

# IRT workshop

Christopher David Desjardins

30 January 2014

1 Overview of the Course & IRT

2 introduction IRT

3 Introduction to R

- Name
- What is your statistical/mathematical background?
- How do you anticipate using IRT (presently or in the future) and what models you are interested in?
- Expectations and goals of this workshop

# Purpose of the workshop

To **introduce** IRT concepts and their **applications** through the use of the **R** programming language

# My expectations

- Come prepared, i.e. do readings outside of the workshop; as there is a focus on application during class time
- Spend time outside of class to learn about R and re-run all code
- Act professionally during class
- Provide feedback throughout; this workshop is for you and should be worth your time
  - If something isn't working let me know, if something is working let me know.

# Administrative business

- Meet once every two weeks (except we are meeting next week).
  - 30/1, 6/2, 20/2, 6/3, 20/3, 3/4, and 17/4.
- Preferred time and day: Wednesday/Thursday after 1.
- Meet for 2 hours.
- Comments? Do you want an additional session?

- Meet once every two weeks (except we are meeting next week).
  - 30/1, 6/2, 20/2, 6/3, 20/3, 3/4, and 17/4.
- Preferred time and day: Wednesday/Thursday after 1.
- Meet for 2 hours.
- Comments? Do you want an additional session?
- Readings
  - Text: Frank Baker's IRT book
  - Optional text: de Ayala, R. J. (2009). The theory and practice of item response theory.
  - I will assign required readings out of Baker's book and optional readings out of de Ayala's.
  - These readings will be used to supplement material, not necessarily mirror it

# Proposed assignments?

- Every class meeting, we will work through code together. Alongside the code, there will be questions that need to be answered and turned in. These can be answered individually, with a partner, or as a class.
  - The goal of these activities is for you to understand how the code is getting information for us and to demonstrate that you understand the IRT model we are investigating.
- A short-paper showing that you know how to run and interpret an IRT model.
  - Very brief intro and discussion; the bulk of this paper will be on methods (describing the IRT model you chose and why it's appropriate) and the results (assessing model fit, interpreting, and demonstrating understanding of model output).
  - I will provide a rubric that will show you what needs to be included.
  - Can you use a class dataset or, preferably, your own.
- Presentation on your paper (12 - 15 minutes).



# Proposed topics

Introduction to R (30/1)	Polytomous models (20/3)
1-PL and Rasch model (6/2)	Latent class analysis (3/4)
2-PL model (20/2)	Addl topics & Presentations (17/4)
3-PL model (6/3)	

These topics are flexible and it's very likely it will all take all 6 remaining sessions to get through these topics.

- IRT is a *measurement* perspective

- IRT is a *measurement* perspective
- What is *measurement*?
  - Assignment of numerals to objects or events leading to different scales and kinds of measurements
  - However, it is also the process by which we attempt to understand a variable

- IRT is a *measurement* perspective
- What is *measurement*?
  - Assignment of numerals to objects or events leading to different scales and kinds of measurements
  - However, it is also the process by which we attempt to understand a variable
- Latent variables may be conceptualized **continuous**, **categorical**, or both.

## Example: Generalized Anxiety

- Anxiety could be loosely defined as *feelings* that range from general uneasiness to incapacitating attacks of terror

## Example: Generalized Anxiety

- Anxiety could be loosely defined as *feelings* that range from general uneasiness to incapacitating attacks of terror
- Should anxiety be conceptualized as observed or latent?

# Example: Generalized Anxiety

- Anxiety could be loosely defined as *feelings* that range from general uneasiness to incapacitating attacks of terror
- Should anxiety be conceptualized as observed or latent?
- Is anxiety continuous, categorical, or both?
  - Categorical - Individuals can be placed into a high anxiety latent class and a low anxiety latent class
  - Continuous - Individuals fall along an anxiety continuum with one end being low anxiety and another end high anxiety
  - Both - Given a latent class (e.g. the high anxiety latent class), within this class there is a continuum of even greater anxiety.

# How to measure generalized anxiety?

- Used observed (i.e. *manifest* variables) that provide a proxy of generalized anxiety
- These provide our *operationalized definition* of generalized anxiety
- But how do we put these observed measures onto the generalized anxiety scale?



# Issues in measurement

- Reliability
- Validity
  - High reliability is imperative for high validity
- Invariance
  - Want our instruments to be independent of what they are measuring
- Scale of the variable
  - Ratio - Continuous scale with an absolute zero
  - Interval - Continuous scale with a relative zero
  - Ordinal - Categorical, natural order to data
  - Nominal - Categorical, no natural order to data

# Item Response Theory

- A system of models that establish the corresponds between latent variables and manifest variables
- Uses latent characteristics of individuals and items as predictors of observed responses
- Doesn't help us answer the how and why of a latent construct, despite the name "theory"
- Places persons and items on the same continuum

# Properties and assumptions

- Properties

- Manifest variables can differentiate among persons located at different locations on the latent variable scale
- Individuals are characterized in terms of their location on the latent variable
- Items are characterized with respect to their locations and capacity to discriminate among person

- Assumptions

- The latent variable is unidimensional (typically)
- Local independence of items
- Response of a person to an item can be modeled with the a specific item reponse function

# Tools for the IRT workshop

- R programming language: <http://www.r-project.org>
- Rstudio (optional, but highly recommended if you are new to R):  
<http://www.rstudio.com/>
  - Rstudio is an IDE for R that greatly expands the default R editor and makes it more user-friendly and uniform across the OSs.
  - So ..., Rstudio is R with some pretty makeup
- Various R packages
  - These will be installed in an ad-hoc fashion via R scripts

# Why R?

- ① R is free
- ② R is open-source
  - All code is 100% visible to the user and can be expanded or audited by anyone.
- ③ R can do everything
- ④ R is cutting edge
- ⑤ R is cross-platform
- ⑥ Once you learn R, it's actually easy

- Please:
  - Read Chapters 1 & 2 in Baker, ignoring the Computer Session sections
  - Optional: de Ayala chapter 2
  - Learn more R and play around with it.
  - Look at Verzani's simpleR if you have time: <http://cran.r-project.org/doc/contrib/Verzani-SimpleR.pdf>