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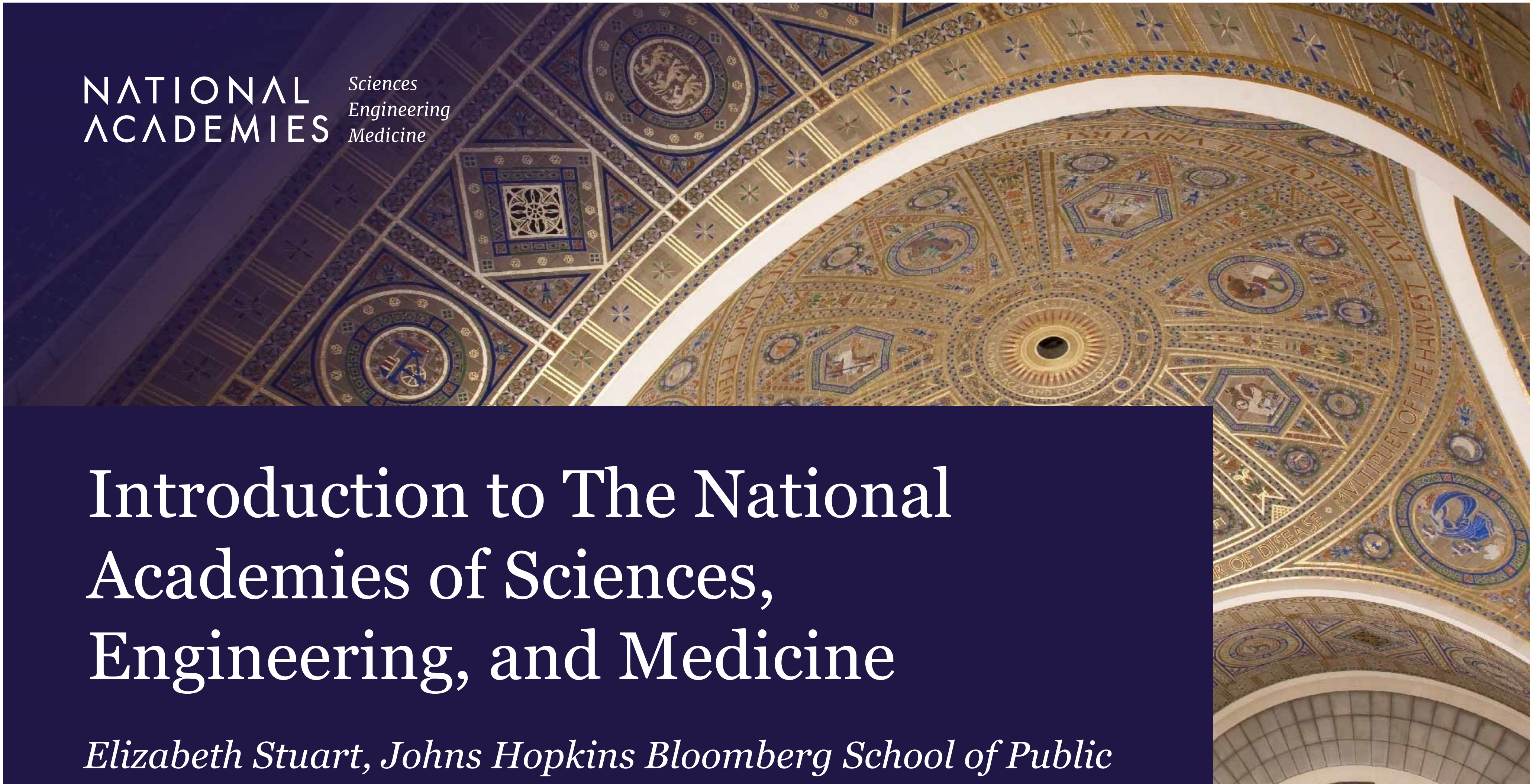

Introduction to The National Academies of Sciences, Engineering, and Medicine

Elizabeth Stuart, Johns Hopkins Bloomberg School of Public Health

FOUNDED IN 1863

The National Academies of Sciences, Engineering, and Medicine is a nonprofit, nonpartisan, and nongovernmental institution providing high quality, objective, evidence-based advice on science, engineering, and health matters.

The National Academies

- A nonpartisan, nongovernmental organization (NGO)
- Honorific arm & operational arm
  - Bring together committees of experts in all areas of scientific and technological endeavor
  - Address critical national issues and give advice to the federal government and the nation
  - Serve as a connection point between research, policy, and practice

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NASEM Activities

Overall goals:

- Provide evidence-based guidance for practice and policy
- Identify future directions for research
- Serve as a connection point between research, policy and practice

Most Common NASEM Activities:

- Workshops: Meetings of Experts (individual opinions)
- Roundtables: Ongoing small meetings related to a topic
- Consensus Reports: ~ 1 year long with Statement of Task (Recommendations to Sponsors)

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Some parts of the Academies particularly relevant to statistics and statistics education

STANDING COMMITTEE

Mathematical Sciences Education Board

The Mathematical Sciences Education Board connects the mathematical sciences research and education communities to provide national-level guidance on issues central to mathematics education.

STANDING COMMITTEE

Board on Mathematical Sciences and Analytics

The Board on Mathematical Sciences and Analytics (BMSA) leads activities in the mathematical sciences at the National Academies.

STANDING COMMITTEE

Committee on National Statistics

The mission of CNSTAT is to provide advice to the federal government and the nation grounded in the current best scientific knowledge and practice that will lead to improved statistical methods and information upon which to base public policy. CNSTAT seeks to advance the quality of statistical information, contribute to the statistical policies and coordinating activities of the federal government, and help provide a forward-looking vision for the federal statistical system and national statistics more broadly in service of the public good.

STANDING COMMITTEE

Committee on Applied and Theoretical Statistics

The Committee on Applied and Theoretical Statistics (CATS) advises stakeholders in government, academia, industry, and nonprofit organizations on statistics and data science, and their many applications.

Read past updates by visiting our email archive.
Visit a site we like: This is Statistics

CONSENSUS STUDY

Modernizing Mathematics Education for Grades 9–14

(Report expected 2027)

Information Gathering Open Session to be held June 23
Noon-4pm ET
Virtual

Use the QR code or link to get more information and to register

https://www.nationalacademies.org/projects/DEPS-MSEB-25-01

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Transforming Undergraduate STEM Education

https://nationalacademies.org/UG-STEM-Teaching


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Data and Computing in K–12 Education
Foundational Competencies
Download the report
nationalacademies.org/data-computing-ed

Statement of Task

Identify competencies needed for students to navigate and succeed in the changing computational landscape — and describe the role K–12 education can play.

1. What competencies and awareness are needed for learners to develop basic literacy in data and computing?
2. How are the foundational competencies for these fields related to foundational competencies in other STEM fields?
3. What should relevant learning experiences look like in practice and how might these experiences be tailored to meet students' interests and lived experiences?
4. What are the implications for K–12 curricula?

Study Sponsor

National Science Foundation

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Louisiana Dept. of Education

Sepehr Vakil
Northwestern University

Aman Yadav
Michigan State University

About the Report · Key Takeaways

A risk of overload

Calls to add CS, data science, AI, and quantum information science to K–12 could overwhelm the system if not done carefully.

Common ground exists

Shared competencies undergird all these fields — and many are already present in the K–12 curriculum.

Multiple paths forward

Engage students from kindergarten by integrating data & computing into existing classes, elevating learning goals, and offering stand-alone courses where appropriate.

nationalacademies.org/projects/DBASSE-BOSE-23-04

Report Contents

Overview of Recommendations

Rec. 1–4 — Adding Data & Computing to K–12

- Integrate competencies into existing courses (K–12)
- Elevate connections to existing STEM content
- Start in Kindergarten and progress through 12th grade
- Evaluate impact on graduation requirements

Rec. 5–9 — Supporting Teachers

- Instructional materials for unplugged & digital learning
- Preservice pathways in computing and data
- In-service professional development opportunities
- Resources to support teachers in using materials

Rec. 10–14 — Transforming the System

- Measure student participation and outcomes
- Coordinate across professional organizations
- Invest in curriculum, PD, and technology access
- Ensure equitable access for all students

Built on Existing Frameworks & Standards

The report's competencies draw from and connect to standards already recognized in K–12 education.

- **Computer Science Framework & Standards**
- **Data Science Progressions**
- **NCTM Standards**
- **Common Core Mathematics**
- **K–12 Science Framework & NGSS**

Foundational Competencies · Chapter 3

Each competency includes a description, components, examples, and connections to other competencies.

Conclusion 3-3

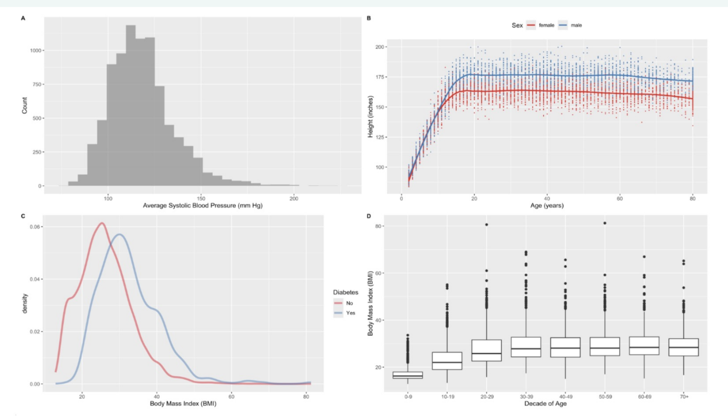
The foundational competencies build upon basic skills already central to existing school curricula. Students need a solid foundation in mathematics (number sense, operations, algebraic thinking, functions, mathematical modeling) and science (concepts, practices, and core ideas) — plus other existing school subjects — to fully engage with these competencies.

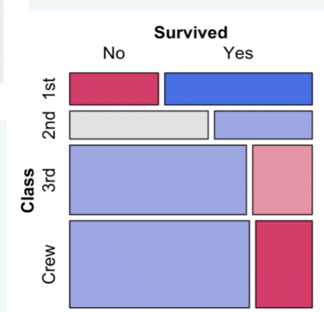
1. Problem Posing & Problem-Solving
2. Producing & Working with Data
3. Abstraction, Algorithmic Thinking & Automation
4. Probabilistic & Inferential Reasoning
5. Models & Representations
6. Technology & Society
7. Data & Computing Systems

COMPETENCY 2

Producing & Working with Data

Measure, organize, explore, visualize





COMPONENTS

- Produce data: measurement & data provenance
- Organize data: case/attribute structure & data moves
- Exploration & data visualization

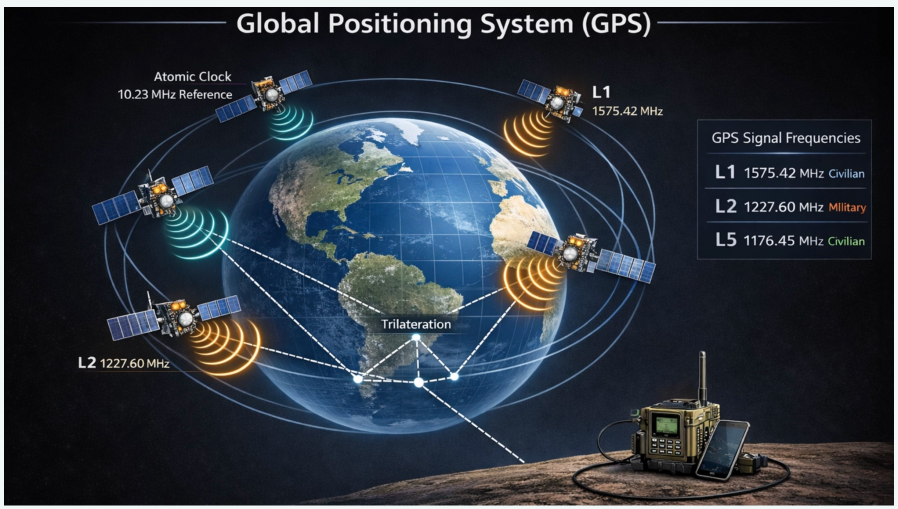
KEY INSIGHTS

- Data is actively "produced," not simply collected — every measurement involves decisions about what and how
- Data provenance matters: who collected it, when, where, why, and who was left out?
- Organizing data through wrangling, filtering, and aggregation is essential before meaningful analysis

COMPETENCY 4

Probabilistic & Inferential Reasoning

Variability, uncertainty, evidence-based conclusions



https://www.tualcom.com/what-is-gps/

COMPONENTS

- Identify sources and impacts of uncertainty & variability
- Recognize the roles of probabilistic, statistical, and deterministic reasoning and apply them
- Make inferences and predictions with appropriate degrees of certainty

KEY INSIGHTS

- Variability is everywhere — measurement, sampling, and natural variation all introduce uncertainty
- Students progress from informal inference (elementary) to formal hypothesis testing (high school)
- Critical for understanding AI and generative models, which produce probabilistic outputs, not definitive answers

There are significant overlaps between the foundational competencies and current math, science, computer science, engineering and statistics standards.

Starting in kindergarten, students can gradually build more sophisticated knowledge using data and computing. While these competencies exist in current STEM frameworks, the current attention given to them is insufficient — especially time spent in elementary school.

Design of Curriculum · Chapter 6

Approaches to Integration

Multiple pathways for weaving data & computing into existing courses, not just standalone classes

Integrating into Math Curriculum

Data & computing topics enhance measurement, algebraic thinking, probability, modeling in math courses

Integrating into Science Curriculum

Science investigations, computational thinking, and data analysis naturally embed these competencies

Promising Grade-Band Approaches

Concrete examples show how integration can progress from elementary through high school

Conclusion 6-1

Current K–12 curricula leave limited room for new stand-alone courses. A more coherent approach integrates foundational competencies into existing subjects — science, social science, and math — beginning in elementary school, helping students grasp complexity and connections across disciplines.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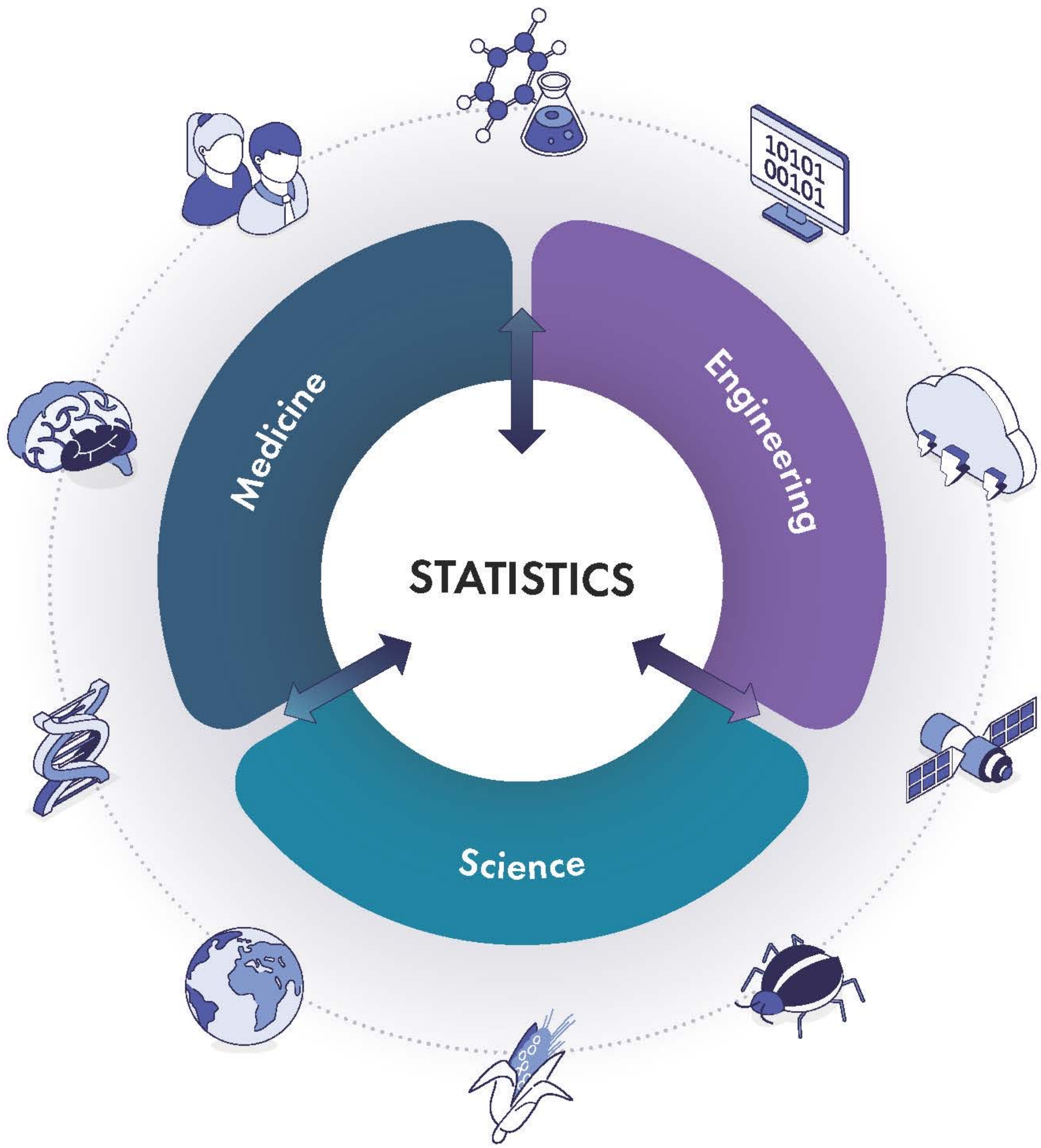
Frontiers of Statistics in Science and Engineering: 2035 and Beyond

Kathy Ensor (chair), ***Lance Waller*** *(vice chair)*

Brittany Segundo, Project Director

eCOTS, June, 2026

Download the report and report resources:
nationalacademies.org/frontiers-of-statistics



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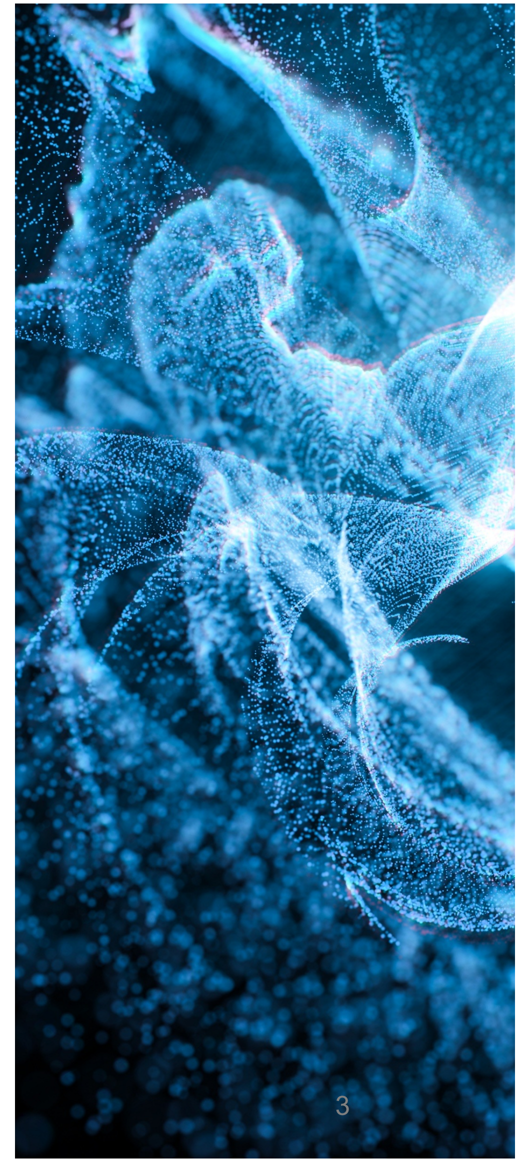
Study Statement of Task

A forward-looking assessment of the current state of the statistical sciences and emerging opportunities for 2035 and beyond that will assess:

- **Statistical research**.
- **Statistical research in allied fields**.
- **Statistical needs to support scientific and technological advances**.
- **Strength of interdisciplinary collaborations.**
- **Statistical education, training, and workforce development**.



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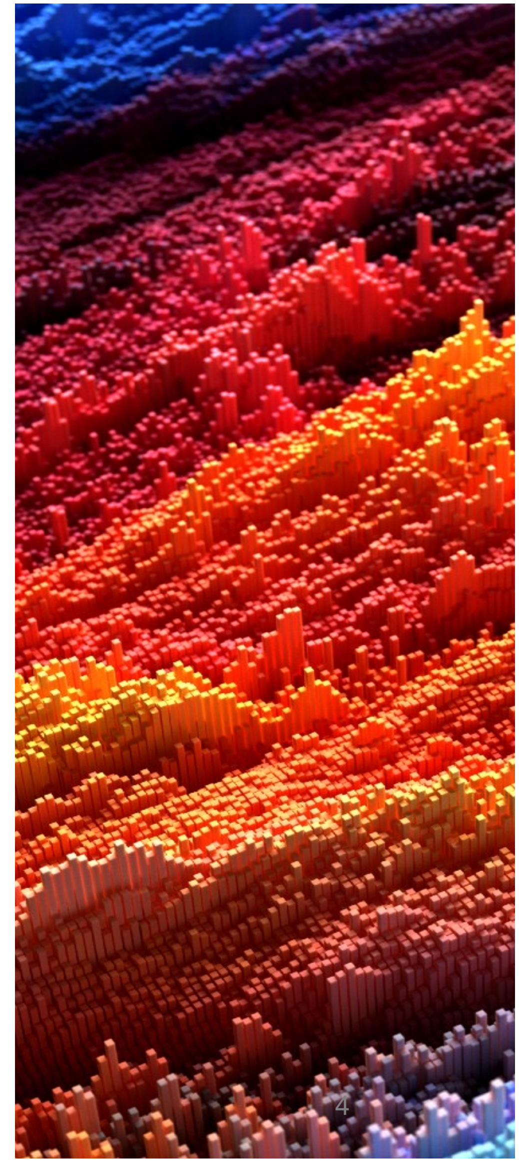

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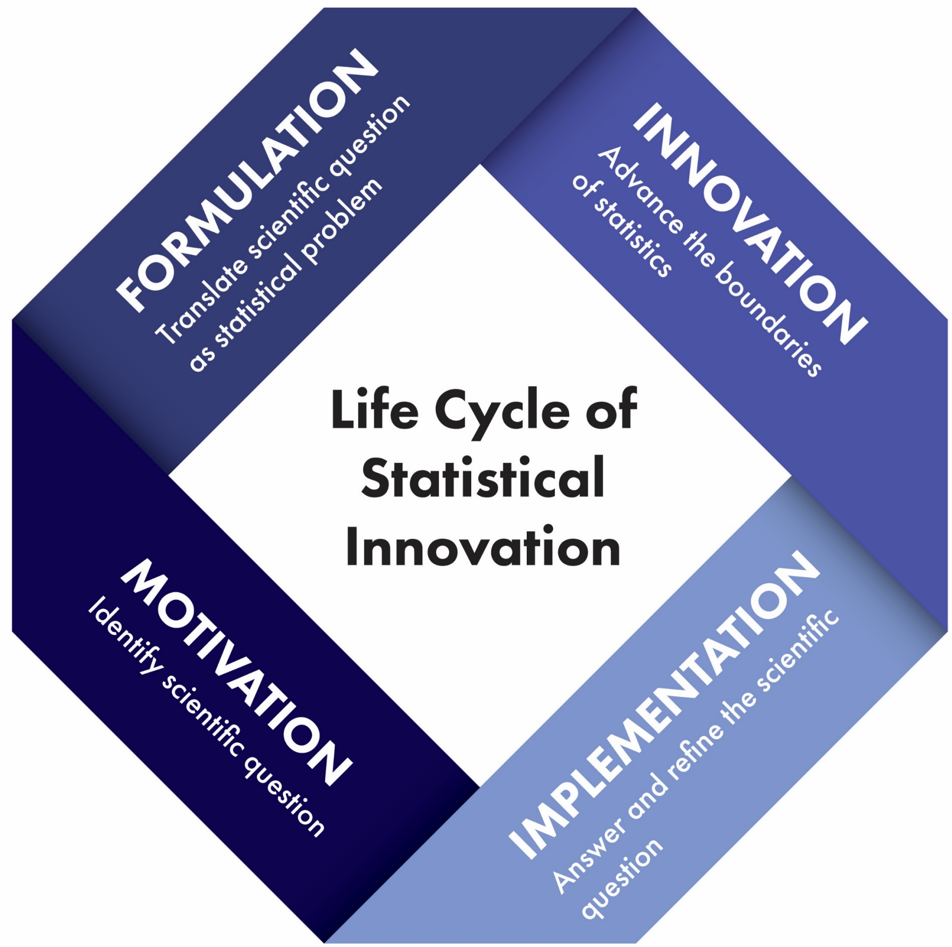
Information Gathering Session on Education

September 9, 2025: Statistics Education discussion

- Donna LaLonde (ASA)
- Dave Hunter (Penn State)
- Beth Chance (Cal Poly)
- Monnie McGee (Southern Methodist University)
- Mark Ward (Purdue)
- Jan Dasgupta (Washington State)

The Nature of Statistical Innovation

Conclusion: Statistical scientists drive the statistical innovation life cycle through the adoption and rigorous evaluation of emerging technologies and applications.



Statistics informs scientific development

Many of today's scientific developments have **deep roots in decades of theoretical statistics**, e.g.:

- biostatistics and genomics
- artificial intelligence
- high-dimensional systems
- social networks
- resilient infrastructure
- pricing financial derivatives
- predicting rare events

Scientific demands and developments **catalyze the frontiers of statistics**, e.g.:

- artificial intelligence
- uncertainty quantification for streaming data and complex systems
- opportunistic and observational data collection and usage
- decentralized and distributed data
- characterizing rare events
- test-time optimization

Scientific developments inform statistics

In other words: There are many, many cool problems in Statistics, in Science, and in their intersection.

Statistics & Artificial Intelligence

The rapid advancement of AI calls for increasing contributions from the field of statistics.

Recommendation: Federal funding agencies should prioritize funding to expand and accelerate rigorous ongoing statistical thinking in AI research and education initiatives.

Successful initiatives should:

- ***Integrate statistical thinking*** into AI and AI-based research through centers of excellence or major collaborations;
- Incorporate ***explicit guidance for statistical rigor*** in data-driven and AI research proposals, as well as include reviewers with statistical expertise;
- Support a comprehensive survey of statistics representation in the AI institutes; and
- ***Include statistical thinking and rigor as a major pillar of AI education and training***, as well as explicitly seek collaboration with the statistics community in AI-related training funding.

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In other words: Statistics needs to be part of AI, AI needs to be part of Statistics.

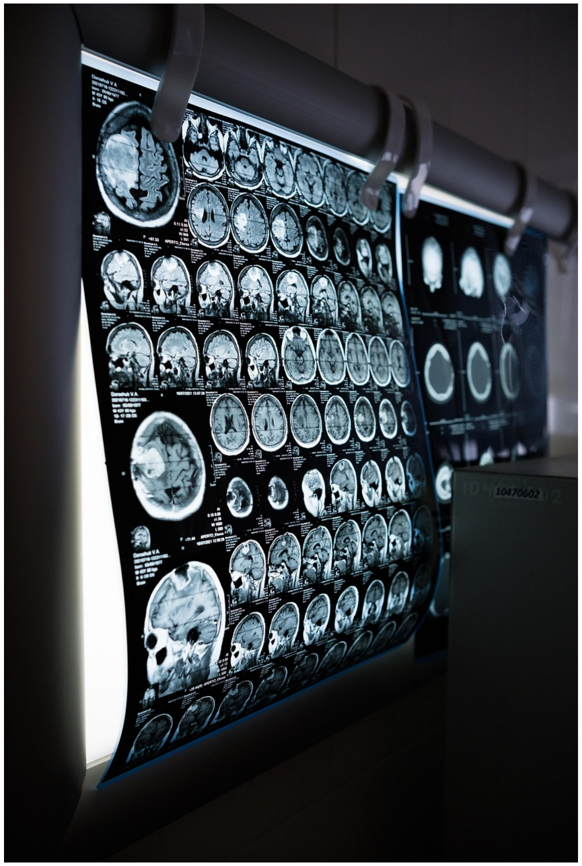
Making Meaning of Data

Conclusion: Statistical research enhances data utility and application. As new data types emerge and as complexity increases, statistics and analytic tools will need to evolve to keep pace with the changing landscape.

The field of statistics must contend with:

- Emerging types of data (images, blockchain, etc.)
- Fused data from heterogeneous sources
- Dynamic and new data storage and access paradigms
- Dual-use nature of data

Key Finding: As new data types emerge and evolve, statisticians will need new methods for structuring, sampling, modeling, and analyzing these data.



In other words: New types of data require new types of statistics and new types of statistical thinking.

Equipping the Statistics Workforce

- Statistics curricula need continual modernization to keep pace with the evolution of the field.
- Statistical thinking plays an important role in AI-focused programs.
- Large-scale computational training is vital.
- An AI-savvy workforce will **understand the strengths and limitations of AI**, thoughtfully evaluate model outputs, recognize potential biases, and incorporate awareness of uncertainty into its decision making.
- **Recommendation: NSF, NIH, and NSA should invest in undergraduate and graduate training in statistics, biostatistics, and data science. Mechanisms include graduate fellowships, research experiences for undergraduates, and innovative programs that vertically and cross-sectionally integrate students, postdoctoral graduates, faculty, and industry researchers in statistics.**

Transforming statistics education is necessary for U.S. competitiveness.

In other words: How best to train statistical problem-solvers?

Bringing together the “in other words”:

- There are many, many cool problems in Statistics, in Science, and in their intersection.
- Statistics needs to be part of AI, AI needs to be part of Statistics.
- New types of data require new types of statistics and new types of statistical thinking.
- How best to train statistical problem-solvers?

Summary for discussion

- Statistics is dynamic.
- The nature of data is dynamic.
  - Challenge: How to train today for needed skills of tomorrow?
- Statistics does not live in a vacuum.
  - Statistics involves collaboration and theory.
  - Teams solve problems.
  - Teams need a range of people with different skillsets.
- The statistical workforce is collaborative, ever evolving, and needs problem solvers.

Thank You

Download the report and report resources:

nationalacademies.org/frontiers-of-statistics