

A Brief Summary of the Attitude Instruments, Inventories, and Website Developed by the MASDER Team



DUE-2013392



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Attitudes

Students

Camila



Ned



Teachers

Ms. Turner



Mr. Nelson



Attitudes

- **Attitudes Matter in Education!**
(Pearl et al., 2012)
- Attitudes are associated with future choices, content retention, and mastery of statistical skills
- **Instructor attitudes** and course environment impact **student attitudes**
- Understanding attitudes can help us identify **evidence-based best practices for teaching data science and statistics**







Motivational Attitudes in Statistics and Data Science Education Research



DUE-2013392

- 5-year NSF IUSE grant (Oct' 20 – Sept '25)
- Develop **6 instruments** evaluating student and instructor attitudes toward statistics and data science, and the learning environment
- Conduct **nationally-representative sample** of students and instructors
- Promote **Stat/DS Ed Research** - improve instruction by understanding the relationships between components
- **Make the tools widely available**



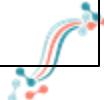
Survey Instruments

	Student Instrument	Instructor Instrument	Environment Inventory



Distinction between S, I, and E Surveys

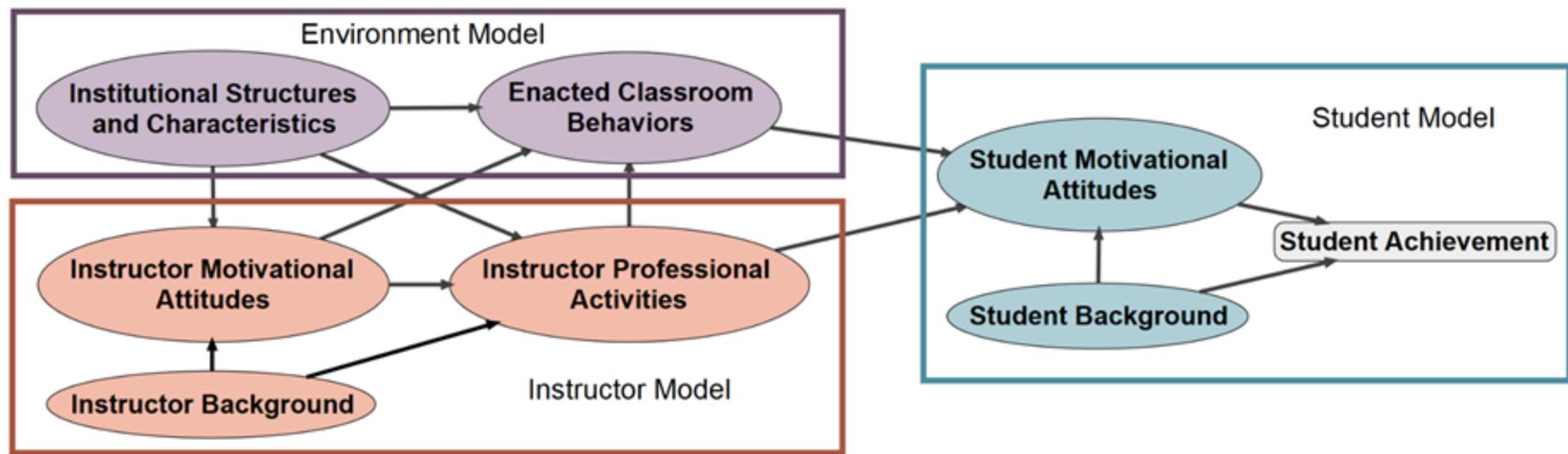
Student Instruments	Instructor Instruments	Environment Inventories
<ul style="list-style-type: none">• Measures attitudes toward Stat or DS• Pre and post semester• Can be used longitudinally	<ul style="list-style-type: none">• Measures instructor attitudes toward teaching Stat or DS• Administered every 2 – 5 years	<ul style="list-style-type: none">• Measures institutional and course characteristics, learning environment, and enacted classroom behaviors• Instructor completes for each course



Theoretical Framework



Meta-Model

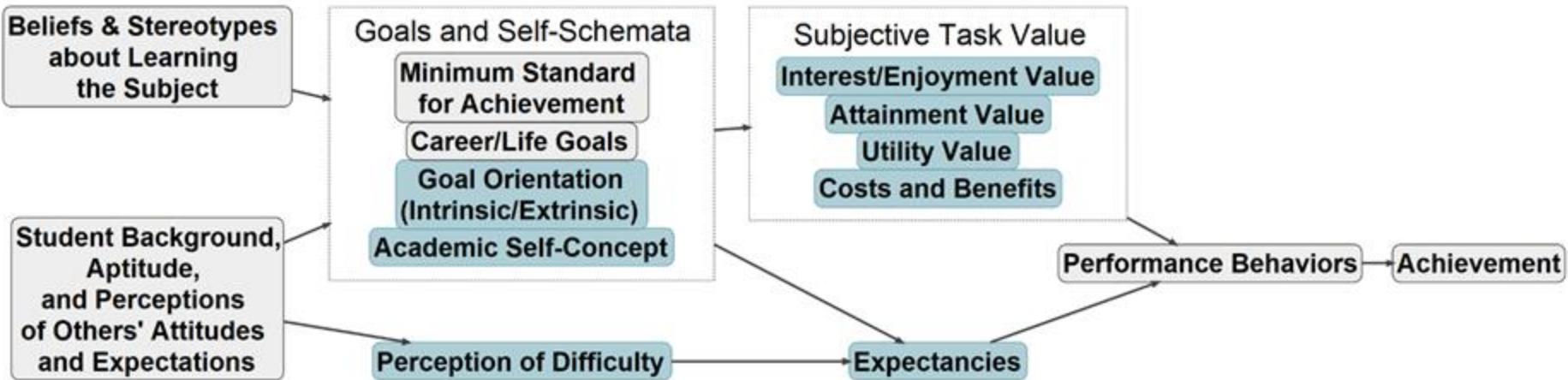




Student Survey of Motivational Attitudes toward Statistics

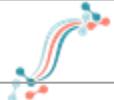


Student Model for Statistics and Data Science



Constructs Definition

Goal Orientation	What drives the students to learn statistics
Academic Self-Concept	Student perceptions about the academic achievement (general and stats-specific)
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
Utility Value	How much the student values statistics for serving or achieving their goals.
Costs	Factors that deter from learning stats
Benefits	Factors that are benefits of learning stats
Perception of Difficulty	How difficult the student perceives statistics to be
Expectancy	How the student thinks they will perform specific tasks in the field of statistics



Utility Value Items

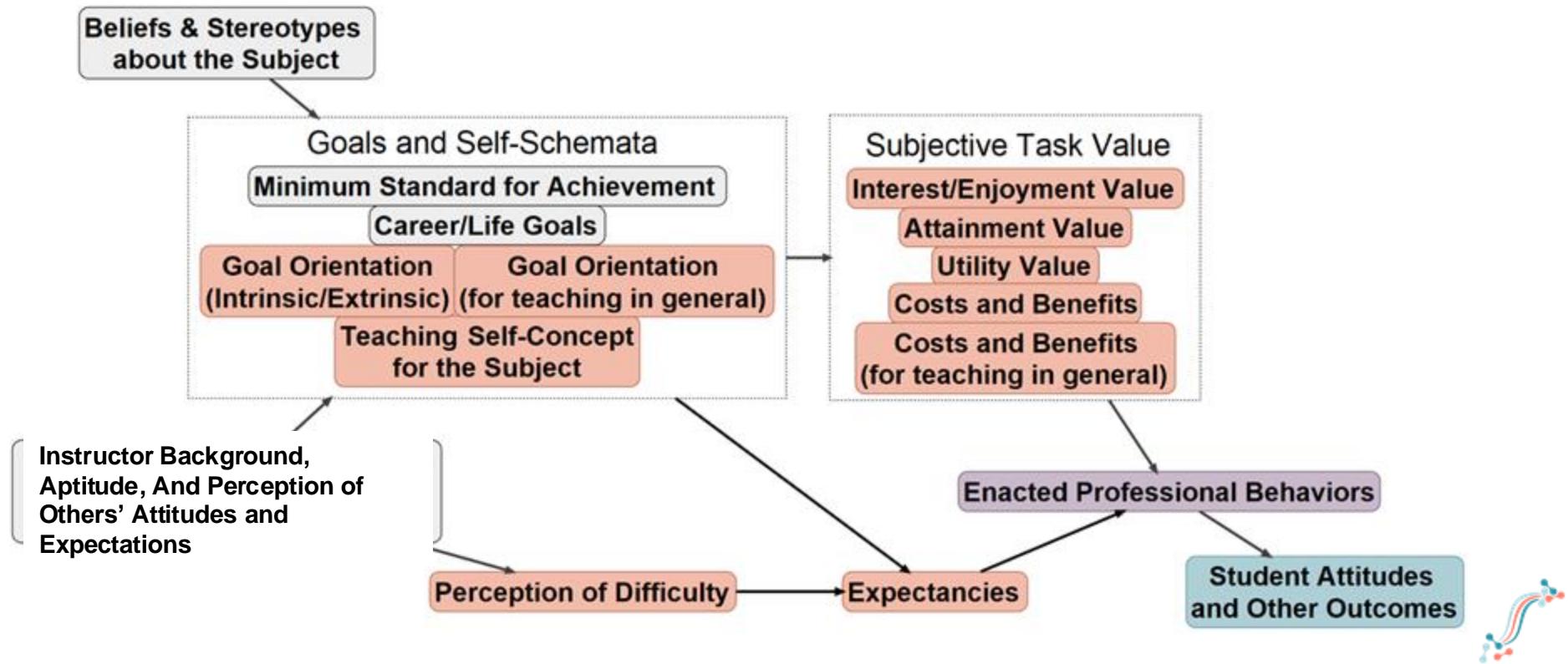
	Strongly Disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly Agree
I need to know statistics to satisfy employers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>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





Instructor Survey of Motivational Attitudes toward Teaching Statistics

Instructor Model for Statistics and Data Science



Constructs

Definition

Goal Orientation, General Teaching	External and internal reasons for teaching, in general
Goal Orientation, Teaching Statistics	External and internal reasons for teaching statistics
Statistics Self-Concept	An instructor's concept of who they are in the domain of teaching statistics.
Perception of Difficulty	Statements concerning the perceived difficulty of teaching statistics.
Expectancies	Statements concerning how the instructor thinks they will do or perform in the area of teaching statistics.



Constructs

Definition

Interest/Enjoyment Value	Whether the instructor values teaching statistics because it is interesting, enjoyable, or fun
Attainment Value	Whether teaching statistics is valued because performing the task well is important to one's sense of self.
Cost and Benefits, General Teaching	The sacrifice necessary to teach in general, not specific to statistics.
Cost and Benefits, Statistics	The sacrifice necessary to teach statistics.
Utility Value	The value of teaching statistics because it meets some future goal. Usefulness of teaching statistics.

I-SOMAS Item Examples

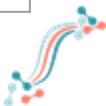
I struggle when teaching others statistical concepts.

Teaching is satisfying.

Preparing to teach statistics takes too much time.

I am able to explain how to use technology for solving statistical problems.

Teaching statistics helps students make informed decisions.

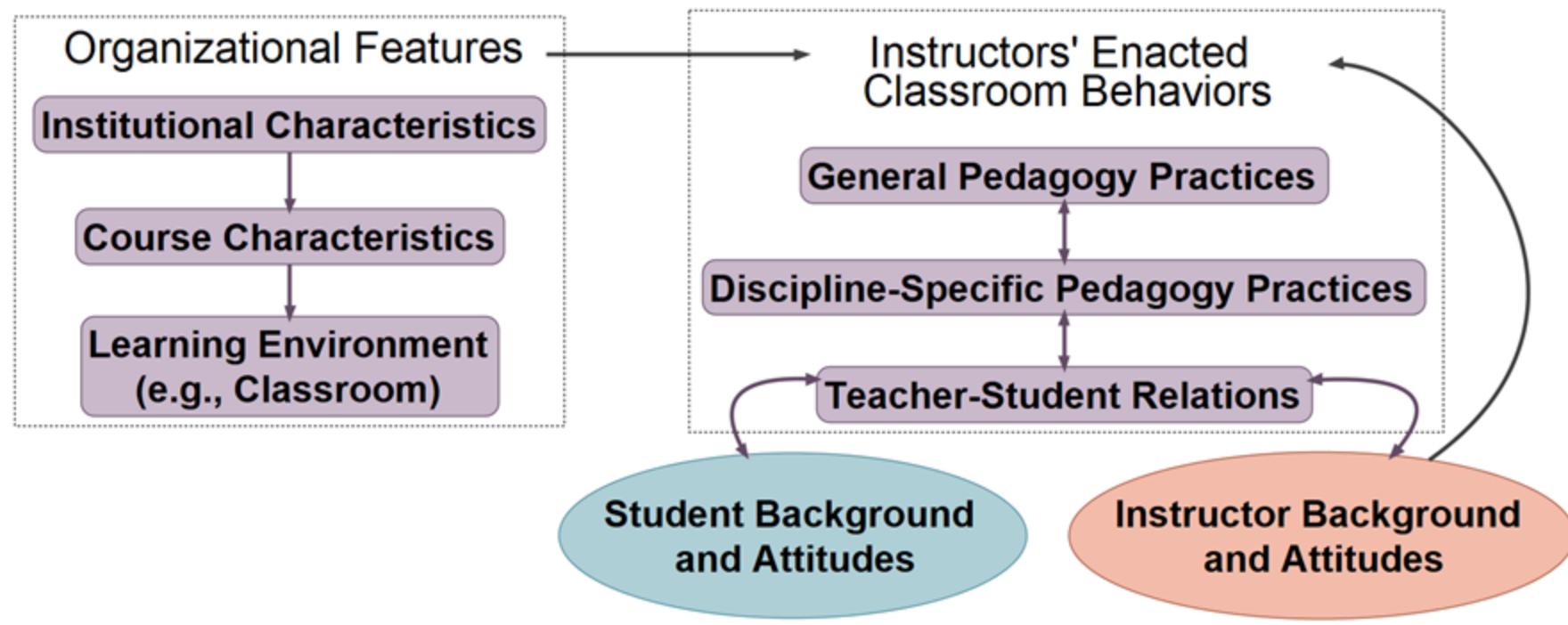




EPIC Inventory for Statistics

(EPIC: Environment, Pedagogy, Institution and Course)

Environment Model for Statistics and Data Science



S- and I-SOMADS

Surveys of Motivational Attitudes toward
Data Science

EPIC-DS

Environment, Pedagogy, Institution, Course
Inventories for Data Science



Design and Administration

- Constructs and theoretical model parallels S-SOMAS
- Designed for Intro DS Courses

► S-SOMADS Example Items



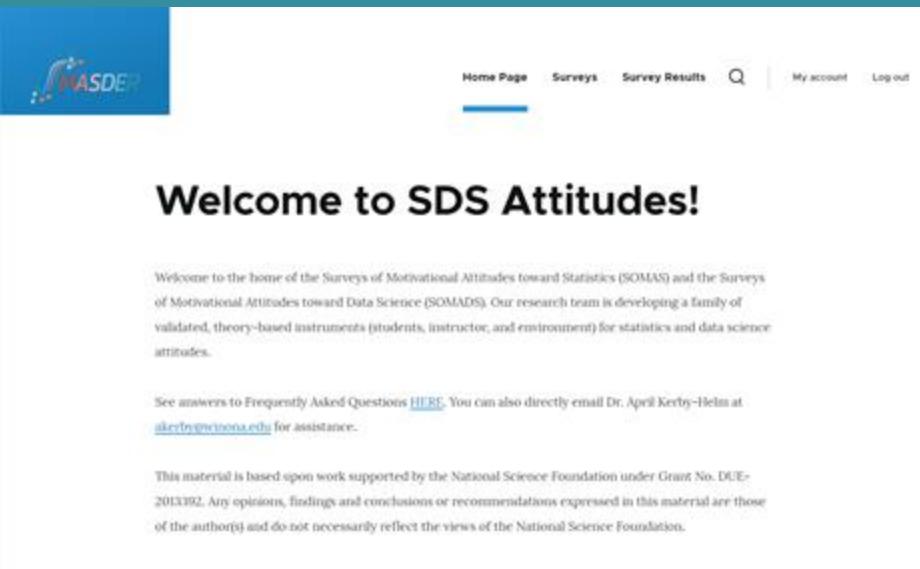
The Websites



Overview

Welcome to the home of the Motivational Attitudes in Statistics and Data Science Education Research (MASDER) team. **Our goal is to develop a family of validated, theory-based instruments (students, instructor, and environment) for statistics and data science attitudes.** These are the Surveys of

Piloting the website PORTAL this Spring



Welcome to SDS Attitudes!

Welcome to the home of the Surveys of Motivational Attitudes toward Statistics (SOMAS) and the Surveys of Motivational Attitudes toward Data Science (SOMADS). Our research team is developing a family of validated, theory-based instruments (students, instructor, and environment) for statistics and data science attitudes.

See answers to Frequently Asked Questions [HERE](#). You can also directly email Dr. April Kerby-Helm at akerby@vassar.edu for assistance.

This material is based upon work supported by the National Science Foundation under Grant No. DUE-2013392. 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.

- Create an instructor account
- Enter your course information
- Complete the instructor surveys
- Get links to S-SOMAS or S-SOMADS for each of your course sections
- At the end of your term, download your data
- Get a custom report of your students' results



Instructor Reports



Automated Reports

S-SOMAS Instructor Automated Reports

Overview

Demographic

- Gender
- Race/Ethnicity/Origin
- Age
- Class Level
- Previous Success
- College GPA
- High School GPA
- Majors
- Minors
- Enrollment Requirements

Pre Class Report

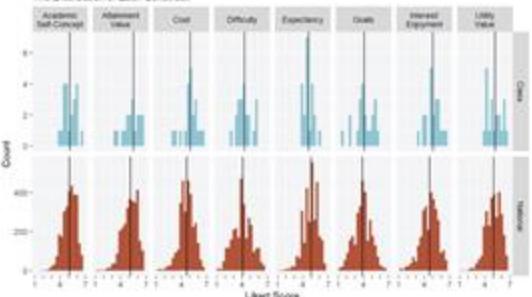
Post Class Report

Pre and Post Class Report

Pre Class Report

Construct Overview

Construct Scores: The Distribution of Each Construct



Count

Likert Score

Distribution of Construct Scores

Construct	Your Class				National			
	n	Median	Mean	St Dev	n	Median	Mean	St Dev
Attainment	21	5.43	5.55	1.08	3,435	5.14	5.13	0.91
Cost	21	5.00	5.05	0.87	3,435	4.67	4.63	0.67

▲ Michael Ford Kurniadi, Cody Lepoint
■ Last compiled on 11 December, 2023

- After your course, receive a custom, automated report summarizing your class compared to the national sample
- Built into R Shiny App that will appear on the website

What's next for you?

- Portal will be piloted for Spring 2025.
- We will also provide PDFs of the survey items
- You can collect data via the website through your own IRB process
- Study...
 - Just your class
 - Multiple classes
 - Instructor attitudes
- Use the EPIC inventories with any stat/ds course research to broadly assess the learning environment



Thank You!

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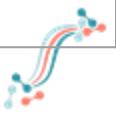


<https://sdsattitudes.com>



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Acknowledgements and Additional Information

This material is based upon work supported by the National Science Foundation under Grant No. DUE-2013392. The opinions, findings, and conclusions or recommendations expressed are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

This work was done by the Motivational Attitudes in Statistics and Data Science Education Research (MASDER) group. This group is supported by the National Science Foundation grant DUE-2013392: Developing Validated Instruments to Measure Student/Faculty Attitudes in Undergraduate Statistics and Data Science Education (10/01/2020 - 09/30/2024) and was previously supported by the American Statistical Association (ROSA 2016 - 2017, PI Marjorie E. Bond). The research team includes:

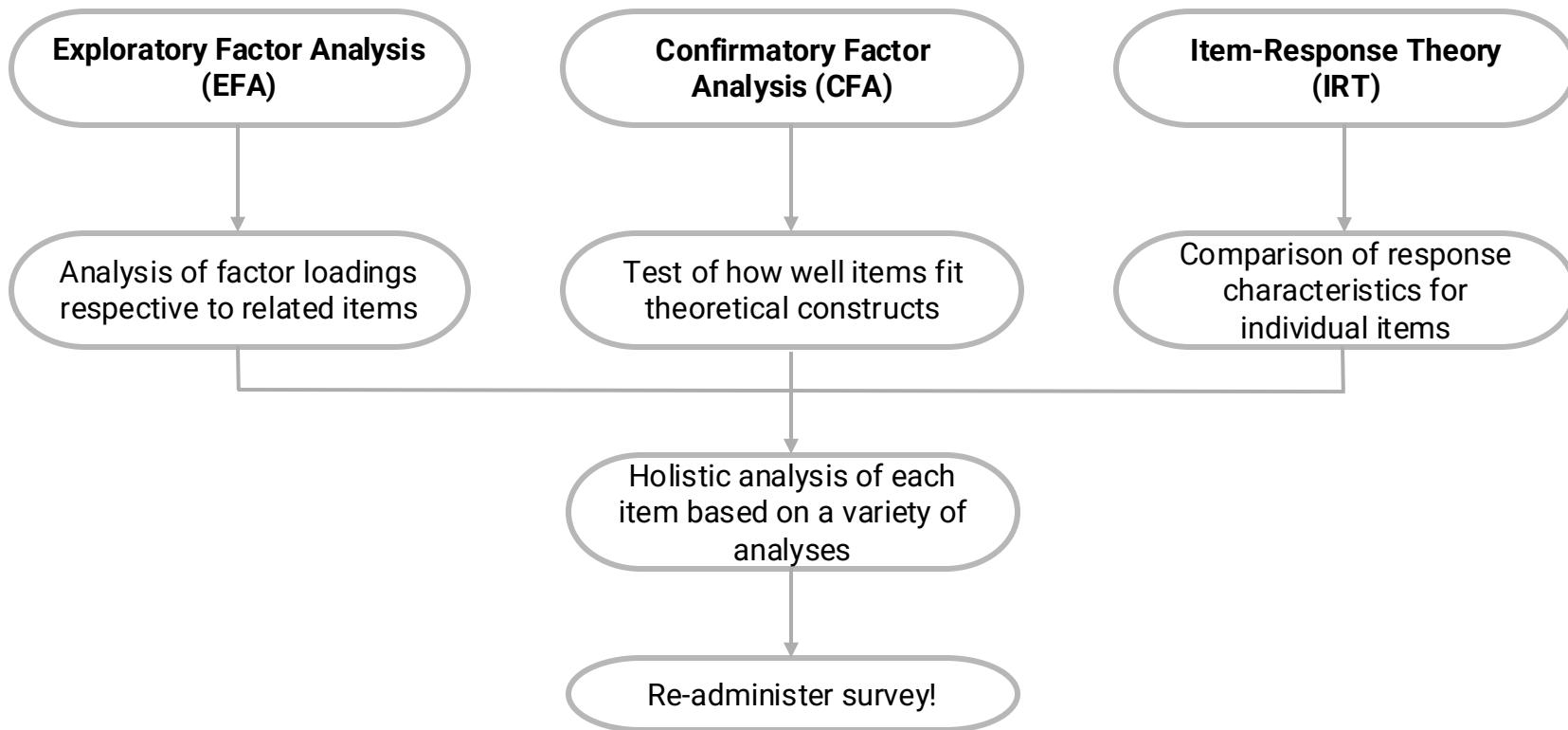
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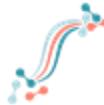
Survey Development Cycle



Methodology



In 2020, the Motivational Attitudes in Statistics and Data Science Education Research (MASDER) team received an NSF grant (DUE - 2013392) to develop a family of instruments to measure students' attitudes toward statistics or data science and instructors' attitude toward teaching statistics or data science as well as the learning environment in which the two interact. The students and instructors' instruments are based on an established psychological theory of motivation (Expectancy Value Theory) and were developed using a rigorous process. The environment inventories are based on a model developed by the team and measure institution and course characteristics, general and discipline-specific pedagogy, the student-instructor relationship, and the environment (physical classroom or online). Besides the lasting impact of these family of instruments, a website has been developed that will allow instructors and researchers the ability to administer the instruments on their own and receive a generated report based on the student data. In this presentation, we will present a brief overview of our models, the instruments and inventories as well as our website and reports.



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Conclusion

- Psychometric properties of the entire survey are **strong** and give clear indications of items that need to be changed/removed and should be kept
- The other surveys will follow the same psychometric process

