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Creating Pathways to Industry for Pre-College Students and Two-Year Undergraduates

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Abstract

Over the last decade, the emergence of technician education has taken center stage at secondary and post-secondary educational institutions through the proliferation of industry needs and employer partner engagement. Through employer-partner engagement, Southern University at Shreveport, Louisiana (SUSLA), a community college unit within the Southern University and A&M College System, conducted a systematic review, assessment, and revision of its curricula that addressed the needs of industry. SUSLA's comprehensive assessment, guided by employer-partner input, community college and 4-year university collaborations, and published workforce data, identified a pressing need to develop an Engineering Technology program. To that end, SUSLA developed a 2+2+2 Matriculation Model within the Engineering Technology associate of applied science degree program designed as a gateway to enable early education, persistence to post-secondary credentials of value, and high-quality career outcomes. Programs with similar demographics may be able to use this as a model which aims to do four things: **1**) facilitate the early engagement of students decreasing the number of academically underprepared learners entering college, **2**) expand postsecondary educational opportunities to improve outcomes fostering economic opportunity **3**) increase the enrollment, persistence and graduation of early education and underserved populations in STEM and, **4**) facilitate a reduction in time to degree. SUSLA's 2+2+2 Matriculation Model provides high school students with the opportunity to earn dual-enrollment post-secondary credentials through its certificate of technical offerings in Engineering and Engineering Technology. Additionally, the model facilitates an increase in the participation rate of students in STEM and provides more academic opportunities and career exploration through collaborative industry-academic networks. Furthermore, the model produces workforce-ready technicians which accelerates academic and technical skill attainment and, thereby addresses a) the shortage in moderate to middle-skill jobs that require some college, but less than a bachelor's degree; and b) the ongoing need for highly skilled STEM graduates to maintain the nation's competitiveness in productivity and innovation

Introduction

Background

Southern University at Shreveport, Louisiana (SUSLA), a comprehensive two-year community college, and Southern University at Baton Rouge, Louisiana (SUBR), a four-year and graduate University, are two campuses that comprise the Southern University System. The Southern University System is the only Historically Black College & University (HBCU) system in the United States. SUSLA serves rural and urban areas of northwest Louisiana bordered to the west by Texas and to the north by Arkansas. The University seeks to provide a quality education for its students, while being committed to the total community. This institution prepares students for careers in technical and occupational fields, awards certificates and associate degrees, and offers courses and programs that are transferable to other colleges and universities. Enrollment at SUSLA averages about 3,000 students per semester. The institution's student population composition has consistently been 90% minority and more than 70% female. An average of 80% percent of the total student population receives some type of financial assistance to cover educational expenses.

SUSLA provides a direct workforce pipeline to business and industry through its certificate and associate degree programs. These programs provide essential technician education and connect employer needs with program completers. As such, it is imperative that degree offerings remain relevant to industry needs, and that programs produce middle-skilled graduates in their respective fields. SUSLA offers degree and certificate programs that prepare students for entry into the workforce or transfer into baccalaureate programs. SUSLA has programs in pre-engineering, engineering technology, computer science, computer information systems, computer networking, and web development.

According to the National Science Board (2018), nationally, engineering technology occupations are projected to grow 7% from 2016 to 2026, nearly as fast as the average for all occupations. These occupations are expected to add roughly 21,300 new jobs from 324,500 jobs to 345,800 jobs from 2016 to 2026. The annual average pay range for electrical or mechanical engineering technicians in the country is between $41,250 and $64,810, and the highest-paid 10% make $76,660 or more per year. According to Lifecycle (2019), "Engineering Education Now: The Widening Skills Gap" article, job openings in tech and manufacturing continues to grow well into the double-digits, however, 39% of companies feel that graduates are inadequately trained. This is manifested in a widening skills gap. This skills gap is exacerbated not only by the evolving engineering skillset needed for technological product development, but also by the rate of retiring engineering workers. This rate of retirement is expected to leave an estimated 2.4 million positions unfilled between 2018 and 2028.

Additionally, According to the Louisiana Workforce Commission (2023), projections indicate stronger long-term growth in SUSLA’s servicing area of Northwest Louisiana through 2026 (for examples 33% in petroleum and 10% in industrial fields). Rapid market changes require retooling or upskilling; however, training frequently lags behind innovation. A regional company in northern Louisiana has indicated that the state is in desperate need of engineering technicians in the areas of electrical linemen, power distribution and power transmission to mitigate the effects of inclement

weather disrupting services to hundreds of thousands of residents. Consequently, workforce needs are expected to grow rapidly in the petroleum, energy and power distribution sectors shifting employment expectations.

According to the National Center for Science and Engineering Statistics (2019), women constitute 51.5% of the population, yet only represent 46% of the labor force. This data is further disproportionate for women of color who make up 11.5% of the labor force. Men make up 54% of the labor force, yet under-represented men of color make up only 19% of the labor force. This lack of gender diversity among engineering disciplines also crosses racial lines. Compared to private industry, overall, the technology sector employed a greater population of whites (63.5% to 68.5%), Asian Americans (5.8% to 14%) and men (52% to 64%) and a smaller share of African Americans (14.4% to 7.4%), Hispanics (13.9% to 8%) and women (48% to 36%) in relation to their population representativeness.

While STEM bachelor's degrees earned by black college students rose from 2000 to 2016, that group's representativeness declined compared to the overall number of bachelor's degrees earned by black students (12%). Meanwhile, the proportion of STEM degrees awarded to white students grew to 18% in relation to the number of bachelor's degrees earned overall in STEM (18%). Furthermore, from 2017-2019, Associate degrees awarded in STEM disciplines by Black and Hispanic students were the lowest (7%) of all Associate degrees awarded to all ethnicities with the largest proportion of Associate degree being awarded to Asian (13%) students. Surprisingly, nonresident aliens were awarded 13% of STEM degrees followed by White students at 12%.

Motivation for this Work

In summary, there is an overwhelming demand for a technically skilled workforce. Specifically, there is a national need for skilled workers in science, engineering, and technology. Additionally, there exists skill gaps, workforce shortages, and underrepresentation of certain populations in the technology sector.

Moreover, studies have suggested that a lack of active recruitment in middle school and high school, a lack of visible role models and a need for more varied pedagogical approaches all severely impact under-represented populations in a negative way (Grayson, 1980; Karimi, et al., 1999; Shadaram & Sachez-Contreras, 2000). Undergraduate programs that more effectively engage minorities including research, hands-on activities, seminars and peer groups have shown to positively impact recruitment, retention and overall representativeness of these same populations.

Training future workers for highly skilled occupations that are in high demand will require colleges or universities to work with secondary schools, businesses, industry and government to create tailored training and technician education programs. These programs should result in diplomas, degrees, industry-recognized credentials and certificates in addition to providing opportunities for retraining and skill enhancement. Thus, it is imperative for academic institutions (especially minority serving institutions) and industrial partners to develop appropriate strategies to efficiently and effectively accomplish the aforementioned tasks.

SUSLA is equipped to provide the skills and knowledge base required of industry workers as well as expand career technical education offerings to diverse populations. Moreover, because of the connection and infrastructure between SUSLA and SUBR, and because these two universities specialize in educating minority students, these two campuses have partnered to provide students with the training and skill necessary for success in full-time positions with industrial partners.

This paper will provide the methods or strategies that were executed to implement this project, as well as the results that have been obtained throughout this project. This will be followed by a summary and conclusion of this work.

Project Methodology

To create multiple pathways for students to enter the technical workforce with the necessary skills, the following methods were utilized to implement this project.

Create the 2+2+2 Pathway

The first task was to establish and strengthen collaborations with stakeholders to foster the development of workforce-ready engineers and technicians. This involved creating a 2+2+2 pathway in which high students are introduced to STEM fields and receive some formal training. Subsequently, students obtain training and education from SUSLA culminating in a 2-year degree. Finally, if students choose to pursue a 4-year degree, they enroll in SUBR to complete two additional years of training and education. **Figure 1** illustrates the 2+2+2 pathway program. The 2+2+2 pathway decreases the time it takes for students to earn their degree in addition to decreasing cost to degree.

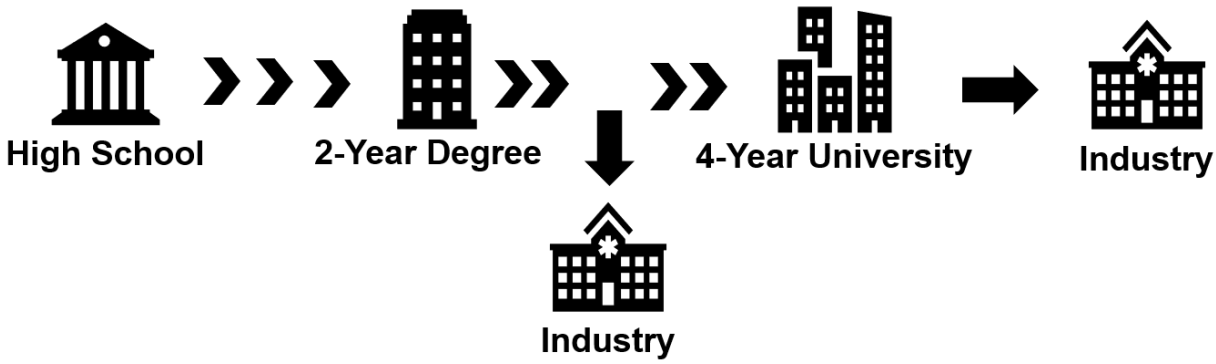

Figure 1. Diagram illustrating the pathways to Industry for Pre-college Students

Implement the 2+2+2 Program

The next task was to Implement the 2+2+2 program. This program was designed to create an academic and career pathway in engineering technology from secondary diploma through associate degree and beyond. Again, Figure 1 shows the progression. The 2+2+2 program offers courses on both SUSLA

and SUBR campuses in order to provide educational opportunities for a larger number of students. This approach also has the benefit of increasing the number of students in the pipeline between SUSLA and SUBR (and thus increasing the number of students that obtain 4-year degrees). Finally, this program provides opportunities for students and industry professionals in the SUSLA and SUBR communities to obtain University-issued and Industry-based certifications utilizing the latest technologies.

Recruit Students for the 2+2+2 Program

The final step was to increase awareness of education and career opportunities through outreach initiatives and recruitment. It is noted that SUSLA and SUBR are HBCUs and therefore they specialize in educating African American who are part of the underserved community in STEM. As part of that effort, SUSLA created the Summer STEM Enrichment Academy (SSEA) for pre-college students in grades 8th through 12th interested in STEM. The 8-week Academy increases STEM career awareness, provides STEM enrichment opportunities, and provides a direct pipeline into the engineering and technology programs at SUSLA. The Academy provides hands-on STEM enrichment activities and teaches skills in the following topics areas: **1**) 3D Printing and software modeling, **2**) Robotics and Mechatronics, **3**) Drone Engineering Technology, and **4**), Electronics and Photovoltaics. In addition, participants receive stipends, training artifacts, FAA Trust Certification and university-issued certificates of completion. Directly connected to SSEA are industry partnerships that provide funding for the STEM topics that are taught to the students at the Academy.

Industry Partnerships Established Through the 2+2+2 Program

A number of key regional and state partners have indicated that, based on their findings, the state of Louisiana is in desperate need of Engineers and Engineering Technicians. This widening employment gap can be attributed to the number of workforce retirements, which has also left a widening skills gap. SUSLA and SUBR has been committed to ensuring that the industry-employer-partner connection facilitates a direct pipeline into well-paying jobs that are representative of the knowledge, skills and abilities learned from both Universities. **Table 1** shows the industry partnerships that are connected to both Universities academic programs.

Entergy	EXXON	CTECH
CenterPoint Energy	Chevron	Future Use of Energy in LA
American Electric Power (AEP)	BP	SciPort
SWEPCO	Cleco	StarBase

Table 1: Industrial Partner Information Table

Outcomes and Results

Enrollment and Retention

As a plan for increased enrollment and completion rates in SUSLA's Department of Engineering & Technology, the Department has reimagined student enrollment in its engineering and technology programs to support the student lifecycle, from high school to enrollment to graduation. This has been accomplished through significant increases in high school dual-enrollment course offerings. The Department offers the state's first-ever Dual-Enrollment certificate of technical studies in Engineering. Course offerings in the certificate include: Calculus, Circuit Analysis, Statics and Dynamics, Technical Communication, Engineering Graphics and Digital Logic Design. Additionally, the Department provides student mentoring, guided research and a sustained scholarship campaign which awards more than 25 scholarships each year through the Louisiana Alliance for Minority Participation (LAMP) program. This active approach to monitoring, integration and removal of financial barriers has proven to increase student enrollment significantly. **Table 2** below shows significant increases in student enrollment between Fall 2021 and Spring 2025. Additionally, **Table 2** shows the percentage of dual-enrollment students enrolled and taking courses in either the Engineering or Engineering Technology degree programs.

Year	Semester	Enrollment #	% Dual-Enrollment	# Transfer to 4-Year
2021	Fall	8	0%	0
2022	Spring	4	0%	0
2022	Fall	24	8%	0
2023	Spring	17	11%	2
2023	Fall	62	27%	2
2024	Spring	102	28%	5
2024	Fall	145	30%	10
2025	Spring	130	44%	15+ (**expected**)

Table 2: Student Enrollment

Through the sustained recruitment efforts of the 2+2+2 program, SUSLA's Department of Engineering & Technology as well as SUBR's College of Engineering has experienced increased enrollment in their engineering and technology programs. Subsequent transfer from SUSLA to SUBR has increased concurrently with increased enrollment into SUBR's engineering programs. In Fall 2024, ten (**10**) students transferred to SUBR's College of Science and Engineering with more than fifteen (**15+**) students expected to graduate and transfer at the end of the Spring 2025 semester. Most transfer students pursue research while engaging in their undergraduate studies.

Summary and Conclusions

In summary, this paper described the design, development and implementation of a 2+2+2 pathway to industry for pre-college students and two-year undergraduates. This paper also described the sustained recruitment, enrollment and retention efforts of Southern University at Shreveport and Southern University at Baton Rouge efforts at the department, college, University and System levels. Additionally, this paper described how the 2+2+2 program successfully integrated academic success and financial success by removing financial barriers to course progression. The overall program provides scholarship opportunities to students through the various grants that SUSLA's Department of Engineering & Technology maintains while providing research and internship opportunities to students through the various industry and educational partnerships. Moreover, the 2+2+2 program provides mentoring and guided research opportunities to students through the LAMP program which pairs student cohorts with STEM faculty members to support the student lifecycle through degree completion.

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