Is Tolerance of Uncertainty Related to Statistical Understanding?

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Introduction

A key part of statistical practice is "Accepting Uncertainty" (Wasserstein et al., 2019).

How people tolerate uncertainty, called **Tolerance of Uncertainty (TU)**, is a domain-stable personality trait (Gerrity et al., 1990).

It is well established that students' **statistics anxiety and attitudes impacts their learning**, but these are not domain stable traits.

Considering that learning statistics requires grappling with uncertainty, does TU, a domain stable psychological trait, play a role in students' learning of statistics by either mediating or being an antecedent of statistics anxiety and attitudes towards statistics?

Methods

Participants

- 599 students from two sections of an **introductory statistics class** for non-majors completed a survey
- Participants were awarded extra credit for completion
  - Response rate of **54.4%**
- **Demographic characteristics**
  - gender identity: 73.3% women; 25.3% men
  - 32.5% first-generation college students
  - year in school: 62.4% freshmen; 23.8% sophomore; 8.2% junior; 5.4% senior
  - 35.5% first-generation American
  - major: 23.1% social sciences; 20% undeclared; 11.4% business; 8.6% physical sciences; 8.2% agricultural sciences; 6.3% humanities; 6.3% STEM

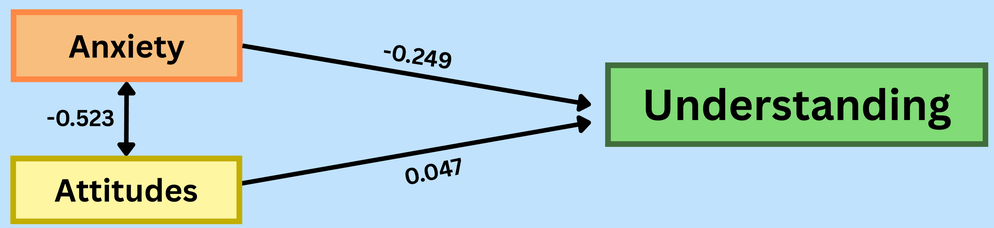
Materials

- Survey constructs:
  - Statistics Anxiety: anxiety arising from exposure to statistical concepts and situations.
  - Statistics Attitudes: perceived importance, interest, and motivation to engage in statistics.
  - General TU: one's willingness to accept uncertainty.
  - Statistics TU: one's willingness to accept uncertainty specific to statistical situations.
  - Understanding: conceptual understanding measured by students' final exam scores.

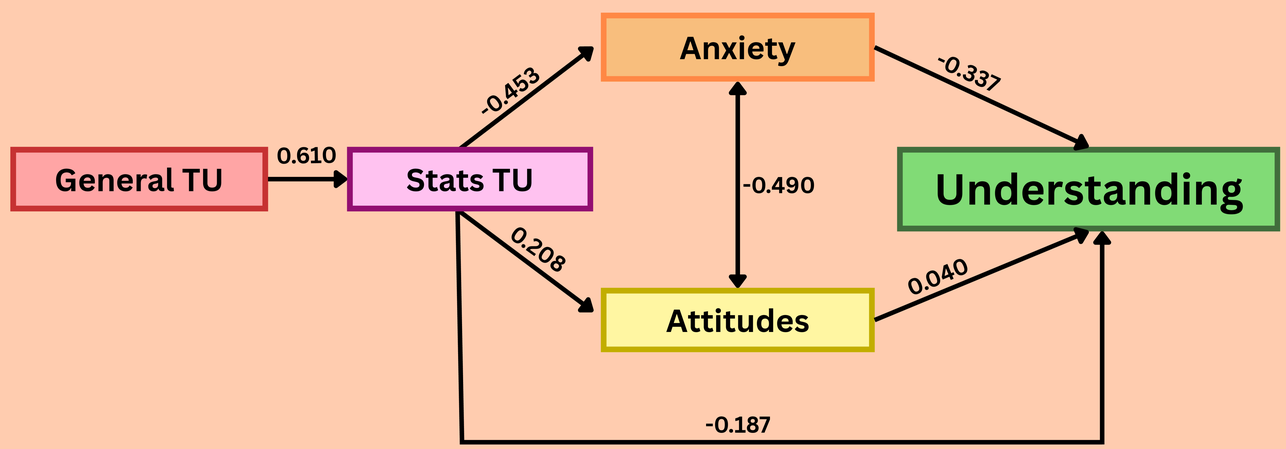
Statistical Analysis

- Structural Equation Model
  - lavaan package in R (Rosseel, 2012)
- 2PL Item Response Theory model for exam scores
  - mirt package in R (Chalmers, 2012)

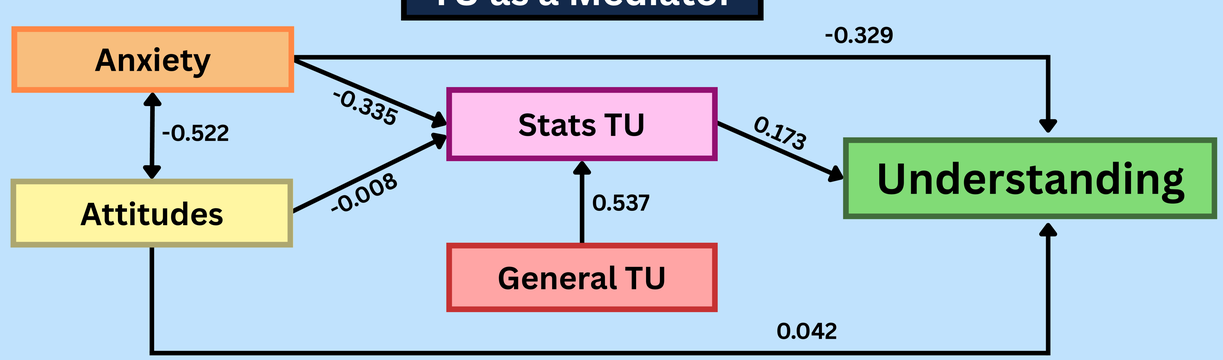
Current Theory



TU as an Antecedent



TU as a Mediator



Results

Measure Reliabilities

General TU	0.819
STATS TU	0.689
Cognitive	0.787
Interpretive	0.799
Inherent	0.697
Affective	0.797
Cognitive Self-Concept	0.719
Task Value/ Interest	0.884
Motivation	0.808
Attitudes towards data	0.840
Understanding	0.709

Fit Indices

Model	RMSEA	SRMR	CFI	TLI	AIC	BIC
Current Theory	0.060	0.101	0.748	0.738	54438	55037
Antecedent	0.059	0.084	0.753	0.743	54363	54975
Mediator	0.060	0.093	0.751	0.741	54396	55008

TU's Relationship with Understanding

Direct	Indirect	Total
0.187	0.161	0.348

Conclusion

TU is a domain-stable **antecedent** of statistics anxiety's and attitudes' effect on students' understanding.