

Measuring Student/Instructor Attitudes and the Learning Environment in Statistics and Data Science



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Need for Attitudes Research

- Attitudes Matter in Education! [2]
- We want students to thrive in the data deluge
- Instructor attitudes and course environment impact student attitudes
- Understanding attitudes can help us identify evidence-based best practices for teaching data science and statistics
- Most widely used statistics instrument (SATS, [4]) exhibits several flaws [5]
- No validated data science instruments



Motivational Attitudes in Statistics and Data Science Education Research

- 3-year NSF IUSE grant (Oct '20 - Sept '23 + NCE)
- Strong theoretical framework and rigorous development process
- Family of instruments evaluating student and instructor attitudes toward statistics and data science, and learning environment
- Establish nationally-representative summaries of students and instructors
- Website interface for both implementation and dissemination of general and instructor-specific results

Broader Impacts

- Surveyed over 18,000 Statistics students nationally from several dozen universities (still counting DS student totals)
- Database allows for robust analyses of connections between course environment, instructor attitudes, and student attitudes and achievement
- Website allows for easy implementation by other educators

Acknowledgments

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References

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- [4] Schau, C. (1992). Survey of Attitudes Toward Statistics (SATS-28).
- [5] Whitaker, D., Unfried, A., & Bond, M. E. (2022). Challenges Associated With Measuring Attitudes Using the Sats Family of Instruments. *Statistics Education Research Journal*, 21(1), 1–23.
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1: Validated Survey Instruments

	Student Instrument	Instructor Instrument	Environment Inventory
Statistics	S-SOMAS*	I-SOMAS	EPIC-S
Data Science	S-SOMADS	I-SOMADS	EPIC-DS

SOMA: Survey Of Motivational Attitudes toward...
EPIC: Environment Pedagogy Institution Course

*For example, **S-SOMAS**: **Student** Survey of Motivational Attitudes toward **Statistics**

Student Instruments

- Measures student attitudes toward Stat or DS
- ~55 items measuring 8 constructs on a 7-point Likert scale
- Additional items measure student characteristics
- Can be used longitudinally

Instructor Instruments

- Measures instructor attitudes toward teaching Stat or DS
- ~68 items measuring 10 constructs on a 7-point Likert scale
- Additional items measure instructor characteristics
- Administered occasionally



S-SOMADS



I-SOMADS



EPIC-DS Pre



EPIC-DS Post

Environment Instruments

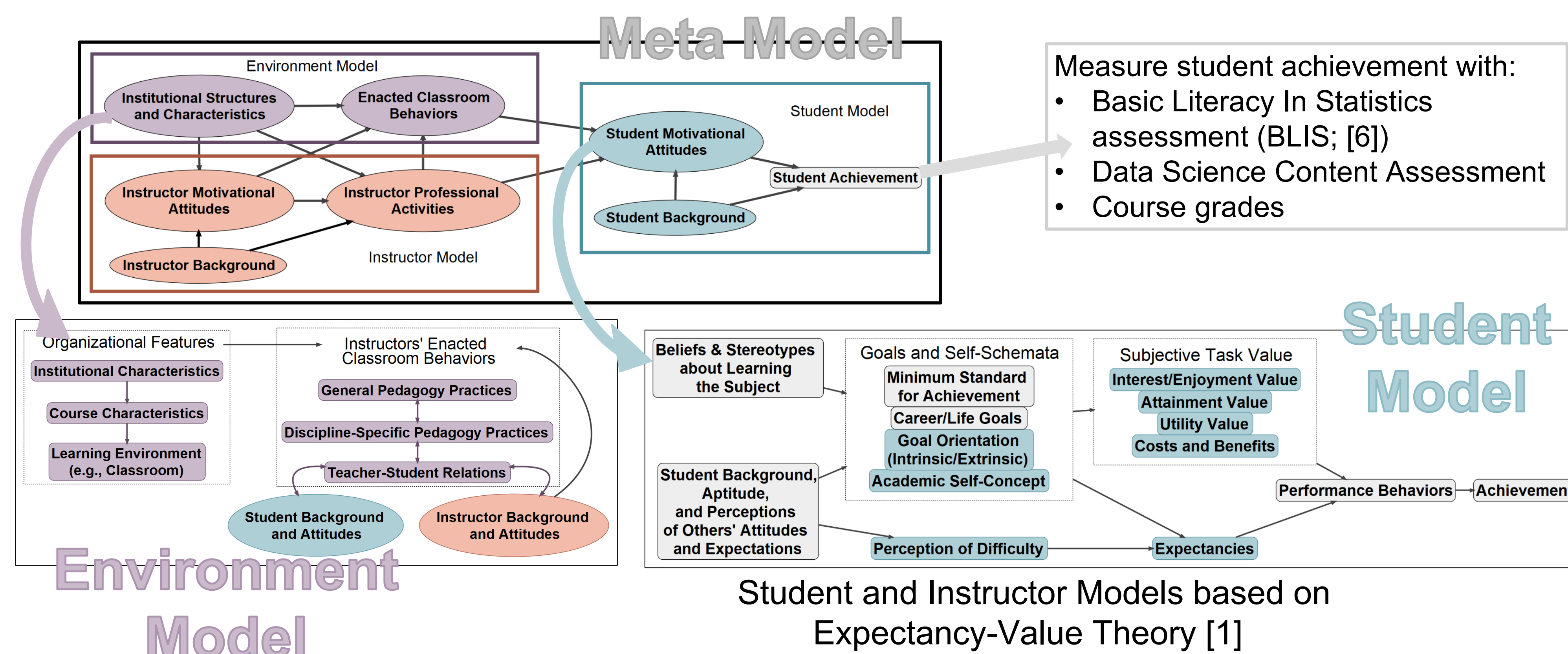
- Measures institutional and course characteristics like level of the course, prereqs, meeting times, etc.
- Summarized enacted classroom behaviors using F-IMPACT [3]
- Instructor completes for each section

Rigorous Development



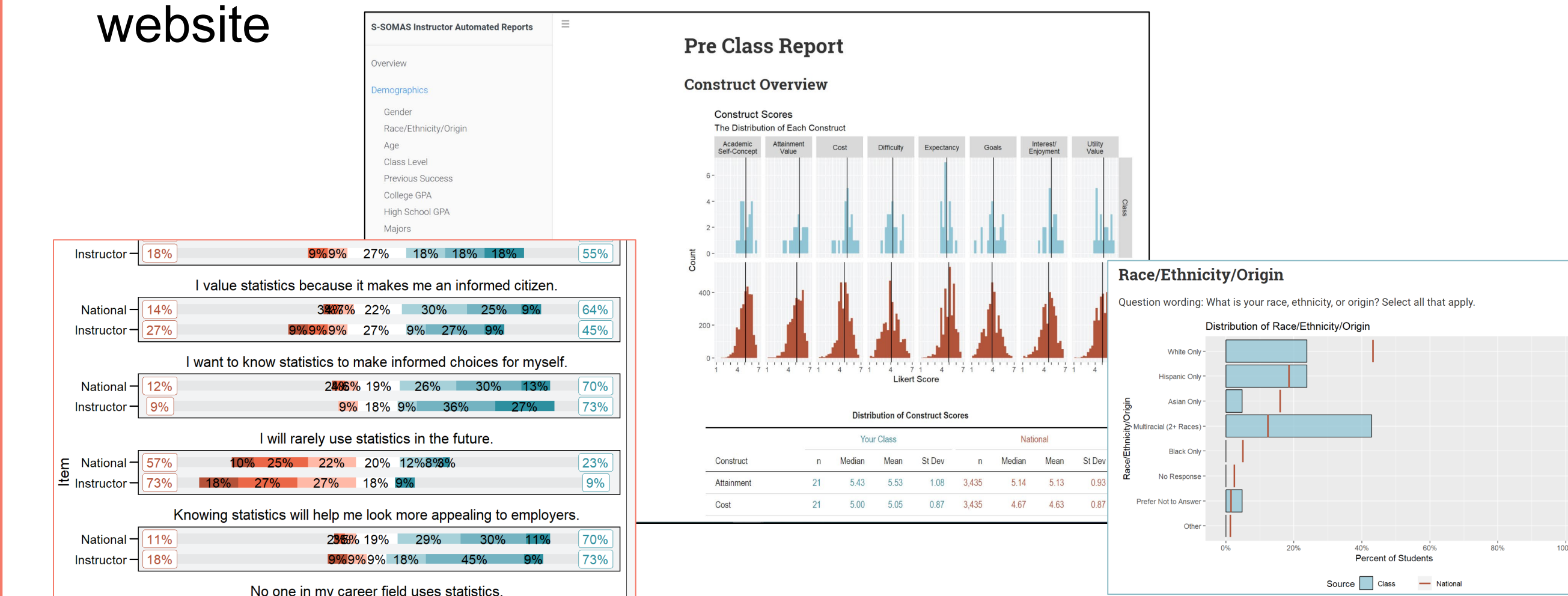
2: Theoretical Models

- **Meta Model** links the models for students, instructors, and the learning environment
- Triangulating these data sources and collecting data nationally, we can develop a robust picture of the current state of statistics and data science education in the US



5: Custom Reports

- After course completion, instructor receives a custom, automated report of class attitudes toward Stat or DS
- Report summarizes the class compared to the national sample
- Developed in R Markdown; will be a Shiny app integrated on the website



3: DS Topics Survey

- Assesses course design of undergraduate data science courses such as department, software used, textbook
- Collects course definition of DS
- Asks to what extent topics are covered in the course data visualization, programming, modeling, wrangling acquisition, ethics communication



4: MASDER Website Portal

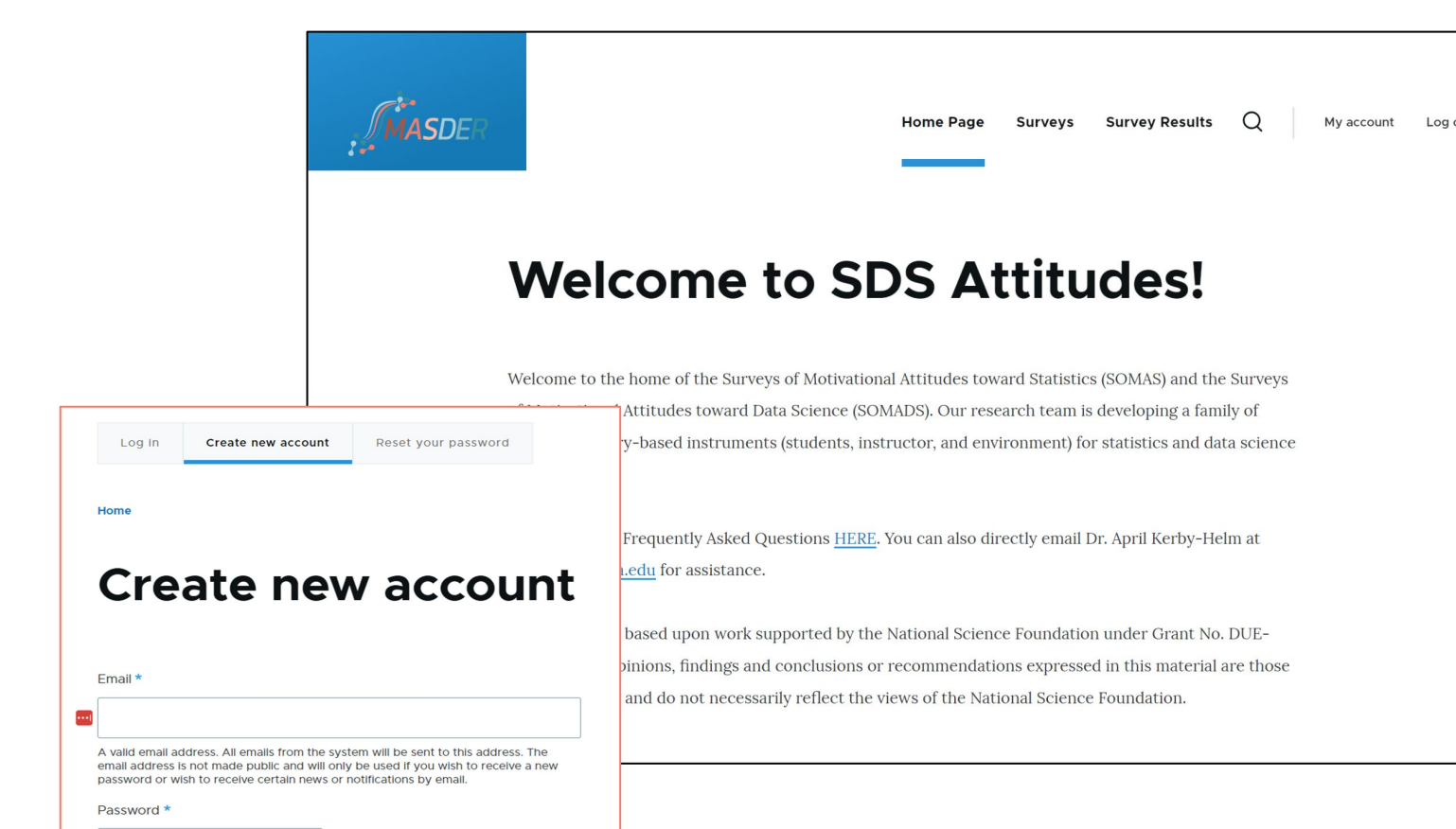
- Allows instructor to create an account and generate links to S-SOMAS and S-SOMADS for each course section
- Will allow instructor to download their data at the end of term
- Create your own survey instances and get reports of results.
- Publicly available end of 2024!



MASDER Website
<http://sdsattitudes.com/>



MASDER Portal for
Data Collection



6: Publicly -Available Data

Surveys were administered via a national stratified sample (+ additional volunteer sample) in 2023-24 Academic Year

- Used College Scorecard database as sampling frame (collegescorecard.ed.gov)
- Stratified by Selectivity, Carnegie Basic Classification, and Minority-Serving status
- Created a database of selected universities' statistics and data science course offerings

Deidentified data from each phase of data collection will be publicly available via GitHub and R package.