Attitudes Matter!
New Instruments in Motivational Attitudes Toward Statistics / Data Science

MathFest 2022

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Attitudes

- **Attitudes Matter in Education!**
  (Pearl et al., 2012)
- 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**

Existing Instruments (Examples)

Student Instruments

- Survey of Attitudes toward Statistics (SATS; Schau, 1992)
  - Most widely used
- Issues (Whitaker, Unfried, & Bond, 2022)
  - Lack of validity evidence
  - Incomplete alignment to theoretical framework
  - Ceiling effects on some scales
  - Rigid pre-post structure
  - Requires stats course enrollment
  - Use restricted - fees/permission

Instructor/Environment Instruments

- Statistics Teaching Inventory (STI; Zieffler et al., 2012)
  - Snapshot of instructor practices in Introductory Statistics
- Issues
  - Does not measure attitudes or learning environment characteristics
  - Not linked to student measures

No Validated **Data Science** Attitudes Instruments

MASDER:

Motivational Attitudes in Statistics and Data Science Education Research

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- 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
- Conduct **nationally-representative sample** of students and instructors
- Create **website** interface for each implementation and dissemination of general and instructor-specific results
- Promote **Stat/DS Ed Research** - improve instruction by understanding the relationships between components

Surveys Of Motivational Attitudes toward...

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

Distinction between S, I, and E Surveys

Student Instruments

- Measures attitudes toward Stat or DS
- Pre and post (optional)
- Can be used longitudinally, including after college

Instructor Instruments

- Measures instructor attitudes toward teaching Stat or DS
- Measure teaching experience, background, etc.
- Administered periodically

Environment Inventories

- Measures institutional and course characteristics, learning environment, and enacted classroom behaviors
- Instructor completes for each section

Development Timeline for S-SOMAS/DS

MASDER Grant Awarded

2009-2017

Identify need for a new instrument

Research On Statistics Attitudes (ROSA) working groups

3 workshops funded by ASA

2017 - present

Develop theoretical models

Started at USCOTS workshop

Continued refinement in consultation with experts and through survey analysis

2017

Create Pilot 0 S-SOMAS Instrument

Write construct definitions and develop items

Conduct student focus groups and subject matter expert review

2018 - 2020

Administer, Analyze, and Revise Pilot 0

2,381 students from 6 institutions

Spring 2021

Administer, Analyze, and Revise Pilot 1

588 students from 15 institutions

SOMADS Development

SOMADS SME Workshop

Fall 2021

Administer, Analyze, and Revise Pilot 1

2,546 students from 41 institutions

SOMADS Refinement

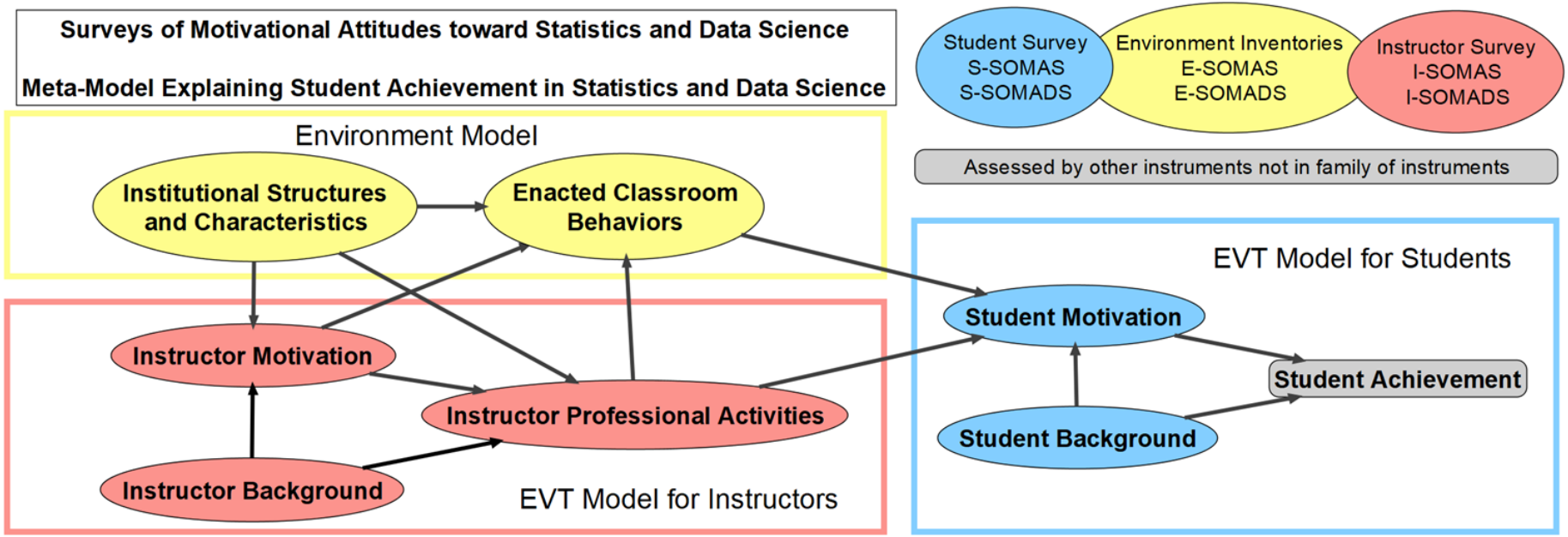
Spring / Summer 2022

Adminster, Analyze Pilot 3

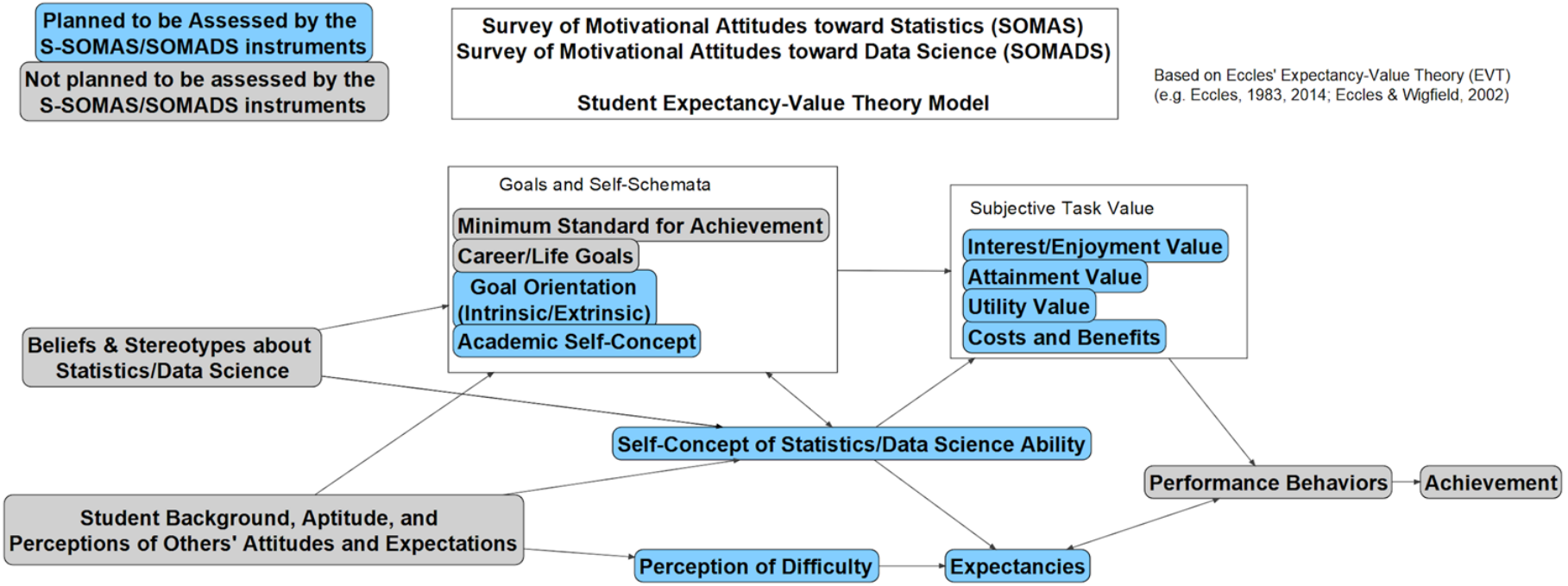
SOMADS Pilot 1

87 students from 4 institutions

Meta-Model


Surveys of Motivational Attitudes toward Statistics and Data Science
Meta-Model Explaining Student Achievement in Statistics and Data Science
Student Survey
S-SOMAS
S-SOMADS
Environment Inventories
E-SOMAS
E-SOMADS
Instructor Survey
I-SOMAS
I-SOMADS
Assessed by other instruments not in family of instruments
Environment Model
Institutional Structures and Characteristics
Enacted Classroom Behaviors
Instructor Motivation
Instructor Professional Activities
Instructor Background
EVT Model for Instructors
EVT Model for Students
Student Motivation
Student Achievement
Student Background

Student Model



Constructs and Definitions

Construct	Definition
Expectancy	How the student thinks they will perform in the field of statistics
Perception of Difficulty	How difficult the student perceives statistics to be
Utility Value	How much the student values statistics for serving or achieving their goals.
Interest/Enjoyment Value	The interest a student has in statistics, or their enjoyment from it
Attainment Value	How important success in statistics is to the student
Costs and Benefits	Factors that deter from learning stats, or benefits of learning stats
Academic Self-Concept	Student perceptions about the academic achievement (general and stats-specific)
Goal Orientation	What drives the students to learn statistics

Example Utility Value Items

	Strongly Disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly Agree
I need to know statistics to satisfy employers.	○	○	○	○	○	○	○
I will rarely use statistics in the future.	○	○	○	○	○	○	○
No one in my career field uses statistics.	○	○	○	○	○	○	○
I value statistics because it makes me an informed citizen.	○	○	○	○	○	○	○
Studying statistics is pointless.	○	○	○	○	○	○	○

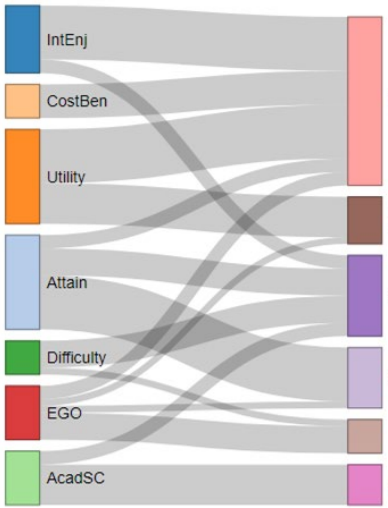
← Negatively Coded

Instrument Design

"I'll take 3-letter acronyms for $200, please"

Item design, SME, Pilots

7-point data, 6-factor EFA, cutoff = 0.40



Value/Reasons for Learning Statistics

Doing Statistics is Challenging/Unenjoyable

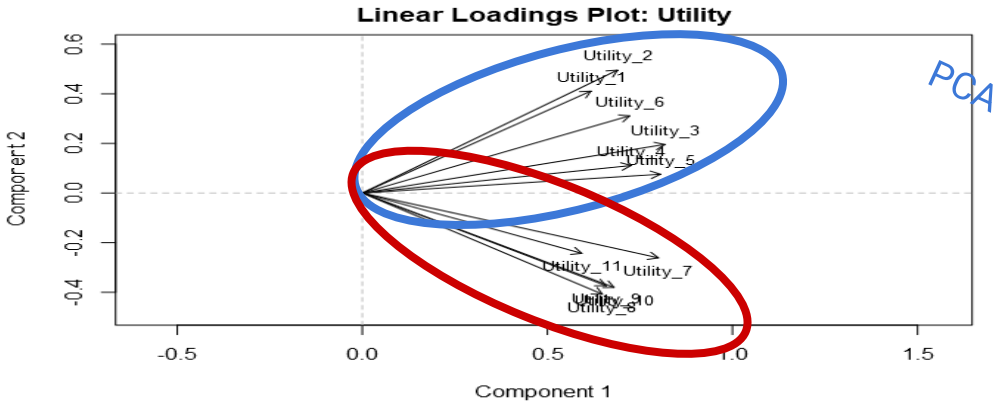
Expectancy/Perception of Statistics Ability

Satisfaction from Learning Statistics/Statistics is Challenging

Utility Value (Career/Future)

Extrinsic Goal Orientation/Statistics and Intelligence

PCA



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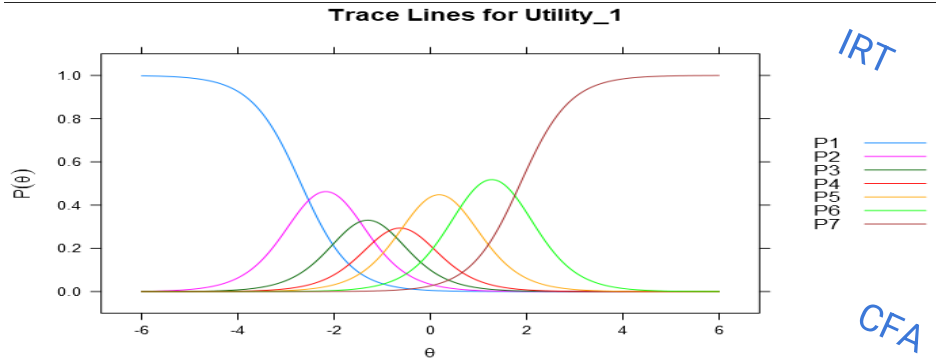

CFA

Get Involved!

Serve as a Subject Matter Expert (SME)

Data Science Topics Survey

Pilot the surveys in your classrooms and as an instructor

See more and sign up to stay updated via our website:
SDSAttitudes.com

Help spread the word about the instruments and our website!

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MASDER Contact Information

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