Measuring Sustainability Literacy

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Overview

Objective

Procedure
- Item development and pilot testing
- Sample Questions
- Current Study

Descriptive Statistics

Factor Analysis
- FA Sustainability Literacy

Item Response Theory
- Wright Map
- Item Characteristic Curve

Interpretation

Conclusion

Objective

Research Question

What do people know about Sustainability Literacy?

Approach

- Question development and pilot testing
- Factor Analysis
- Item Response Theory
- Interpretation

Question Development

Map to construct

- What is sustainability?
- Write questions that tap each aspect.
- Write questions that vary in difficulty.
- Consult with experts

Pilot Testing

- 143 questions in first round.
- Reduce number of questions.
- Test with a different class.
- Repeat. Down to 36 knowledge questions.

Sample question

A group of fishing boat owners share equal access to a common fishing area and are dependent upon it for their livelihoods. For each individual, it is economically rational to: a. Limit the number of fish he or she catches to ensure there will be fish to catch in the future. b. Catch all the fish he or she can to maximize the profit. c. Limit the number of fish he or she catches to ensure there everyone gets an equal shared. d. Catch all the fish he or she can to eliminate the competition.

Current Study

Sampling Procedure

- Email sent to all 1st and 4th year students.
- Follow-up emails sent to improve response rate.
- 605 participants in survey.

The Sample

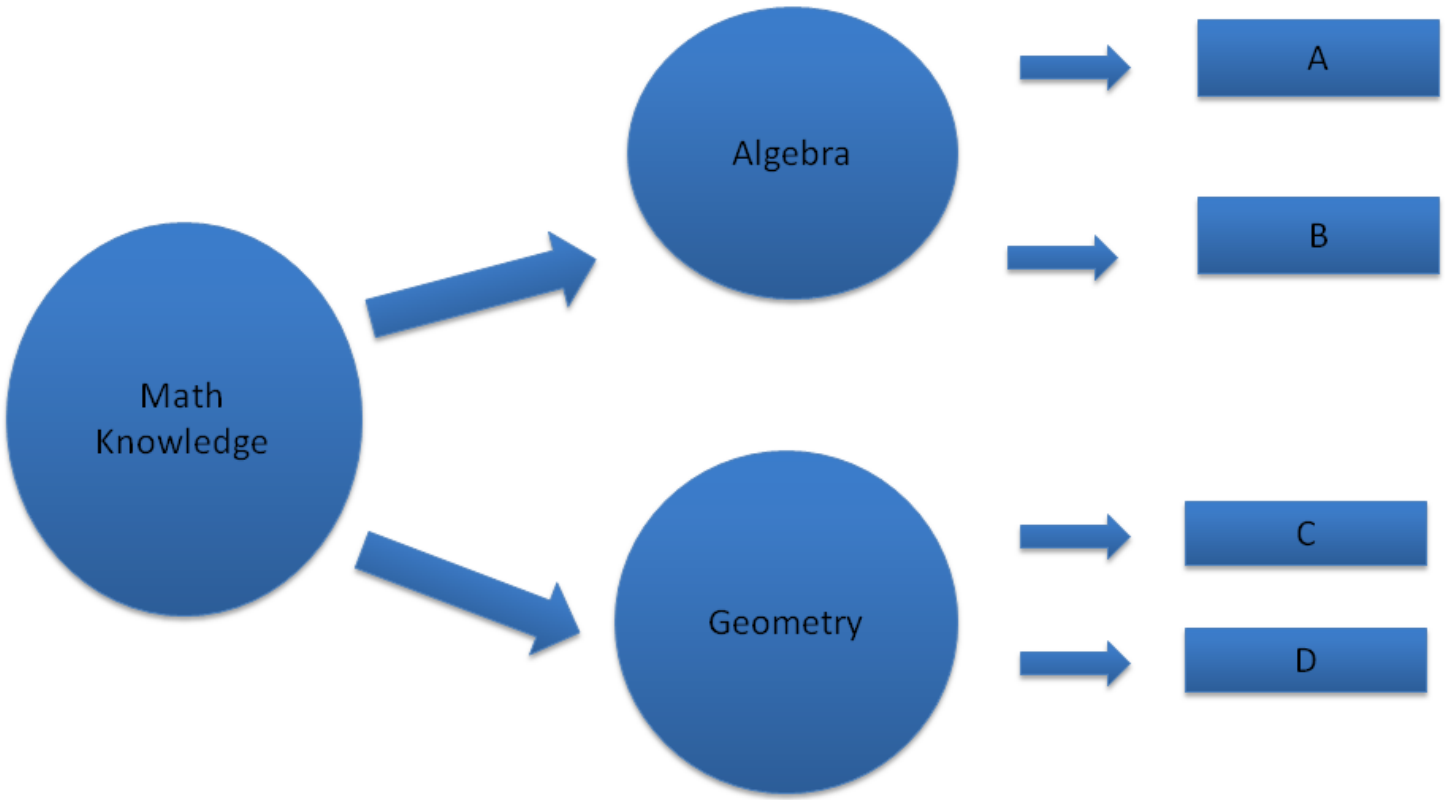
- Even distribution of class rank and ethnicity
- More female than male
- Disproportionately ES and pre-Bio.
- Very few from Math, art, and language.

Descriptive Statistics

Group	Mean	difference	significance	Alpha
Total	33	-	-	-
1st year	32.1	-	-	-
4th year	33.8	1.7	.000	-
ES	37.1	-	-	-
not ES	32.5	4.6	.000	-
Cronbach	-	-	-	0.73

Table: Descriptive Statistics

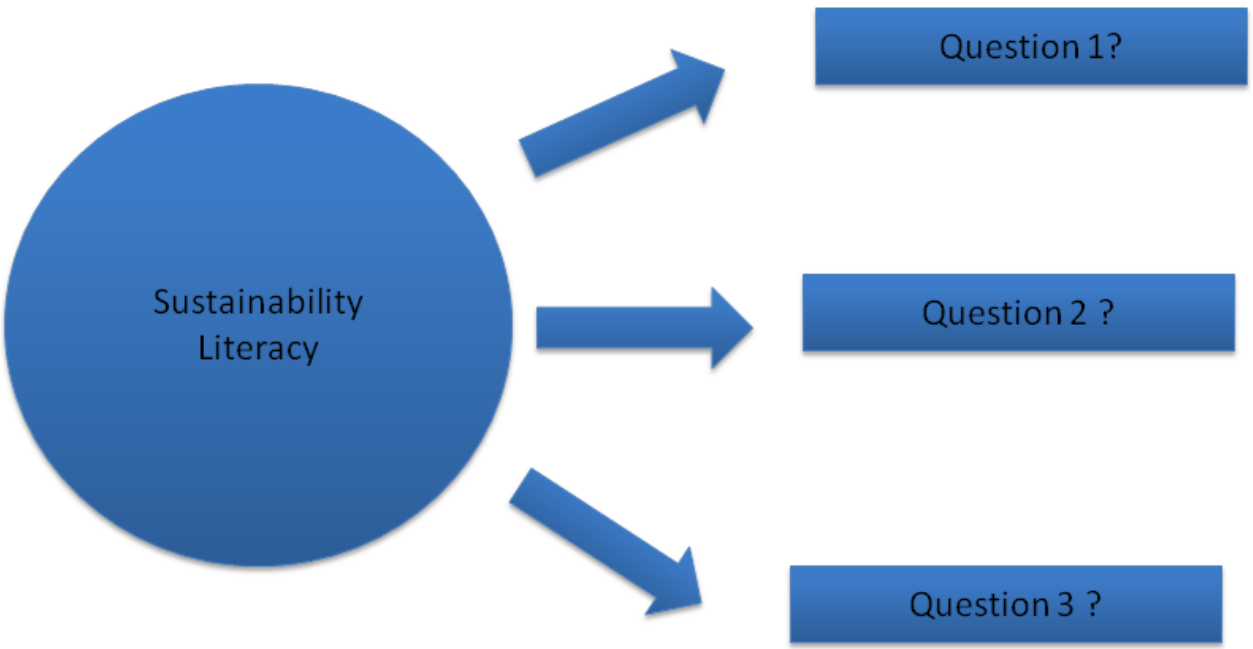
Factor Analysis: an example



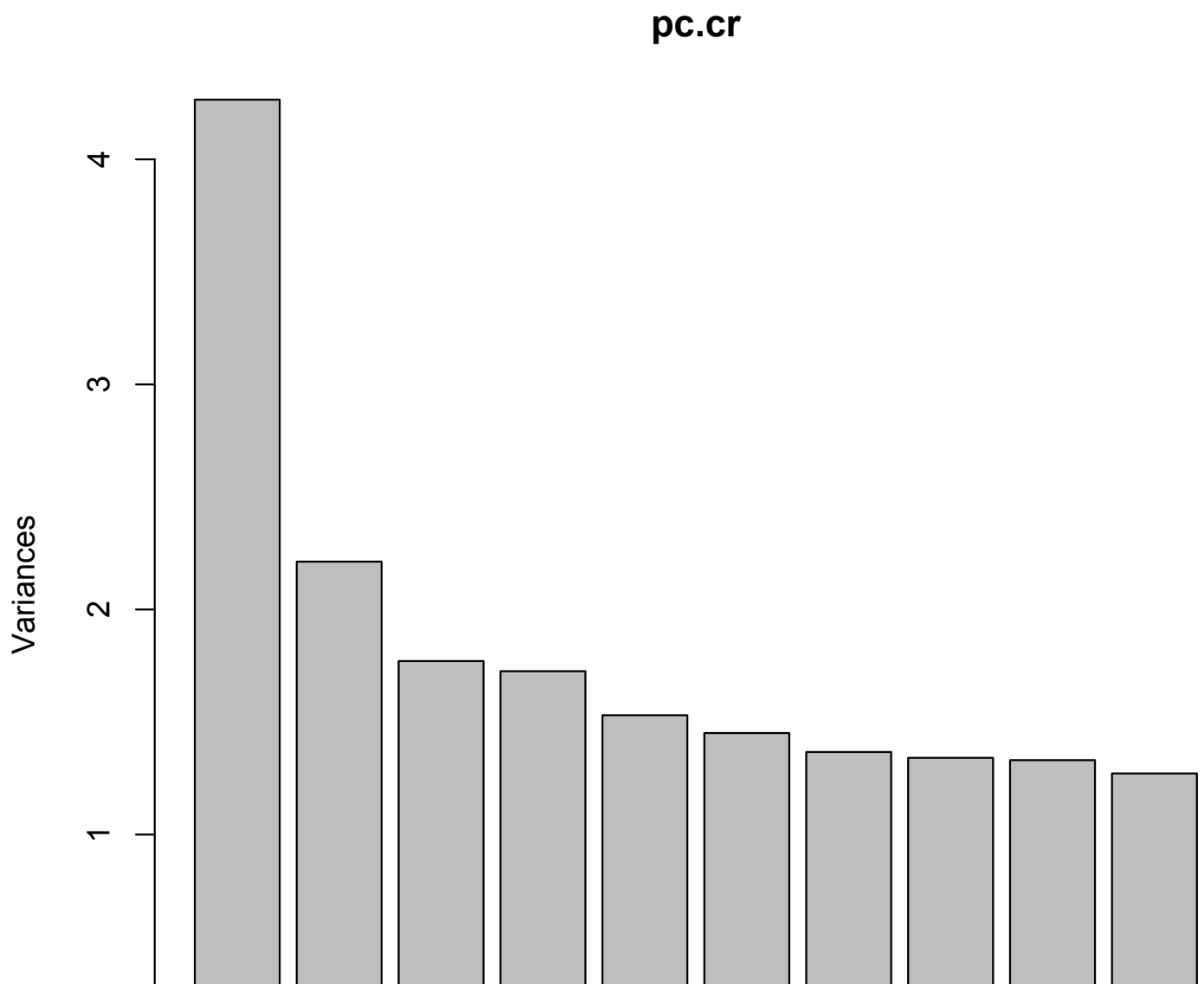
example notes

Previous slide: SAT as example: Quantitative knowledge (unobserved) causes the (observed) ability to answer math questions Show slide: Circle around math knowledge; arrows to boxes, Q1, Q2, etc.; error arrows from bottom Explain that (for those of you who know statistics), factor loadings are standardized regression coefficients with one independent variable and one dependent variable Add a 2nd Verbal Ability latent factor and full 2 factor model with the SAT model
The following slide shows a circle representing sustainability knowledge that is predicting correct responses to several questions about sustainability.

Factor Analysis: sustainability literacy



Factor Analysis: Scree Plot



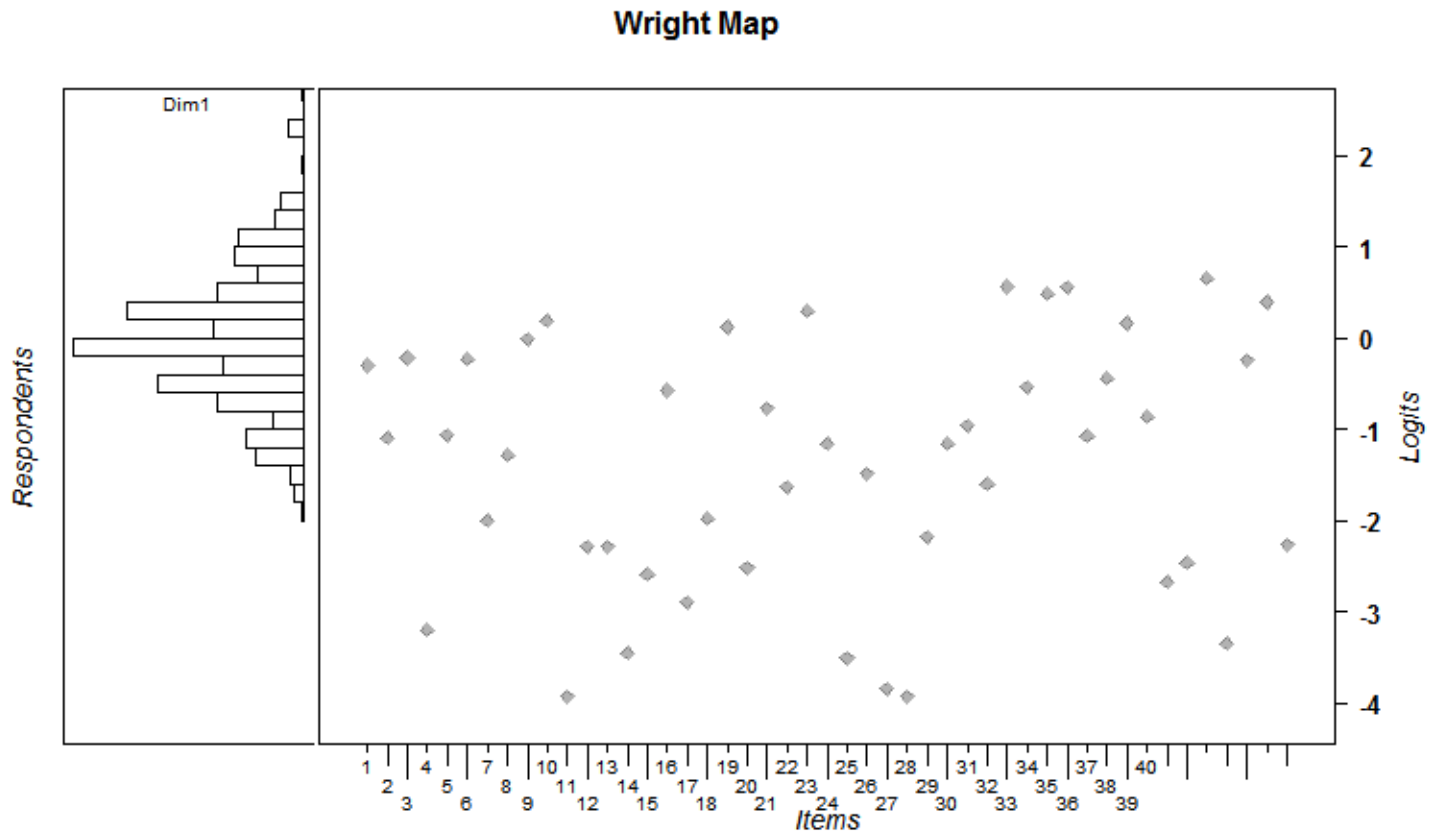
Factor Analysis: Scree Plot

The previous slide is a scree plot which is a visual representation of how strong the various are.

Factor Analysis: Results

Need visualization of results showing no strong factor structure

Wright Map


Wright Map
Dim1
Respondents
Logits
2
1
0
-1
-2
-3
-4
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Items

Wright Map explanation

The Wright Map shows the ability of our respondents in the histogram on the left hand side of the figure. The Y-axis is logits, which can be interpreted as ability. It should be possible to translate logits into percentiles. This way, we could see the percentile ranking for the individuals and for the items.
Based on the spread of the items, in terms of logits required to get them correct, we have more items in the easier range. There are not any items that require more than 1 logit of ability to have a 50 percent probability of answering them correctly. This means we may not have enough items to discriminate those are most proficient from lower levels of proficiency.

The Rasch Model

The Rasch Model

$$P(Xij = 1|\theta j, \delta i) = \theta j - \delta i = \left(\frac{\exp(\theta j - \delta i)}{1 + exp(\theta j - \delta i} \right)$$

2PL Model

$$P(Xij = 1|\theta j, \alpha i, (\delta i) = \theta j - \delta i = \left(\frac{\exp(\alpha i(\theta j - \delta i))}{1 + exp(\alpha i(\theta j - \delta i} \right)$$

Item Characteristic Curve

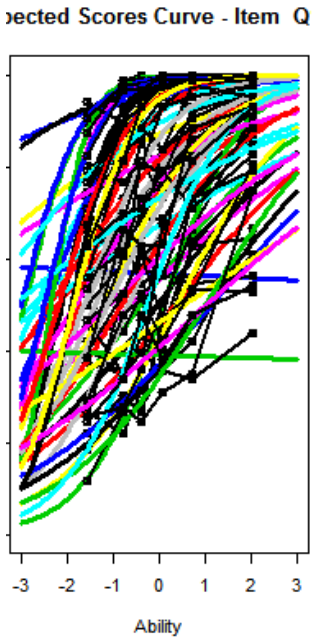


Figure: Placeholder until I can get a better looking one

The previous slide shows item characteristics curves. It is hard to see here, but the items the furthest to the right, are the most difficult. Item difficulty is estimated by seeing how much ability (in this case plotted by logits) it requires to have a 50 percent probability of correctly answering the item (y-axis.) A two parameter model has been estimated. This means the model makes an estimate of difficulty and the slope. The plot is not presented here because the aggregate is really messy. By looking at the plots for each item individually, it is clear that we have some very discriminating items, and some that are not good at all. Ideally, they would all be very discriminating. It will be easier to look at these in person since there are so many items.

Interpretation

Putting it all together.

Conclusion

Takeaways and remaining questions