

entry points II

Pathways and Possibilities to Support Student Learning
about Data and AI

EVENT #1 | POSTSECONDARY PROGRAMS AND PATHWAYS

Sponsored by the College of Education, Health and Human Sciences at
the University of Tennessee, Knoxville

March 6, 2026



COLLEGE OF EDUCATION,
HEALTH & HUMAN SCIENCES

INTRODUCTION

Entry Points Presenters



**NCSU: Data Science & AI
Academy, ESTEEM Project**



MTSU: LEADS Project



**UTK: CADE Graduate
Programs**

01

Data Science & AI Academy

Data Science and AI Education with ADAPT Model

ADAPT your pedagogy.

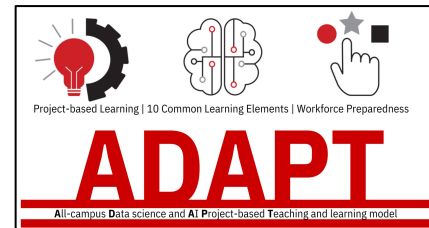
All-campus Data Science and AI Project Based Teaching and Learning Model

**Sunghwan Byun, Ela Castellanos-Reyes, Andrea Crowley, Joe Faith, Lane Freeman,
Meredith Graham, Eleanor Hasse, Rachel Levy (Ray), Pamela Lovin, Dana Newton, Taryn Shelton**

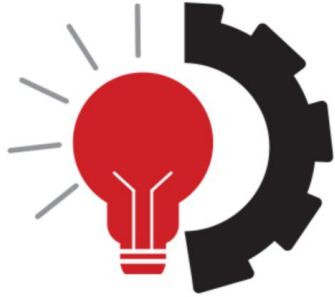
WEBSITE: [GO.NCSU.EDU/DSA](https://go.ncsu.edu/dsa)



This material is based upon work supported by the National Science Foundation under Grant Number 2313644 and 2222148. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.



Data Science and AI Education with ADAPT Model

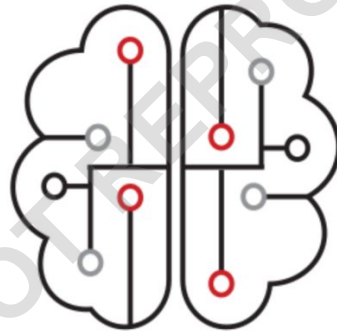


Project-based Learning | 10 Common Learning Elements | Workforce Preparedness

ADAPT

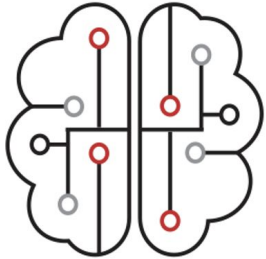
All-campus **D**ata science and **A**I **P**roject-based **T**eaching and learning model

Three Components of the ADAPT Model



Project-based Learning | 10 Common Learning Elements | Workforce Preparedness

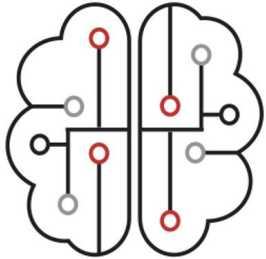
10 Common Learning Elements



Data Perspectives

1. Recognizing **data as information - not truth** - with error, variability, and missing information.
2. Explaining what it means **to be a data scientist and AI expert**
3. Observing a **variety** collection of data scientist **role models and careers**.

10 Common Learning Elements



Data Practices

4. Examining **how data are created**, and the related assumptions and collection practices.
5. Practicing during **curation, wrangling, and cleaning**.
6. Assessing **validity of data, methods, results and communication**.
7. Employing **design practices**.
8. Investigating **ethical issues** and ways to approach them.

10 Common Learning Elements



Data Discoveries

9. Articulating **current issues or open questions** in data science and AI.
10. Specifying **exciting discoveries or impacts** of data science and AI.

DO NOT REPRODUCE

1-credit courses: prototype and iterate

Standing Courses

- Intro to R/Python for Data Science
- Intro to Data Visualization
- Data Communication
- Introduction to AI Ethics
- Data Science for Social Good
- Intro to Data Science for Cybersecurity
- Measuring Success
- Data Wrangling and Web Scraping
- Exploratory Data Analysis for Big Data
- Data Internships for Social Impact
- Exploring Machine Learning

Special Topics Examples

- Intro to APACHE Spark Using Big Datasets
- Sports Analytics and Forecasting Using R
- Bayesian Computations for Machine Learning
- Predictive Analytics for Improving Services
- R for Biological Research
- Neural Networks and Reinforcement Learning
- BIG Data for Disease and Disparities
- Machine Learning for Computer Vision
- R for Social Sciences
- Social Media: Data, Ethics and Theory

Levels: 200s no prerequisite 400s suggested skills 500s graduate

DSA Curricular Pathways



Minors and Certificates

Minors

- Data Science in Business
- Data Science with Graphic and Experience Design
- Data Science in Engineering Analytics and Decision-Making
- Mathematical Data Science
- Interdisciplinary Applied Data Science
- Data Science in K–12 Education

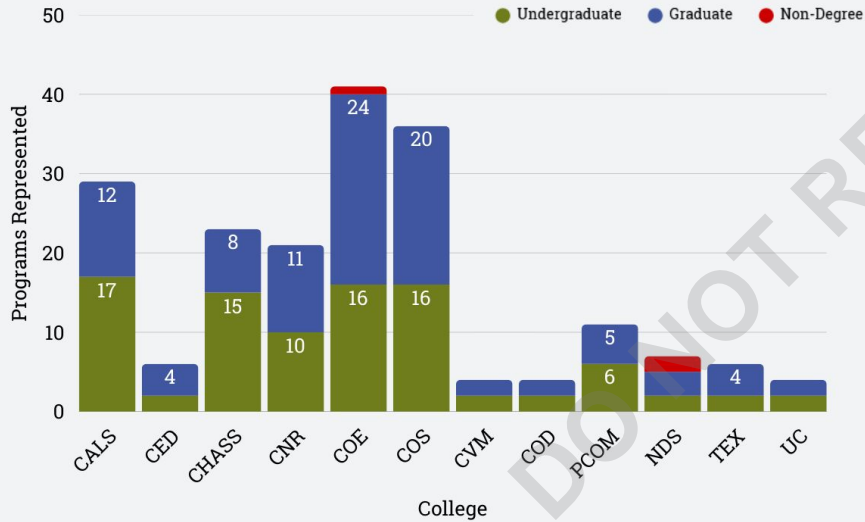
Certificates

- Data Science in Business
- Data Science with Graphic and Experience Design

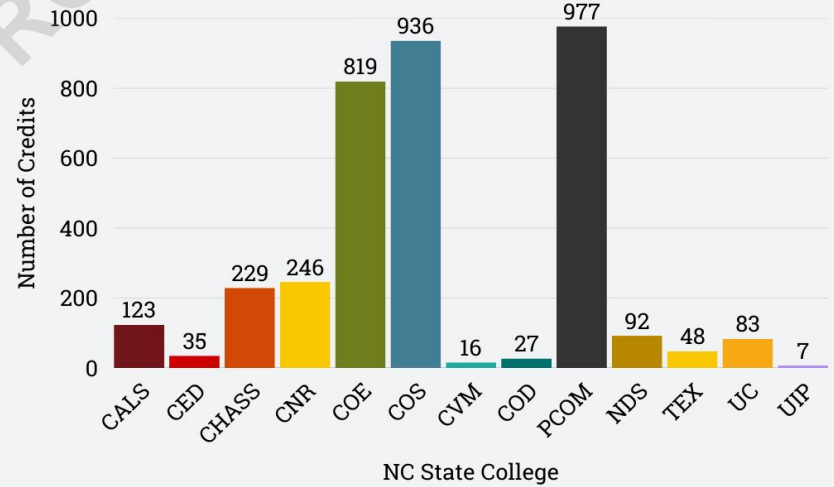
Credentials are often composed of 1-credit DSA courses and 3-credit courses from departments. Departments decide which DSA courses can count for their students.

DSA Course Enrollment 2021-2026

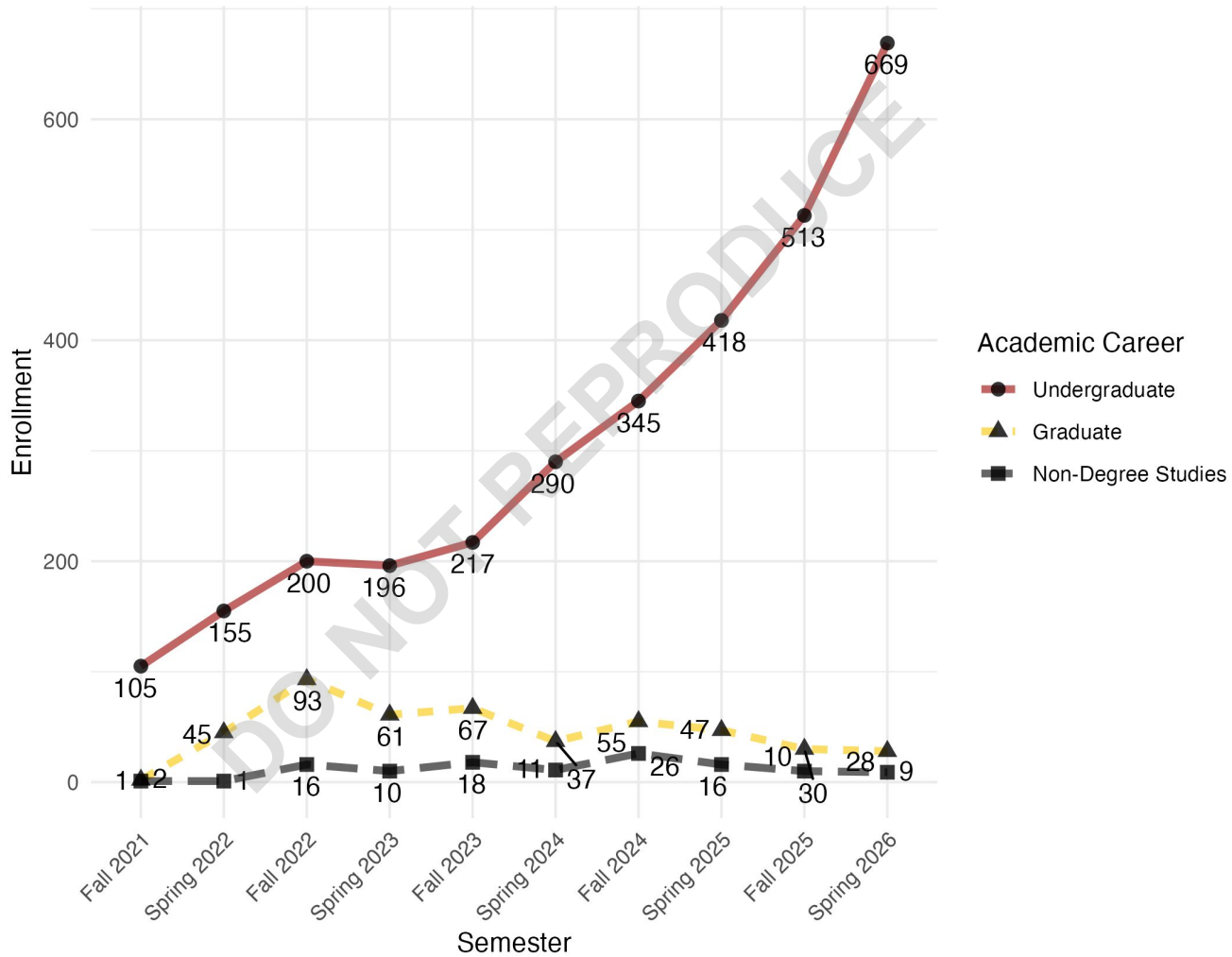
Number of Majors Represented in DSA Courses Per College



Total Credits Per NC State College



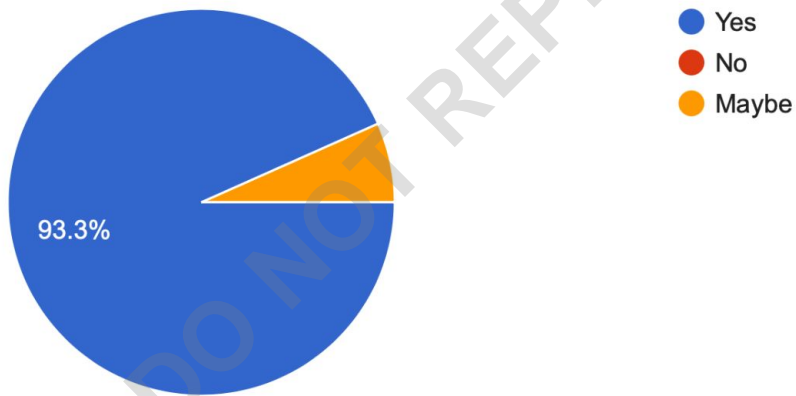
Semester Enrollment by Academic Career



Students prepared for what's next

Will you reference your DSA course experiences in interviews or applications when appropriate and applicable (e.g., speak about your course projects ...rses on applications, when possible and relevant)?

15 responses



Data Science and AI Education with ADAPT Model

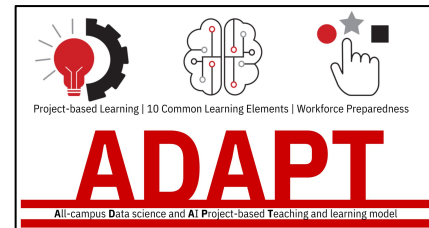
Thank you!

WEBSITE: [GO.NCSU.EDU/DSA](https://go.ncsu.edu/dsa)

**Sunghwan Byun, Ela Castellanos-Reyes, Andrea Crowley, Joe Faith, Lane Freeman,
Meredith Graham, Eleanor Hasse, Rachel Levy (Ray), Pamela Lovin, Dana Newton, Taryn Shelton**



This material is based upon work supported by the National Science Foundation under Grant Number 2313644 and 2222148. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

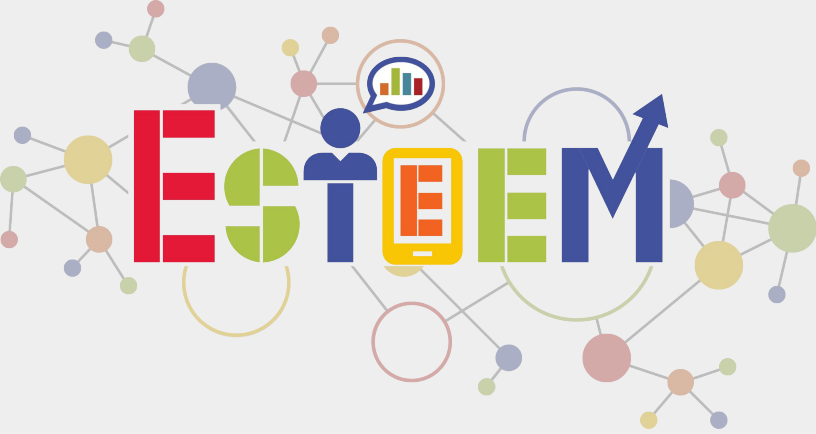


02

ESTEEM

DO NOT REPRODUCE





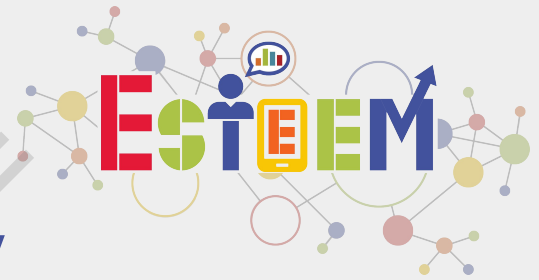
Supporting University Data Science & Statistics Teacher Education

Hollylynne Lee

EntryPoints Webinar: Postsecondary Programs and Pathways

March 6, 2026

Enhancing Statistics and Data Science Teacher Education: Transforming & Building Community



NC State University

Hollylynne Lee (PI)

Gemma Mojica (Co-PI)

Emily Thrasher (Senior Researcher)

Rachel Abel (GRA)

Adrian Kuhlman (GRA)

Eastern Michigan University

Stephanie Casey (PI)

University of Southern Indiana

Rick Hudson (PI)

The Concord Consortium

Bill Finzer (Co-PI)

NC STATE UNIVERSITY

E EASTERN MICHIGAN UNIVERSITY

UNIVERSITY OF
SOUTHERN INDIANA

The Concord
Consortium



Materials used in this presentation were funded by the National Science Foundation under grants DUE 2141727 and 1625713 awarded to North Carolina State University, DUE 2141716 awarded to Eastern Michigan University, and DUE 2141724 awarded to University of Southern Indiana. Any opinions, findings, and conclusions or recommendations expressed herein are those of the presenters and do not necessarily reflect the views of the National Science Foundation.

Broad ESTEEM II Goal

Transform

undergraduate teacher preparation

to support developing teachers who are knowledgeable and confident in teaching
Data Science & Statistics

Specific Project Goals

Goal A: Investigate the current systems in undergraduate teacher preparation for teaching data science and statistics [DS&S].

Goal B: Build and sustain a DS&S teacher education networked improvement community.

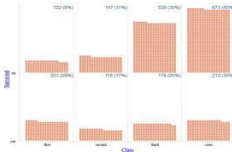
Goal C: Reach a broad teacher education audience through developing, curating and disseminating high quality DS&S teacher education curriculum materials.

The ESTEEM Dream Began in 2016


Enhancing Statistics Teacher Education Through E-Modules

Learn to investigate bivariate categorical data in CODAP

Two-way binned plot with conditional relative frequencies



Segmented bar graph



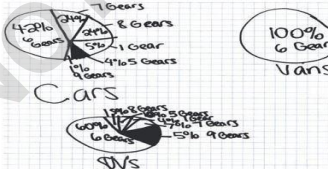
Learn common student approaches when analyzing bivariate categorical data

Common student approaches when analyzing data in a two-way table

Pedro Animation: Equal-Number Concept


Branchial distance	No branchial distance	Total
Smoke	60	160
Not smoke	60	100
Total	120	260

Student-created graphs

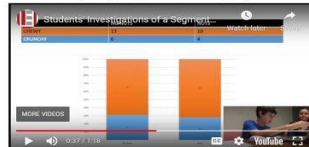


Synthesize & apply learning

Census at School data investigation



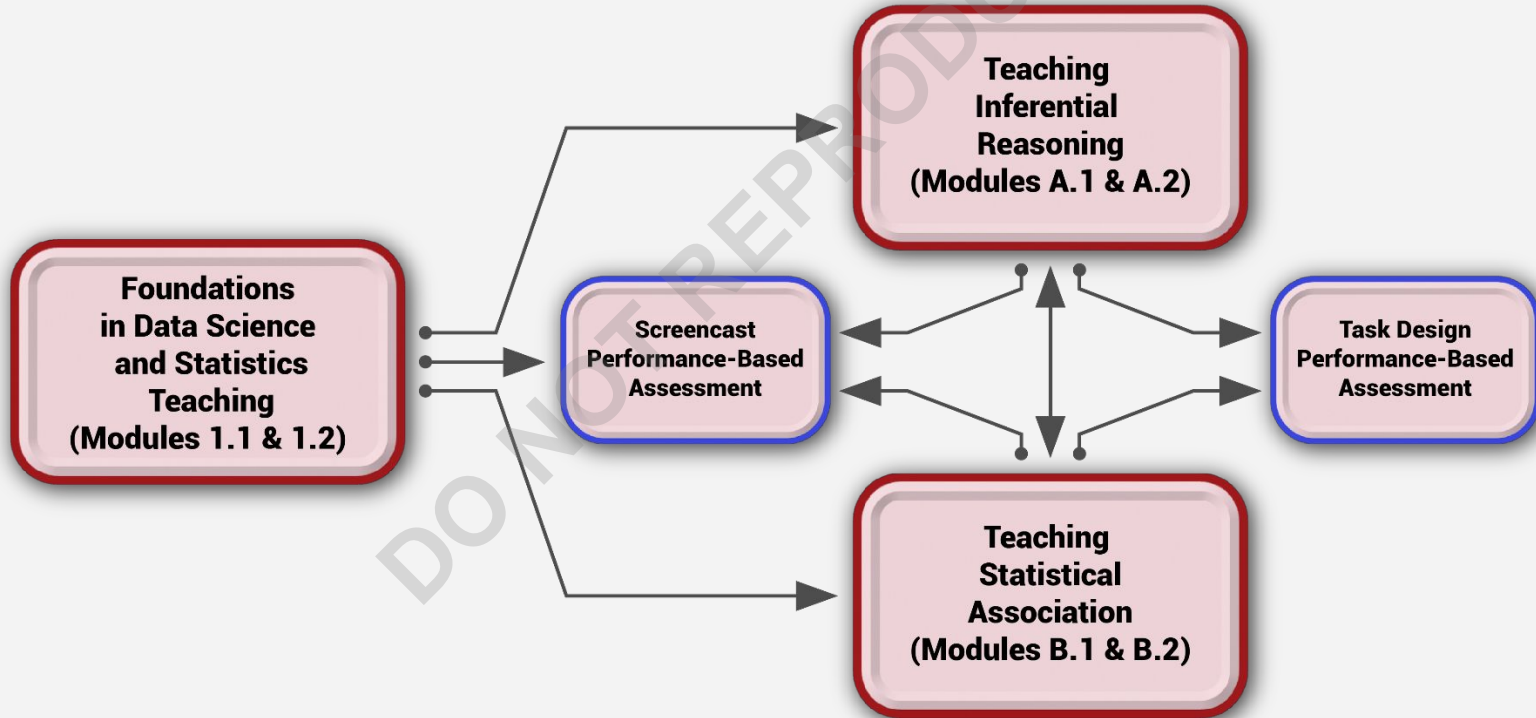
Professional noticing of students' thinking when analyzing segmented bar graphs



40+ hrs of multimedia material

500+ registered users

Materials are FREE and can be imported directly into LMSs



Who Are These Modules For?


These modules are designed for use in online, hybrid, or face-to-face teacher preparation courses. Mathematics teacher educators can incorporate them into existing courses or use them as standalone learning experiences. Each module includes interactive activities, real-world data investigations, and resources that support the development of strong statistical reasoning in preservice teachers.

1.1.g Making Sense of Data Visualizations: A Look at Mathematics and Science High School Course Enrollment

In the activity detailed below, you will analyze the enrollment of U.S. high school students in mathematics and science courses through examining a series of data visualizations that have been used in educational reports. Many news outlets and social media also present data visualizations as part of a story they are trying to communicate. Thus, part of the role of statistics and data science education in schools is to develop a data literate citizenry for interacting with visualizations made by others. This activity will illustrate the use of this framework in making sense of data visualizations regarding mathematics and science course enrollments.

Framing How to Make Sense of Data Visualizations

To support students in **Making Sense** of data visualizations, Thrasher et al. (2024) proposed a framework that begins with three components — **Unpacking Context and History**, **Reading the Visualization**, and **Personalizing the Data** — which then lead to an additional component regarding how a data visualization could be used to **Communicate and Propose Action**. This diagram helps to communicate how the components work together in the sense-making process; further explanation of each component is provided below:



Unpack the Content and History

Unpack the Content and History includes identifying the context or phenomena of the data. Students should discuss what they already know about the context and any historical perspectives related to the context.

Read the Visualization

Read the Visualization entails carefully attending to structures in the visualization like scale, axes, and color, as well as understanding what was being measured and any computed statistics that are being displayed (like averages or proportions). Additionally, reading the Visualization involves noticing unique cases or groups with similarities as well as overall trends and patterns.

Personalize the Data

Personalize the Data involves prompting students to think about how they and others may be represented in the data. Data visualizations may also evoke an emotional response (e.g., surprise, happiness, empathy, disappointment) that can contribute to students' sense-making and lead them to consider biases and different perspectives, or promote an urge to take action on an issue.

1.2.c Designing and Adapting Statistics and Data Tasks

Considerations for Designing and Adapting Tasks

The tasks and tools we use in classrooms with our students are primary ways that a teacher provides opportunities for students to learn important aspects of statistics and data. Many times, teachers use tasks that are provided in a set of curriculum materials or a lesson they have found online. Teachers often have to adapt these tasks to best fit the needs of students in their classrooms and/or to align with their local standards.

Below we highlight considerations for teachers as they develop, identify, adapt, analyze, and implement tasks to engage students in learning about statistics and data science ideas and practices. In Part 1 of this module, you learned about important differences between mathematics and statistics. The ideas are important to ensure you are designing learning experiences that promote reasoning about statistics and data, which is explicit in several ideas identified below.

Learning Goals and Task Focus

- Do the learning goals of the task focus on developing significant ideas related to mathematics or statistics and data?
- Do the learning goals align with supporting engagement with mathematics or statistics (data practices)?
- To what extent does the task focus on procedural understanding, conceptual understanding, or connecting procedures and concepts?
- Does the task promote teaching practices related to learning about statistics and data and in what ways?

Problem Solving, Context, and Real-World Connections

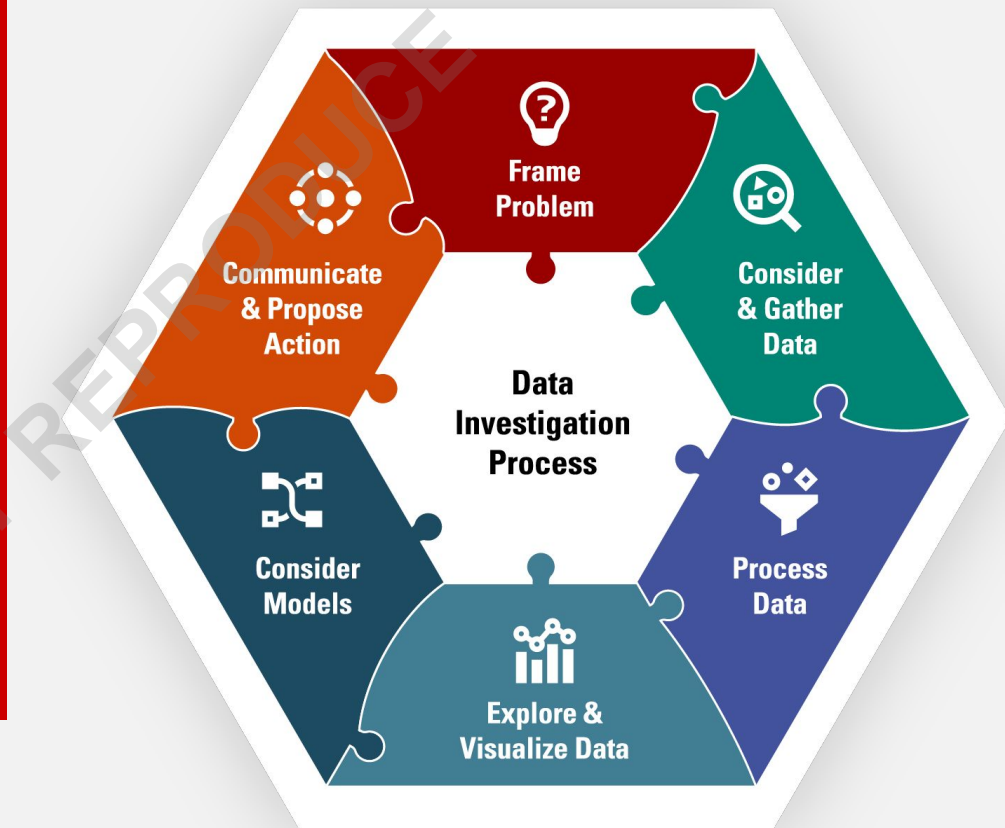
- Does the task provide opportunities for students to engage in problem-solving? Is the emphasis on statistical problem-solving or mathematical problem-solving?
- Does the task provide opportunities for making sense of data with respect to a real-world phenomenon/context and investigative question? Is the context of the data likely to be accessible and of interest to students? Are there opportunities for students to formulate and explore their own questions?
- Are there opportunities for students to attend to variability in data and uncertainty in models and claims?

Materials are FREE and can be imported into learning management systems (LMSs)

Data Investigation Process

More holistic, nonlinear, and reflective of data science practices

Lee, Mojica, Thrasher, & Baumgartner, 2022

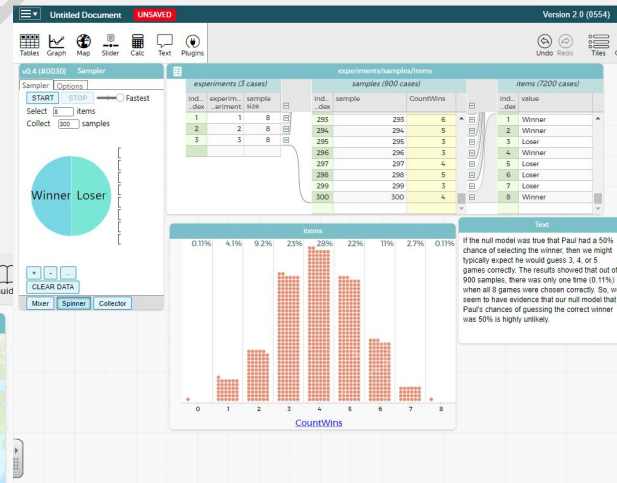


NC STATE

College of Education
Friday Institute
for Educational Innovation

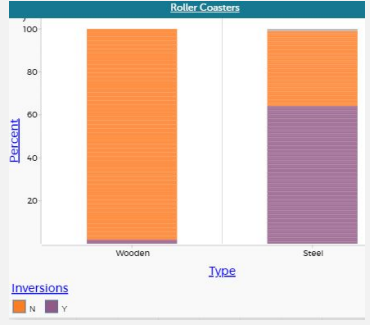
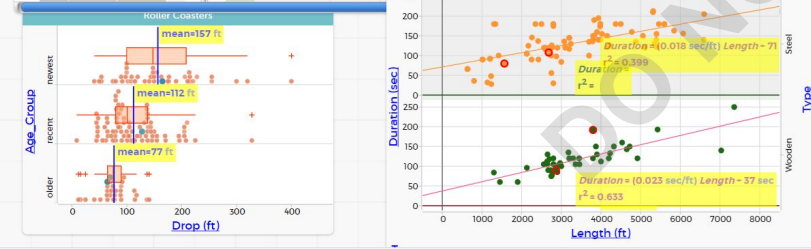
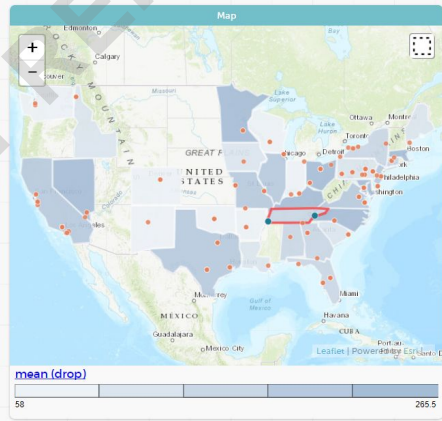
Contribute to Design of CODAP

CODAP: Common Online Data Analysis Platform



Sample of US Roller Coasters Across Years

States (32 cases)			Roller Coasters (157 cases)												
in-dex	State	mean (drop)	in-dex	Coaster	Park	Top Speed (mph)	Max Height (ft)	Drop (ft)	Length (ft)	Duration (sec)	Type	Design	Year Opened	Age Group	Invs
24	Ohio	177.21	1	Swamp Fox	Family	50	75	65	4400	90	Wooden	Sit Down	2000	newest	N
25	Oklaho...	62.33	2	Hurricane	Myrtle	55	102	100	3900	120	Wooden	Sit Down	1915	older	N
26	Pennsyl...	82.61	1	Zippin Pippin	LibertyL...	40	70	70	2865	90	Wooden	Sit Down	1999	recent	Y
27	South C...	82.5	2	Revolution	LibertyL...	55	70	65	1565	80	Steel	Sit Down	1979	older	Y
28	Tennesse...	107	3	Tennessee Tor...	Dollywo...	63	163	128	2682	108	Steel	Sit Down	1999	recent	Y
29	Texas	116.91	4	Lightning Rod	Dollywo...	73	165	165	3800	192	Wooden	Sit Down	2016	newest	N
30	Virginia	125.44	1	Texas Cyclone	Six Flag...	52	93	80	3180	135	Wooden	Sit Down	1976	older	N
31	Washin...	58	2	Big Bend	Six Flag...	52	81	81	2876	98	Steel	Sit Down	1971	older	N
32	Wiscon...	68.33	3	Ultra Twister	Six Flag...										
			4	Judge Roy Scr...	Six Flag...										



How Do I Access ESTEEM Materials?

go.ncsu.edu/esteem-modules



COURSE

ESTEEM II: Foundations in
Data Science and Statistics

Undergraduate - Graduate

ESTEEM Project

↓ 13 ☆ 2



COURSE

ESTEEM II Association
Modules

Undergraduate - Graduate

ESTEEM Project

↓ 6 ☆ 2



COURSE

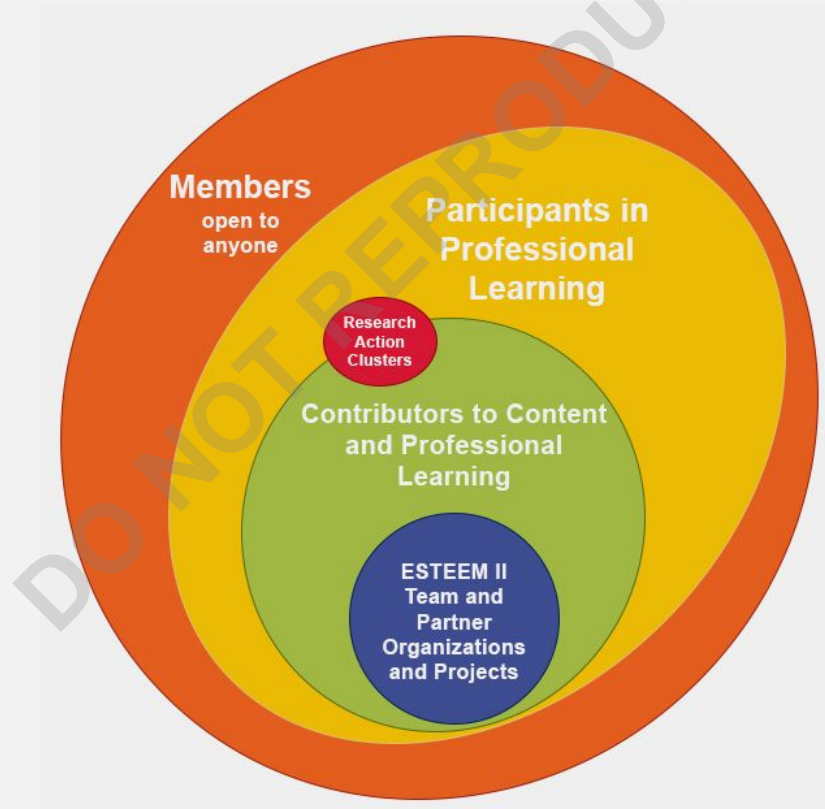
2021 ESTEEM: Enhancing
Statistics Teacher Education

Undergraduate - Graduate

ESTEEM Project

↓ 3 ☆ 2

Model for our Networked Improvement Community



ESTEEM Network: Sample of Key Partners

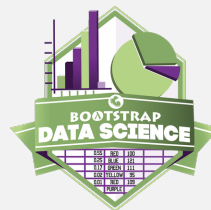


CODAP



MODULE(S²)

Mathematics Of Doing, Understanding, Learning
and Educating for Secondary Schools



NATIONAL COUNCIL OF
TEACHERS OF MATHEMATICS



Online HUB to Support the Network



As part of the ESTEEM Network, this hub is designed to support the collaborative network of faculty and educators interested in preparing secondary teachers for teaching data literacy, data science, and statistics. The primary focus is supporting teacher education in undergraduate teacher preparation programs for future secondary teachers.

CONNECT IN



EXPLORE
RESOURCES



JOIN THE
ESTEEM
CONVERSATION!

go.ncsu.edu/esteemhub



STAY INFORMED



ESTEEM Network for Transforming Teacher
Preparation in Statistics and Data Science Education



03

**UTK CADE
Programs**

DO NOT REPRODUCE



Data Science and AI Education

Postsecondary Programs & Pathways at the University of Tennessee, Knoxville



THE UNIVERSITY OF
TENNESSEE
KNOXVILLE

Introductions

Joshua Rosenberg is Haslam Family Professor and Associate Professor of STEM Education

Louis Rocconi is Associate Professor of Evaluation, Statistics, and Methodology

The **University of Tennessee, Knoxville** is a public, land-grant university and the flagship campus of the UT System.



Photo from NY Times/The Athletic

Pathway Overview

1. **Graduate Certificate** in Educational Data Science
2. **Intercollegiate Graduate Statistics and Data Science Program (IGSDSP; there will be a quiz later!)**
3. **M.S.** in Computing, AI and Data Analytics in Education (coming Fall 2026)
4. **Ph.D.** in Evaluation, Statistics, and Methodology

Pathway 1: Graduate Certificate

A total of 4 graduate courses and a capstone project are required for the certificate. Students may substitute one of the four required courses with a related graduate course approved by the Educational Data Science Graduate Certificate program coordinator.

STEM 680: Foundations of Educational Data Science I



STEM 685: Foundations of Educational Data Science II



STEM 691: Visualizing Data Using R



STEM 695: Capstone in Educational Data Science



Pathway 2: IGSDSP

- Minor or Masters in Statistics and Data Science
- Add on to existing program
- Earned concurrently with main degree
- Minor is 15 credit hours

PARTICIPATING PROGRAMS AND COMMON ACADEMIC PATHWAYS

If your program is not listed, contact your [college representative](#) to start the process of getting program approval.

Program:

- + ACCOUNTING AND INFORMATION MANAGEMENT
- + AGRICULTURAL AND RESOURCE ECONOMICS
- + ANIMAL SCIENCE
- + ANTHROPOLOGY
- + BIOCHEMISTRY & CELLULAR AND MOLECULAR BIOLOGY
- + BIOSYSTEMS ENGINEERING AND SOIL SCIENCE
- + CHEMICAL ENGINEERING
- + CHILD AND FAMILY STUDIES
- + CIVIL & ENVIRONMENTAL ENGINEERING
- + COMMUNICATION & INFORMATION
- + COMPARATIVE & EXPERIMENTAL MEDICINE
- + ECOLOGY & EVOLUTIONARY BIOLOGY
- + ECONOMICS
- + EDUCATIONAL PSYCHOLOGY AND COUNSELING
- + EDUCATIONAL LEADERSHIP AND POLICY STUDIES
- + ENTOMOLOGY & PLANT PATHOLOGY
- + FINANCE
- + FOOD SCIENCE & TECHNOLOGY
- + GENOME SCIENCE & TECHNOLOGY
- + GEOGRAPHY
- + INDUSTRIAL & SYSTEMS ENGINEERING
- + KINESIOLOGY, RECREATION, AND SPORTS STUDIES
- + MANAGEMENT AND ENTREPRENEURSHIP
- + MANAGEMENT SCIENCE
- + MARKETING
- + MATERIALS SCIENCE & ENGINEERING/POLYMER ENGINEERING
- + MATHEMATICS
- + MECHANICAL, AEROSPACE, AND BIOMEDICAL ENGINEERING
- + MICROBIOLOGY
- + NATURAL RESOURCES
- + NUCLEAR ENGINEERING
- + NURSING
- + NUTRITION
- + PLANT SCIENCES
- + POLITICAL SCIENCE
- + PSYCHOLOGY
- + PUBLIC HEALTH
- + RETAIL, HOSPITALITY, & TOURISM MANAGEMENT
- + SOCIAL WORK
- + SOCIOLOGY
- + SUPPLY CHAIN MANAGEMENT
- + THEORY AND PRACTICE IN TEACHER EDUCATION

Pathway 3: M.S.

The concentration in Computing, AI, and Data in Education (CADE) prepares educators, designers, and researchers **for the future of learning**. As schools and organizations integrate computational thinking, artificial intelligence, and data science into educational experiences, the **demand for expertise in these areas has never been greater**. CADE is **equipping students to lead** at the intersection of these domains.

TRACKS:

- 1. PEDAGOGY.....**
TEACHING AND LEARNING WITH DATA & AI
- 2. METHODS.....**
USING COMPUTATIONAL METHODS TO STUDY
EDUCATION PHENOMENA
- 3. DESIGN.....**
COMING 2027

Pathway 4: Ph.D.

- PhD in Evaluation, Statistics, and Methodology
- 90 credit hour program
- Strong foundation in program evaluation, applied statistical concepts, and educational research methodology
- Students can branch off into a focus area which includes Data Science
- Alumni are working as Data Scientists, Data Analysts, Psychometricians, AI Engineers

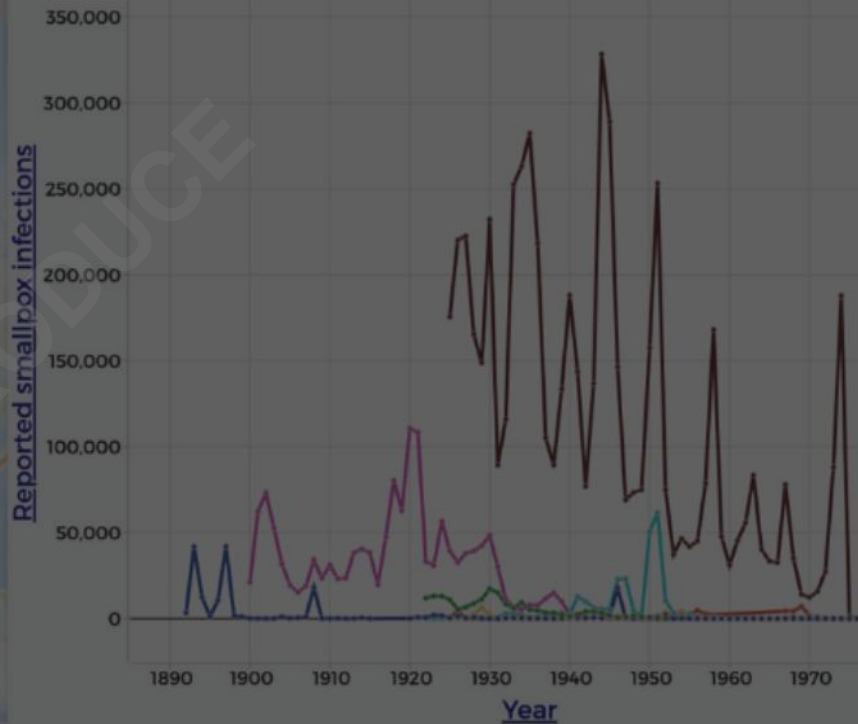
Takeaways – we are ...

- Building upon current offerings and strengths
- Partnering across departments and colleges
- Designing flexible programs for diverse learners
- Increasingly, offering deeper experiences for those interested

04

MTSU LEADS
Program

LEADS: LEADERS IN EDUCATION TO ADVANCE DATA SCIENCE

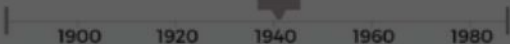


Number of Smallpox Cases in year



Drag me or press play

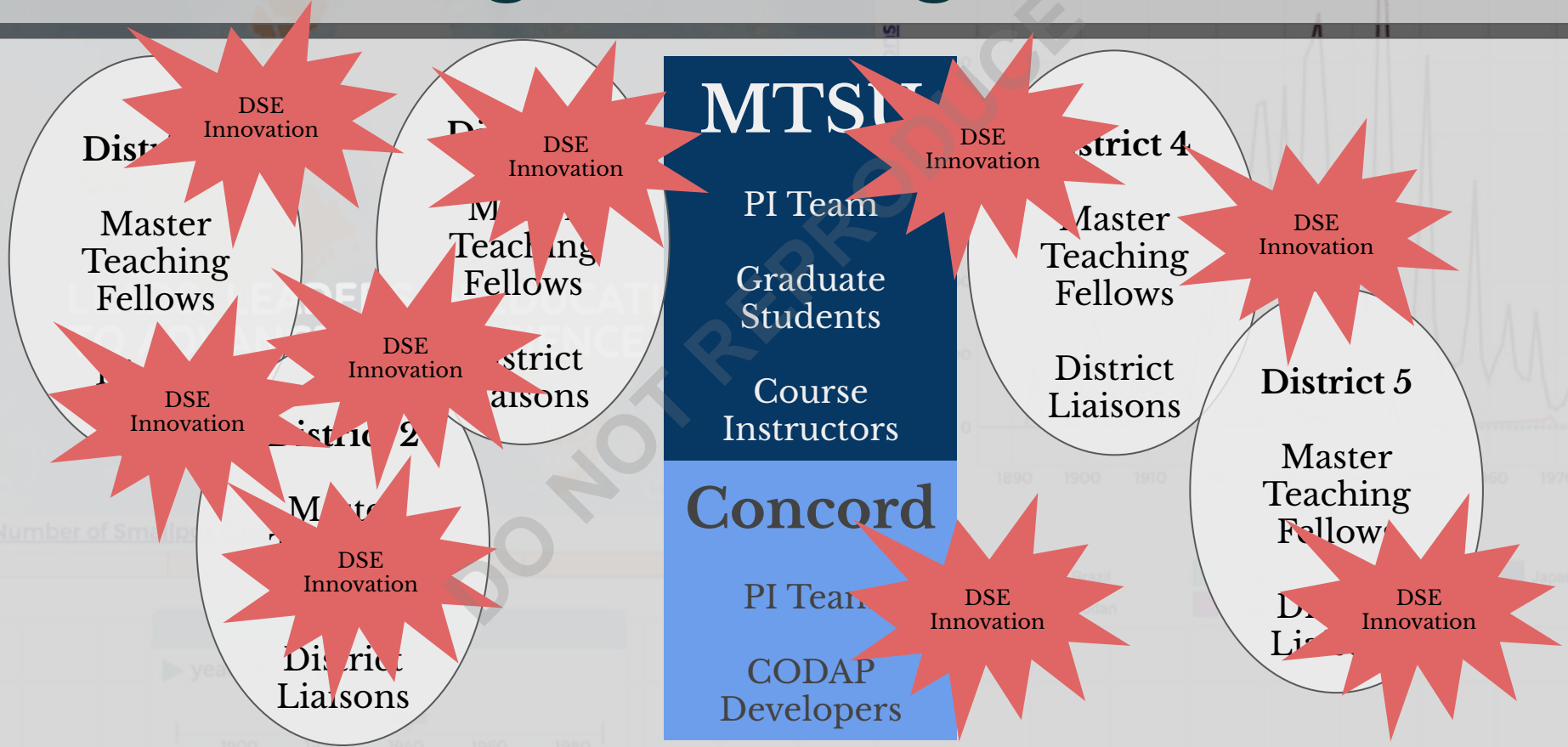
▶ year_ = 1941



OUR CONTEXT

- University Setting
 - Middle Tennessee State University
- Funding
 - NSF Noyce Grant (5 years)
- Collaborative Team
 - Keith Gamble, Seth Jones, Greg Rushton, Kevin Krahenbuhl, Kate Miller
- LEADS Program
 - Ed.S. degree program in data science teacher leadership designed for teachers in grades 5-9

LEADS Program Design



Years 1-2: Ed.S. Coursework

- Data Science Education
 - Data Literacy in Grades 5-9 (2 courses)
 - Data Ethics
 - Data Science Education Capstone Project
- Teacher Leadership
 - Collaborative Teams
 - Leadership Identity and Skills
 - Applied Research

Years 3-5: Two Tracks

- Ed.D. Track
 - Coursework towards Ed.D. in Assessment, Learning, and Student Success
 - Collaborative projects to position teacher as DSE leader in school and district
- Collaborative Partnership Track
 - Collaborative projects to position teacher as DSE leader in school and district

Additional LEADS Supports

- LEADS Days
 - Data dives
 - Standards exploration
 - District field trips
- District Liaisons
 - LEADS Advocate in district
 - District advocate for LEADS team
 - Teacher support for innovation and leadership

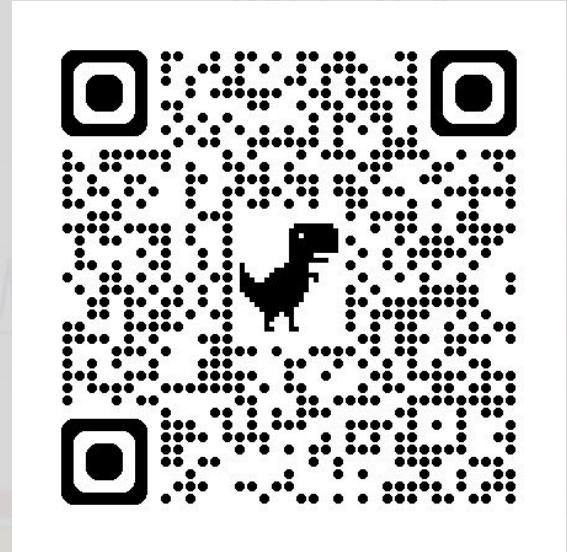


Early Results (1 Year In)

- **Teacher Professional Identity**
 - Teachers describe an increased sense of energy and curiosity towards the teaching profession
 - “I’m not just surviving, with LEADS I’m thriving”
- **DSE Leadership Activities**
 - Teachers leading PD
 - Teachers influencing colleagues in their schools
 - Teachers getting grants for their DSE projects
 - (Soon) Teachers writing/presenting about their work

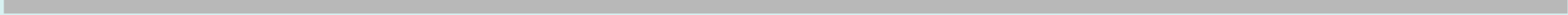
Connect with us!

- Emails
 - ryan.jones@mtsu.edu
 - keith.gamble@mtsu.edu
 - greg.rushton@mtsu.edu
 - kevin.krahenbuhl@mtsu.edu
 - kmiller@concord.org
- Project Website



Panel Discussion

DO NOT REPRODUCE



Q & A

DO NOT REPRODUCE



entry points

Pathways and Possibilities to Support Student Learning
about Data and AI

EVENT #2 | K-12 PROJECTS & OPPORTUNITIES (MAR 31)

EVENT #3 | NATIONAL FRAMEWORKS & RECOMMENDATIONS (APR 28)

entrypointsutk.org



THE UNIVERSITY OF
TENNESSEE
KNOXVILLE

COLLEGE OF EDUCATION,
HEALTH & HUMAN SCIENCES