# Designing STEM Curriculum for K12 Students

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Abstract

United States is facing tremendous shortage of Science, Technology, Engineering, and Mathematics (STEM) graduates. This shortage is poised to hurt the future workforce and hence economic growth of this country. One of the STEM discipline is logistics transportation which is a growing area that lacks adequate workforce. Our nation's economic strength and competitiveness depends on a safe, efficient, sustainable and secure logistics transportation system. Each day the nation's commercial carriers deliver 30 million tons of freight using one or more modes of transportation. Each mode is a network of infrastructure that is leveraged to provide the goods we expect to find in our everyday lives – whether it is clothing at our favorite retail store or home heating oil. In addition to serving the population and economy by moving goods and people, logistics transportation adds to the national economy by providing jobs for millions of people. This is one of the fastest growing professions in the US and lacks trained professionals in this field[1]. The need for this profession is even severe in the state of Mississippi. Mississippi Gulf Coast industries have been experiencing significant growth in logistics transportation. The ports of Gulfport and Pascagoula are expecting a threefold increase in operations and freight movement (from 230,000 in 2012 TEUs to 750,000 TEUs by 2025) due to the expansion of the Panama Canal and the strategic location of these ports[2]. This growth will require an improved logistics transportation network in the region and will significantly increase demand for workers trained in logistics technology. Without an increase supply of professionals in this discipline, the US companies will face labor shortages and future regional economic development will be hampered.

Logistics Transportation is a multidisciplinary applied science and engineering program. High school students are not familiar about this promising filed. Without creating an awareness program in the K12 system, a consistent supply of students in logistics transportation program in universities will not be realized. Due to the tremendous need of this profession, we have designed a secondary curriculum in logistics transportation for high school students with the help of public and private funding. The curriculum design consists of six modules of lectures, hands on projects, and educating the K12 educators. The lecture modules and hands on projects are designed to provide fundamental understanding of basic concepts in logistics transportation and relating classroom theories with real time examples. Educating the K12 educators program was designed to educate them with career opportunities, future perspectives of logistics transportation professionals, and resource availability. This paper will discuss the need of STEM education in logistics transportation, sample curriculum design, implementation issues, and lessons learned regarding the project.

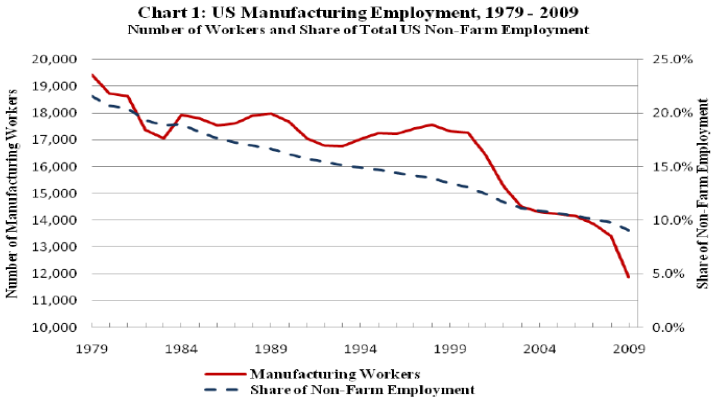
## Introduction

Logistics transportation has become one of the last frontiers that still remain to be conquered by most businesses in the twenty first century. Yet this cannot be done unless *all logistics professionals*, irrespective of their functional orientation and current job responsibilities, fundamentally understand the dynamics of their logistics operations. United States (US) has been dominating in manufacturing until early 1980s, but started declining steadily since then. Due to the mass outsourcing of US products and services to overseas countries, US has lost and still losing millions of manufacturing jobs to overseas countries specially to China and India. Very recently, US manufacturers started to realize the cost of poor quality, rising labor costs, huge logistics costs, and other negative impacts of offshored products and started thinking about reshoring[3]. Many US companies went for offshoring without a thorough analysis and realized the bitter consequences. Same way, it will not be a prudent strategy for companies to start reshoring without a clear understanding of its dynamics. Unfortunately, the US is facing two major issues within the logistics profession. The outsourcing operations are still done in way that incurs negative consequences for the company as well as for the US due to the lack of knowledgebase in this area. The second issue is that the number of graduates in this field is not meeting the current industry demand. To create knowledgeable and adequate graduates in Logistics area, it is necessary to involve K-12 stakeholders in the education process.

The educational objective of this initiative was to implement an integrated, hands-on education platform that promotes logistics profession from K–12. "Train-to-train" and "active engagement" themes underpin each of the proposed efforts towards this objective. First, a significant outreach program comprising a teacher training and immersion program aims to train High School (HS) teachers in effective inquiry-based teaching methods using logistics-themed hands-on science kits. Second, a high school summer research experience program aims to provide HS students with on-the-job training in an academic logistics research environment. Third, an undergraduate engagement program aims to attract and specifically *retain* logistics majors over the freshmen/sophomore years using a series of retention programs. The ultimate outcome of this K–12 platform is to provide a large socio-economic impact by encouraging a diverse population of young students to pursue careers in scientific disciplines.

## Need of logistics profession in the US

As mentioned earlier that US domination in manufacturing in the 1980s are declining steadily since then due to the mass outsourcing of US products and services to overseas countries (see chart 1). On the other hand the logistics transportation sector is booming in the US (see table 1)[4]. Even though mass outsourcing is blamed for manufacturing job losses, it also helps companies achieve an end

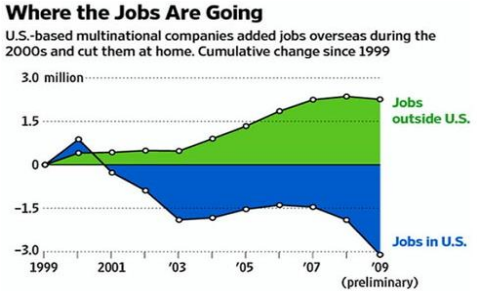


product or service by providing an input that is outside the company's present capabilities and they help the company meet a schedule constraint if manufacturing the good is outside the schedule plan. There are also challenges and shortfalls with outsourcing. First there are always the cultural differences when outsourcing the work to overseas companies. This includes communication issues that stem from differences in language and just simply the processes for accomplishing the same task. Job loss in the U.S. is another side effect to outsourcing. Some experts argue that outsourcing takes up the lower-level jobs and that allows Americans do perform the higher value jobs. But what that argument does not address is the impact it has on the Americans that lose the lower-level jobs or the rising unemployment rate in the U.S. Many workers that are laid off do not immediately find new employment and if they are unemployed for a lengthy time, they may lose their homes and other property they once owned. This can, of course, affect the American economy in a negative way.

Table 1: Employment by Major Industry Sector[4]

| Employment by major industry sector | Thousands of jobs | | | Change | | Percent distribution | | | Annual rate of change | |
|---|---|---|---|---|---|---|---|---|---|---|
| Industry sector | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000 | 2010 | 2020 | 2000-10 | 2010-20 |
| Total[1] | 146,236.0 | 143,068.2 | 163,537.1 | -3167.8 | 20,468.9 | 100.0 | 100.0 | 100.0 | -0.2 | 1.3 |
| Nonagriculture wage and salary[2] | 132,425.0 | 130,435.6 | 150,176.8 | -1,989.4 | 19,741.2 | 90.6 | 91.2 | 91.8 | -0.2 | 1.4 |
| Goods-producing, excluding agriculture | 24,569.7 | 17,705.5 | 19,496.8 | -6,864.2 | 1,791.3 | 16.8 | 12.4 | 11.9 | -3.2 | 1.0 |
| Mining | 520.4 | 655.9 | 680.7 | 135.5 | 24.8 | 0.4 | 0.5 | 0.4 | 2.3 | 0.4 |
| Construction | 6,786.4 | 5,525.6 | 7,365.1 | -1,260.8 | 1,839.5 | 4.6 | 3.9 | 4.5 | -2.0 | 2.9 |
| Manufacturing | 17,262.9 | 11,524.0 | 11,450.9 | -5,738.9 | -73.1 | 11.8 | 8.1 | 7.0 | -4.0 | -0.1 |
| Services-providing | 107,855.3 | 112,730.1 | 130,680.1 | 4,874.8 | 17,950.0 | 73.8 | 78.8 | 79.9 | 0.4 | 1.5 |
| Utilities | 601.3 | 551.8 | 516.1 | -49.5 | -35.7 | 0.4 | 0.4 | 0.3 | -0.9 | -0.7 |
| Wholesale trade | 5,933.5 | 5,456.1 | 6,200.2 | -477.4 | 744.1 | 4.1 | 3.8 | 3.8 | -0.8 | 1.3 |
| Retail trade | 15,279.8 | 14,413.7 | 16,182.2 | -866.1 | 1,768.5 | 10.4 | 10.1 | 9.9 | -0.6 | 1.2 |
| Transportation and warehousing | 4,410.3 | 4,183.3 | 5,036.2 | -227.0 | 852.9 | 3.0 | 2.9 | 3.1 | -0.5 | 1.9 |
| Information | 3,630.6 | 2,710.9 | 2,851.2 | -919.7 | 140.3 | 2.5 | 1.9 | 1.7 | -2.9 | 0.5 |
| Financial activities | 7,687.5 | 7,630.2 | 8,410.6 | -57.3 | 780.4 | 5.3 | 5.3 | 5.1 | -0.1 | 1.0 |
| Professional and business services | 16,666.1 | 16,688.0 | 20,497.0 | 21.9 | 3,809.0 | 11.4 | 11.7 | 12.5 | 0.0 | 2.1 |
| Educational services | 2,390.6 | 3,149.6 | 3,968.8 | 759.0 | 819.2 | 1.6 | 2.2 | 2.4 | 2.8 | 2.3 |
| Health care and social assistance | 12,718.3 | 16,414.5 | 22,053.9 | 3,696.2 | 5,639.4 | 8.7 | 11.5 | 13.5 | 2.6 | 3.0 |
| Leisure and hospitality | 11,861.6 | 13,019.6 | 14,362.3 | 1,158.0 | 1,342.7 | 8.1 | 9.1 | 8.8 | 0.9 | 1.0 |
| Other services | 5,885.7 | 6,031.3 | 6,850.7 | 145.6 | 819.4 | 4.0 | 4.2 | 4.2 | 0.2 | 1.3 |
| Federal government | 2,865.0 | 2,968.0 | 2,596.0 | 103.0 | -372.0 | 2.0 | 2.1 | 1.6 | 0.4 | -1.3 |
| State and local government | 17,925.0 | 19,513.1 | 21,154.8 | 1,588.1 | 1,641.7 | 12.3 | 13.6 | 12.9 | 0.9 | 0.8 |
| Agriculture, forestry, fishing, and hunting[3] | 2,396.2 | 2,135.5 | 2,005.3 | -260.7 | -130.2 | 1.6 | 1.5 | 1.2 | -1.1 | -0.6 |
| Agriculture wage and salary | 1,354.0 | 1,282.1 | 1,236.1 | -71.9 | -46.0 | 0.9 | 0.9 | 0.8 | -0.5 | -0.4 |
| Agriculture self-employed and unpaid family workers | 1,042.2 | 853.4 | 769.3 | -188.8 | -84.1 | 0.7 | 0.6 | 0.5 | -2.0 | -1.0 |
| Nonagriculture self-employed and unpaid family worker | 9,313.7 | 8,943.8 | 9,720.6 | -369.9 | 776.8 | 6.4 | 6.3 | 5.9 | -0.4 | 0.8 |
| Secondary wage and salary jobs in agriculture and private household industries[4,5] | 141.7 | 111.6 | 112.7 | -30.1 | 1.1 | 0.1 | 0.1 | 0.1 | -2.4 | 0.1 |
| Secondary jobs as a self-employed or unpaid family worker[4,6] | 1,959.4 | 1,441.7 | 1,521.7 | -517.7 | 80.0 | 1.3 | 1.0 | 0.9 | -3.0 | 0.5 |

With a focus on the United States, the majority of companies that chose to leave the country relocated to Asian countries. Principal among these are China and India. The table 2 below illustrates the fact that these two countries have captured the majority of the outsourcing market, but the percentage of the market that they claim is



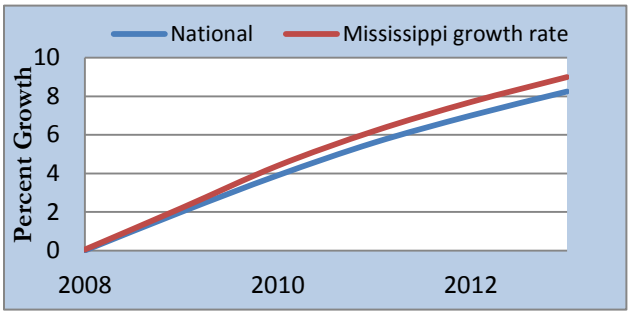
shrinking. These countries were chosen due to their perceived extreme cost advantage with an emphasis in the area of low cost labor. It is possible that the perceived cost advantage of locating outside of the United States does not truly exist and can be dispelled by exposing hidden costs that are associated with location outside of the United States.

The emerging outsource market trends may provide evidence of this. In 2008, India played host to 60% of companies who outsource; in 2011 India claimed slightly less than half of that amount with 29%. In the same time period, China lost nearly 10% of the companies who chose to outsource within it, and Southeast Asia dropped from 50% to 24%. While Asia is losing favor as an outsourcing destination, the United States has entered the ranks. In 2008, the United States did not rank as an outsourcing destination; but, in 2011, the United States hosted 6% of outsourcing companies. In addition to the United States, Western Europe is showing a positive change, and Canada has remained relatively constant[4].

| Table 2: Current Outsourcing Destinations | **2011** | **2010** | **2009** | **2008** |
|---|---|---|---|---|
| Canada | 9% | 11% | 4% | 17% |
| China | 35% | 44% | 19% | 46% |
| Eastern Europe | 9% | 17% | 12% | 19% |
| India | 29% | 36% | 50% | 60% |
| Latin America | 9% | 22% | 8% | 19% |
| Southeast Asia | 24% | 36% | 31% | 50% |
| United States | 6% | 11% | 8% | N/A |
| Western Europe | 24% | 22% | 19% | 21% |

Need of logistics profession in Mississippi

The Mississippi Gulf Coast industry sector has been experiencing tremendous growth in the area of logistics transportation. The Mississippi Department of Workforce Development projects faster-than-average job growth for the state's core STEM occupational groups (www.economicmodeling.com). In fall 2008, Economic Modeling Specialists Inc. (EMSI) provided a report focusing on the top ten growing industries in Mississippi. STEM and STEM related services scored the highest. There has been a strong interest by Mississippi's public and private sector officials in expanding the state's share of regional, national and international trade. The University of Southern Mississippi Gulf Coast is poised to coordinate and implement a regional STEM consortium to meet this growing need focused on the rebirth and reconstruction of the region. According to the U.S. Department of Education (www.economicmodeling.com/data), recent graduates from the STEM academic programs are too few to meet the demand of the regional job outlook. This situation is more pronounced in the Gulf Coast region where growth projection exceeds the rest of the country. To help address this shortage, our university partnered with the local high schools.



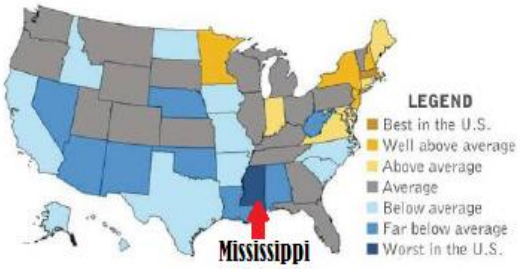

According to a study conducted by the Gulf Coast Business Council Research Foundation (Mississippi Gulf Coast 3.0, 2008), Mississippi Gulf coast region has added about 5000 logistics related jobs since Hurricane Katrina in 2005. However, Mississippi Universities and the local community colleges could not produce enough logistics graduates during the same period. This

deficit and future trend will sustain the growth of logistics jobs in the region for decades to come. Without a sustainable supply of graduates in these disciplines, the local companies will face labor shortages and regional economic development will be hampered in the future.

Table 3: Average Annual Openings - Information by Occupation

| | Focus Occupation | 2008-13 Average Annual Openings | | | | | |
|---|---|---|---|---|---|---|---|
| | | TX | LA | MS | | FL | Gulf Coast States |
| Occupation Title | Construction/Civil engineers | 1,423 | 123 | 91 | 182 | 881 | 2,691 |
| | Transportation and material- moving machine and vehicle operators | 643 | 93 | 82 | 172 | 438 | 1,436 |
| | Construction/Civil engineering technician | 554 | 47 | 33 | 86 | 211 | 904 |
| | Logisticians | 456 | 29 | 18 | 58 | 194 | 709 |
| | Environmental engineers | 218 | 20 | 17 | 42 | 138 | 501 |
| | Transportation workers, Industrial | 181 | 11 | 8 | 35 | 121 | 345 |
| | Transportation inspectors | 146 | 11 | 7 | 18 | 45 | 232 |
| | Environmental engineering technicians | 109 | 5 | 3 | 18 | 39 | 191 |
| | $TOTAL_1 (T_1)$ | 3,731 | 339 | **259** | 612 | 2,067 | 7,008 |
| Degrees awarded | Award < 2 years | 143 | 0 | - | 11 | 60 | 214 |
| | Associate's | 81 | 8 | 19 | *1040* | 342 | 1490 |
| | Bachelor's | 1100 | 222 | 96 | 279 | 977 | 2674 |
| | Master's | 421 | 26 | 10 | 60 | 376 | 893 |
| | Doctor's | 84 | 16 | - | 8 | 61 | 169 |
| | $TOTAL_2 (T_2)$ | 1829 | 272 | **125** | 1398 | 1816 | 5440 |
| | % Shortages (by $T_1$ and $T_2$) | 50.98 | 19.76 | **51.74** | -56.22 | 12.14 | 22.37 |

*Source: Department of Education, for Education*
*Statistics: Integrated Postsecondary Education Data System (IPEDS)*




No other states in the US have the same level of desperate need as Mississippi to increase its STEM degrees. A September 2011report published in Industrial Engineer Magazine reveals that Mississippi ranked the lowest in preparing STEM students as shown in the figure (right)[6]. Mississippi has the highest African American population (38%) of states in the US (U.S. Census Bureau) yet only 19% of our university's logistics students are minority students. Female students are also disproportionately low (14%). We launched an education project to increase our BS students in the logistics program. This project was implemented in 2010 to increase the total enrollment to nearly 1.5 times within four years and target women and African-American students. This project nearly doubled the number of yearly graduates from 15 to 25 students at the end of three-year period. Detailed yearly target of enrollment and graduation is shown in table 4.

| Table 4 | Enrollment in our Logistics | | | | | Number of Graduates | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Current | 2010 | 2011 | 2012 | 2013 | Current | 2010 | 2011 | 2012 | 2013 |
| Total | 91 | 102 | 117 | 125 | 134 | 15 | 18 | 22 | 25 | 27 |
| Women | 13 | 16 | 20 | 22 | 26 | | | | | |
| African American | 18 | 24 | 32 | 36 | 40 | | | | | |

Integrated education initiatives for K-12

If it is true that virtually every major issue facing global society today has science and technology at its core, then it is vital that we – as professors, K-12 teachers, and parents – engage young generations of students in scientific conversations and curricula at every step in the education process. To this end, the education initiatives of our project describe a knowledge-driven education platform that promotes logistics from K – 12 and aims to increase participation of underrepresented minorities.

The project's educational overarching objective was to increase the number of Mississippi Logistics Transportation graduates to meet the growing regional industrial need. To achieve this aim we targeted K-12 stakeholders by focusing on the following phases: (1) K-12 students' awareness initiatives (2) recruit and retain K-12 students in the logistics transportation program, and (3) Educating the Educators. Within each phase, we had several research goals and objectives summarized in the table 5 below.

| Table 5<br>**Research Questions** | **Supports & Mechanisms** | **Measurements & Assessments** |
|---|---|---|
| **Phase # 1 – K-12 students' awareness initiatives** | | |
| a. Through what media do potential students respond to programs and career possibilities?<br>b. Which incentives and recruitment methods are the most effective for Logistics programs?<br>c. Which methods do minorities and women report are the most enticing? | 1. Improve program awareness in HS through Let Them Know and institutional visits<br>2. Increase transfers from HS through CRM database<br>3. Increase women and minority students through program awareness<br>4. Provide early undergraduate research programs for HS students<br>5. Identify potential students through outreach programs such as industry visits, job fairs, etc. | • Student Database<br>- ACT and SAT scores<br>- Previous GPA<br>- Track student enrollment<br>- Enrollment departments contact students<br>• Survey HS students<br>- Early undergraduate research experience<br>- Desire for BS degree<br>- Role of financial support |
| **Phase # 2 – Recruit & Retain K-12 students in Logistics program** | | |
| a. In what way does professional mentoring and enhanced advising benefit Logistics students?<br>b. How and in what ways are students using the university centers and other provided resources?<br>c. In what way does the internship experience direct the student to a career path and does this differ | 1. Support academically week students<br>- Extra time with teachers<br>- Help with project ideas<br>2. Mentoring by professionals in the field<br>- Students matched to mentor<br>3. Motivate students through close academic advising<br>4. Monthly guest speaker series | • Survey students<br>- Relationship with mentors<br>- Extra help<br>• Internship<br>- Performance evaluation from supervisor.<br>- Required student report<br>• Log of time spent in Center<br>• Interview students individually to discuss program specifics<br>• Assemble course evaluations, |

| | | |
|---|---|---|
| for women and minorities?<br>d. How do our support mechanisms help weak students stay on track academically?<br>e. How are students motivated to complete the Logistics degree requirements in a timely fashion? | | student comments and feedback about delivery method. |
| **Phase #3 – Educating the educators** | | |
| a. In what ways should communication be facilitated between K-12 and university to best support curricular improvements?<br>b. Which mechanisms best facilitate student transfer from HS to university?<br>c. How can HS teacher be encouraged to assist in the recruitment efforts into logistics programs? | 1. Provide HS teachers 3-day training on to develop sample K-12 curriculum in logistics<br>2. Support K-12 educators with course content and project ideas<br>3. University – High School partnership program | • Personal communication with K-12 partners<br>• Survey HS teacher<br>- university support, materials<br>- Recruitment materials<br>- Suggestion for recruitment<br>• Evaluation of 3-Day Logistics training and immersion Exit surveys for HS Students<br>- University Survey<br>- Logistics Open Ended |

Recruitment, Retention, and K-12 Students' Awareness Initiatives

K-12 students are mostly driven by their peers and teachers. If these students and their teachers are not aware of a particular STEM fields such as logistics, it is very unlikely that will pursue that career. We have come up with several awareness programs for the K-12 students. Our ***Let 'em Know*** program, (which is similar to the Catch the Dream program implemented at Lake Michigan College)[7,8] focuses on disseminating logistics education and its potential among targeted high schools. *Let 'em Know* program provides K-12 students with logistics degree guidance regardless of institutional enrollment. The focus is to improve communication between MS gulf coast HSs and Universities. Information, in various formats, was sent to K-12 students at all participating HSs. Logistics program information included program offerings, course information, career prospects, articulation catalogs, scholarship information, resource loan details, early undergraduate enrichment opportunities, recruitment schedule, retention activities, facilities and location information, dates of key events, and any other relevant information.

Another program called "inter-institutional visits" was designed to motivate K-12 students during their final year at the participating HSs. Each fall university faculty members visited all participating HS campuses. Providing university faculty as guest speakers has proven an effective tool for student motivation. Faculty members talk about logistics career prospects, research opportunities and degree programs. Faculty members and recruitment staffs also visited HS career fairs and interacted with these young and non-traditional students to attract them in to STEM disciplines.

To provide a lasting impression on the minds of K-12 students, at the start of each fall semester, potential students from local HSs were invited to spend a FOCUS day at the university. A presentation covered our logistics programs, explained potential careers, and emphasized the

importance of immediate job placement and potential opportunities in coastal Mississippi, in the state and in the nation[9,10]. Students were provided a hands-on activity that gave them a taste of university's ongoing research projects and a tour of the logistics center and labs. Each summer we offered a week-long Summer Academy Program. This program targeted primarily senior HS students. Students engaged in daily logistics exercises and week-long projects with faculty and current university students, by getting involved in real world logistics projects. This week-long program allowed students to meet and interact with university faculty, current logistics students, and get familiarized with the university experience. The overall goal was to build students' interest and confidence in their ability to pursue STEM programs, to ensure success in entry level courses, and to create relationships that can lead to an early undergraduate research experience.

Educating the Educators

As mentioned earlier that K-12 students can be motivated by their teachers. These teachers need to be involved with the future workforce development process. We have developed a training program for K-12 teachers to help them with developing a STEM curriculum in logistics that is suitable for K-12 students. In part of that three day training program, we trained 75 HS faculty members over the course of three years period. The goals of this training are to: (1) increase awareness and understanding of the logistics program at our university through tours of the facilities, study center, and curricular information, (2) inform them of future job potential through industrial speakers, representatives, and salary data, (3) develop their content knowledge about current logistics projects by working through hands-on projects in groups, (4) provide classroom materials and activities the HS educators can use in their STEM content courses (e.g. logistics), and (5) increase their awareness of the professional opportunities in the coastal region with a variety of site visits (e.g. Huntington Ingalls Industries, Port of Gulfport). A sample K-12 curriculum in logistics is summarized in Table 6.

| Table 6: Modules | Objectives |
|---|---|
| Module 1: Fundamentals of Intermodal Transportation | • Understand the impact of intermodal transportation in national economy<br>• Understand the concept of intermodalism<br>• Learn how to select the best mode/s of transportation |
| Module 2: Panel Discussion | • Understand current state of art practice in the US |
| Module 3: Building Competitive Operations, Planning, and Logistics | • Understand natural dynamics within the supply chain to optimize performance and profitability<br>• Evaluate the process constraints and choices within global logistics to establish a plan linked to overall strategy<br>• Apply technology to enhance performance of distribution, reverse logistics, and global supply chain communications |
| Module 4: Managing Customer and Supplier Relationships | • Effectively use customer data to improve service performance and increase value to suppliers and customers<br>• Understand the strategic importance of purchasing and supplier relationships |
| Module 5: Panel Discussion | • Understand the importance of logistics & transportation education specially for high school students |
| Module 6: Preparing a | • National trend and career prospect of these professionals |

| | |
|---|---|
| generation of experts in this domain | • Understand the role of educators to prepare a generation of these professionals<br>• Get familiar with the educational and training resources available in this discipline |

Program Evaluation and lessons learned

We have evaluated our program activities at the end of each design period and found very effective for promoting and recruiting HS students in our logistics program. Inter-institutional visits and early research experience had the most positive impact on awareness of K-12 students. Educating the educators was very successful in buy in K-12 teachers to promote logistics in the HSs. These educators were very helpful to craft a curriculum that is suitable for K-12 students. They developed some hands-on project for their students that are very creative and engage students in the learning process. We have evaluated the effectiveness of the educating the educators program using the following survey questionnaire.

Name: _____School: _____
Address: _____
Telephone: _____ Email:_____ Are you interested in CEU credit? □ yes □ no

What courses do you teach? _____
What grade(s) do you currently teach? _____

Please respond to the following statements: 5 = strongly agree; 4 = agree; 3 = neutral/undecided; 2 = disagree; 1 = strongly disagree

1. The goals and objectives of the Training were clear.
   5 4 3 2 1
2. The concepts, activities and materials met the goals and objectives of the training.
   5 4 3 2 1
3. The presentations were clear and well organized.
   5 4 3 2 1
4. The lesson plan demonstrations were clear and well organized. .
   5 4 3 2 1
5. This training provided me with ideas and materials that I will use in my classroom.
   5 4 3 2 1
6. This training was beneficial to my professional development.
   5 4 3 2 1
7. I would be interested in attending another training session on related discipline.
   5 4 3 2 1
8. Logistics education should play a significant role in the public school curriculum of Mississippi.
   5 4 3 2 1

What did you do to be successfully prepared for today's class?

Please provide any recommendations on how the workshop could be improved:

We found our program easily implementable in other states and in any STEM discipline. The key to the success is the buy in of K-12 teaches in the awareness and recruitment programs. Following table summarizes the impact of our project.

| Table 7: Benchmarking impact throughout the project | |
|---|---|
| Regional Recruitment | 1000 potential logistics students at HSs |
| University Enrollment | 156 new logistics students |
| Training & logistics Immersion | 12 ET faculty members for academic advising<br>75 STEM educators from 8 participating HS campuses |
| Engagement | 56 existing ET students in various retention programs |
| Project Employment | One graduate and one undergraduate assistant |
| Effect | An additional 45 ET graduates per year |

## Conclusion

For K-12 students, we propose activities geared to attract new entrants into logistics transportation that contributes to our nation's economy. We piloted several new and innovative activity models at schools for K-12 students and teachers that utilized the expertise and effectiveness of university faculty members presenting transportation-related contents and hands-on activities for the younger students. Many of these activities are found effective and implementable at other institutions and other STEM disciplines.

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