Quantitative Measures

EDUC 641: Class 2

David D. Liebowitz

Quiz

Roadmap

Research is a partnership of questions and data		What types of data are collected?	
		Categorical data	**Continuous data**
What kinds of questions can be asked of those data?	Questions that require us to describe single features of the participants	• How many members of class have black hair? • What proportion of the class attends full-time?	• How tall are class members, on average • How many hours per week do class members report studying, on average?
	Questions that require us to examine relationships between features of participants	• Are male-identifying students more likely to study part-time? • Are PrevSci PhD students more likely to be female-identifying?	• Do people who say they study for more hours also think they'll finish their doctorate earlier? • Are computer-literate students less anxious about statistics?

Class goals

1. Describe types of and differences in measurement scales

Types of data

Research is a partnership of questions and data		What types of data are collected?	
		Categorical data	**Continuous data**
What kinds of questions can be asked of those data?	Questions that require us to describe single features of the participants	• How many members of class have black hair? • What proportion of the class attends full-time?	• How tall are class members, on average • How many hours per week do class members report studying, on average?
	Questions that require us to examine relationships between features of participants	• Are male-identifying students more likely to study part-time? • Are PrevSci PhD students more likely to be female-identifying?	• Do people who say they study for more hours also think they'll finish their doctorate earlier? • Are computer-literate students less anxious about statistics?

How we collect and quantify the data informs the kind of analysis we will conduct.

Levels/scales of measurement

What is measurement? assigning categories or numbers based on a set of rules

This concept is **critical** to quantitative research: we have some idea of a "thing" we want to examine (sometimes called a construct), and we need to figure how to turn the observed thing into a category or number.

Levels of measurement: how categories/numbers are defined

Each type of measurement has a set of properties which determines the appropriate analysis.

Four levels/scales of measurement

1. Nominal
2. Ordinal
3. Interval
4. Ratio

Nominal scale

No hierarchy among levels of a variable

Levels are unordered, representing labels

A variable defining whether someone is an omnivore, vegetarian, vegan or fruititarian is on a nominal sclae

Most demographic variables are nominal:

- Hair color
- Race
- Ethnicity
- Gender

Ordinal scale

Levels are logically ordered; a higher level indicates "more"

Distances between levels are not necessarily equal

Level 1 < Level 2 < Level 3 < ... (monotonicity)

Examples:

- Grades (A - F letter grades)
- Competition (1st place, 2nd place, 3rd place)
- Likert scale (on a scale of 1 to 10 with 1 being *very unhappy* and ten being *very happy*, how happy are you today?)

Interval scale

Represents *quantity* and has *equal units*

Ordinal scale + equal measurement units

There is no absolute zero

Examples:

- The Fahrenheit temperature scale
  - The difference between 20 F and 30 F is the same as the difference between 60 F and 70 F
  - 0 does not represent "no temperature"
  - There is no concept of dividing or multiplying values on the scale. There are no ratios. We can't describe 50 F as half as hot as 100 F or twice as hot as 25 F

Ratio scale

Interval scale + True zero point

True zero means a point where the thing being measured does not exist

Examples:

- Height
- Mass
- Distance
- Length of a piece of wood
- Test score (?)

Levels of measurement

	Indicates difference	Indicates direction of difference	Indicates amount of difference	Has absolute zero
?????????	X			
?????????	X	X		
?????????	X	X	X	
?????????	X	X	X	X

Can you match the four measurement scales to their characteristics in the above table?
Try not to peek ahead to the next slide?

Levels of measurement

	Indicates difference	Indicates direction of difference	Indicates amount of difference	Has absolute zero
Nominal	X			
Ordinal	X	X		
Interval	X	X	X	
Ratio	X	X	X	X

Alternative measure terms

Categorical variable

- Nominal and ordinal measures
- Use labels to describe

Continuous variable

- Interval and ratio measures
- Data with arithmetic properties

Four levels/scales of measurement

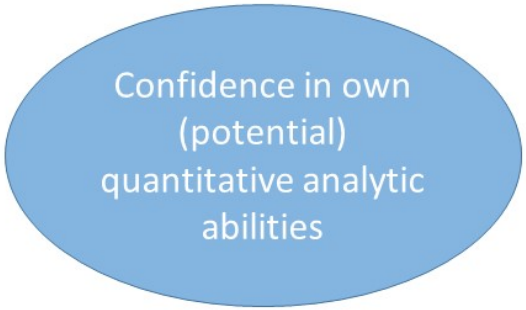
1. Nominal
2. Ordinal
3. Interval
4. Ratio

Why does this matter? Different scales contain different information and have different mathematical properties.

Is someone who says they are at 8 on a happiness scale twice as happy as someone who says they are at a 4?

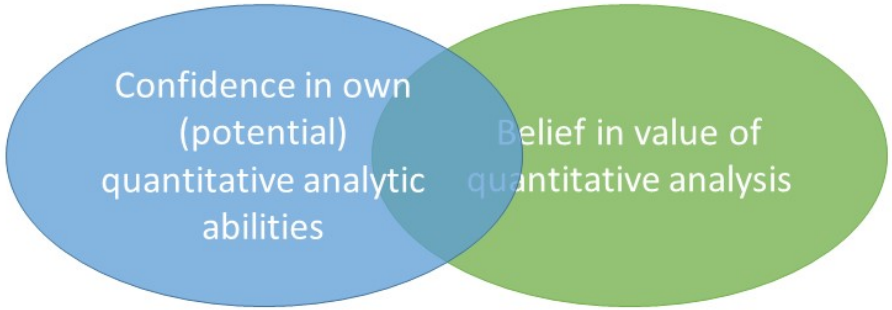
Is there a mean (or standard deviation) for the hair color of the students in this class?

The measure of our class

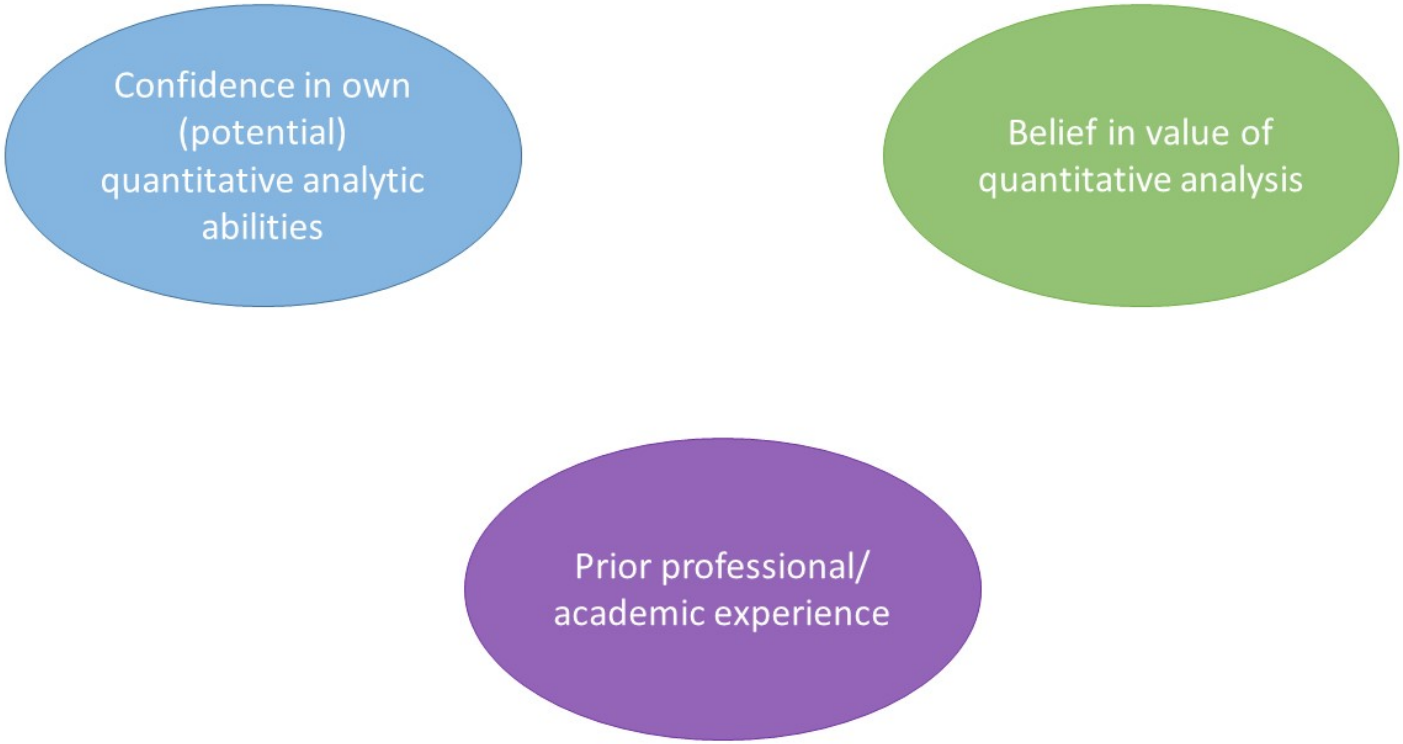


The measure of our class

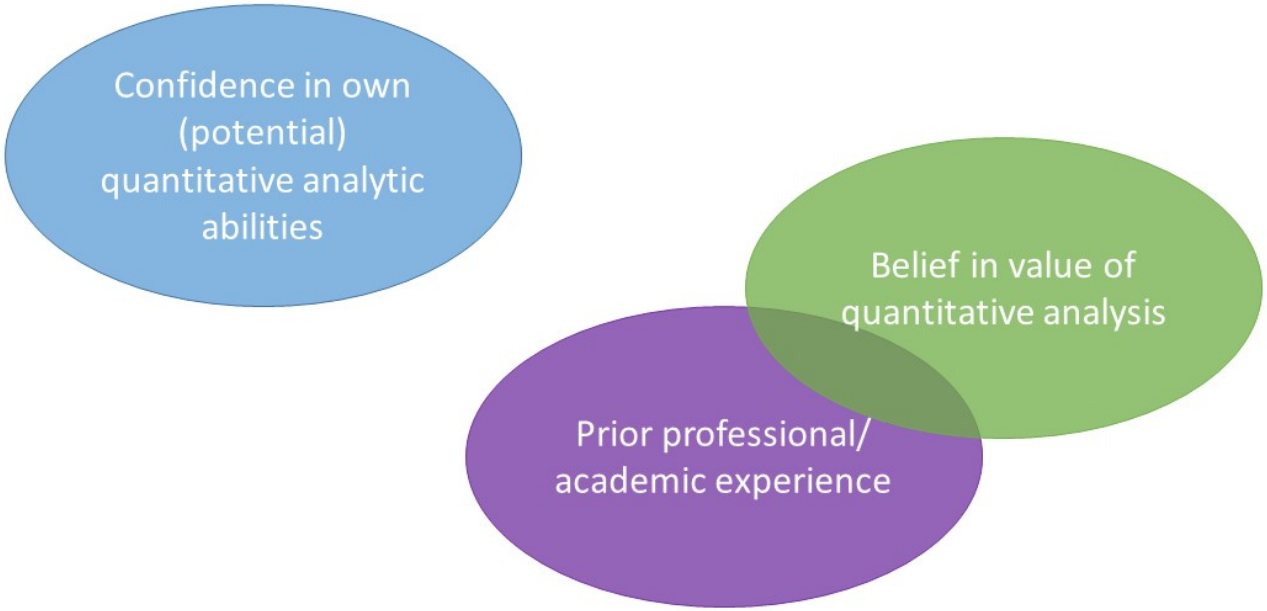
The measure of our class



The measure of our class



The measure of our class



The measure of our class

The measure of our class

Qualtrics: https://oregon.qualtrics.com/jfe/form/SV_0MSB8ExhepNtVdA

or

Synthesis and wrap-up

Class goals

1. Describe types of and differences in measurement scales

To-Dos

Optional follow-up:

- Complete Module 4 in R Bootcamp (data types)
- Complete Module 5 in R Bootcamp (vectors)