Building an Academic Pathway for Industrial Engineering Operations Technicians

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Executive Summary

Columbus State Community College (CSCC), with funding from the National Science Foundation (NSF), is creating the Logistics Engineering Technician (LET) Pathway[1]. By developing career pathways for LET technicians, and meeting the industry need for this skilled workforce, this project aims to: 1) establish an academic model for STEM-intensive programs that can be used to support a variety of technical occupations and sectors, 2) provide access to careers that offer significant earnings potential in the central Ohio area and provide flexible skill sets to meet the needs of many industries, and 3) increase diversity in the workforce through intensified outreach to underserved populations such as women, minorities, and veterans.

During Year 2, the project team implemented project aspects as outlined in the proposal. The project is in the process of seeking approval for the LET curriculum that was developed during Year 1. The approval process is taking longer than anticipated because of an unexpected requirement to gain approval from two entities that were not originally identified. Final approval is expected for the program in Fall 2016 and will be implemented in Spring 2017. Additionally, during Year 2 the project team hosted a pre-college initiative in the form of a two-day summer camp experience. Unlike the summer camp experience sponsored during Year 1, the event this year was solely focused on LET. A benefit of this change was that students who had a particular interest in LET were recruited to participate. Another benefit of CSCC hosting the summer camp experience was that participants were from the project's target audience of high school students and more females participated.

Also in Year 2, the project team engaged in outreach activities to industry and community partners. These efforts appeared to have increased the breadth and depth of partnerships. Indeed, an industry relationship score was calculated which indicated an increase in partnerships from Year 1 to Year 2. Other activities during Year 2 included faculty development and hosting the first annual summit on Logistics and Automation.

The report concludes with recommendations as the project enters its third year of funding.

[1] The official title of the grant is Industrial Engineering Operations Technicians. Best on industry feedback, the pathway is more appropriately describes as Logistics Engineering Technology technicians pathway.

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Background

Logistics operation is a key industrial sector in the central Ohio region, as such, it is critical to the growth of the region. The continued economic stability of the region depends on attracting and retaining a competent technical workforce. As the need for a workforce with increasingly sophisticated technological skills increases, there is need for a curriculum that provides individuals with foundational STEM knowledge as well as integrated technical skills in industrial engineering, information technology, and operations.

To help meet this need, Columbus State Community College (CSCC) received funding from the National Science Foundation (NSF) in 2014 to develop an academic pathway for Industrial Engineering Operations Technicians. Based on feedback from industry, this academic pathway has been distilled to specifically develop a Logistics Engineering Technicians (LET) academic pathway.

CSCC is collaborating with Eastland-Fairfield Career Center, Franklin University, the Columbus Region Logistics Council, and several other industry partners in this endeavor. The project is developing a multi-disciplinary 2+2+2 career pathway in LET. It also includes a pre-college education initiative to increase the visibility and desirability of a career in LET for high school students. Finally, the curriculum design intends to optimize emerging techniques and technologies in distance education to prepare a technical workforce appropriately educated to support the increasingly complex supply chain operations infrastructure.

By developing career pathways for LET, and meeting industry need for this skilled workforce, this project has the following four (4) goals[2]:

- Plan, schedule, and organize and all-day Industry Job Skills Analysis using Compression Planning session focusing on the logistics engineering technician occupation to identify the top knowledge, skills, and abilities of logistics engineering technicians as well as the specialized tools required and the desired certifications of new hires;[3]
- To develop a Logistics Engineering Technology associate's degree and certificate curriculum that is aligned with industry through guidance of an established Industry Advisory Committee;
- To launch a Logistics Engineering Technology Pre-College Initiative to increase the number of students matriculating from high school by educating students, faculty and advisors on career opportunities in the central Ohio region; and
- To establish a Logistics Engineering Technology career education 2+2+2 pathway from high school to community college and then to university level baccalaureate programs.

The purpose of the current document is to provide formative and evaluative evaluation results through Year 2.

Purpose and Design of the Evaluation

[2] Two (2) of the original goals are omitted because they have not been addressed as of yet, but will be in Year 3. These two (2) goals are: "*To design curriculum that includes virtual simulations that use learning object methodology;*" and "*Create a hands-on learning experience at a state-of-the-art facility that will provide the real-work experience in designing and using Logistics Engineering Technology-related software and hardware.*"

[3] The original goal was worded, "To *conduct a comprehensive DACUM in Central Ohio on the Industrial Engineering Technician occupation.*" The goal was rephrased to reflect the use of Compression Planning® and not the DACUM model as originally proposed.

The Rucks Group, LLC began working with the CSCC project team in 2014 as the external evaluator. The evaluation has a two-fold purpose: 1) to capture information regarding the activities of the project (formative evaluation); and 2) to assess the outcomes of the project (summative evaluation). Key elements of the evaluation are the project logic model, its objectives, and the evaluative questions. The logic model (see Appendix A) provides the frame for the evaluation, while the evaluative questions guide the nature of the data to be collected. The theory of change underlying the project is that if a quality curriculum in LET which aligns with stated industry needs is established and if high school students, women, and minorities are made aware of the existence of the program and opportunities available in the field, then the number of individuals serving as LET Technicians will increase.

The logic model is a visual overview of the project's hypothesis on how it will achieve its goals. The evaluative questions to be addressed over the life of the project are:

1. How effectively is the project being implemented? What obstacles are being experienced? (Formative)
2. How is the curriculum meeting the needs of industry? What is the quality of the curriculum? (Summative)
3. How are the various modalities affecting student learning (e.g., curriculum, and the summer camp)? (Summative)
4. What difference is the project having on overall student enrollment and retention? What difference is the project having on enrollment and retention for underrepresented groups? (Summative)
5. What difference is the project having on industry/relationships with industry? (Summative)

As the project finishes its second year of funding, the work to-date has primarily focused on the development and pending approval of a curriculum and to attract students into LET, engaging students in the pre-college initiative, and connecting with industry and community partners. As such, the evaluative questions addressed in this report relate primarily to evaluative questions #1 thru #3 with initial commentary on evaluative questions #4 and #5. These latter two questions will be more fully addressed in Year 3.

Findings

Evaluative Question #1: How effectively is the project being implemented? What obstacles are being experienced?

The primary activities for Year 1 revolved around developing the curriculum and implementing the pre-college initiative. In Year 2, these activities continued along with outreach to potential industry and community partners which included hosting the first annual summit on Logistics and Automation and outreach to high school career advisors, and faculty development. There are two activities, *development of an operations simulation laboratory* and *creation of model university articulation agreements*, that were originally outlined to be addressed during Year 2, but will instead be folded into Year 3's work. Each of these tasks are discussed in further detail below.

<u>Development of Curriculum</u>

As noted in the Year 1 evaluation report (Rucks & Clasen, 2015), the development of the curriculum included working with industry partners to determine the appropriate content using a compression planning method (McNellis, 2009). What emerged was a need for a LET program of study at the two-year degree level (see Appendices B and C). After the session, a survey was sent to industry participants to rank the importance of each identified area to a LET technician position. Later, an additional survey was disseminated to a wider audience to confirm these initial

findings (The Rucks Group, 2016a)[4]. The results from the compression planning session and follow-up survey were used to develop the curriculum. The creation of the curriculum involved the development of three (3) new courses, modification of four (4) courses, and the inclusion of other existing courses.

Approval of the curriculum is taking longer than expected. It was initially anticipated that approval and launch of the LET major would occur by Fall 2016. However, when the curriculum was finalized at the end of Year 1 (Summer 2015), the project team understood the process to involve approval by an internal curriculum committee within CSCC and the Ohio Department of Higher Education (formerly known as the Ohio Board of Regents). Through the actual process, the project team learned that approval is required by four (4) entities, the two already mentioned as well as approval by CSCC's Board of Trustees and the Higher Learning Commission. Approval by the final entity, the Higher Learning Commission, is still pending. As a consequence, the curriculum will not be offered until Spring 2017; however, general courses that will ultimately lead to the LET degree can be completed by students in Fall 2016.

Once approval is granted, the project team can more directly engage in outreach activities with community partners and implement the dual credit LET program. Towards that end, an instructor has been identified to teach the dual enrollment courses at the high school level and work in an advisory role for students. This individual has taught at the high school and college level, but also has industry level workforce experience. Adding this individual to the team will be a valuable asset in establishing the curriculum at high schools (more is discussed in evaluative question #5).

Pre-College Initiative (Summer Camp Experience)

In Years 1 and 2, the project team worked with K12 partners to implement a pre-college initiative (e.g., summer camp). It is important to note that the structure of the camps differed across these two years. In Year 1, the team partnered with Honda, who has sponsored a pre-college initiative for several years, to implement the summer camp experience. The project team decided to implement its own summer camp in Year 2 because there was not enough time allotted in the schedule to focus on LET with the Honda version of the camp. The summer camp in Year 1 reflected a broad approach to engineering with a 30-minute session on LET. Over two days, the Year 2 iteration of the summer camp allowed for more exposure to the program and facilitated focused recruitment of students interested in LET as a potential career. The additional time allowed for more hands-on activities and a tour of an industry partner (more is discussed in evaluative question #3).

Furthermore, by CSCC hosting their own LET focused summer camp experience, the composition of the participants was more in alignment with their target audience. In Year 1, 20 students participated in the summer camp experience with 30% (n=6) of the participants who were high school students. In Year 2, all 22 students who participated were high school students. Additionally, in Year 2, 27% (n=6) of the participants were female students, where none of the participants were female students in Year 1 (more is discussed in evaluative question #4). Moreover, these students were also more interested in LET. In response to the question item, "Why are you interested in participating in the Logistics Engineering Technology Early College Experience?", posed on the registration documents, participants wrote:

- *"As a junior in high school, I'm open to all ideas as an engineer… Logistics engineering sounds like an interesting topic that I could get into because I love math and I'm a big fan of science as well."*

[4] These findings are summarized in a separate document. Because of the length of the document (33 pages), the report is not included in the Appendices.

- *"I want to explore all areas of engineering to see what fits best for me. I want to explore what job opportunities would be available to me in the area of study and what direction I need to go in choosing my future classes. I want a chance to see what logistics engineering is all about."*
- *"I am interested in the program because I love science…It would be exciting to have this opportunity in a small group with other people my age."*

Industry and Community Partner Outreach

During the current funding year, there was significant effort by the project team to engage in outreach to industry and community partners. In Spring 2016, the team hosted its first annual summit on Logistics and Automation. Approximately, 15 area organizations were represented at the event, which provided an overview of the LET program and solicited involvement by industry. Moreover, the project Principal Investigator (PI) is a contributing member of the Columbus Area Logistics Council. In this capacity, the PI is able to promote awareness of the LET program and solicit needs of industry organizations.

The project team also reached out to nearly 60 local high school and career technical schools to begin or expand on relationship to promote awareness of the LET program (more is discussed in evaluative question #5).

Faculty Professional Development

Various professional development opportunities were completed during Year 2 by both the project staff and faculty members, including completing online training courses, participating in workshops, serving on both industry and technical school advisory boards, and attending professional organization conferences.

Develop an Operations Simulation Laboratory

The simulation component is in the process of being developed to be utilized for the curriculum and will be more directly addressed as the curriculum is implemented in Year 3.

Create Model University Articulation Agreement

To-date, no new articulation agreements from the project have been created. As context, CSCC currently has an articulation agreement in place with Eastland Fairfield Career Center, which has been in existence for approximately 15 years. A component that complicates the development of new articulation agreements, is the implementation of the College Credit Plus system from the Ohio Department of Higher Education. College Credit Plus provides an options for students "to pursue rigorous academic coursework beyond the high school classroom…earning college credits while in high school."[5] With the emergence of the College Credit Plus program, articulation agreements are becoming less relevant. Therefore, during Year 3, the project team will assess the need of creating model university articulation agreements given this evolving contextual issue.

Evaluative Question #2: How is the curriculum meeting the needs of industry? What is the quality of the curriculum?

Quality is operationalized as the extent to which the program produces qualified job candidates. Because the program will not be implemented until Spring 2017, measuring the "quality" of the program is not yet feasible.

[5] For more information on College Credit Plus, visit their website: https://www.ohiohighered.org/ccp/background.

However, towards achieving this ultimate goal, the curriculum development methodology was designed to tightly align with industry's workforce needs.

The curriculum development methodology can be conceptually divided into *exploratory* and *confirmatory* phases. In the "exploratory" phase, the project team invited comments from a seven (7) person focus group regarding industry's workforce skills needs through a day-long compression planning session.[6] As noted earlier in this report, results of the compression planning session indicated that industry partners needed workers with "light" LET skills or in other words a LET technician.

In the "confirmatory" phase, a survey summarizing the components of LET technician skills were provided to a wider audience to indicate the extent to which those particular skills are needed as reported by other industry representatives (The Rucks Group, 2016a). Of the approximately 40 individuals to which the survey was disseminated, 19 industry representatives responded for about a 48% response rate. Overall, the findings from the survey (confirmatory phase) were consistent with the findings from the compression planning session (exploratory phase). For instance, when industry representatives were asked: *"To what extent does your company have a current or anticipated need for an operations analyst, systems specialist, or other comparable position?",* 30% of respondents reported a high or medium need while 40% of industry representatives reported a future need (see Figure 1).

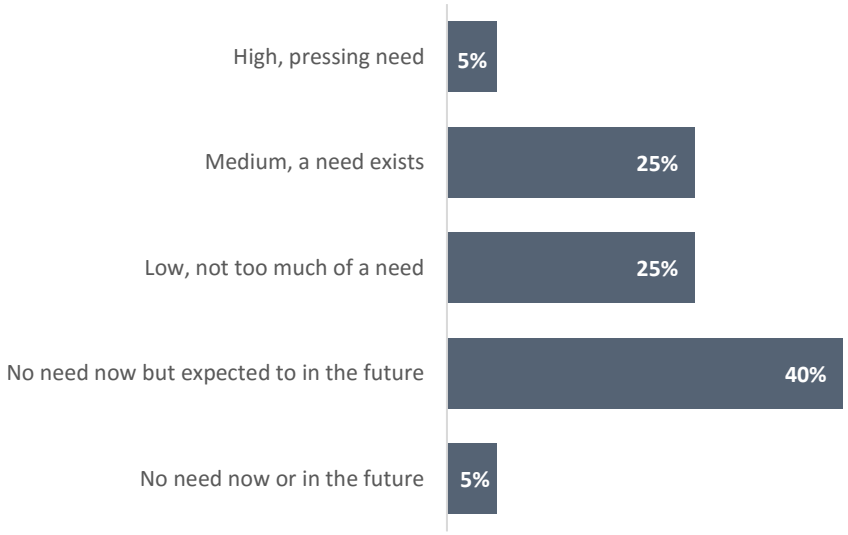

Figure 1. Responses by industry representatives to the item "*To what extent, does your company have a current or anticipated need for an operations analyst, systems specialist, or other comparable position?"*

While the need for a LET technician position appears to be high, industry representatives also indicated that they rarely fill these positions with individuals with a two-year degree. For instance, when asked, "*How frequently does your organization hire an operations analyst, systems specialist, or other comparable position with a two-year degree and with experience in logistics?",* three-fourths of industry representatives indicated that they either never or infrequently hired an individual with a two-year degree (see Figure 2).

[6] The compression planning session was detailed in the Year 1 evaluation report (Rucks & Clasen, 2015).

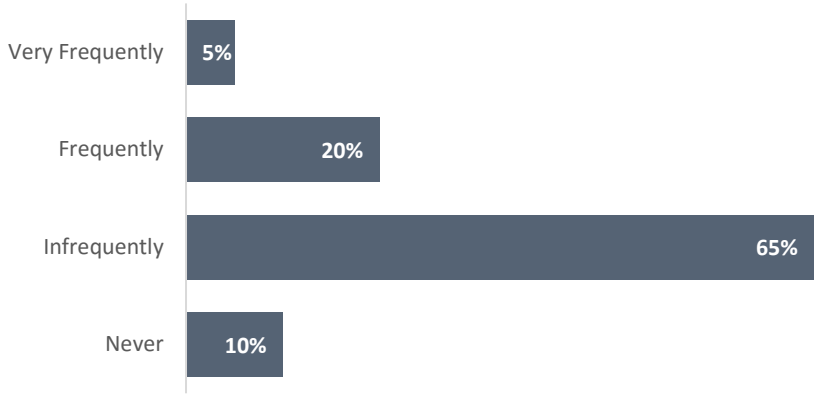

Figure 2. Responses by industry representatives to the item "*How frequently does your organization hire an operations analyst, systems specialist, or other comparable position, with a two-year degree and with experience in logistics experience?*"

While on one hand this finding presents a challenge for the project team, on the other hand, it also offers much opportunity. It would make sense that industry representatives would report that they have not hired an individual with a two-year degree for LET technician positions, because the training had not been previously available. The opportunity, therefore, emerges because hiring individuals from four-year programs had retention problems. Importantly, industry does appear willing to shift away from previous tendencies, as 40% reported that they are "very interested" in providing internship positions to CSCC students, and 30% reported interest in gathering more information about the CSCC's LET program (see Figure 3).

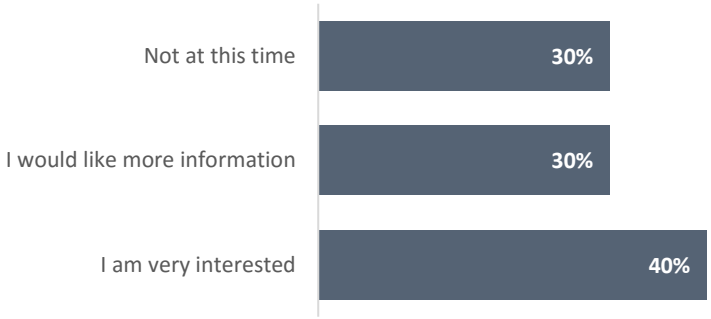

Figure 3. Responses by industry representatives to the item "*What level of interest would you have in providing internship opportunities to students in this type of program?*"

Similar findings were obtained from a survey disseminated to current and potential industry partners at the Logistics and Automation wide summit in Spring 2016. For instance, of the six (6) individuals who completed an on-line survey, nearly all respondents reported being either "Very likely" (67%) or "Likely" (33%) to partner with two-year colleges for recruiting entry-level technician positions.

Evaluative Question #3: How are the various modalities affecting student learning (e.g., curriculum and the pre-college initiative)? How are perceptions in learning about LET changing with regard to the project?

Perceptions of Students Participating in the Pre-College Initiative (Summer Camp Experience)

A primary objective of the pre-college initiative, summer camp experience, is to expose high school students to LET with the goal of encouraging students to pursue LET as an area of study. The pre-college initiative was offered during both years of the grant. In Years 1 and 2, 20 and 22 students participated, respectively.

To gather feedback regarding students' attitudes of LET as a career option, a counterfactual questionnaire was disseminated to summer camp attendees. In essence, a counterfactual survey asks respondents to provide their pre-intervention attitudes and their current attitudes on the same instrument (Mueller, Gaus, & Rech, 2014) as a measure of impact. In the present context, "before" reflects participants' attitudes regarding a particular item before the camp and related activities whereas, "after" reflects participants' attitudes after completing the camp and related activities. The counterfactual survey was utilized because research indicates that individuals tend to make overestimations in the absence of a defined standard regarding attitudes and skills (Kruger & Dunning, 1999). As a consequence, traditional pre-/post-test dissemination methodologies do not fully reflect the impact of an intervention. The items included on the survey were modeled after a nationally sponsored questionnaire designed to assess attitudes towards manufacturing and related careers (Deloitte Development LLC and The Manufacturing Institute, 2014). Reponses were captured using a 5-point scale of agreement, with *strongly disagree* rated as "1" and *strongly agree* rated as "5".

As noted earlier in this report, the approach taken for the pre-college initiative evolved from Year 1 to Year 2. Regardless of format, across both years of the project, findings suggest that the pre-college initiative positively impacted on students' perceptions of LET as a career. For instance, in 2015, prior to the summer camp experience, students indicated that their average attitude related to *"I think there are plenty of jobs in logistics engineering technology"* was m=3.89; afterwards, it was m=4.70. That change in reported mean attitude was almost a one-point shift. The results of a t-test comparing the before and after scores indicated that the change for all items, except for the item "*A job in logistics engineering technology would have a good pay*," was statistically significantly different. That is, there was a less than 5% probability that the observed changes in scores occurred solely by chance.[7]

[7] The following are the results from the t-test analysis comparing the before and after reporting scores for each survey item that reached statistical significance: *I think a job in logistics engineering technology would be both interesting and rewarding*, $t(18) = -3.01$, $p < .01$; *I think are plenty of job in logistics engineering technology*, $t(16) = -3.85$, $p < .01$; *I think a job in logistics engineering technology would be in a clean and safe environment*, $t(18) = -3.75$, $p < .01$; and *I would like to major in logistics engineering technology*, $t(16) = -2.22$, $p < .05$.

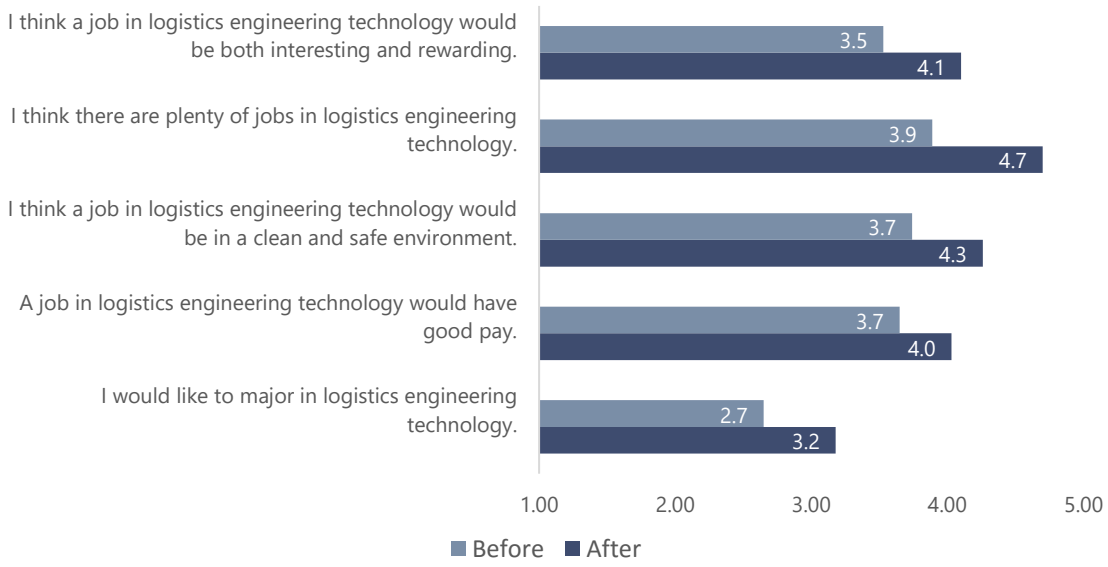

Figure 4. 2015 Mean Summer Camp 2015 Responses

In 2016, a similar method, however, with a slightly different timing in data collection, was utilized. Responses for 2016 Summer Camp were collected following key times throughout the two-day camp experience: the campus tour, two labs, and the entire camp experience. At each data collection time the "after" score was higher than the "before" score indicating more agreement with the item after participation in the summer camp experience (see Figures 5 – 8).

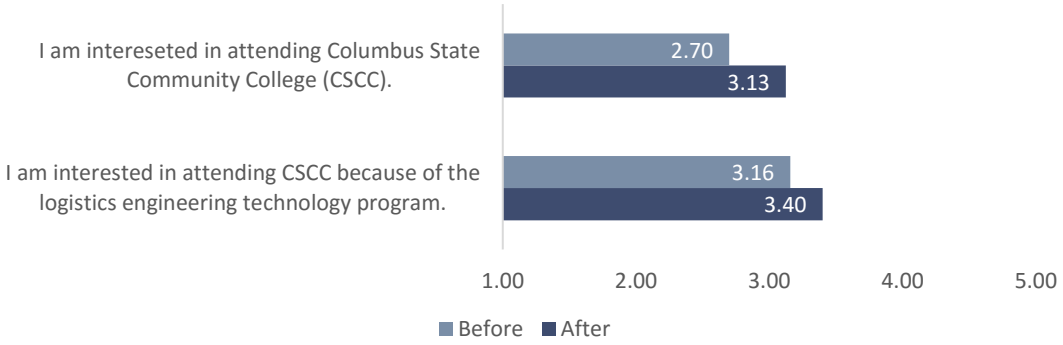

Figure 5. Mean Summer Camp 2016 Responses (Campus Tour)

Responses to either of the two campus tour items were statistically significant; however, the pattern of response for both items followed the trend of all other survey items in that the "after" score was higher than the "before" score.

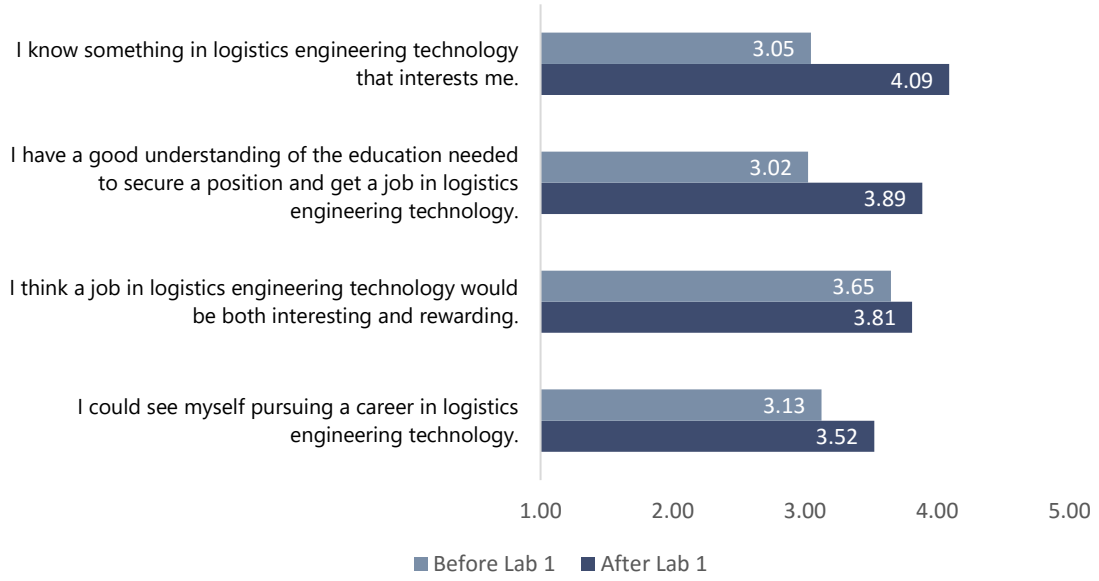

Figure 6. Mean Summer Camp 2016 Responses (Lab 1)

The items "*I know something in logistics engineering technology that interests me*" and "*I have a good understanding of the education needed to secure a position and get a job in logistics engineering technology*" were statistically significant.[8]

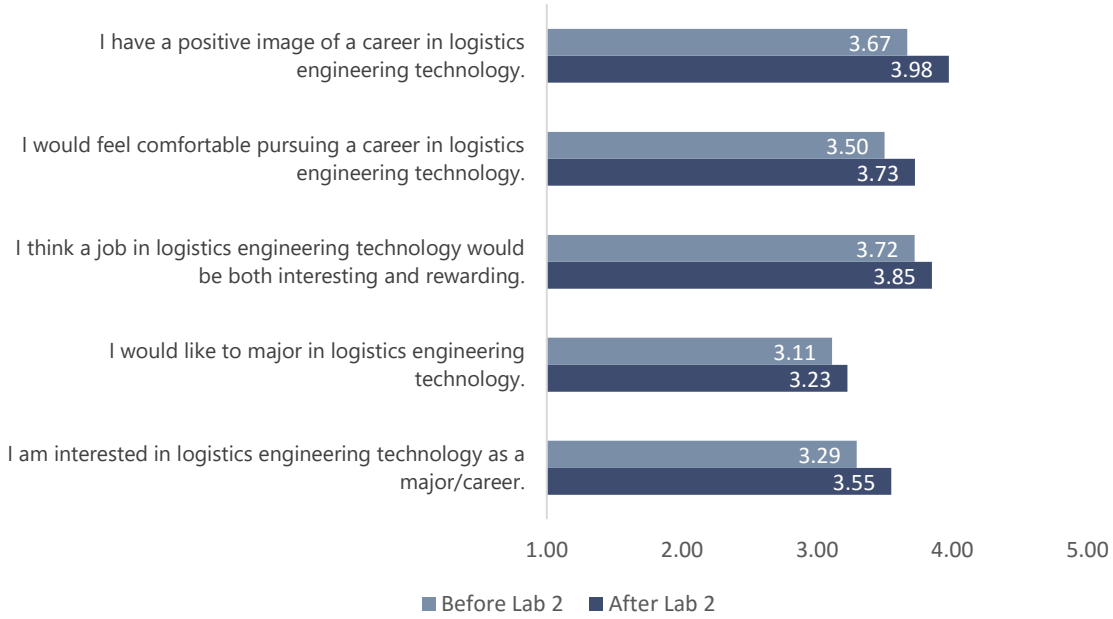

Figure 7. Mean Summer Camp 2016 Responses (Lab 2)

[8] The following are the results from the t-test analysis comparing the before and after reporting scores for each survey item that reach statistical significance: *I know something about logistics engineering technology that interests me*, $t(21)=-5.46$, $p < .001$; and *I have a good understanding of the education needed to secure a position and get a job in logistics engineering technology*, $t(21)=-4.63$, $p < .001$.

The items "*I have a positive image of career in logistics engineering technology*" and "*I am interested in logistics engineering technology as a major/career*" were also statistically significant.[9]

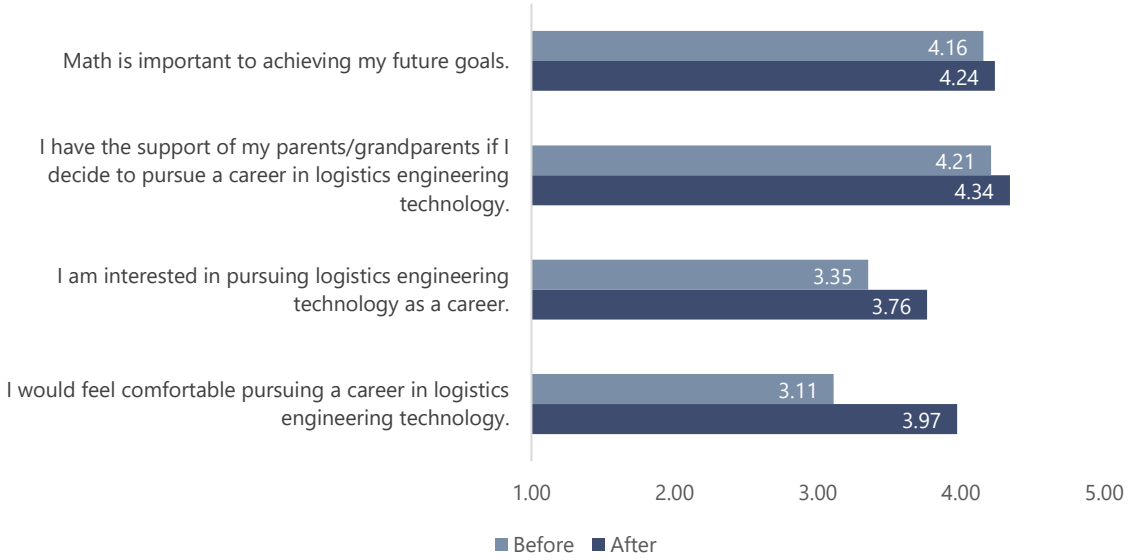

Figure 8. Mean Summer Camp 2016 Responses (End of Camp)

Importantly, attitudes related to the main purpose of the summer camp experience also were statistically significant. These items are "*I am interested in pursuing logistics engineering technology as a career*" and "*I would feel comfortable pursuing a career in logistics engineering technology.*"[10]

Over the course of the two (2) day camp Year 2 summer camp, students reported an increase in the positive attitudes related to LET technician as a career option. To illustrate this change, responses to conceptually similar items were mapped over time.[11] As Figures 9 and 10 demonstrate, over the two (2) day summer camp experience, attitudes appear to be continually impacted by the linear increase of the "after" score.

[9] The following are the results from the t-test analysis comparing the before and after reporting scores for each survey item that reach statistical significance: *I have a positive image of a career in logistics engineering technology*, t(19) = -2.62, p = .017; and *I am interested in logistics engineering technology as a major/career*, t(19) = -2.38, p = .028.

[10] The following are the results from the t-test analysis comparing the before and after reporting scores for each survey item that reach statistical significance: *I am interested in pursuing logistics engineering technology as a career*, t(18) = -2.31, p < .033; and *I would feel comfortable pursuing a career in logistics engineering technology*, t(18) = -3.15, p < .006.

[11] Because the exact items were not asked at each data collection point, items that were conceptually similar were paired in order to demonstrate the changes in attitudes by summer camp participants over time.

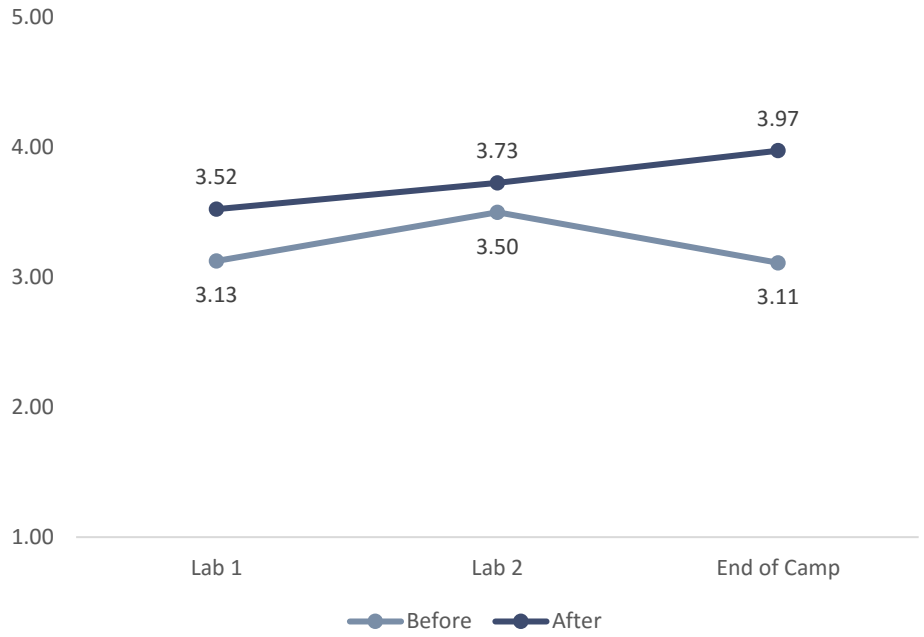

Figure 9. Responses by students to items "*I could see myself pursuing a career in logistics engineering technology*" and *"I would feel comfortable pursuing a career in logistics engineering technology*" over the course of the two-day camp.

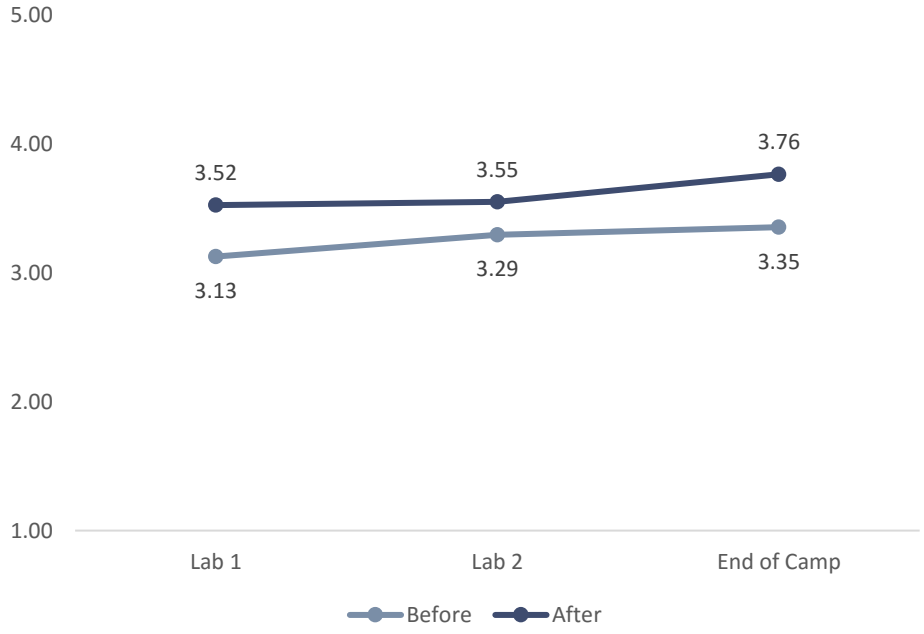

Figure 10. Responses by students to item "*I could see myself pursuing a career in logistics engineering technology*" and *"I am interested in logistics engineering technology as a career*" over the course of the two-day camp.

Comments provided by students were consistent with these findings. Nearly 56% (n=10) of students indicated in an open-ended question item question that the tour of the Boar's Head facility was the most interesting part of the

camp. Additionally, 22% of respondents (n=4) in a similar open-ended question item indicated that the hands-on activities were the most interesting.

Taken together, these data suggest that even with a relatively brief exposure to LET, perceptions of the career can be positively impacted. While this finding emerged across both years of the summer camp experience, it is likely that the more in-depth version implemented in 2016 will produce behavioral outcomes of having participants actually enroll in the LET program. Monitoring enrollment data will be able to provide insights into this hypothesis.

Perceptions of Students Enrolled in Supply Chain Management Courses

To understand the factors impacting on students' decisions to choose LET as a program of study, a survey was disseminated to students enrolled in supply chain management courses in Fall 2015 and Spring 2016. The survey yielded 86 responses. Examining responses regarding student intention to pursue LET revealed interesting variation among those who are currently or plan to major in a supply chain or logistics management related career compared to those who are not. Overall, 67 (80%) of students reported that they are currently or planning to major in a supply chain (SCM) or LET program of study. For students answering that they are either currently or planning to major in a supply chain or logistics management related career the belief in being able to get a job and the potential for pay, appear to drive this interest. Students who reported that they do not plan to major in supply chain or logistics management reported less agreement with these two items (see Figure 11; The Rucks Group, 2016b). This attitude differential may have implications to how students are recruited into the LET program. For responses to all items, see Appendix D.

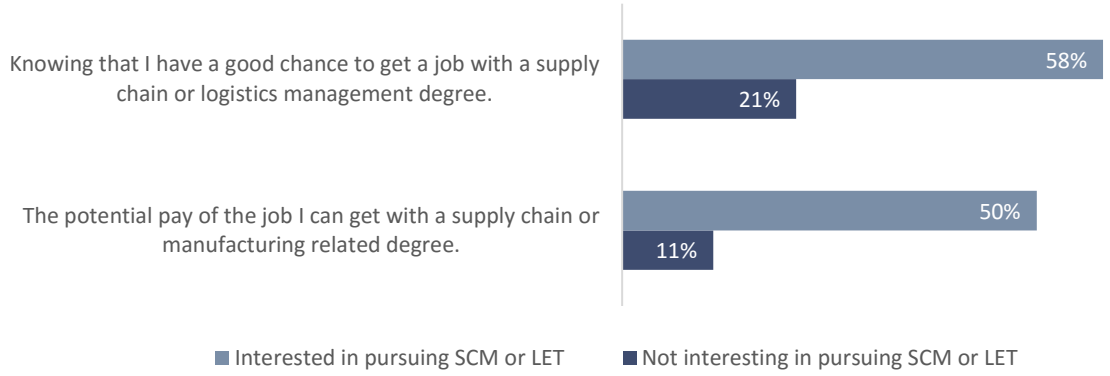

Figure 11. Responses by students enrolled in a supply chain management course to items *"Knowing I have a good chance to get a job with a supply chain or logistics management degree"* and *"The potential pay of the job I can get with a supply chain or manufacturing related degree"* by those who are interested in pursuing supply chain management or LET and those who are not.

Evaluative Question #4: What difference is the project having on overall student enrollment and retention? What difference is the project having on enrollment and retention for underrepresented groups?

The evaluative question related to enrollment and retention will be addressed more completely after implementation of the LET program and actual enrollment has begun, however, data that could predict enrollment of underrepresented groups are available. As noted earlier, participation by students in the pre-college initiative is

important because it serves as a pipeline for eventual enrollment in LET. Therefore, it was encouraging that a relatively large percentage of participants in the pre-college initiative were female. Specifically, 27% (n=6) of participants from the 2016 summer pre-college initiative were female, whereas in 2015 none of the participants from the pre-college initiative were female.

Evaluative Question #5: What difference is the project having on industry/relationships with industry?

The number and the depth of industry and community partnerships have changed from Year 1 to Year 2. For instance, as noted earlier in the report, the project team is actively reaching out to all area schools to increase awareness of the LET program among high school career advisors. The reaction from the high school career advisors has been positive. Specifically, they have made the following comments to the project team:

- *"I would love to meet with you to discuss a possible partnership."*
- *"This sounds like a great opportunity for future students. I would be interested in helping any way I could."*
- *"This sounds like a wonderful opportunity and I would like to hear more about it."*
- *"Thank you so much for the information. What a wonderful plan! I will do my best to disperse this information and will talk with our teachers to see if we can plan a visit for you. I think that will be very helpful!"*
- *"I would be happy to talk to you about this program and introduce it to students."*

As a result of these efforts, 16 of the 58 schools (28%) that that the project team has contacted has agreed to in some way support recruitment activities. Similar additional outreach efforts have occurred directly to industry partners and indirectly through professional and business organizations.

In an attempt to quantify these changes in industry and community relationships, an industry relationship partner score was calculated. The score was created by first identifying nine areas related to a pathway development. These are program design, curriculum development, recruitment, training, placement, program management, leveraging resources, and commitment of sustainability. *Program design* involves all the decisions of inclusion or exclusion of the elements involved in the learning process (e.g., the curriculum, whether or not there's an internship, articulation of the pathway etc.); *Curriculum development* relates to the didactic areas of the course; *Recruitment* is the identification of participants for the program; *Training* refers to the professional development targeted to instructors or when involving participants activities that are not course related; *Placement* involves the hiring of interns or providing actual employment; *Program management* involves the day-to-day operations of the program; *Leveraging resources* is the obtainment of cash or in-kind resources; and *Commitment to Program Sustainability* refers to the willingness to transition the program from "grant" status to institutionalization of the training program.

A point is assigned to each area of involvement (see Appendices E and F). The score is calculated by totaling the number of points for each area by industry and community partners. In Year 1, the industry relationship partner score would have been 30, by the end of Year 2 the industry relationship partner score was 48. While admittedly the industry relationship partner score has not been validated, it does provide a useful means to quantifying the changes in the number and depth of partnerships across time.

Recommendations

The project appears to be on track and moving forward as expected. In this second year of the project, activities have primarily centered on identifying and developing an appropriate curriculum for approval, engaging in the pre-college initiative, as well as planning and implementing outreach activities. As the project moves into its third year of funding, the following recommendations are provided. These recommendations have been discussed in collaboration with the project team.

- As mentioned earlier, there is a potential challenge or potential opportunity of gaining acceptance by industry to hire qualified students from a two-year program, rather than the status quo of hiring students from four-year programs. Industry does appear willing to make this shift, as long as students are viewed as "qualified." Therefore, the project team should understand that performance from initial CSCC program interns and completers may be closely monitored.

- The project team will need to continue leveraging their relationships to recruit high school students and increase enrollment in the pre-college program (i.e., summer camp) to achieve the Year 3 projection of 100 students participating in the summer camp, as well as the three-year projection of 150 students.

- Historically, having individuals under 18 years of age complete a tour is problematic because of concerns by industry. One industry partner, Boar's Head, created a release form that allowed students under the age of 18 to participate in tours with parental consent. Because of the positive feedback on tours from students, allowing these students to participate early within their educational careers in important.[12] Encouraging additional industry partners to utilize a similar release form would create increased opportunities for students.

- As the curriculum approaches approval and the program prepares for its launch, the project team should consider disseminating information about the program at the Hi-TECH Conference, NSF Advanced Technological Education Annual PI conference, ATE Central, and on the CSCC website.

[12] The importance of tours to changing perceptions about jobs of this nature is supported by from the evaluative work from other NSF ATE projects.

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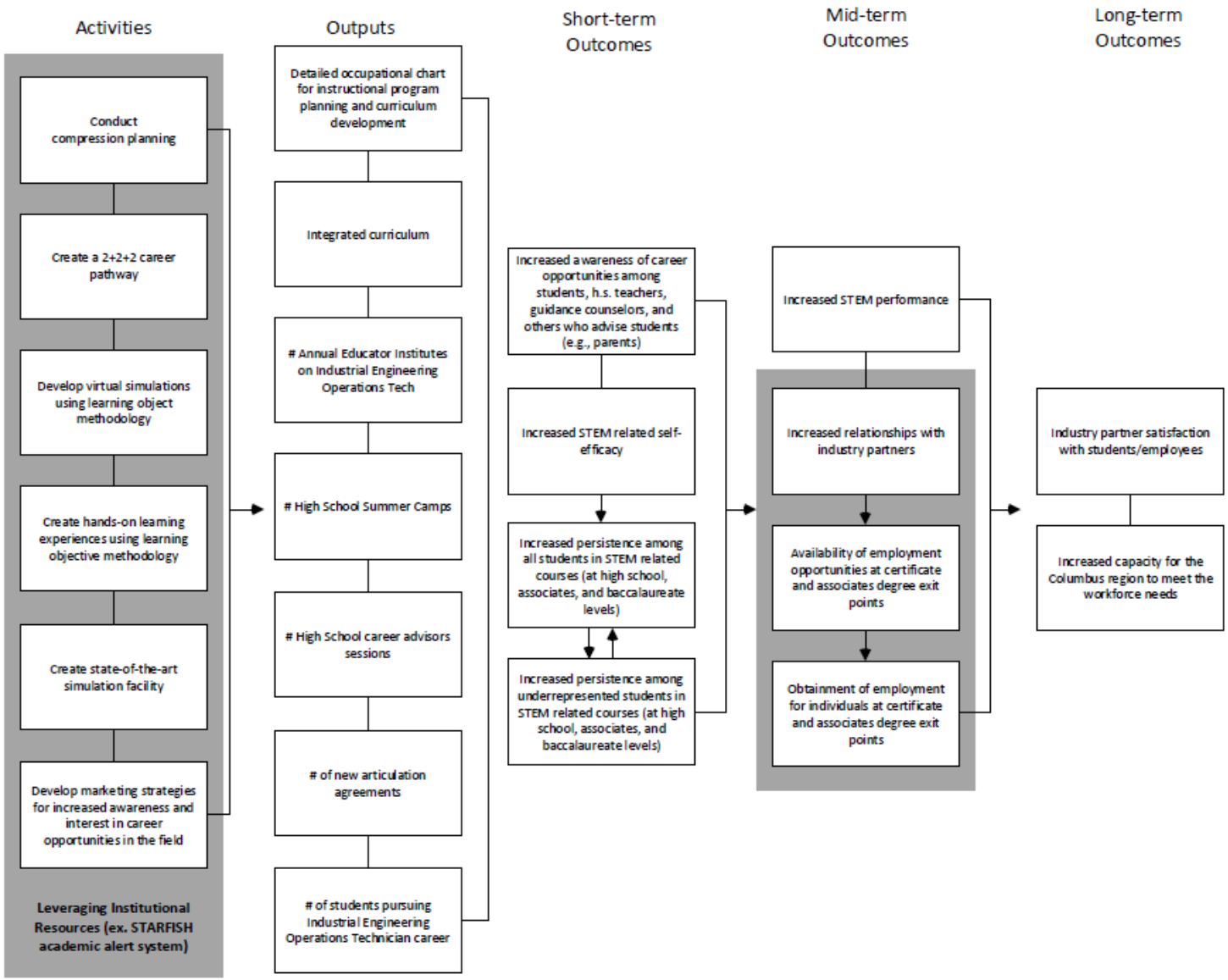
Appendix A - Building an Academic Pathway for Industrial Engineering Operations Technicians Logic Model



Appendix B - Results of Compression Planning Session with Industry

Logistics Engineering Technician [1]

Job Description from the Industry Compression Planning & Storyboarding Session of 02-09-2015

Overview
The job description of a Logistics Engineering Technician is the combination Core Knowledge, Technical Knowledge, General Knowledge, and Workplace Dispositions.

Core Knowledge	Technical Knowledge
1. Accounting and Finance	A. Industrial Engineering Technology
2. Communication	B. Electro-mechanical Engineering Technology
3. Information Technology	
4. Leadership	
5. Logistics	

1. Accounting and Finance Core Competencies

1.01	Understand basic accounting and finance terminology
1.02	Apply managerial and cost accounting concepts in daily work
1.03	Conduct return on investment analysis
1.04	Employ inventory and inventory controls
1.05	Formulate and use key performance indicators

2. Communication Core Competencies

2.01	Use appropriate interpersonal communications
2.02	Utilize effective oral and written presentation skills
2.03	Interpret data and translate to co-workers and supervisor

3. Information Technology Core Competencies

3.01	Be proficient with the Microsoft Office software suite
3.02	Operate a labor management system
3.03	Operate a warehouse management system
3.04	Conduct data mining and analysis
3.05	Depict results of data mining into a report
3.06	Extract data from a programmable logic controller and analyze results
3.07	Use data identification systems including barcodes and RFID (radio frequency identification) tags

4. Leadership Core Competencies

4.01	Achieve key performance indicators of the employer
4.02	Achieve key performance indicators of immediate customers
4.03	Serve as liaison between the operations team, equipment and space
4.04	Conduct "what if" analyses of multiple scenarios
4.05	Serve as a project manager

5. Logistics Core Competencies

5.01	Understand the full spectrum of supply chain management
5.02	Manage the deployment of material handling equipment

A. Industrial Engineering Technology Skills

A-01	Troubleshoot and resolve issues with unfamiliar processes
A-02	Understand basic capabilities and uses of simulations
A-03	Review vendor specifications
A-04	Use basic AutoCAD software functions
A-05	Adhere to safety concepts in operations and materials handling
A-06	Be aware of the regulatory environment (codes, permits, etc.)
A-07	Apply ergonomics concepts within daily work
A-08	Conduct fundamental work measurement and time study
A-09	Adopt continuous process improvement to discover and resolve problems
A-10	Optimize resources (machines, technology, space, funding) within an environment
A-11	Review facility layouts for optimization
A-12	Design the optimal process for moving products
A-13	Understand the impacts of process on operations and equipment
A-14	Assist with the conceptual design and execution of processes
A-15	Exercise effective decision-making

B. Electro-mechanical Engineering Technology Skills

B-01	Understand the use and programming of programmable logic controllers
B-02	Recognize the fundaments of machine control
B-03	Use warehouse control systems
B-04	Understand basic IT networking for the location of data drops
B-05	Operate barcode scanners

B-06 Operate industrial electricity controllers

B-07 Be aware of the basics of heating, ventilating, and air conditioning within a warehouse

B-08 Apply basic facilities management principles

General Knowledge

GN-01 Basic mathematics (including algebra, geometry, and statistics)
GN-02 Customer service
GN-03 Customer focus
GN-04 Cultural diversity and respect
GN-05 Expectation for continued personal and professional growth and development
GN-06 High ethical standards
GN-07 Manage vendor relationships
GN-08 Problem-solving
GN-09 Project team skills
GN-10 Read and interpret facility drawings
GN-11 Time management
GN-12 Work independently but knows when to reach out for direction and assistance

Workplace Dispositions

WD-01 Common sense
WD-02 Appropriate dress
WD-03 Attention to detail
WD-04 Confident
WD-05 Dedicated
WD-06 Efficient
WD-07 Energetic
WD08 Flexible
WD09 Good hygiene
WD10 Honest
WD-11 Motivated
WD-12 Personable
WD-13 Proactive
WD14 Positive
WD15 Punctual
WD-16 Resourceful
WD17 Team player
WD18 Thorough
WD19 Trustworthy
WD20 Willing to ask questions
WD21 Willing to change
WD22 Work unsupervised

Desired Credentials

DC01 Six Sigma
DC02 Lean
DC03 Project Manager Certification
DC04 American Production Inventory Control (APICS Certification for personnel in operations):

A. Certified in Production and Inventory Management (CPIM)
B. Certified Supply Chain Professional (CSCP)

DC05 MOST (Maynard Operation Sequence Technique) Work Measurement which is a pre-engineered time standards credential from Maynard—an international consulting, software, and training company

DC06 SCPro™ a three-level certification that offers global supply chain management professionals offered by the Council of Supply Chain Management Professionals

Specialized Equipment used by Logistics Engineering Technicians

SE-01 Storage rack systems
SE-02 Mobile materials moving equipment
SE-03 Conveyer systems
SE-04 Box handling cranes and robots
SE-05 Mobile computing technology

Next-Generation Technologies

NG01 In general, any technology that enables the compression of supply chain timelines
NG02 Voice Control and voice direction of systems
NG03 Pick or Pack to Light
NG04 Use of mobile communications technologies to increase efficiency
NG05 Real-time system processing of automated systems
NG06 Automated guided vehicles
NG07 3D printing
NG08 Expanded use of robotics
NG09 Cloud computing
NG10 Reduction of resource utilization (green focus, energy efficiency, labor efficiency)

Appendix C - Curriculum Outline for Logistics Engineering Technology

National Science Foundation: Academic Pathway Planning for Logistics Engineering Technology

Revised 7/22/2015

Scott Wegeng/J.J. Schultz

Complete Course List for an AAS in Logistics Engineering Technology

Industry Compression Planning with Storyboarding Session held 02-06-2015

General Education and Basic Related

General Education (GenEd) Courses

Course Name	Course Number	Credits	Map to Compression Planning	Notes
Into to Environmental Science Safety & Health	ESSH-1101	3	A-05, A-06, A-14, WD-01, WD19	Placement in ENGL 1100
Technical Math	MATH-1102	3	3.04, A-03, A-11, GN-01, GN-08	
Composition I	ENGL-1100	3	2.01, 2.02, 2.03, GN-10, WD18	ENGL-0190 or COMPASS writing 69-99
Engineering Statistics	MECH-2270	3	1.02, 3.04, A-08, 4.04, GN-01	
Ethics	PHIL-1130	3	GN-06, WD10, WD19, WD22	
Total General Education Credit Hours		**15**		

Basic Related Courses

Course Name	Course Number	Credits	Map to Compression Planning	Notes
Database Fundamentals	CSCI-1320	2	1.04, 2.02, 3.03, 3.07, 4.04, A-10	
Project Management Fundamentals & Case Studies	CSCI-2330	4	1.03, 2.03, 3.05, 4.05, GN-09, DC03	
Excel I (Intro to Excel)	BOA-1102	2	1.02, 2.03, 3.04, 3.07, 4.04, GN-08	Placement into ENGL 1100 & MATH 1010
Excel II (Intermediate Excel)	BOA-1172	2	1.02, 2.03, 3.04, 3.07, 4.04, GN-09	BOA 1102
Computer Applications in Construction/Engineering	ITST-1102	2	1.03, 3.02, 3.03, 3.05, 3.06, A-02, A-04	
Managerial Accounting	ACCT-1212	3	1.01, 1.02, 1.03, 1.04, 1.05	
First Year Experience Seminar	COLS-1100	1	2.01, WD-07, WD-11, WE-13	
Total Basic Related Credit Hours		**16**		

Technical Courses

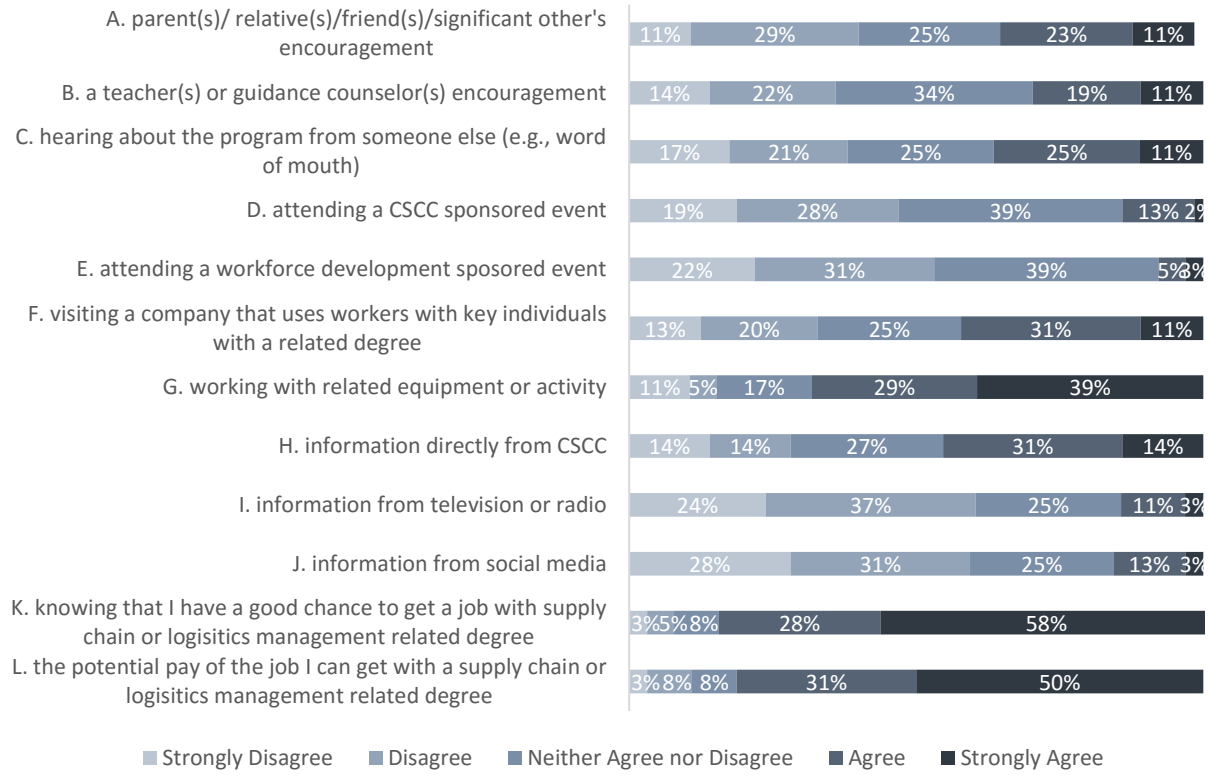
SCM Technical Courses				
Course Name	**Course Number**	**Credits**	**Map to Compression Planning**	**Notes**
SCM Principles (SCM)	SCM-1100	3	1.04, 5.01, 4.01, 4.02 & A-03	
Transportation & Traffic Management (SCM)	SCM-1101	3	1.02, 2.02, 4.04. GN-09, WE-06A-12	SCM 1100
IT in Logistics	SCM-1501	3	1.05, 3.01, 3.02, 3.03, 3.07, A-04, DC04(b)	SCM 1100
Warehouse Management	SCM-2110	4	1.04, 3.04, 3.06, 4.03, A-08, B-08, 3.03, WD-16	SCM 1100
Inventory Management	SCM-2111	3	1.01, 1.02, 1.04, 3.03, 3.04, A-11, A-12, B-08	SCM 1100
Supply Chain Management Seminar	SCM-2802	1	5.01, 5.02, GN-07, DC04, DC05, DC06	Corequisite SCM 2902
Supply Chain Management Practicum	SCM-2902	1	5.01, 5.02, GN-07, DC04, DC05, DC07	Corequisite SCM 2802
Total SCM Technical Credit Hours		**18**		

CSCI Technical Courses				
Course Name	**Course Number**	**Credits**	**Map to Compression Planning**	**Notes**
Introduction to Programming Logic	CSCI 1103	3	3.01 TO 3.03, A-02, A-04, B-04 TO B-06,GN-01, DC05	
Operating Systems / Networking	CSCI 1152	3	3.01 TO 3.03, A-02, A-04, B-04 TO B-06,GN-01, DC06	CSCI 1103
Total CSCI Technical Credit Hours		**6**		

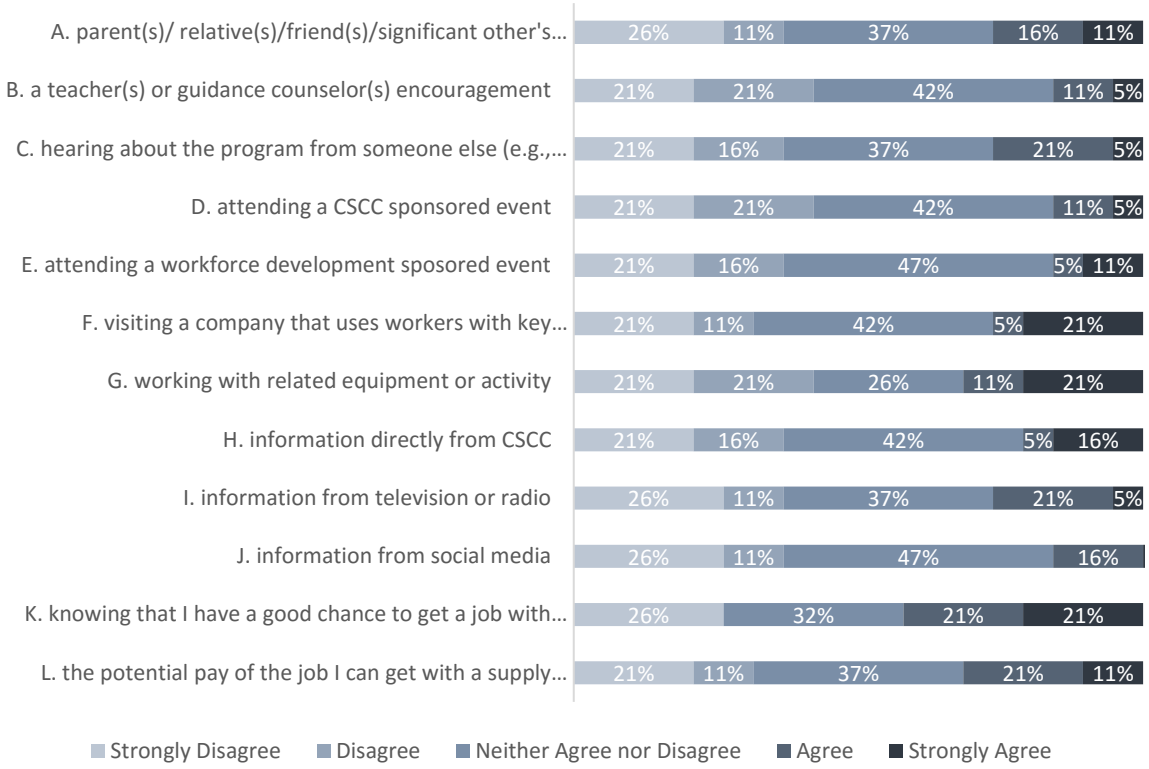
ENGT Technical Courses				
Course Name	**Course Number**	**Credits**	**Map to Compression Planning**	**Notes**
Intro to Industrial and Systems Engineering	ENGT 1200	3	A-01 TO A-15	
Intro to Electric Motors, Controls, and PLC's	ENGT 1300	4	B-01 TO B-08	
Engineering Graphics	ENGT-1115	3	A-21, A-04, A-07, A-11	
Total Engineering Technical Credit Hours		**10**		

Total GenEd & Basic Related Credits	**31**
Total Technical Credits	**34**
Total AAS Degree Credits	**65**

Appendix D – Responses from Supply Chain and Logistics Management Students



Appendix D1 - Responses by students NOT planning to major in LET to item "I am interested in a supply chain or logistics management related career because of…"



Appendix D2 - Responses by students NOT planning to major in LET to item "I am interested in a supply chain or logistics management related career because of..."

Appendix E – Overview of Partnership Involvement

(greyed areas indicates involvement) as of **July 2015**

Program Development Areas								
Partner	Program Design	Curriculum Development	Recruitment	Training	Placement	Program Management	Leveraging Resources	Commitment to Program Sustainability
Employer								
Ashland								
Boars Head								
Cardinal Health								
Columbus Region Logistics Council								
Dole								
Honda								
Intelligrated								
MAST								
ODW Logistics, Inc.								
Thirty-One Gifts								
Workforce System								
Columbus Downtown Career Center								
Eastland-Fairfield Career Center								
High Point Career Center								
Training and Educational Institutions								
Dublin Schools								
Focus Learning Academy								
Franklin University								
National Center for Supply Chain Technology Education								

Industry Partner Score: 30

Appendix F – Overview of Partnership Involvement

(greyed areas indicates involvement) as of **July 2016**

Program Development Areas								
Partner	Program Design	Curriculum Development	Recruitment	Training	Placement	Program Management	Leveraging Resources	Commitment to Program Sustainability
Employer								
Ashland								
Boars Head								
Cardinal Health								
Columbus Region Logistics Council								
Dole								
Honda								
Intelligrated								
MAST								
ODW Logistics, Inc.								
Thirty-One Gifts								
Workforce System								
Columbus Downtown Career Center								
Eastland-Fairfield Career Center								
High Point Career Center								
Training and Educational Institutions								
Columbus Downtown H.S.								
Dublin Coffman H.S.								
Dublin Jerome H.S.								
Dublin Scioto H.S.								
Eastland Fairfield Career Center								
Focus Learning Academy								
Franklin University								

Program Development Areas								
Partner	Program Design	Curriculum Development	Recruitment	Training	Placement	Program Management	Leveraging Resources	Commitment to Program Sustainability
Gahanna Lincoln H.S.								
Hi-Point Career Center								
Lancaster-Stanberry								
National Center for Supply Chain Technology Education								
New Albany								
Northland High School								
Tolles Career Center								
West Jefferson Middle School								
Westerville City Schools								

Industry Partner Score: 48

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