Langston University Contributes to Nation's STEM Workforce and Medical Fields

"Langston's Integrated Network College for STEM (LINC) demonstrated the impact of scholarships and other financial resources in recruiting, training, and producing highly motivated and capable STEM scholars", says Dr. John Coleman, LINC's Director and Chairman of LU's Chemistry and Physical Science Department.

During a period of little more than a decade Langston University created and managed a premiere STEM intensive program, Langston's Integrated Network College (LINC) for STEM. 133 students participated in the program; 123 of these students (92.5%) earned a B.S. in STEM disciplines (biology, chemistry, mathematics, and computer science). 81 of the degree earners (66%) matriculated to an advanced STEM or professional degree program. (The other 42 are in the STEM workforce). Thus far, 50 of the 81 have already earned advanced degrees and another 6 are in at least their 3rd year of medical or graduate school. Over 60% of these are terminal degrees (PhD and medical doctor degrees). Their advanced STEM or professional degrees were earned at major universities that include Vanderbilt, University of Kansas Medical School, Meharry Medical College, University of Texas, Baylor University, University of Oklahoma, Iowa State University, and more. One LINC scholar became a lawyer (JD). Another 6 LU STEM grads are into at least their 3rd year of medical or graduate school.

Tomica Blocker, MD/PhD

LU Grad/LINC Scholar – Biology. 2008. PhD Oklahoma State University 2016. MD – University of Kansas 2017. Currently **Resident Physician at Children's Health.** Dallas, Texas

The LINC program was supported financially by grants from the National Science Foundation: LU added to this support with financial and human resources, as well as with a nurturing environment and high expectations. The phenomenal graduation rate of 92.5% far exceeds the 59% graduation rate for the nation as reported by the National Center for Education Statistics (NCES. 2010).

During LINC, STEM majors increased as follows: Biology majors - 49% (avg. of 85/year to avg. of 127/year) and Chemistry majors experienced a 150% increase, from an average of 10/year to 25/year.

LINC students were exposed to STEM scholars across the nation through their participation in summer research internships at institutions that include Johns Hopkins, University of Texas,

Stanford, Cal Tech, University of California at Berkley, University of Oklahoma, and more. Their research work generated over 300 Abstracts. Their participation in competitive research presentation events throughout the U.S. earned over 50 top awards. Their advanced STEM or professional degrees were earned at major universities that include Vanderbilt, University of Kansas Medical School, Meharry Medical College, University of Texas, Baylor University, University of Oklahoma, Iowa State University, and more.

Several LINC alums returned to LU as faculty and staff, and are actively contributing to the next generation of STEM professionals. Many alums frequently return to LU to encourage current students and serve as role models and mentors.

LINC alums featured in this article are representative of the well over 30 who now how terminal degrees. All of them, as well as the almost two dozen who earned a M.S. degree, have now joined the ranks of STEM or medical professionals throughout the U.S.

Karole Blythe, PhD

LU Grad/LINC Scholar – Biology. 2009. PhD University of Texas at Austin. Currently **Chemist/Program Manager - Bureau of Engraving and Printing. Washington, DC**

About LINC

Langston University's LINC (Langston Integrated Network College for STEM) program in full effect from 2003 through 2014. It was made possible through an HBCU-UP grant from the National Science Foundation. Its specific goals were to increase the number of underserved students who enter college, receive undergraduate and advanced degrees in STEM disciplines, and choose STEM careers.

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The LINC program results exceeded its goals in that it substantively surpassed its target for increasing the number of LU students who selected a STEM major, as well as exceeding goals for the cohort's retention through graduation. The project also contributed substantively to the number of students who matriculated into, and completed, advanced STEM and professional degree programs.

Dr. John Coleman, LINC's Director and Chairman of LU's Chemistry and Physical Science Department, explains it this way: "LINC demonstrated the impact of scholarships and other financial resources in recruiting, training, and producing highly motivated and capable STEM scholars." "However, LU's dedication to grooming its students for excellence was already in place. During my tenure preceding LINC, Langston produced a number of excellent STEM students who earned advanced STEM degrees who are now employed within the STEM industry

and medical professions in Oklahoma and throughout the nation. That trend continued throughout LINC, and continues today. ”

LINC Project Primary Components

> **On Mentoring**. *“LINC’s STEM faculty embraced hands-on nurturing, deemed necessary to retain and influence LINC program participants… When nurtured, [students’] brilliance and capabilities became evident.”*

LINC’s model followed many of the best practices cited by literature; however, numerous innovative and “tried and true” processes were also integrated in order to adapt these practices to the LINC scholar population. The program’s primary components were:

Derek Blythe, PhD

LU Grad/LINC Scholar – Mathematics 2007
PhD – Iowa State University 2014. Currently **Statistician and Data Scientist**, **Intel Corporation**. Chandler, Arizona

Developmental Academic Mentoring for Intentional Outcomes. Mentoring, as traditionally defined, does not adequately describe the support the LINC team provided for program scholars. LINC’s STEM faculty embraced hands-on nurturing, deemed necessary to retain and influence LINC program participants. STEM faculty had to adjust to the reality of who LU students were in general, and LINC scholars in particular, and what influenced their behavior and decisions. Many were first generation college students who don’t get a lot of encouragement from their family and friends to pursue a STEM college or an advanced degree. Reaction from the homefront is generally quite the opposite; they want their children to get a degree and go to work so they can help out financially. LU STEM faculty soon discovered that the role of motivator and source of inspiration and encouragement fell on them if the LU and NSF goals were to be achieved. For instance, LINC students did not easily or quickly comply with application deadlines, or queries into graduate school or research internship opportunities. They were not readily compliant with many other administrative duties that support success. When nurtured, however, their brilliance and capabilities became evident. Although faculty and staff might grumble that assisting these otherwise bright, talented young people should not be necessary, all realized that we were in the process of creating a mindshift – a process that requires patience, perseverance, and dedication. Follow up and follow through were daunting in order to support sustained successes that ultimately created a success culture. Faculty and peer mentoring training handbooks were developed, along with mentor training, to ensure consistency. Student surveys indicated that LINC’s mentoring played a role in their success, and program outcomes were a commentary on its overall success.

Competency Performance Recording for Learning. (CPR-L). Operationalizing LINC'S processes for Intentional Outcomes demanded an innovative solution for improving students' academic prowess, particularly in foundational STEM courses. True academic prowess needed a thorough understanding of a course's foundational concepts. To this end, a member of the LINC team who was already incorporating novel approaches in teaching chemistry developed and incorporated CPR-L.

Phoebe Lewis, PhD

LU Grad/LINC Scholar –- Biology 2012. PhD - Baylor College of Medicine 2018. Currently **Medical Science Liaison, Mayne Pharma**. Houston, Texas.

CPR-L is a teaching and learning methodology enabled by authenticated, broadly accepted learning protocols and 21st century technologies. It is aimed at "resuscitating" student's learning of the analytical process of problem solving, thus enhancing their problem solving skills as well as their understanding of core course concepts. Although it utilizes modern technologies to involve larger groups of students more rapidly than could be possible without technological support, the processes it adheres to have been effective for learning throughout the ages. The CPR-L process, guided by Rubrics, delivers a recording of students' homework that enables the instructor to determine, with great precision, the student's grasp of concepts and ability to use those concepts to solve problems. Its contribution is to strengthen the problem solving techniques of students, and to provide academic enhancement to engage students in more in-depth science curricula, and was instrumental in improving students' grasp and retention of core course concepts and grades.

Steve Harris, PhD

LU Grad/LINC Scholar – Chemistry 2006. PhD – University of Oklahoma 2011.

STEM Digital Village (SDV). SDV was developed as a digital solution that could assist with easing the administrative "information" burden, expand the pool of credible mentors, expand the LINC impact to LU STEM scholars who were not directly involved, and create an exciting, informative, online space that appealed to this generation of students. It made relevant information available to LINC scholars 24/7, and displayed their accomplishments and other successes. It continues through the present. Many of the 123 LINC program alumni, as well as LU STEM graduates who preceded them, are featured at SDV.

Dr. Coleman says that "the most important component of LINC was its construct. LINC integrated LU's network of resources - including smaller dollar amounts from a variety of grants and LU scholarships, student services support, STEM department heads who worked collaboratively to recruit and support brilliant students in their disciplines, and LU management – who ensured that LINC had its total support. That cohesiveness and focused attention had a huge impact."

Why it matters

The NSF grant that supported the creation of LINC was a response to a problem that was recognized at the highest level of the U.S. government. A 2016 Whitehouse Stem-for-all blog entry indicated that there was a projected workforce need of 1 million additional STEM graduates by 2022. To meet this need, and to realize the vision of a highly diverse, creative, and sufficient STEM workforce and a STEM-literate citizenry, it stated that the Nation must engage all students, including minorities and women. Failing to engage underrepresented groups would lead to shortfalls in our Nation's STEM workforce and, more importantly, would prevent the STEM professions from capitalizing on the power of human diversity. In 2012, about 8%–10% freshmen reported that they intended to major in engineering; about 12% in biological and agricultural sciences; 3% in mathematics, statistics, or computer sciences; and 2% in physical science (NCSES). A college attrition rate of 48% in STEM disciplines (NCES) further eroded the number of college graduates in STEM disciplines. African Americans were (and still are) seriously underrepresented in STEM disciplines and in STEM careers. As late as 2016 African-Americans were still not at population parity in STEM areas: they received 7.7% of bachelor's degrees in biological and biomedical sciences, 4.3% in mathematics and 4.9% in physical Science and technologies. Also, in 2016 African Americans lagged behind parity numbers in STEM advanced degrees that would permit them to participate at the highest levels: they received 3.4% of PhD degrees in biological and biomedical sciences, 2.1% in mathematics, and 2% in in physical Science and technologies. Although some progress has been made, there is still much to be done. According to the 2018 NSF Science and Engineering Indicators report, Blacks accounted for 5% of S&E employment, which is lower than their share of the U.S. population age 21 and older (12%).

Kendra Vann, PhD

LU Grad/LINC Scholar - Chemistry 2009. PhD - Vanderbilt University School of Medicine 2016. Currently **Biomedical Researcher- University of Colorado Anschutz**

LU Grad/LINC Scholar – Chemistry 2009. DPT Langston University. 2013. Currently Head Performance Coach, Iowa Wolves (Minnesota Timberwolves G League Affiliate)

Increasing demand for workers with advanced training at the graduate level, an inadequate domestic talent pool, and a small representation of women and minority graduates at all education levels are among some growing concerns over workforce issues that relate to the vitality and competitiveness of the U.S. economy. Improving completion rates for all doctoral students, and particularly for those from underrepresented groups, is vital to meeting our nation's present and future workforce needs. (Council of Graduate Schools Report). A 2019 book, *Minority Serving*

Institutions: America's Underutilized Resource for Strengthening the STEM Workforce, presents a compelling case for utilizing Minority Serving Institutions such as Langston University to meet current and future STEM workforce needs.

Broader Impact

Langston's LINC program results demonstrate that African American STEM college students' retention through graduation can be equal to or better than the nation's norm. Further, its CPR-L teaching and learning process can be adapted for other disciplines.

While other programs have achieved notable success at producing African American STEM graduates who matriculate to advanced and professional degree programs, most if not all have college acceptance criteria that is radically different from that at Langston. LINC's students were drawn directly from its student population, an Open Admissions environment. They were required to have a 3.0 or above GPA, and were primarily attracted to the funding provided by the program. 98% of participants were Black.

Below are photos of additional LINC alums who have earned advanced terminal or professional degrees. Space limitations precluded displaying all of them; however, you can see more at www.stemdigitalvillage.com.

Shabree Nichols. B.S. Biology 2010. OD Northeastern State University. Currently Optometrist at Vision Source, Del City OK

Samuel Henderson. B.S. Chemistry. 2010. MD Meharry Medical College. Currently Resident Physician UAMS Family Medical Center, Little Rock AK

Argenia Doss. B.S. Biology 2005. PhD Univ. of Kansas School of Medicine. Currently Program Dir. The Henry M. Jackson Foundation for the Advance of Military Medicine, Bethesda MD

Courtney Barrett. B.S. Biology 2004. DDS OUHSC School of Dentistry. Currently Dentist, Oklahoma City OK

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