Establishing an Industrial Engineering Internship Pipeline for Data Analysis Careers in Collegiate and Professional Athletics

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Dr. Glenda D. Young is a visiting assistant professor at Mississippi State University. She completed her doctoral work at Virginia Tech's in the Department of Engineering Education. Her research include the role of university-industry partnerships in shaping student career expectations and pathways, the student to workforce continuum, and broadening participation in engineering. Dr. Young has worked as an Employer Relations Assistant for the VT Career and Professional Development office and has a B.S. degree in Industrial Engineering from Mississippi State University and Master of Industrial and Systems Engineering from Auburn University. She is a Gates Millennium Scholar.

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Reuben F. Burch V received his Ph.D. in Industrial and Systems Engineering from Mississippi State University in 2014. He has also received a Master of Engineering Management in Industrial and Manufacturing Systems Engineering from Kansas State University and a Bachelors of Science in Computer Engineering from Mississippi State University. Dr. Burch's work history largely consists of research and development in the virtual reality space where he consulted for NASA, Naval departments from multiple countries, and the Department of Defense and Energy. Recently, his Research and Development (R&D) expertise has expanded to include logistics and industry. He currently serves as a faculty consultant and logistics and technology advisor for numerous universities and multiple Fortune 100 companies around the world. He is also an elected official for a small municipality in western Tennessee where he works with local entrepreneurs to build a better ecosystems for creativity with the goal of growing a stronger community and workforce. Dr. Burch's primary research interests center around human factors, ergonomics, and future generations of technologies. He is particularly interested in the design of and human interaction with rugged mobile tools, robotics, and contextual awareness within the industrial workplace. Other work includes studying the current demographic shift in the global workforce and what new expectations from a self-actualized generation of workers mean for the future of all industrial technology. Dr. Burch has a number of publications regarding ruggedized handheld devices in the industrial work environment and has filed a number of potential new intellectual properties and inventions as part of his research.

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Abstract

This work in progress paper describes the development of an on-campus internship that offers industrial and systems engineering students the opportunity to explore their interests in both athletics and data analysis. With awareness of student interest as well as research interests in sensor data analysis in collegiate and professional athletics, authors seek to connect engineering students with their data analytics and/or sports interests by establishing internship opportunities with the on-campus athletics program. In Fall 2017, eleven industrial engineering undergraduate students who are considering careers in athletics data analytics or general data analysis fields participated in a pilot internship program with a variety of athletics programs on campus. Following an encouraging pilot phase (based on informal interviews/testimonials), we now work to establish a formal research and assessment plan for the internship program Via surveys and interviews with student participants as well as participants' supervisors (i.e., athletic coaches/assistants), we seek to investigate the components of the internship and explore how the experience impacts students career interests and self-efficacy related to pursuing a career in data analysis in particular as it relates to sports programs. We introduce the partners, provide an overview of the anticipated research and assessment plan, and discuss preliminary lessons from the program development and implementation. We anticipate that our findings will ignite discussion of how engineering departments can proactively reach beyond industry partners and explore on campus experiential opportunities for students.

Background

In the traditional sense, university-industry partnerships serve as the basis for engineering student work experiences and occur commonly across the manufacturing, service, or government sectors. Yet, we know that students are interested in career fields that extend beyond these sectors (e.g., entertainment). Such cross-boundary internship experiences may be difficult to access for the less-connected student, i.e., student who lacks the social capital to know that such diverse career paths exist or have the means to gain entry. These students are susceptible to choosing the more directly accessible internship or co-op opportunity, forgoing the opportunity to evaluate their personal interests in alignment with their engineering career option. Moreover, even the well-connected student may experience difficulty obtaining cross boundary internship experiences as they are often not linked to clearly outlined career paths.

Authors noted that industrial engineering students at Mississippi State University received little to no exposure to work opportunities related to sports careers. With awareness of student interest as well as an author's interests in sensor data analysis in collegiate and professional athletics, authors sought out to establish a program to connect engineering students with their sports interests by establishing internships with on-campus athletics programs. For engineering students, internships serve as the gateway to future employment. Both internships and co-op work experiences provide engineering students with opportunities to expand their coursework knowledge by applying that knowledge within professional environments [1,2]. In doing so,

students who participate in these kinds of experiences are more likely to look toward engineering related employment post-graduation during their career decisions [3].

In this paper, we discuss the partnership between the industrial and systems engineering department faculty and students and athletic coaches across sports programs and the creation of the internship. We introduce the components of the internship and discuss our plans to understand how the experience impacts students career interests and self-efficacy related to pursuing a career in data analysis in particular as it relates to sports programs.

Context

The approach to establishing an industrial eengineering internship pipeline for data analysis careers in collegiate and professional athletics involves the Department of Industrial and Systems Engineering (students/faculty) and multiple sports programs at Mississippi State University. Collaborative efforts center on student intern participation in collection and analysis of athlete performance data. The sports program coaches serve as direct supervisors of student interns while faculty in the ISE department coordinate assignments and research and assessment activities. Each partner is described in more detail below.

The program has been designed with several intentions that span across student, department, and university goals:

- Objective 1: Aid participating students in becoming more attractive for internships and co-ops while, at the same time, getting valuable experience in a field that is highly-competitive and difficult to enter.
- Objective 2: Serve as an exemplar to other departments (internal influence) and universities (external influence) by showing them that Mississippi State University has successfully explored a win-win partnership between engineering and athletics
- Objective 3: Provide underclassmen industrial and systems engineering students with the opportunity to work hands-on with real-time data collection and analysis.

A. About the Industrial Engineering/Sports Data Internship

The internship program is a semester long program for industrial and systems engineering students ranging from freshman to senior level. The program was piloted in Fall 2017 with eleven internship participants across seven sports programs. Students were selected after a call for participation in Introduction the Industrial Engineering- a course taught by Dr. Burch. Students' resume, hours/week for participation and G.P.A. were used as criteria for selection. Students were assigned in groups of 2-3 to ensure necessary coverage of a sports program's needs. As of publication, 11 students completed the Fall term and 4 will continue in their internship in the Spring semester. Additional students are currently being recruited. Internships are unpaid and require ~6-10 hours per week. Intern assignments involve hands-on data collection and analysis.

B. Partners

1) Department of Industrial and Systems Engineering (ISE): The Department of Industrial and Systems Engineering at Mississippi State University is home to 170+ undergraduate students and twelve tenure track faculty members. The National Science Foundation ranks the ISE department in the top 15 of all industrial and manufacturing engineering departments for 2016 research expenditures. Two ISE faculty members established the internship program in Fall 2017. Dr. Reuben Burch is a tenure track faculty member with research interests centered around human factors, ergonomics, and future generations of technologies. He is a former athlete at Mississippi State University with natural ties to the football program. Dr. Glenda D. Young is an engineering

education researcher and former student of the host ISE department. As an alumni of Mississippi State University, she is passionate about Mississippi State University's athletic programs. Her research investigates organizational and educational contexts to bridge university and industry efforts to develop the STEM workforce.

2) Sports Programs: Most of the sports teams at Mississippi State University participated in this internship during the Fall 2017 pilot phase (semester one). Seven types of sports were involved with three of those sports including both men and women student athletes. This offered a wide range of exposure for the student interns as they were collectively given access to both men and women athletes, indoor and outdoor environments, playing fields of different sizes and surfaces, different types of biometric data of interest, different athletic movements, and different sized teams ranging from seven student athletes to 120. The sports programs were interested for two primary reasons:

(a) Purchasing additional wearable and athletic technologies increase the amount of data collected for decision making but it also increase the workload on an already limited and regulated number of staff. The interns were an excellent way to more fully analyze and utilize this technology.

(b) The coaches and athletic trainers are always looking to offer students an opportunity to work in collegiate sports. They were in the same shoes as the student interns and needed someone to give them a chance to pursue their career goals. The coaches saw this as a way to give back while also getting useful assistance in return. The coaches and athletic trainers gave of their time in training the new interns on how to work with the data, wearables, and other athletic technology. They gained a small staff of people who were able to spend time with the data and provided assistance that they would have been responsible for doing themselves.

Guiding framework

Social Cognitive Career Theory (SCCT) will serve as the guiding framework for the study of how the Industrial and Systems Engineering (ISE)/Sports Data internship impacts students career related thinking. Shown in Figure 1, Social Cognitive Career Theory (SCCT) provides a broad explanation of how participation in an internship theoretically impacts students' self-expectations, interests, and choice behaviors related to engineering career decision-making. With prior application in both university and industry contexts [4-11], SCCT has been used to explore how engineering students and professionals develop beliefs about engineering careers and how beliefs about outcomes contribute to career interests, goals, and actions.

We will leverage the framework by deeming the internship as the learning experience that shapes interns' self-efficacy and outcome expectations related to working in a data analytics and/or sports industry career post-graduation. Levering the SCCT framework, we have designed our assessments to explore student beliefs as well as contextual (and environmental) variables by exploring the supervisor's perspective.

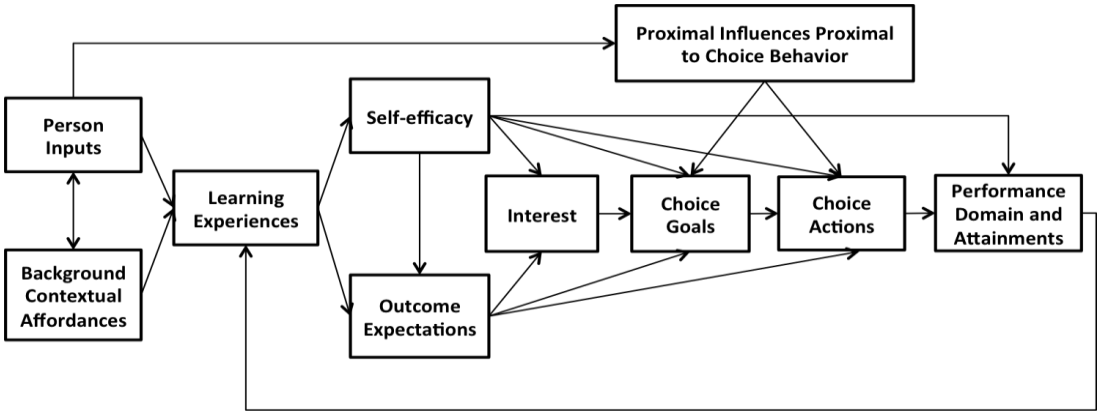

Figure 1. Social Cognitive Career Theory [12]

Assessment methods

To capture the individual student experience as well as the organizational context, we are developing an assessment plan to measure changes in student learning and perceptions, as well as collect data on program elements, including both local and national organizational characteristics.

Driven by sports program needs, we could not delay the start of the internship to provide time to develop assessment approaches. However, during the Fall 2017 pilot phase, we began to consider opportunities to assess student and supervisor outcomes in conjunction with exploring research related to career self-efficacy. We began discussions to develop assessment techniques during the pilot (semester 1) experience. Assessments capture both the intern and supervisor perspective. Table 1 highlights the data source, data collection instruments, and timeline of internship where data has (or will be) collected. Both the survey and interview protocol are developed for the study based on research related to career self-efficacy and internship/co-op experiences [13].

Table 1. Data Collection Methods

		Timeline of Internship	
Data Source	***Data Collected***	Semester 1 Pilot (Fall 2017)	Future Semesters (Spring 2018+)
Sports Coaches/Supervisors	Survey (pre)		
	Survey (post)		X
	Interviews (post)	X	X
	Student Evaluation		X
Interns	Survey (pre)		
	Survey (post)		X
	Interviews (post)	X	X

Interviews: To understand influences on the career decisions of ISE/Sports data intern program participants, we will conduct interviews with participants as well as their sports' coach/assistant. Primary topics of exploration during the interview will include individual and structural factors. For student participants, we will investigate a) reasons for participating in the IE/Sports data intern program b) learning experiences that impact student outcome expectations of what it means to work in data analytics or sports' industry position and c) understanding how the participant's outcome expectations/self-efficacy relates to pursuing data analytics or sports' industry positions. Interviews will also explore systemic factors that support the intern program as well as explore/identify growth opportunities to enhance the program.

Surveys: For student participants, we will administer a questionnaire to approximately 15 ISE/Sports data intern program participants. Participants will have participated in the internship for at least one semester during the 2017-2018 school year. The questionnaire will request demographic data, ratings of the internship administration, ratings on work environment, and suggestions for improvement. For sport coaches/assistant participants, the questionnaire will be used to assess the supervised students' performance but more effectively used to gather feedback on the program structure overall.

Lessons from Pilot Semester

The pilot phase of the internship program ended December 2017. Assessments to capture post participation viewpoints from interns and supervisors are in development and will be submitted to the Institutional Review Board (IRB) for review. Still, reflections by Dr. Burch and Dr. Young yield several preliminary sharable lessons.

- Industrial and Systems Engineering (ISE) interns were a good fit for the athletic department. The students often choose ISE as their major because they want to work with people. Athletics needs people who are willing to work with people while also being able to figure out technology and technological challenges.
- The biggest factor that established a "good fit" between student and coach pairings was the student's willingness to learn and step out of their comfort zone. As long as the student was willing to learn and excited, this made the job of the strength coach very easy.
- The overall experiment worked very well. The new perspective that the ISE students brought to the athletics programs was very successful because these students questioned why everything was done, which then caused the strength coaches to questions it themselves. The ISE's ability to adapt well to technology and how to use the technology and organize the data served the coaches well.
- As the internship develops, we note the benefit of first having strength coaches to define intern requirements and duties. Moving forward, we will first draft a clear internship task description and then recruit students based on those requirements to ensure an even better fit. We would make sure the students know that data and wearables go hand in hand so some days they will be using the technology and other days they will be analyzing data.

Ultimately, we anticipate that our preliminary lessons and subsequent findings will ignite discussion of how engineering departments can proactively reach beyond industry partners and explore on campus experiential opportunities for students.

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