MASDER Your Educational Research:

How to Cohesively Study Students, Instructors, and the Learning Environment

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MASDER

Motivational **A**ttitudes in **S**tatistics and **D**ata Science **E**ducation **R**esearch

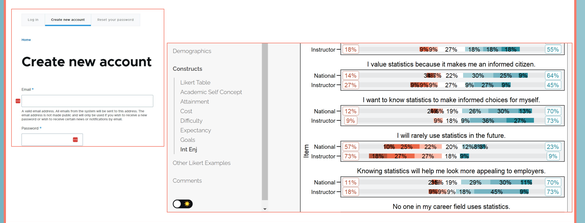
- 3-year NSF IUSE grant (Oct '20 - Sept '23)
- Strong theoretical framework (EVT) and rigorous development process
- Family of 6 instruments evaluating student and instructor attitudes toward statistics and data science, and the learning environment
- Establish nationally-representative summaries of students and instructors
- Create website interface for each implementation and dissemination of general and instructor-specific results

Attitudes

- Attitudes Matter in Education!
- 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 existing statistics instrument (SATS; Schau, 1992) exhibits several flaws (Whitaker et. Al, 2022)
- No validated data science instruments

Website

- Website interface for survey implementation and dissemination of results
- Create your own survey instances and get reports of results.
- Publicly available 2024!



Get Involved! Take Surveys

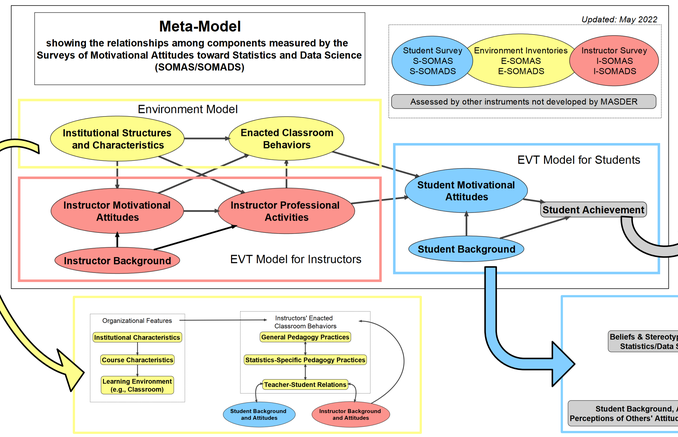
Tell us what you teach in Intro Data Science!

MASDER Website http://sdsattitudes.com/

Test out our Statistics Learning Environment survey!

Models

- The Student, Instructor, and Environment instruments each have a theoretical model.
- These individual models are linked by an overall **Meta Model**.
- 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



Measure student achievement using some content assessment such as:

- Basic Literacy In Statistics (BLIS; Ziegler, 2018)
- Levels of Conceptual Understanding in Statistics (LOCUS; Jacobbe et al., 2023)
- Course grades or final exam (not optimal because they are harder to compare across schools)

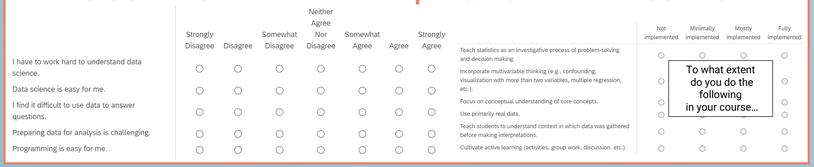
Survey Instruments

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

*For example, S-SOMAS: **S**tudent **S**urvey **o**f **M**otivational **A**ttitudes toward **S**tatistics

S-SOMADS

Example Items



E-SOMAS

National Data Collection

- National Stratified Sample will be implemented Fall 2023
- Using College Scorecard database as sampling frame (collegescorecard.ed.gov)
- Stratified by Selectivity, Carnegie Basic Classification, and Minority-Serving
- Creating a database of selected universities' statistics and data science course offerings

Pilot 4 S-SOMAS Pre/Post

- Pilot 4 data: responses from approx. 2000 students from 23 instructors at 12 universities
- First pilot study with pre/post student data and all three instruments used (data not yet linked across instruments)

Component	Pre Mean	Post Mean
Academic Self-Concept	5.26	5.12
Attainment Value	5.18	5.12
Cost	4.65	4.51
Difficulty	4.13	4.09
Expectancy	5.09	5.24
Goals	3.91	4.07
Interest/Enjoyment Value	4.64	4.44
Utility Value	4.89	4.80

- Scale means suggest that students begin and end courses with mildly positive attitudes about statistics.
- Using only data from 16 instructors with pre/post student results, we examined the mean differences (cf. Whitaker et al., 2022).

Component	Mean Difference	Cohen's d	Interpretation
Academic Self-Concept	0.01	0.03	Negligible
Attainment Value	-0.31	-0.78	Medium
Cost	-0.04	-0.19	Negligible
Difficulty	-0.02	-0.06	Negligible
Expectancy	-0.12	-0.37	Small
Goals	0.07	0.17	Negligible
Interest/Enjoyment Value	-0.32	-0.78	Medium
Utility Value	-0.12	-0.26	Small

- Based on preliminary data, we are not currently seeing attitude changes using S-SOMAS, but these were all 'typical' courses: we might see changes when examining subgroups by linking E-SOMAS or when conducting interventions.

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