PREPARING THE FUTURE WORKFORCE

◆ Through a Data Analytics Pathway

2024

"Find the need and endeavor to meet it."
- David A. Sinclair

SINCLAIR COLLEGE

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Professor Paul Hansford
Associate Professor of Computer Science
Sinclair Community College
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Dear Colleagues,

I hope this message finds you well. I am Professor Hansford, an Associate Professor of Computer Science at Sinclair Community College in Dayton, Ohio. I am the lead faculty **specializing in data programs**, which include data literacy, database management, information systems and design, data visualization, generative AI, and more.

I invite you to review our exciting project funded by the **National Science Foundation** (NSF) under the NSF Award #2055411 titled, "Expanding the Data Analytics Technician Pipeline from High School into College and High Demand Jobs in Southwest Ohio."

The **demand for a data-literate workforce is rapidly growing** as businesses and organizations increasingly rely on data-driven decision-making.

In today's digital age, data literacy is no longer a specialized skill but a fundamental requirement across industries. This surge in demand is driven by the **exponential growth of data generation** and the need to analyze and interpret this data effectively.

As a result, employers are actively seeking professionals who can not only understand and manage data but also **extract meaningful insights** to inform strategy and operations.

77%

OF EMPLOYERS WILL PAY A SALARY PREMIUM TO DATA-LITERATE CANDIDATES.

—— **The State of Data Literacy Report 2023**

A Message from Professor Hansford

At Sinclair, we launched a one-year data analytics certificate in 2011, an associate degree in 2018, and a short-term certificate in 2019. These programs attracted many nontraditional students, but I saw a **gap in attracting traditional high school students** and a need for a clear pathway. This guide describes how the grant enabled Sinclair College to create a **pathway from high school to college**, focusing on key areas including:

- Pathway development with new courses, content, and programs for high school and college
- Career awareness and professional development activities for students
- Efforts to prepare high school teachers to deliver data analytics content to their students
- Experiential and service learning projects
- Lessons learned along the way

Together, we can build more pathways and data programs that not only serve the academic community but also have a **profound impact on local industry needs**.

We invite you to borrow our blueprint for success by offering insights to guide you in building a localized data program.

Best regards,

Professor Paul Hansford
Associate Professor of Computer Science
Sinclair Community College
Dayton, Ohio

Paul D. Hansford II.

> "WE'RE ENTERING A NEW WORLD IN WHICH DATA MAY BE MORE IMPORTANT THAN SOFTWARE."
> —— **Tim O'Reilly**
> **CEO, O'Reilly Media, Inc.**

Instructional Guide

The purpose of this guide is to assist educators and institutions in implementing and benefiting from our grant-supported activities and resources. Please use the instructions below to maximize results.

1. Understanding the Workbook Structure:
- Begin with the Welcome Letter to get an overview of the grant's objectives and the importance of data analytics education.
- Review the Table of Contents to familiarize yourself with the workbook content.

2. Navigating the Grant Activities:
- Each section of the workbook corresponds to a specific component of the grant activities, such as building course and certificate programs, professional development, and student engagement.
- Sections are designed to be standalone resources but are best utilized as part of a comprehensive approach.

3. Enhancing and Building Programs:
- The Course Development and Enhancements and Sinclair Data Career Programs sections describe how we evaluated and improved existing courses, created certificate programs, and offered new certificate options.

4. Professional Development:
- These sections outline our approach for professional development for two different audiences: high school teachers who must learn new skills to teach data analytics and college students who can benefit from early introduction to professional conferences and events.

5. Experiential Learning:
- In this section, we discuss how we integrated experiential learning opportunities such as student competitions and service learning projects.

6. Lessons Learned:
- This entire guide highlights our achievements. The lessons learned section describes unique challenges that caused us to pivot, adapt, and in many cases improve our objectives.

Thank you for your commitment to advancing data literacy and analytics skills. Together, we can prepare a skilled workforce ready to meet the challenges of digital work.

Grant Activities Overview

Data analytics is having an enormous impact on people, society, and the economy. As the field of data analytics evolves, there will be an **increasing need for technicians with skills in data analytics** who can work in a wide range of roles and industries. Unfortunately, the number of students pursuing careers in data analytics is not keeping pace with workforce demand, particularly among populations underrepresented in science, technology, engineering, and mathematics (STEM).

This project is preparing future workforce technicians by establishing pathways that support data analytics careers, boosting the transfer of data-literate high school students into post-secondary programs, and preparing them to fill the growing demand for data analytics roles. Project activities provide **multiple opportunities for high school students** to explore and begin learning about data analytics.

TANGIBLE PROJECT DELIVERABLES INCLUDE

- The development of a Data Literacy Foundations certificate for high school students.
- New college-level courses tied to certificates and degrees.
- Career and academic modules with experiential learning for high school students.
- Student Data competitions using real-world datasets.
- Annual 'train-the-trainer' professional development workshops for high school teachers.
- Service-learning projects embedded in the coursework for students.
- Sponsored opportunities for students to attend professional conferences and networking events.

The project leverages several strategies for **attracting and retaining populations typically underrepresented in STEM careers**, including women and minorities, and supports student success. These strategies include equitable and inclusive instructional design, experiential learning, accelerated credential completion, affordability, flexible delivery, and student support.

Sinclair Community College partnered with local industry in southwest Ohio to develop a data analytics technician pathway for students to facilitate their transfer into college and support their post-secondary credential completion in preparation for careers in data analytics.

A stackable model was broadened to **prepare students for entry-level data analytics jobs** and to enable those who need to earn a credential quickly to enter the job market. The model also provides clear pathways to further education that can lead to higher-paying jobs.

Extension Year 2024-2025

Covid-19 had a significant impact on the speed at which we were able to accomplish our goals (a slowing effect), but left us with sufficient funds to complete our work. Thus, the NSF granted an additional no-cost extension year to complete grant deliverables.

The project continues to provide a range of opportunities to share data analytics concepts and information about data science careers with high school students and teachers. The use of dual high school and college credit courses to **accelerate college credentialing** is being actively piloted and continuously improved.

The grant also **engages high school teachers in professional development opportunities** related to data literacy that will ultimately support program implementation. College students continue to benefit from **enhanced experiential learning opportunities** designed to increase data career-related technical skills and connections with potential employers.

PIONEERING PROGRESS IN DATA ANALYTICS
ACCOMPLISHMENTS QUANTIFIED: YEARS 1-3

	Year 1 — AY 2021 - 2022	Year 2 — AY 2022 - 2023	Year 3 — AY 2023 - 2024
Courses and Pathways	• Created **dual enrollment** pathway for high schools and **piloted Python** course • Developed 3 **new courses** and updated Data Visualization	• Piloted new **Data Literacy course** with high schools • Piloted new **Advanced Python** course at Sinclair	• **Piloted** Intro to Data Literacy and Intro to Data Science courses with **college students** • **Began rewrite** for Database Management course
Professional Development	• Hosted **summer workshop for high school educators** and equipped them with data skills and knowledge	• Hosted **summer STEM workshops** for high school educators and students • Sponsored college students to **attend conferences**	• Hosted **data workshop** for high school educators • **Sponsored college students** to attend conferences, workshops, and hiring events
Events, Activities & Projects	• Drafted **academic modules** for high school teachers to use in their classrooms • Drafted a **career module** for high school teachers	• **Completed academic modules** for high school teachers and students • Hosted Sinclair's first ASA **DataFest competition**	• Hosted ASA DataFest • Completed a **Gender Study** • Developed "Exploring Data" modules for **high school teachers and students**
Marketing, Outreach & Dissemination	• Hired a crew to begin filming a **"Data in Action" video series** showcasing data careers at local organizations	• **Completed production** on five "Data in Action" videos with regional partners in the public and private sector	• Produced a **DataFest video** • Created a **Replication Guide** • Professor Hansford **selected to present** at Hi-Tec 2024

"DATA LITERACY
WILL BE THE MOST CRITICAL SKILL FOR THE WORKFORCE IN 2030."
—— Qlik, 2023

Initial Course-Building Principles

1. Use Open-Source tools and materials
2. Select low-cost or no-cost textbooks (Open Educational Resources)
3. Limit prerequisites (as few as possible for equity)
4. Embed Service-Learning (project-based learning)
5. Offer multi-modality options (flexible course offerings)
6. Solicit industry guidance (reviewed by and aligned to local industry)
7. Emphasize data for good (real-world community projects)
8. Support articulation alignment (support transfer to 4-year programs)
9. Templatize, share, and disseminate (ATE Central and conferences)

Existing Course Updates and Enhancements

- Created and dropped **BIS 1600**: Data Visualization
  - Course dropped to streamline course sequence
  - Modules incorporated into **BIS 1230**: Spreadsheet Software
- Updated **CIS 2265**: Data Visualization (now titled "Data Visualization with Tableau")
- Updated **CIS 2266**: Python for Data Analytics
- Revised **CIS 2165**: Database Management

New Courses Created

- Created **CIS 1160**: Introduction to Data Literacy
  - New survey course with an introduction to data tools and skills
- Created **CIS 2267**: Advanced Python for Data Analytics
  - Advancing students to build up additional Python skills
- Created **MAT 1455**: Introduction to Data Science
  - Statistics course using R programming

New Certificate Created

- Data Literacy Foundation - DL.S.CRT
  - Evolved from a short-term certificate to a one-year certificate
  - Designed for the traditional student pathway
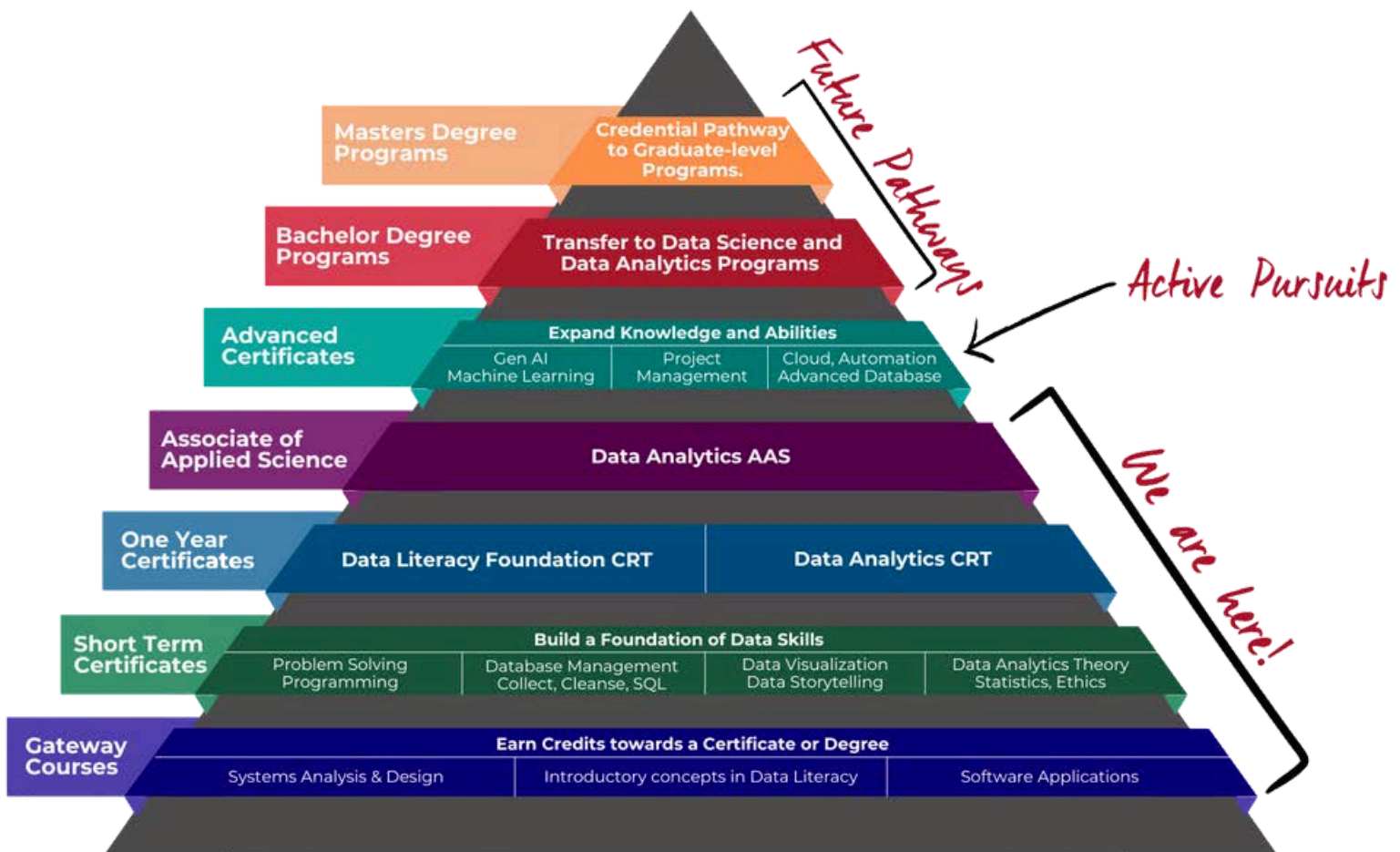 - Start in high school, continue and complete in college quickly

Maximizing Flexibility for Concurrent Work and Education

Technological innovation is accelerating, and innovations that once took years now happen in weeks. The change is forcing organizations to compress education, training, and adoption timelines. This accelerated pace is having a **dramatic effect on the workforce**, who must learn new skills and become productive almost immediately. Skills-first learning is necessary to support career readiness.

To help address this need, the grant seeks to **soften the barriers between high school, college, and the workforce** by creating a system of overlapping rather than sequential pathways:
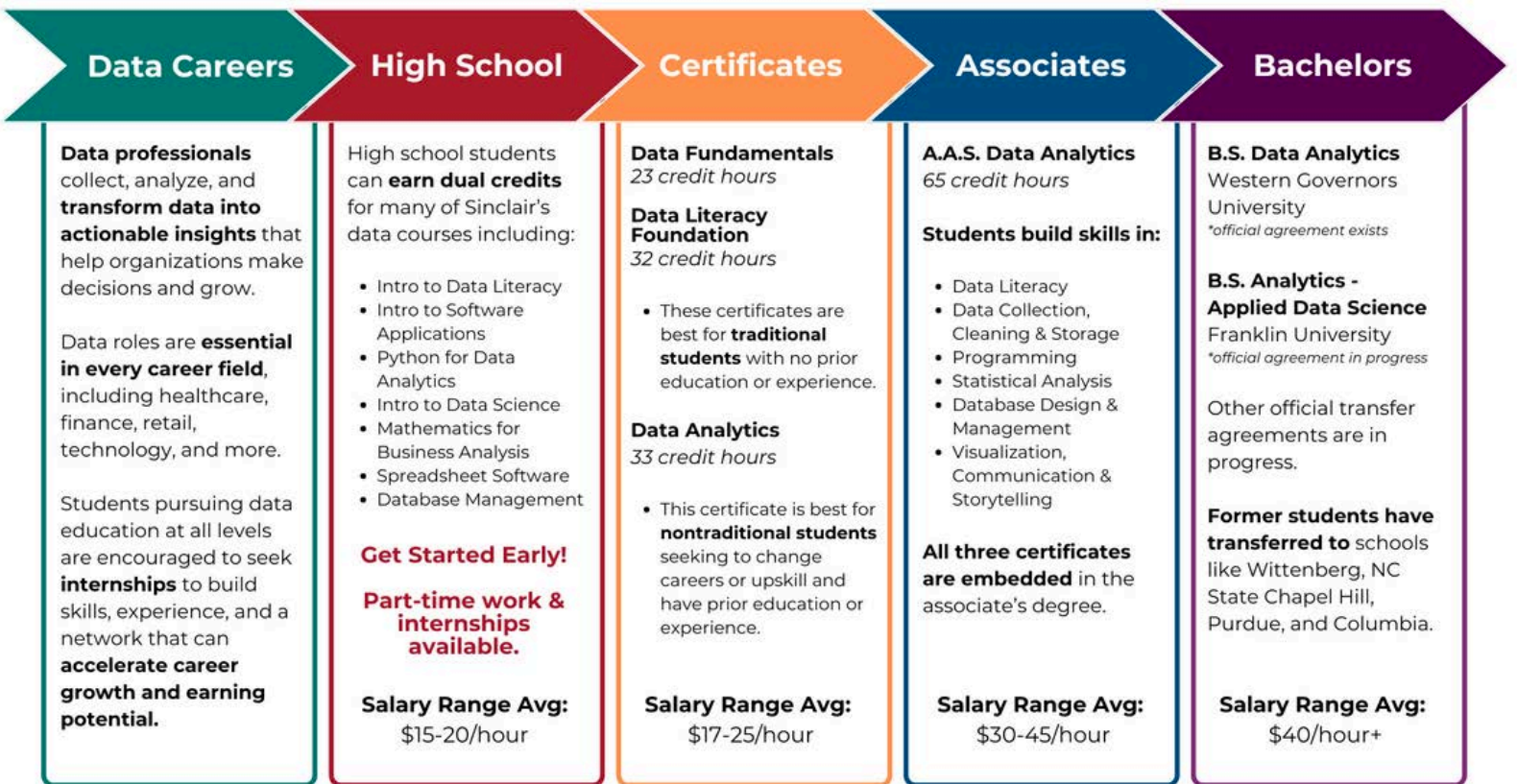
- **High school students** earn college credit.
- **College students** are quickly and regularly engaged in professional development.
- **Non-traditional students** seeking to upskill or reskill can do so quickly and easily through flexible, multi-modality offerings with certificates or degrees focused on skill building.

STACKABLE PATHWAYS
WITH EMBEDDED CERTIFICATES

Mapping Data Career Opportunities & Economic Mobility

Data Careers	High School	Certificates	Associates	Bachelors
Data professionals collect, analyze, and **transform data into actionable insights** that help organizations make decisions and grow. Data roles are **essential in every career field**, including healthcare, finance, retail, technology, and more. Students pursuing data education at all levels are encouraged to seek **internships** to build skills, experience, and a network that can **accelerate career growth and earning potential.**	High school students can **earn dual credits** for many of Sinclair's data courses including: • Intro to Data Literacy • Intro to Software Applications • Python for Data Analytics • Intro to Data Science • Mathematics for Business Analysis • Spreadsheet Software • Database Management **Get Started Early!** **Part-time work & internships available.** **Salary Range Avg:** $15-20/hour	**Data Fundamentals** *23 credit hours* **Data Literacy Foundation** *32 credit hours* • These certificates are best for **traditional students** with no prior education or experience. **Data Analytics** *33 credit hours* • This certificate is best for **nontraditional students** seeking to change careers or upskill and have prior education or experience. **Salary Range Avg:** $17-25/hour	**A.A.S. Data Analytics** *65 credit hours* **Students build skills in:** • Data Literacy • Data Collection, Cleaning & Storage • Programming • Statistical Analysis • Database Design & Management • Visualization, Communication & Storytelling **All three certificates are embedded** in the associate's degree. **Salary Range Avg:** $30-45/hour	**B.S. Data Analytics** Western Governors University *official agreement exists* **B.S. Analytics - Applied Data Science** Franklin University *official agreement in progress* Other official transfer agreements are in progress. **Former students have transferred to** schools like Wittenberg, NC State Chapel Hill, Purdue, and Columbia. **Salary Range Avg:** $40/hour+

Data Fundamentals DF.S.STC

Data Literacy Foundation DL.S.CRT

Data Analytics DA.S.CRT

Data Analytics DATA.S.AAS

Market Insights: Lightcast provides labor market data that helps educators and training providers understand the landscape of data jobs. This information is crucial for aligning curriculum with industry needs and guiding students toward successful careers. For more detailed information, you can visit Lightcast's Data Analyst role page and Lightcast Skills Knowledge Base. Job roles are always changing, so check for updated salary ranges.

"The path to economic mobility is paved with hard work, determination, and access to education." - Anonymous

Empowering Analytical Thinking

According to the **Ohio Department of Education & Workforce**:

 *"Contemporary mathematics education has **not been keeping up with the rapid emergence of data and computing**.*

*To **help students thrive in data-related fields** of education or careers, students should be exposed not only to Statistics and Probability but also be **well-equipped with a basic understanding of data science**.*

*It is evident that students who develop data fluency are **better prepared for 21st century careers**."*

(https://education.ohio.gov/Topics/Learning-in-Ohio/Mathematics/Resources-for-Mathematics/Math-Pathways/Data-Science-Foundations)

As states, including Ohio, **update graduation requirements to include data literacy and data science**, professional development for high school teachers is crucial.

Following our state's direction, we not only made **dual credit courses** in data analytics available to high schools, but also developed and delivered workshops to **provide teachers with the skills and knowledge required** to deliver those courses and meet these evolving educational demands.

YEAR ONE

Professional development in year one was focused on:
- Introducing the overall program and plans
- Providing a foundational understanding of data literacy educational goals
- Sharing new course overviews and administrative strategies for adoption
- Setting the stage for deeper engagement with content under development

YEAR TWO

- The emphasis on hands-on training in Python and Tableau in year two equipped teachers with practical, in-demand technical skills essential for teaching contemporary data literacy concepts.

YEAR THREE

- Including both teachers and curriculum decision-makers in year three workshops ensured that the deliverables are not only comprehensive but adaptable and responsive.

We now have comprehensive offerings including courses, videos, and (non-credit) customizable modules and lesson plans that can be easily adopted and adapted for use in high schools.

Inspiring Engagement

In this age of compressed timelines, organizations seek to hire individuals who can quickly and seamlessly adapt to a new environment. From the beginning, the grant prioritized **sponsoring students** to attend local, regional, virtual, and physical professional conferences and events.

UC Data Science Symposium Fall 2023

Women in Analytics DataConnect Summer 2023

Student professional development activities, such as peer-group meetings and conferences, are **essential experiences during college years**. Rather than waiting until after graduation to provide networking opportunities, skill development through industry insights is crucial for career readiness.

Regular participation in professional events **allows our students to connect with industry professionals**, stay current on industry trends, and develop essential soft skills like communication, teamwork, and leadership.

Engaging in these activities early demonstrates proactivity and commitment to professional growth, significantly enhancing resumes and job prospects upon graduation. Additionally, they **compliment academic learning by providing real-world context and applications**, making theoretical knowledge more practical and relevant, thus better-preparing students for the workforce. Engaged Sinclair Data Analytics students are career-ready.

UC Analytics Summit Spring 2024

UC Analytics Summit Spring 2024

MAKE YOUR BREAKTHROUGH IN DATA ANALYTICS

SINCLAIR COLLEGE

WiA Women in Analytics

TECHNOLOGY FIRST

Highlighting Experiential Learning in Data Analytics Education

Projects: Engaging in hands-on projects allows students to apply theoretical knowledge to real-world problems. This **practical experience enhances their understanding** and retention of data analytics concepts and tools. Project-Based Learning (PBL) is a great way to develop skills.

ASA DataFest: Participating in competitions such as DataFest offers students the opportunity to solve complex data problems in a collaborative and high-pressure environment within 48 hours. These contests **encourage creativity, critical thinking, and teamwork** and often involve industry-relevant challenges that provide insights into real-world data issues.

Industry Peer Groups: Learning within peer groups fosters collaboration and knowledge sharing. Students can discuss challenges, share insights, and support each other's learning processes. This collaborative approach helps **build communication and teamwork skills**, which are crucial in the field of data analytics.

Service-Learning Projects: Engaging in service-learning projects allows students to apply their skills to benefit the community. By **working on real-world projects** for local organizations, students can enhance their practical experience while making a positive impact. These projects also foster a sense of civic responsibility and community engagement.

These experiential learning methods help students build practical skills, industry insights, and a network of peers and professionals so they are well-prepared for careers in data analytics.

ASA DATAFEST
SPRING 2023 & SPRING 2024

ASA DataFest 2024 Media Clip
Welcome to DataFest

ASA DataFest Winners & Data Pros

Lessons Learned

Bridging Theory and Practice

It is inevitable that initiatives of this scope and duration will result in **valuable lessons learned**. Our hope is that this candid discussion of the challenges and difficulties we faced can benefit other teams and help you overcome similar challenges.

Challenge: Generating interest with high school students - *"What's in it for me?"*

The value of data literacy, skills, and earning potential can be very abstract concepts for high school students. Job titles such as data architect, business intelligence analyst, or machine learning engineer can be indecipherable and intimidating. The gap in understanding how data guides decision-making in all industries can be a barrier in attracting interest.

Lesson Learned:
To attract students, we must translate the opportunities into **meaningful, relatable language to help them understand** why data literacy is crucial, how portable those skills are, and the high value and earning potential these skills represent.

Challenge: Gaining adoption in high schools - *"It's complicated."*

We focused early on 'training the trainers' – teaching data skills to high school instructors. However, high school teachers are not curriculum decision makers. They are influencers and implementers, but do not have ultimate decision-making authority. Further, planning cycles to analyze, make decisions, and take action on curriculum changes at the high school level can take several years; much longer than anticipated.

Lesson Learned:
Engage **curriculum decision makers** at the high schools early and gain their support.

Challenge: The role of the Principal Investigator (PI) - *"To lead, or to do?"*

Proper resource planning and team building is a key element to ensure grant deliverables are accomplished as effectively and efficiently as possible. PI Professor Paul Hansford took responsibility for building many program deliverables, including new courses. Instead of leading, he was busy doing. This was a planning issue, not an execution issue. As a result, some deliverables were delayed early in the grant.

Lesson Learned:
PI's should recruit a team, lead the team, and **manage the deliverables**; not necessarily be responsible for creating all deliverables.

Data courses taught in high school generate a great deal of excitement!

Find the need and endeavor to meet it.
- David A. Sinclair

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