisonville
Bastyr University
Benedictine University
Bennett College
Colorado State University
Berea College
Bridgewater State University
Brown University
Bryn Mawr College
California Polytechnic State University
California State University
California State University Fresno*
California State University Sacramento*
California State University San Bernardino
Central State University
Chapman University
Claflin University
Clarkson University
Clayton State University
College of the Holy Cross
Missouri University of Science and Technology*

Columbia College
Connecticut College
Cornell University
Council on Undergraduate Research
Davenport University
Denison University
Drew University

East Stroudsburg University
Endicott College
Everett Community College
Fairleigh Dickinson University
Fayetteville State University
Florida Gulf Coast University
Florida International University*
Franklin & Marshall College
Genesee Community College
Georgia Gwinnett College
Georgia Institute of Technology
Georgia State University
Gettysburg College
Goucher College
Great Bay Community College*
Harry S Truman College
Hartwick College*
Inter American University of Puerto Rico
Iowa State University
Jacksonville University
James Madison University
Juniata College
Kalamazoo College
Lawrence Technological University
Lewis University
Lindsey Wilson College
Louisiana State University
Macalester College
Malone University
Mercer University
Merrimack College*
Middle Tennessee State University*
Midwestern State University
Swarthmore College
Texas A&M University

Monroe Community College
Montgomery College
Morgan State University
Mount Holyoke College
Mt. San Antonio College
New Jersey City University
North Carolina Agricultural and Technical State University
North Carolina Central University
North Carolina State University
Northampton Community College
Northern Kentucky University
Nyack College
Ohio Northern University
Old Dominion University
Oregon State University
Oregon State University Cascades
Otterbein University
Owens State Community College
Paul Smith's College
Pennsylvania State University
Philadelphia University
Pitzer College
Point Loma Nazarene University
Polk State College
Portland State University
Rider University
Roger Williams University
Rowan University
Salem State University
Shenandoah University*
Skidmore College
Smith College
Spelman College
St. Edward's University
St. John Fisher College
St. John's University
St. Mary's College of Maryland
State University of New York at Fredonia
Stevenson University
West Virginia University
Western State Colorado University
Texas A&M University-Kingsville

Texas Southern University
Texas Tech University
The College of New Jersey
The College of New Rochelle*
Towson University
Truman State University
University of Arizona
University of California, Los Angeles*
University of California, Irvine
University of California, Riverside
University of California, San Diego
University of Colorado Denver*
University of Mary Washington
University of Maryland Baltimore County
University of Massachusetts Amherst
University of Massachusetts Lowell
University of Minnesota
University of Minnesota Twin Cities
University of Mount Union
University of New Orleans
University of North Carolina at Asheville*
University of North Georgia
University of Oklahoma
University of Portland
University of Puerto Rico-Humacao*
University of San Diego
University of Southern Indiana
University of St. Francis
University of Texas at Dallas
University of Texas El Paso
University of Toledo
University of Washington Tacoma*
University of Wisconsin River Falls
University of Wisconsin-Whitewater
University of Wyoming
Washington & Lee University
Washington State University
Wellesley College
Western Washington University
Westmont College
Whatcom Community College
Wichita State University*
Winston Salem State University
Winthrop University
Wittenberg University
Worcester Polytechnic Institute
Worcester State University
Wright State University

(*) *Institutions that have committed to creating and uploading a two-minute video based on their Active Learning Day activity.*

October 3, 2016

President Barack Obama
The White House
1600 Pennsylvania Avenue, NW
Washington, DC 20500

Dear President Obama:

Albany State University (ASU) is a Historically Black University (HBCU) in rural Southwest Georgia with a primary mission of educating students to become outstanding contributors to society. We recognize that to carry out this mission, training faculty to implement strategies that engage students and promote critical thinking and problem solving skills is crucial so that our students will be prepared and competitive in this global society.

With support from the AAC&U PCFF (Preparing Critical Faculty for the Future) Program, Albany State University, has implemented a professional development program to increase faculty knowledge, confidence and use of active learning strategies in instruction. Professional development of faculty is essential for transforming teaching practices for enhanced student learning and retention in STEM disciplines. Heavy teaching loads, advising and service commitments at many teaching institutions, especially HBCUs like ASU, present an ongoing challenge to effective faculty professional development. As part of the program faculty were trained in evidence based learner-centered strategies that included, case studies, flipped instruction, cooperative learning through group projects, group presentations, and peer to peer instruction. The program also included faculty peer mentoring as an integral component to support faculty efforts. The results to date indicate positive changes in instructional approaches from both faculty and student perspectives and affirmed that a structured professional development program with an integral mentoring component can foster progressive change in faculty teaching in our institutional environment. This work continues to be extended successfully throughout the institution to other STEM faculty, transforming the culture of the institution to one that actively engages students in the learning process.

Another strategy that we have implemented across the STEM curriculum, in biology, chemistry and physics courses, is the embedding of research into the laboratory curriculum. The initiative is entitled 'A course embedded for integrating inquiry based projects and research into the undergraduate curriculum utilizing nano-science and nanotechnology'. Undergraduate research is recognized as a high impact practice that develops higher level learning in students and increases interest and participation in STEM careers. The project utilizes the interdisciplinary topic of nano-science to allow students to explore projects across discipline including the following:

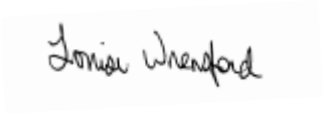
i) Exploring things at the Nano-scale: An Introduction of Nanotechnology where students will prepare gold nanoparticles under varying conditions and characterize and study their properties

ii) Biomedical Application of Carbon Nanomaterials where synthesis, functionalization, characterization, wave-nanoparticle interactions and delivery applications of graphene and ferrite nanoparticles are investigated.

iii) The Effect of Nanoparticles on Living Organisms will focus on investigations of the effect of nanoparticles on cells, plants, microorganisms and biological macromolecules.

The work that we have been able to achieve and will continue to build upon to integrate learner-centered teaching and active learning in the STEM curriculum, is important to building competencies of students attending HBCUs. This allows us to be responsive to the needs of our students and to the nation in developing the critical thinking skills and other competencies in our students that are necessary to prepare them effectively for the STEM workforce. We are committed to this effort.

Sincerely,



Louise Wrensford
Associate Provost of Research & Sponsored Programs
& Graduate Dean

AAPT PHYSICS EDUCATION
American Association of Physics Teachers

September 28, 2016

President Barack Obama
The White House
1600 Pennsylvania Avenue NW
Washington, DC 20500

Dear President Obama:

The American Association of Physics Teachers (AAPT) has been promoting "active learning" pedagogies for many decades. Here we list a few of the Association's activities.

AAPT Promotes Physics Education Research Providing Evidence for Active Learning
For more than 40 years, AAPT has fostered the development of Physics Education Research that has provided the evidence of the effectiveness of active learning in physics education at all levels. A synthesis of that research can be found in Jennifer L. Docktor and José P. Mestre, "Synthesis of discipline-based education research in physics," *Physical Review Special Topics – Physics Education Research* **10**, 020119 (2014).

AAPT Encourages Faculty to Adopt Active Learning Methods
To encourage college and university physics faculty to adopt active learning in their classes, AAPT in collaboration with the American Physical Society (APS) and the American Astronomical Society (AAS) has, since 1996, hosted the Physics and Astronomy New Faculty Workshops. Those workshops now reach about 50% of the new tenure-track hires in physics and astronomy in the U.S. AAPT also hosts Experienced Faculty Workshops and workshops for physics faculty in Two-Year Colleges along with special workshops for physics faculty in Historically Black Colleges and Universities in collaboration with the National Society of Black Physicists.

AAPT Engages Departments Implementing Active Learning
In American higher education, the department is the crucial unit for change. Recognizing that fact, AAPT in collaboration with APS and the American Institute of Physics and with support from the ExxonMobil Foundation and the National Science Foundation, ran the Strategic Programs for Innovation in Undergraduate Physics (SPIN-UP) effort. That program worked with physics departments to implement active learning in the undergraduate curriculum and to foster other strategies known to increase recruitment and retention of physics majors. In the past fifteen years those and other efforts have led to more than doubling the number of undergraduate physics graduates in the U.S. (During that same period, the overall number of STEM graduates increased by about 25%.) AAPT and APS also host an annual physics department chairs meeting, which includes sessions on implementing active learning in all undergraduate physics courses.

AAPT Provides Extensive Resources for Active Learning
To make active learning strategies more accessible to faculty, AAPT, with support from the National Science Foundation developed the web site PhysPort.org, which provides curated guides to more than 50 active learning strategies (with summaries of the evidence of their effectiveness) and more than 80 research-based assessment tools to test for the effective implementation of those strategies.

AAPT Promotes Integrating Computational Thinking and Physics to Aid Active Learning
Recognizing the importance of computational thinking in all STEM careers, AAPT is currently running four projects, with NSF support, to integrate computational work into physics courses as a tool for enhancing active learning. Three of those projects focus on undergraduate physics. The fourth supports the integration of computational thinking into "physics first" courses in schools where all students take physics, thus making computational thinking work accessible to a much wider range of students compared to those served by the typical stand-alone computer science courses in secondary schools.

AAPT Works to Increase the Number of Highly Qualified Physics Teachers Using Active Learning
AAPT and APS, with support from NSF, have developed the Physics Teacher Education Coalition to enhance the engagement of physics departments in the education of future K-12 teachers of physics. As a result of that program, the number of highly qualified physics teachers has almost doubled in the past ten years. In addition, the diversity of these new physics teachers is significantly greater than that of physics majors overall and that of the current cohort of teachers of physics nationwide.

AAPT Engages Physics Master Teacher Leaders to Promote Active Learning
AAPT has recently established the Physics Master Teacher Leader Corps to provide the Association with guidelines and recommendations for enhancing its professional development programs for K-12 teachers of physics. Many teachers in the Corps will become leaders in those professional development programs, which then provide a platform for them to enhance the teaching of physics across the country.

AAPT Meetings Foster the Development and Dissemination of Active Learning Strategies
AAPT's national meetings and its annual Physics Education Research Conference are the primary mechanisms for physics teachers, faculty, and physics education researchers to meet, share the results of their work, and to develop new ideas to further enhance the adoption of active learning techniques at all levels of physics education.

Sincerely,

Beth A. Cunningham
Executive Officer

BRYN MAWR
COLLEGE

October 5, 2016

President Barack Obama
The White House
1600 Pennsylvania Avenue NW
Washington, DC 20500

Dear President Obama:

Bryn Mawr College, which graduates women with STEM degrees at a rate almost three times the national average, joins our fellow TIDES grantees in supporting active teaching and learning in STEM.

Bryn Mawr's activity and achievement in implementing active STEM teaching and learning strategies reflects our deep commitment to improving undergraduate STEM education for all students. Typically, only 40% of students who intend to major in STEM fields actually persist beyond gateway courses. And women and members of underrepresented groups leave STEM majors at higher rates than their peers. It has become critical that STEM higher education reforms efforts to broaden the participation of women and members of other underrepresented groups in STEM, who not only represent a rich source of talent, but are also the fastest growing populations in undergraduate higher education.

Our strategy for broadening the participation, retention, and graduation of members of underrepresented groups in the STEM fields is not only significant pedagogical reform, but pedagogical reform that is culturally sensitive to the lived experiences of these populations. We use a multi-pronged approach that includes 1) using new technologies to create more culturally responsive classrooms, 2) empowering faculty to adopt culturally sensitive pedagogies, 3) providing just-in-time fundamentals review, and 4) supporting cohort programs.

1) Leveraging new technologies in blended formats that combine classroom, online, and community-based learning opportunities ensures that effective pedagogy practices reach all of our students and are culturally responsive to the academic needs of our current undergraduate population. With support from the AAC&U TIDES initiative, we have created and deployed a suite of blended learning Modules in Computational Skills and Numerical Methods using IPython Notebooks. The notebooks are a versatile medium for faculty to integrate culturally responsive teaching elements (e.g., scientist profiles, self-efficacy prompts for journaling, and advice for decoding the culture of computer science and STEM fields) directly into the executable notebooks that then become a dynamic e-portfolio record of student learning and development.

2) To achieve systemic change in our institutions it is also critical to empower faculty to adopt culturally sensitive pedagogies and sustain the necessary changes in practice required for relevant and inclusive teaching. We have designed a faculty workshop informed by the literature on inclusive teaching and learning that uses actual student and faculty case studies to illustrate challenges and solutions. We've delivered this workshop multiple times and have made the

materials along with the learning modules available on our GiTHub repository for anyone to download and use. To date over 12 additional institutions have made use of our materials.

3) STEM completion rates for low-income, first-generation, and under-represented students are shaped in large part by a key stumbling block: college readiness in quantitative skills and mathematics preparation. With support from a First in the World grant from the U.S. Department of Education, we have designed and developed over 20 interactive online fundamental math review learning modules that are directly linked to gateway science courses. They provide an opportunity for students to practice math skills in context and move through the review at their own pace to demonstrate proficiency. As an alternative to a remedial course approach, students get just-in-time support and can begin their STEM courses right away and minimize their time to degree. Beginning this year we are conducting a two-year research study on the effectiveness of the materials in improving student achievement in such courses in partnership with eight other liberal arts colleges.

4) Beginning in 2013 and in each of four subsequent years, Bryn Mawr College has enrolled overlapping "STEM Posse" cohorts of ten students from underrepresented groups with strong aptitude and interest in math and science. The program will increase the participation and persistence of nontraditional STEM majors by providing innovative curriculum, early research opportunities, comprehensive mentoring, and leadership development. The new STEM Posse Scholars also serve as highly visible role models for other students, especially those from underrepresented minority groups, thereby helping to recruit additional students into science and math majors at Bryn Mawr.

We can do more. To systemize all that we have learned, expand its impact, and share what we've learned, we are preparing an invited proposal for the Howard Hughes Medical Institute. We will establish a task force of Bryn Mawr faculty, staff and students, to develop, implement, assess and document our multi-pronged strategy to deploy and institutionalize our best educational practices across the College's STEM departments. This initiative aims to extend the use of our high-impact innovations to reach students in all STEM courses. It includes plans for broadening the reach of faculty development efforts, an in-depth examination of STEM advising practices, and important revisions to the programs supported by our Quantitative Center. It will be an unprecedented, broad, and coherent institutional response to eliminate disparities in student achievement and persistence in STEM after graduation.

With your attention and support, much has been accomplished. We thank you for your work in realizing the promise of women's achievement and leadership in all fields of science and mathematics.

Sincerely yours,

Kim Cassidy, President

Mary J. Osirim, Provost and Professor of Sociology

Elizabeth McCormack, Professor of Physics and Director of STEM Initiatives

Council on Undergraduate Research
Learning Through Research

September 30, 2016

The Honorable Barack Obama
President of the United States
The White House
1600 Pennsylvania Ave, NW
Washington, D.C. 20500

Dear President Obama,

On behalf of the Council on Undergraduate Research (CUR), we join with our partner organizations in applauding your deep commitment to and evident interest in Science, Technology, Engineering, and Mathematics (STEM) education. In this letter, we present our commitment to active learning in STEM higher education, and examples of the types of programs and services that we offer to support the national STEM higher education enterprise and build a well-qualified STEM workforce.

CUR is a dynamic and vibrant non-profit organization of more than 10,000 members, representing close to 900 institutions. We are the voice for undergraduate research, both nationally, and increasingly, internationally, and dedicated to providing programs and services to support high-quality faculty-mentored undergraduate student research. CUR identifies undergraduate research as an inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline, in close collaboration with faculty members and other professional mentors. Undergraduate research is a keystone concept within the pantheon of strategies that encompass the active learning movement, and acts to move students from passive participants in lecture-based classroom experiences, to independent researchers, with strong critical thinking, communication, organizational, and team work skills.

Federal investments in undergraduate research play a critical role in engaging students into the STEM fields, and investments in undergraduate research are particularly sound ones as they often directly cultivate the STEM workforce pipeline. CUR strongly supports continued and enhanced funding for federal programs that have demonstrated success in broadening and diversifying the STEM pipeline, particularly for members of groups historically underrepresented in STEM disciplines. Undergraduate research is a proven strategy to attract, retain, and graduate STEM students who are members of historically underrepresented groups. In addition, CUR applauds the linkages between education and the workforce that are carefully woven throughout many of the federal programs supporting the nation's research enterprise.

CUR believes that for the U.S. to retain its position as an innovation leader there must be a two-pronged approach to research and innovation: the discovery of new knowledge must be coupled with the fostering of future researchers through research training grants and other types of direct support. All sectors of higher education, including research-intensive Master's and Ph.D. granting institutions, predominantly undergraduate four-year institutions, as well as community colleges, should be encouraged to connect the *creation* of new knowledge and the *process* of discovery-based knowledge to support innovation. One without the other is insufficient to ensuring the long-term vitality of the nation's workforce and its economic well-being.

734 15th St. NW • Suite 550 • Washington DC 20005 • *Phone* (202) 783-4810 • *Fax* (202) 783-4811 • cur@cur.org • http://www.cur.org

Council on Undergraduate Research
Learning Through Research

The President's Council of Advisors on Science and Technology report of 2012, *Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics*, asserted that independent research in collaboration with faculty projects "is a direct way for students to experience real discovery and innovation and to be inspired by STEM subjects." CUR agrees strongly and further asserts that undergraduate research is not just the province of higher education- increasingly, partnerships between federal research labs, institutions of higher education, industry and even secondary schools or career and technical education centers are commonplace.

Our organization is leading the way as the major voice and resource for undergraduate researchers and their mentors. We are:

- *Investing in STEM faculty development to support and promote active learning strategies and foster long-lasting institutional change efforts* through our series of professional development institutes. Our institutes have empowered more than 700 colleges and universities to build STEM curricula centered around the undergraduate research paradigm, and change faculty reward structures to emphasize work with undergraduate student researchers
- *Publicly showcasing undergraduate research achievements* through our yearly Posters on the Hill conference, conducted in partnership with the American Chemical Society, which highlights 60 of the best and brightest undergraduate researchers in the nation. In addition, our annual National Conference on Undergraduate Research, brings together more than 4000 students and faculty to celebrate the vitality and achievement of undergraduate scholars.
- *Broadly disseminating our lessons learned* through our peer-reviewed journal, and annual professional development conferences. Our conferences offer excellent learning and networking environments for higher education faculty engaged in changing their teaching to active research-based instruction.

Thank you for your leadership. We look forward to working with you and your administration, our partner organizations, and the colleges and universities that are committed to thoroughly transforming STEM higher education from passive to active learning pathways. Together, we can create STEM professionals superbly equipped to undertake research, translate research to economic benefit, and use the results of research to solve the pressing challenges our society faces.

Sincerely,

Elizabeth L. Ambos
Executive Officer
Council on Undergraduate Research

734 15th St. NW • Suite 550 • Washington DC 20005 • *Phone* (202) 783-4810 • *Fax* (202) 783-4811 • cur@cur.org • http://www.cur.org

THE LEADER IN GLOBAL EDUCATION

FAIRLEIGH DICKINSON UNIVERSITY

OFFICE OF THE PRESIDENT

Metropolitan Campus
1000 River Road, H-DH1-03
Teaneck, New Jersey 07666 (USA)

201-692-7100 Voice
201-692-7099 Fax

www.fdu.edu/president

October 1, 2016

President Barack Obama
The White House
1600 Pennsylvania Avenue NW
Washington, DC 20500

Dear President Obama:

Fairleigh Dickinson University is a comprehensive university with two campuses in Northern New Jersey serving a diverse population of students, many of whom are first generation college students. We view as part of our global mission the need to encourage and support underrepresented populations in STEM fields. To this end, we have engaged in a conscious, strategic effort to grow our STEM offerings and to expand engagement and access by all students with the implementation of curricular and teaching reforms such as culturally relevant pedagogy. Through the support of a generous grant from the AAC&U TIDES project, we have been able to broaden the reach of our STEM programs and develop our teaching across campus to be much more inclusive through culturally responsive approaches in the classroom.

The scope of our AAC&U TIDES project specifically address the area of computer science, a discipline that has traditionally had a low participation rate by female and African American, Hispanic and Native American students. To address this, we looked at classroom practices and the role that faculty approaches played in creating a learning environment that enable underrepresented populations to succeed. Over the course of two years, FDU delivered a series of training sessions, evaluation and feedback to adjust teaching practices. Besides discussing evidence-based research in STEM education, our faculty development activities brought into focus such phenomena as implicit bias and impostor syndrome, which deter persistence and success in STEM.

Modifying computer science classroom practices to implement active learning to consistently engage students, implementing low-stakes assessment and increased instructor awareness of the impact of micro-aggressions in the classroom are just a few examples of the changes we made. Our faculty implement active learning in classrooms that also involve being cognizant of the cultural differences of our students and resultant effects on students' learning styles and problem solving approaches. Instead of traditional “one-way” lectures, faculty provide contextual information about a problem and encourage students to develop skills with their own interpretation of the problem and potential solutions.

#

In response to these modifications and transformations, we found significant improvement in the engagement and academic performance of female students, including African American females, as well as Hispanic students of both genders. We have seen increased representation of Native American, African American and Hispanic students in computer science (from 33% to 39%) and increased representation by females overall (11% to 22%). Retention rates also showed improvement, particularly among African American females, where all those enrolled in computer science were retained.

Additionally, the benefit of the campus workshops, training sessions, and faculty development activities went well beyond just the computer science classroom. Training was opened up to the entire campus community to include all disciplines, with particular interest in developing the skills of our University CORE faculty and freshman year instructors who played a critical role in helping students from underrepresented populations feel a sense of connection, belonging and empowerment for their academic future. We also expanded these activities to include other local universities in the New York and New Jersey area, to broaden impact and to develop a community of educators who promote culturally sensitive pedagogies and active learning.

Our momentum in teaching transformation also inspired us to expand our outreach opportunities to help the local communities and school districts that are building computer science curricula and resources. In that process, we engaged our students as teachers to inspire younger students to develop skills in computational sciences.

At Fairleigh Dickinson University, we take great pride in our global mission and our dedication to serving students of all backgrounds and in encouraging them to achieve personal and professional success. Through initiatives such as the AAC&U TIDES project, we are able to leap forward in making these goals a reality.

We hope you find these results to be informative and encouraging.

Sincerely yours,

Christopher A. Capuano, Ph.D.
President

Kiron Sharma, Ph.D.
Principal Investigator, TIDES Project

THE HENRY M. ELDRIDGE
DEPARTMENT OF MATHEMATICS
AND COMPUTER SCIENCE

FAYETTEVILLE
STATE UNIVERSITY

October 3, 2016

President Barack Obama
The White House
1600 Pennsylvania Avenue NW
Washington, DC 20500

Re: Commitment to Teaching to Increase Diversity and Equity in S.T.E.M. (TIDES Grant)

This letter of commitment is written on behalf of the Henry Eldridge Department of Math and Computer Science's TIDES Grant initiative as it relates to your unwavering leadership and support for culturally responsive teaching efforts. In reiterating your support, this effort especially allowed women and minority students to benefit in relating to transitional pedagogical efforts via culturally responsive teaching redesigned in the department's mathematics and computer science curriculum.

Additionally, evidence of the professional development monetarily supported by TIDES program via the Association of American Colleges and Universities (AAC&U) for professors of our Science, Technology, Engineering and Mathematics (STEM) programs, supported active learning and culturally responsive teaching efforts, proving victorious for our computer science student team who won first place in the NASA Swarmathon Competition (spring 2016) at NASA's Kennedy Space Center,.

The TIDES grant has ended on September 30, 2016. It is our grave intent to continue to educate our STEM faculty as well as students and administrative leadership, mentor STEM students towards graduate school and successful careers, and obtain higher student numbers to produce cultural responsive teaching resulting in support of competitive scholarship among students across the country.

Finally, immense thanks and respect to you and your staff for allowing your leadership to support our efforts in producing twenty-first century culturally responsive teaching for conscientious faculty and students at Fayetteville State University's Henry Eldridge Department of Mathematics and Computer Science. As you move forward, we know that you will to continue to support America's educational efforts to expose all students to STEM support in all of our higher educational institutions.

Sincerely,

Sambit Bhattacharya
Associate Professor of Computer Science
TIDES Grant Director

R. Nickolov

Radoslav Nickolov
Professor and Chair
TIDES Co-Principal Investigator

September 23, 2016

President Barack Obama
The White House
1600 Pennsylvania Avenue, NW
Washington, DC 20500

Dear President Obama,

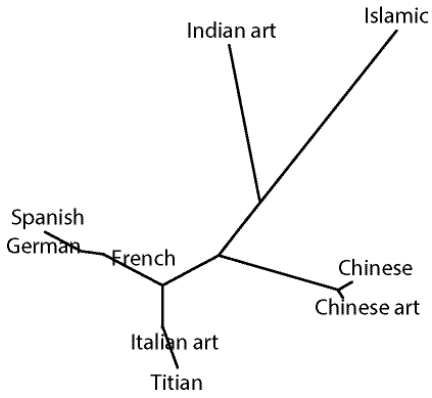
As an institution committed to excellence in STEM education, Lawrence Technological University is dedicated to the development of novel pedagogical practices based on active learning, aiming at improving student engagement, and consequently attracting and retaining students in STEM. In particular, we have been focusing on groups that are underrepresented in the STEM disciplines, and especially computer science. Since computer science has been expanding from a discipline that changes our economy to a discipline that shapes our culture, we believe that diversity in computer science is a top priority to the nation and human kind.

One of the practices used in our institution is undergraduate research experience, a proven pedagogical approach that increases recruitment and retention of students in the various STEM disciplines, improves student learning, and better prepares students to solve real-world problems and make connections among seemingly disparate pieces of information. We also combined culturally-sensitive elements in our pedagogy, allowing students to express their identity such as gender or ethnicity through computing.

Our innovative approach brings research experiences into regular classroom courses, exposing all students to research at an early stage of their degree program. That was achieved by transforming three core-curriculum courses in three different disciplines --biology, psychology, and the humanities-- into courses taught by engaging the students in research activities. Instead of lectures, the students learn by hands-on activities and solving authentic research problems. The concept works by allowing the students to define their own research question, and then applying computational and quantitative research methodology.

In the transformed humanities course the students use image analysis tools to study different hypotheses regarding art history such as links of artistic influence between painters and similarities between artistic movements. The quantitative nature of the research introduces a novel approach to art history, which traditionally has been studied at the undergraduate level by manual observation of the art and analysis of historical information. That active learning approach allows the students to learn and analyze art history, while testing their own hypotheses using quantitative tools and making authentic discoveries about art.

In the social science course the students apply automatic text analysis to identify patterns in the way people use social media such as Facebook, and analyze trends and patterns in the way social media is used. Each student can choose a different aspect of social media patterns to analyze such as different demographic group (e.g., age, gender), different topics (sports, food, art), etc. In the introductory biology course the students apply automatic microscopy image analysis to identify the effect of substances on c. elegans nematodes. That is done by applying quantitative analysis of microscopy images, that can detect physiological changes on the worms before the effect becomes fatal.
Since students can choose different substances, different social media topics or population, and different painters and schools of art, each student has the opportunity to create new knowledge by performing research that goes beyond "recipe" experiments with known results.



Outcome of student research in the freshman core-curriculum humanities course. The experiment aimed at identifying similarities between artistic styles based on geographic locations by applying quantitative analysis to sets of digital paintings. The graph was generated automatically by the computer, based on image data alone, showing the similarity between how the different artistic styles.

Through the process, the students apply computer science concepts in a discovery-driven fashion that exposes them to computational science and its application to disciplines that are seemingly unrelated to information technology. Since these courses are not computer science courses, they provide students who did not choose computer science as their major to practice computational science in an active learning pedagogy as early as their first year.

All software tools and detailed step-by-step protocols are publicly available, so that the modules can be easily used by any interested institution, instructor, student, or researcher.

The project was enabled by the paradigm-shifting TIDES (Teaching to Increase Diversity and Equity in STEM) program – a unique program of the Association of American Colleges and Universities, designed not only to develop pedagogy that supports inclusion, but also to provide training and professional communities to enable a true change in higher education. That approach is conceptually different from the common practices of government and private funding bodies, and makes a truly effective solution to these burning problems in higher education. TIDES provides institutions of higher education not just with the resources to build and modify programs, but also with the knowledge and intellectual tools required to make a successful and sustainable change.

Sincerely,

Lior Shamir, Ph.D

Assoc. Prof., Computer Science

Asst. Dean, College of Arts and Sciences

Office of the President

October 3, 2016

President Barack Obama
1600 Pennsylvania Avenue
Washington, DC 20500

Dear President Obama:

Montgomery College, not far from the White House, is a three campus community college—the largest in Maryland—that is proud of its incredible diversity. Our 24,000 credit students, who span multiple generations and socio-economic groups from the US and over 160 other nations, beautifully reflect the ever-evolving tapestry of American society. Our STEM programs include engineering, mathematics, physics, chemistry, life sciences, as well as cutting-edge programs in biotechnology and cybersecurity. Advanced pedagogies that actively engage students in learning are a hallmark of our classrooms, laboratories, and learning centers. Our School of Education offers degrees that are preparing the next generation of high school chemistry, mathematics, and physics teachers. Teaching the teachers of digital natives emphasizes best practices to ensure that technology enhances learning both in and outside of the classroom.

Recognizing that advances in STEM fields require hands-on capabilities with modern equipment, Montgomery College has, over the last decade, demonstrated its strong commitment to STEM education with the opening of its new Science Center at the Rockville Campus in 2011 and the opening of the Bioscience Education Center at the Germantown Campus in 2014. These LEED-certified buildings also provide opportunities for students to observe, in real time, the operations of these facilities. A new math and science building is in the funding pipeline for the Takoma Park/Silver Spring Campus. But it's what is happening inside the buildings that matters.

Science Center at Rockville Campus

Biotechnology students at work in lab

Bioscience Education Center at Germantown Campus

Montgomery College (MC) has invested in professional development and has been the recipient of numerous STEM grants, including awards from the National Science Foundation (NSF), the Association of American Colleges and Universities (AAC&U), and the US Department of Labor (DOL). These grants, as well as others, focus on the success of underrepresented groups, including workers transitioning to in-demand career opportunities, and have included: NSF Scholarships in STEM (S-STEM) grant; NSF Graduate and Transfer Science, Technology, Engineering, and Math Talent Expansion Program (GT-STEP) grant; Teaching to Increase Diversity and Equity (TIDES) grant; and a DOL Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant.

In order for active learning and other best practices to be effective, they must be culturally responsive and relevant to our highly diverse student population. The MC TIDES project team created a model of culturally responsive teaching (CRT) and made it available online. The model has been presented to faculty and administrators at numerous workshops and presentations at the College, as well as at local and national conferences. The model emphasizes the importance of discovering those factors that impact learning as well as "cultural assets" that faculty can use to create or tailor activities in ways that engage students. One example, "Getting to Know You" surveys, revealed that time management is a challenge: our students lead busy, complicated lives influenced by their cultures. An iterative programming activity was created that focuses on time management by having students use their actual daily schedules as data.

A learning community pairs Computer Science I and Calculus I courses with the calculus course taught using the flipped-classroom approach: students watch short instructional videos created by the professor on concepts that they then engage with by working on related problems during the class periods. In another learning community, students engage in a number of active learning activities, such as demonstrating the sort algorithm by acting as parts of the sorting groups themselves.

Faculty participating in the TIDES grant have helped to foster a culture of innovative, engaging, and culturally responsive teaching in STEM classes. Physics classes reflect best practices in physics education by incorporating elements of discovery-learning, inquiry-based techniques, experimental design and student-directed outcomes. Models used by some faculty combine data analysis, white-boarding activities, small group discussions, and flipped classroom techniques.

Many physics classes have implemented JITT (Just In Time Teaching) pedagogy developed at the University of Illinois Urbana-Champaign. In this "flipped" classroom environment, students use online programs to view pre-class lectures and answer a set of questions, which require them to explain their reasoning. Students indicate what was clear or confusing; instructors use class time to meet the immediate needs of the students. Class time, no longer for lecture, consists of rigorous conceptual training through discussion questions and intense problem-solving where the groups of students use white boards to show their work.

Chemistry faculty who have also flipped their classes claim they would never return to traditional lecture style teaching. Learning communities pairing biology with student development courses have been effective in helping students develop skills that improve performance in any class.

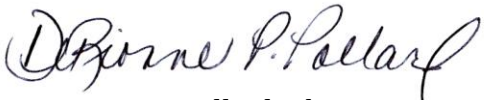
The Keystone Project combines challenging real-world problems and exemplary teaching in fundamental engineering courses. Outstanding faculty members teach the most fundamental courses. Courses are constantly reviewed to achieve academic excellence and high student interest. The project serves as a national model of increasing student retention and graduation.

The TIDES project team has partnered with the GT-STEP Program for the Active Learning in STEM (PALS) initiative to conduct Active Learning Open Labs several times during the semester. TIDES faculty have also worked with the College's professional development division, E-Learning, Innovation, and Teaching Excellence (ELITE), to issue a monthly online publication, *Teaching Tips of the Month from MC Faculty*, featuring active learning activities and strategies. Workshops include *Applying Culturally Responsive Teaching to Address Classroom Challenges* and *Culturally Responsive Teaching.*

Montgomery College is actively engaged in creating a culturally responsive learning environment. Grants that support faculty efforts to innovate in and out of the classroom are critical to the success of this mission. We are very proud to be part of your effort to promote active learning and teaching in STEM education.

Thank you for your leadership in launching this critical initiative.

Sincerely,



DeRionne P. Pollard, PhD
President

Center for Science, Math and Technology
Education

October 3, 2016

President Barack Obama
The White House
1600 Pennsylvania Avenue, NW
Washington, DC 20500

Dear President Obama:

The demand, by the general worker and the ever-growing, diverse population of nontraditional students, for education beyond the confines of the brick and mortar campus has steadily increased. Consequently, online delivery of degree-related instruction is growing as universities respond to rising demands for educational access. On July 1, 2007 the University of North Carolina system launched the University of North Carolina Online. This site lists more than 170 degree, certificate, and licensure programs that are offered by the constituent universities. North Carolina Central University (NCCU) is one of those constituent universities, making it one of only 19 of the nation's 105 Historically Black Colleges and Universities offering online degrees.

As former U.S. Secretary of Education Arne Duncan indicated, accomplishing national goals for increased college completion means "student populations with high dropout rates, especially minority students, will have to exponentially increase their college graduation rates...[Therefore,] HBCUs will - and must - play a critical leadership role in meeting this challenge."

NCCU is the nation's oldest public liberal arts institution for African Americans, and is an institution with a strong tradition of teaching, research, and service. Many of the students entering the university come underprepared in the basic mathematics, science, and general education courses necessary for persistence to science, technology, engineering, and mathematics (STEM) degrees. Thus, new approaches are needed to address basic mathematics, science, and general education course requirements of our entering freshmen in order for them to become successful learners. Because student success is paramount, the professional preparation of faculty members to effectively communicate and transfer information to students is also essential. This becomes especially important as institutions like NCCU place increasing emphasis on online course delivery as a means to accommodate increasing course enrollment in the face of constraints on physical infrastructure.

Led by two science faculty, a faculty learning community in partnership with the NCCU Division of Extended Studies was created to assess online science course offerings and instruction. Faculty within this learning community completed the Quality Matters Program's "Applying the Quality Matters Rubric" course. Quality Matters is an international quality assurance process developed to certify the design of online and blended courses. This online training course, coupled with services provided by the NCCU Division of Extended Studies, offered the faculty learning community a variety of pedagogical strategies to meet their instructional needs. All faculty participating in this learning community completed the online training course, and all faculty indicated that they implemented changes in their subsequent online course offerings.

From our vantage point, 'Course Design, Quality Matters Training, and Student Outcomes: Applying the Quality Matters Rubric in an Online Biology Course' yielded a forum for us to broadly disseminate useful information to our peers about our course redesign and faculty learning communities. As these two entities are broadly utilized, it is anticipated that our research may present an effective strategy to increase the quality and quantity of online STEM courses at similar institutions.

This project was generously supported by the National Science Foundation HBCU-UP Program (NSF ID 1235727) by means of a grant through the American Association of Colleges and Universities Preparing Critical Faculty for the Future program.

As leaders of STEM higher education reform, we are committed to contributing to your administration's priorities by: 1) cultivating common ways of knowing, understanding, and appreciating active teaching and learning within the STEM higher education enterprise, and 2) developing a shared competence among STEM faculty members and administrators in valuing, implementing, and rigorously documenting the effectiveness of active learning strategies in all institution types.

Sincerely,

Racheal Brooks

Racheal M. Brooks, PhD
Coordinator, Office of e-Learning, Division of Extended Studies

Gail P. Hollowell, PhD
Director, Center for Science, Math, and Technology Education

Pitzer College
Computer Science and TIDES. Filling the Toolbox for Liberal Arts Education.

Pitzer College's mission is to produce engaged, socially responsible citizens of the world through an academically rigorous, interdisciplinary liberal arts education emphasizing social justice, intercultural understanding and environmental sensitivity. The intersection of STEM with all disciplines and its prevalence in society have contributed to a surge in students applying to and majoring in STEM fields at Pitzer College. Specifically, student enrollment in science classes has increased 40% in the past 10 years, with 70% of the students majoring in science department being women and 15% from ethnic groups underrepresented in the sciences. All Pitzer students increasingly require the tools of science to provide needed analyses and solutions for pressing societal problems that address critical social justice issues. This is especially evident in computer science here at Pitzer College. While a small number of students, between 3-4 per year, have graduated with degrees in computer science over the last five years, overall enrollments in computer science classes has risen from 37 in 2011 to 180 students in 2016.

We attribute a significant portion of these increases to the Teaching to Increase Diversity and Equity in STEM (TIDES) Program of the Association of American Colleges and Universities (AAC&U). In 2014, Pitzer College was awarded an honorable mention from the AAC&U for the TIDES Program. Although we were not fully funded, and therefore not able to implement our proposal, we were able to participate in all TIDES Program workshops and consult with the Program experts who are leaders in the area of diversity and education. In total, five different faculty and administrators attended TIDES workshops, and through these engagements, we (1) saw examples from institutions who have successfully increased diversity and equity in their STEM programs, (2) learned techniques to help underrepresented students succeed in their STEM courses, and (3) gained critical insight on how to tackle difficult and controversial topics that our students are grappling with. Our participants in the TIDES Program gained the cultural competence and the ability to be responsive to our students' needs, and they have been able to successfully implement these skills with tangible results on our campus. As a result, the diversity of our students has increased greatly in the time period that Pitzer has been involved with TIDES. The percentage of Hispanic and Black students taking computer science courses has increased from 6 to 11% in this time period. We have also experienced a 15.7% increase in the number of multi-racial students taking computer science courses over the past five years.

As indicated above, these students are mostly *not* majoring in computer science, but rather taking one or two computer science courses to support a broad spectrum of majors, from English to media studies to

environmental analysis and everything in between. Through the special consortial relationship we have with Harvey Mudd College, the computer science faculty at Harvey Mudd College developed a course that follows CS5 Introduction to Computer Science. This course, CS35 Computer Science for Insight, is a terminal course, but it helps students to better apply computer science to their majors and other interests. In effect, it allows students to fill their analytical toolbox for accomplishing their academic and philanthropic goals. The latter is especially relevant at Pitzer College, where just this year, we put into place a new Social Responsibility and Social Justice graduation requirement. All students at the College are now required to take a social justice theory course and a social responsibility praxis course. Both courses support and bolster the over 100,000 hours of volunteer work that Pitzer students contribute to the communities both locally or globally every single year. We have learned that many of the organizations that our students volunteer at are in need of people with computer-related skills to help promote their causes and activities.

The outlook for STEM education at Pitzer College is bright and hopeful. Since 2014, the year we were awarded our Honorable Mention from the AAC&U, the College has garnered $1.3 million in scholarship funding for STEM education. This has been in the form of a National Science Foundation S-STEM grant, and a Rose Hills Foundation Grant. Both of these awards are specifically for high-achieving, low income students who choose to major in STEM fields. The principle investigators on both of these grants were faculty and administrators who participated in the TIDES Program from day one. Our goal is to continue to use the skills and knowledge gained from the AAC&U TIDES Program to advance STEM education at Pitzer College. In doing so, we now know that we will be effecting positive change for all Pitzer students who seek to become engaged, socially responsible citizens of the world.

Sincerely,

Kathleen Purvis-Roberts
Assistant Vice President for Student Development &
Professor of Chemistry

A Letter to President Obama on Reforming STEM Higher Education Through Active Learning

President Barack Obama
The White House
1600 Pennsylvania Avenue, NW
Washington, DC 20500

Dear President Obama:

On the Audacity of Hope book you mention that "*It is our duty to identify those (academic) reforms that have higher results on the students, finance them adequately and eliminate those programs with no results*" p. 171. Indeed reforming higher education requires the selective financing of initiatives that by the training of a few will result in the real impact of thousands. As faculty of a Hispanic Serving Institution (HSI) we thank you for the priority areas selected on your 2017-STEM for All policy. Over the last two years, I have worked along with professors from the Biology and Mathematics Programs at the University of Puerto Rico-Humacao to actively engage students (particularly females) to enhance their critical thinking and computational skills. Our empowering movement is called *Cybernetic Girls can be Pinky* and it aims to break stereotypes that Latinas face to enter into computational fields due to their femininity. Thanks to the funds provided by the American Association of Colleges and Universities (AACU) through the program Teaching to Increase Diversity and Equity in STEM (TIDES) we have implemented a series of effective strategies to create a pipeline of Latinas into STEM (see Figure 1).

Figure 1: Representatives of the Cybernetic Can be Pinky pipeline from University of Puerto Rico at Humacao

All our initiatives involve active teaching and learning. First, we have 7-9th grade students that are part of the Seeds of Triumph program funded by a collaboration of Amgen Foundation, cienciapr.org and the Yale Center for Teaching and Learning. On the last meeting a seventh grade student cried as she felt abandoned in the small island of Vieques with no resources to complete a career in STEM. Thanks to her honesty, last August her school was visited by the staff and faculty leading the NSF-PREM program at the UPRH and now she is actively engaged into STEM. Secondly, we train undergraduate females to enter into graduate programs and change the sad statistics that less than 5% of Latinas pursue a doctoral degree in STEM in the US. Our institution has joined the Small Word Initiative (from Yale University) where students are trained to look for antibiotics in the soils of their backyards. The SWI is a great example of how professional development exponentially multiplies into a successful program that allows easy access to STEM careers. I attended the workshop in Yale in the summer of 2014, and to date more than 100 undergraduate students are engaged into a research project while attending a regular class at the UPRH. Contrary to other research programs like NIH-MARC where only

10 privileged students were able to receive specialized training, now the whole class is actively engaged.

Another important STEM initiative implemented at UPRH is the course Woman in Science (WinS) imparted last year. A retired professor came back to the classroom to teach students about the accomplishment of other Puerto Ricans in STEM at the WinS course. Students were able to learn about their civil rights and became active investigators learning about the discrimination that women in Puerto Rico still face when trying to become successful scientists. As shown in the last panel, the pipeline is ended by our faculty joining other professionals from Historically Black Colleges at an Educational Hackaton last January. All the elements of the pipeline are important but to me training in higher education is pivotal, only when faculty is well trained they become real agents of transformation.

During my graduate school in the United States I faced many obstacles due to the lack of cultural sensibility of most of my professors. The liberating training I recently received by the TIDES program have allowed me to learn about implicit bias, white privilege, impostor syndrome (really important for all Latinos) and the sad reality of horizontal aggression. My graduate training in the US never included these important aspects, even though they are so relevant for us “minorities” to be successful. Thanks to the training received by TIDES I now understand I am not dysfunctional, the system is. Thinking back I regret all the energy lost in the process, creative energy that could be used to be more productive in the laboratory. At the end, it is all a matter of productivity and I know you care about leading a productive country. Consequently, I hope in the near future all graduate programs include these hard to talk topics in their agendas; every respected STEM program in the US should include them in the preparatory week for international students. Furthermore, each Natural Science program should have them in their seminar series and the funding agencies should include them as part of their broader impacts. Only then effective conversations about Equity and Diversity will begin.

Again I thank you for all your reforms in STEM higher education through the implementation of effective programs that promoted active teaching and learning. I hope you count on our efforts at Hispanic Serving Institutions to continue spreading the audacity of knowledge in our communities.

Greetings,

Lilliam Casillas-Martínez, PhD
Associate Dean of Research Affairs
University of Puerto Rico-Humacao
Humacao, PR 00791
Tel. 787-850-0000 x 9598
lilliam.casillas@upr.edu

WESTMINSTER

1840 South 1300 East
Salt Lake City, Utah 84105
801.484.7651
www.westminstercollege.edu

October 1, 2016

President Barack Obama
The White House
1600 Pennsylvania Avenue, NW
Washington, DC 20500

Dear President Obama:

Westminster College of Salt Lake City is committed to incorporating active learning strategies in our STEM courses. All ten of our Science, Technology and Mathematics programs regularly incorporate student-centered pedagogies to improve students' retention of course materials and students' success in our programs.

At Westminster, all first-year students are required to complete a Learning Community, which is team-taught by two faculty members from different disciplines. Westminster's Learning Communities have been demonstrated to help students adjust to college, which in turn improves student retention. As part of the Association of American Colleges and Universities (AAC&U) Teaching to Increase Diversity and Equity in STEM (TIDES) Initiative, we developed three new Learning Communities:

- Atoms and Apps: The Role of Computers in Science and Medicine
- Understanding You: Unlocking the Mysteries Behind Your Aptitude, Interests, and Attitudes
- Wired or Fired: Understanding the Digital Divide in Society

Instead of lecturing, these five Biology, Chemistry, Computer Science and Sociology faculty members have developed Process Oriented Guided Inquiry Learning (POGIL) activities to help students discover the course content for themselves. POGIL (http://www.pogil.org) is an active-learning pedagogy that focuses on the simultaneous development of knowledge and process skills (such as critical thinking, problem solving, teamwork, and leadership). Students develop these skills by working in the framework of learning teams on specifically designed inquiry-based activities that guide them through the construction of course content.

Thanks to the AAC&U TIDES Institute held every July for the past three years, these Westminster College faculty have recognized that high student engagement depends not only on how they teach (using active learning pedagogies to allow *all* students to participate in class), but also on *what* they teach (using culturally relevant curriculum to help students recognize how course content relates to

their lives). The POGIL activities developed by Westminster faculty have been designed to prompt students to reflect on the relevance of the curriculum to their own lives.

For the past five years, the Westminster Computer Science department has been increasing the active learning and cultural relevance of its courses. The success of its efforts can be seen in the doubling of the percentage of female graduates among Westminster's computing majors (from 14% in 2012-14 to 28% in 2015-17). We will be using our recent five-year, $1.9 million National Science Foundation award (NSF DUE-1626765), to provide support for faculty from other institutions as they adopt our culturally relevant POGIL curriculum in their introductory computer science classes.

Westminster College is working to further our commitment to active learning in all our STEM courses. Thank you for this national call to action to improve STEM teaching.

Sincerely,

Helen H. Hu, Ph.D.
Professor and Co-Chair of Computer Science

And

Dr. Lisa Gentile
Provost and Professor of Chemistry
801-832-2585; lgentile@westminstercollege.edu

WINSTON-SALEM STATE UNIVERSITY

W. B. Atkinson Science Building
Winston-Salem, NC 27110

October 3, 2016

President Barack H. Obama
The White House
1600 Pennsylvania Avenue NW
Washington, DC 20500

Dear President Obama:

In 2011, Winston-Salem State University (WSSU) was afforded the opportunity to participate in the *Preparing Critical Faculty for the Future (PCFF) Initiative* through the Association of American Colleges and Universities (AAC&U). The goals of the PCFF project for our university was to develop and expand our STEM faculty learning communities, create a summer bridge program to improve STEM education, and foster collaborations amongst STEM students and faculty. Previously known as Winston-Salem Teachers College, WSSU is committed to the enhancement of student learning and reforming STEM higher education. The university prides itself on allowing students the opportunity to engage in active and experiential learning. Due to the fact that WSSU is a historically black college and university (HBCU), the majority of the student population is African-American. This is important to improve cultural relevance in STEM, especially as students graduate and help diversify the community of STEM professionals and given the changing demographics in our nation.

WSSU faculty across STEM disciplines have been working together to improve students' critical thinking, problem solving, and cognitive skills. In accordance with the mission of the university and the PCFF project, integrative learning approaches have been implemented in STEM courses. Specifically, within general biology, physics-related concepts were embedded to promote enhanced holistic thinking. Students were actively engaged through reading, writing, discussions, as well as problem solving. This particular course was chosen because many students who learn basic biological concepts have difficulty connecting them to those in other disciplines. In addition, many of the students who take biology aspire to matriculate into professional school and/or join the STEM workforce. It was important to identify physics-related topics that were interconnected with specific topics in the introductory biology course while having a real world connection across disciplines. Importantly, a high percentage of the students must also take physics; however, they often become intimidated by the materials and find it very challenging. Through this pedagogy, we demonstrated that connecting biological and physical concepts should be more of a fluid process instead of viewing each subject individually.

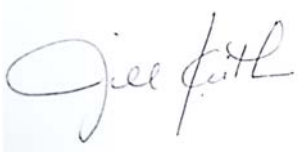
Through our efforts, we also unified and strengthened collaborations amongst faculty on our campus through the development of Faculty STEM Institutes (FSIs) over the course of two years. The first FSI was a half-day "retreat" that included faculty from the departments of Biological Sciences, Chemistry, Computer Science, Education, Mathematics, and Psychology. This institute was a perfect platform for STEM faculty to come together and share best practices for improving retention in our STEM majors. There were discussions on how to promote active learning through critical thinking, aspects of self-efficacy and

how it influences student learning, as well as establishing ways to improve communication amongst faculty members to enhance student learning. At the conclusion of this institute, faculty members agreed that the workshop was useful, timely, and that they would implement some of the ideas discussed. Three additional FSIs followed which included discussions related to "gamifying learning", as well as active and integrative learning. The final institute included faculty, students, alumni, and local K-12 teachers to address effective strategies that will allow us to come together as a community to efficiently educate our youth. From these institutes, numerous professors have modified their pedagogical approaches to include more inquiry-based learning, active learning, integrative learning, problem-based learning, as well as service-based learning to improve STEM education. Notably, PCFF fueled the cycle of sharing best practices being that faculty were funded from this grant to attend regional and national meetings, and return with useful information on STEM learning and retention.

An additional major outcome was developed from a collaborative effort with the director of the Center for Teaching and Learning and the principal investigators of WSSU's PCFF project. We became keenly aware of the need to help students become self-regulators, *i.e.,* be more responsible for their own learning. Through this joint effort, an invited speaker who is an expert in this field, provided workshops to faculty, staff, students, advisors, and tutors to enhance mentoring and metacognition. Nine workshops were given that addressed relevant and effective strategies to improve STEM recruitment and retention on our campus. To date, the majority of the attendees are still utilizing the skills and knowledge gained.

Building our HBCUs is critical to the advancement of diversity within STEM higher education. We extend our sincerest gratitude to you for your leadership, commitment and efforts towards improving STEM education within this great nation. We look forward to playing an active part in the work ahead.

Sincerely,



Tennille D. Presley, Ph.D.
Associate Professor of Physics
presleyt@wssu.edu

Jill J. Keith, Ph.D.
Professor of Biochemistry
harpj@wssu.edu

NORTH CAROLINA
AGRICULTURAL AND TECHNICAL
STATE UNIVERSITY

www.ncat.edu

A LAND-GRANT UNIVERSITY *and* A CONSTITUENT INSTITUTION *of* THE UNIVERSITY *of* NORTH CAROLINA

October 19, 2016

President Barack Obama
The White House
1600 Pennsylvania Avenue NW
Washington, DC 20500

Dear President Obama:

North Carolina Agricultural and Technical State University, the largest Historically Black College and University (HBCU) in the nation, is committed to transformative teaching and learning, aligning with the recommendations of your 2012 President's Council of Advisors on Science and Technology Report. We join with the Association of American Colleges and Universities (AAC&U) in advocating for the development and implementation strategies that will contribute to the goal of producing more than one million science, technology, engineering and mathematics (STEM) graduates over the next decade to maintain the nation's preeminence in science and technology.

The university has a long and distinguished history of incorporating active learning principles, strategies, and pedagogical styles into its STEM education efforts. The university's most recent initiative is the STEM Center of Excellence for Active Learning, established in 2013, with support from the North Carolina GlaxoSmithKline (GSK) Foundation. The overarching goal of the STEM Center is to transform pedagogy and institutional teaching and learning at N.C. A&T to significantly increase the number of high-achieving students who will pursue careers and increase diversity in the STEM workforce. The objectives of the STEM Center are to build a strategic pipeline for high-achieving STEM students; build and implement mathematics and science models for student-centered active learning; and build a community of practice for student-centered learning. Also, the STEM Center embraces the vital role that the humanities play in producing critical thinkers and proficient communicators. The center has partnered with the university's Department of English to enhance reading, writing, and comprehension STEM students.

In order to increase the retention and persistence of STEM majors, faculty in the Departments of Mathematics, Chemistry, Biology, and Physics have adopted active learning teaching methods in redesigning 12 freshman and sophomore courses which include calculus, algebra, general chemistry, physics and biology. The Emporium model for introductory mathematics, which includes self-paced mastery of the content and the SCALE-UP model which integrates a non-standard classroom design with technology-based resources to create a highly interactive learning space. Additionally, faculty in the Department of Biology have instituted case studies, problem-based activities, interactive online learning tools, research on non-cognitive skills, a Biology Outside of the Classroom Project, Process Oriented Guided Inquiry Learning (POGIL)

Office of the Provost and Vice Chancellor for Academic Affairs
Dowdy Administration Building Room 315
1601 East Market Street Greensboro, NC 27411
Office 336-334-7965
Fax 336-334-7136

and multiple discovery-based research courses that include the Howard Hughes Medical Institute (HHMI) Science Education Alliance (SEA) PHAGES project. Last year, over 3,500 students benefitted from these innovative course redesigns.

The STEM Center has catalyzed a transformation in classroom redesign, which has led to the renovation of two existing classroom/laboratory spaces into Mathematics and Science Emporiums and Student-Centered Active Learning Environment with Upside-down Pedagogies (SCALE-UP) laboratories. In addition, N.C. A&T has renovated two traditional classroom spaces to create the mathematics and science teaching facility and a studio-like collaborative SCALE-UP laboratory.

The STEM Center has been instrumental in building a community of practice among STEM faculty. In 2014, the STEM Center hosted its first campus symposium on "Innovations in Active Learning," An outgrowth of discussions at the symposium is the expansion of the SCALE-UP Project from the Department of Mathematics to the Department of Physics. The Emporium-style model for active learning piloted in the Department of Chemistry and funded by the National Science Foundation became the first chemistry emporium model in the United States. Since 2014, STEM Center-affiliated faculty have garnered over $1 million in research awards to create and implement active learning pedagogies for STEM introductory courses in mathematics, chemistry, and physics. In addition to transforming STEM instruction, the university has a robust research experiences for its undergraduate program coordinated jointly by the STEM Center and the Office of Undergraduate Research.

The center also hosts an annual Advancing Mathematics and Science Skills (AMASS) program for high school students, and supports the GSK Scholar's Fund, which has shown great promise in increasing the numbers of high-achieving students interested in pursuing STEM degrees at N.C. A&T. Since 2013, AMASS has hosted over 80 students of whom one-third have matriculated to the university. Eighty-nine percent of those students have entered STEM degree programs. The GSK Scholarship Fund supports STEM undergraduates' persistence and progression through graduation.

The university is delighted to partner with AAC&U in transforming undergraduate STEM education via active STEM teaching and learning. Thank you for your commitment to improving STEM education across the nation.

Sincerely,

Joe B. Whitehead, Jr., Ph.D.
Provost and Vice Chancellor for Academic Affairs

JBW/hrh

xc: Dr. Margaret I. Kanipes, Professor and Director, STEM Center of Excellence for Active Learning