

# *Rasch Psychometric Analysis of a Course Satisfaction Survey*

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## The Theory | The Rasch Model

- Using log-odds transformations, Georg Rasch developed his measurement model to solve a testing problem for the Danish Department of Defense
- Initial model assumed dichotomous items arranged in difficulty along a single dimension; goal to create a scale in which each unit along it means exactly the same thing (i.e., it is objective and a true interval scale)
  - There are a number of ways to determine degree of deviation from the theoretic ideal
  - Variations from the basic model support use of multiple choice items, partial credit scoring, multiple dimensions
- The Rasch approach differs from other theories in some important respects
  - Classical test theory (CTT); now increasingly marginalized to smaller sample or clinical work
  - Item response theory (IRT); conceptually different in some ways from Rasch, but as usually implemented (3-parameter logisitic, or 3PL) requires quite large Ns (beware: true-believers!)

## Software | Winsteps

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- Winsteps, single-user \$149, the basic program
- Facets, single user \$149, the more powerful but more complex version
  - Use Winsteps unless Winsteps won't work on a problem
- Licenses available for use by groups
- Other deals seem to be available as well, more on an ASP model
- Free time-limited license, and a free Ministeps version (restricted features)
- See handout for details

### Example | Teacher Subscale on EOT Survey

- 15 Items, 4 of which also comprise Seminar subscale, and 5 more of which comprise the Discussion subscale

|      |  |                      |
|------|--|----------------------|
| 19   | The professor stated clearly what is expected of students.   | Teaching             |
| 20   | The professor was responsive to my questions and concerns.   | Teaching             |
| 21   | I received helpful feedback from the professor on my course work   | Teaching             |
| 22.1 | The professor engaged students in seminar by: sharing relevant knowledge.  | Teaching, Seminar    |
| 22.2 | The professor engaged students in seminar by: keeping the discussion focused.                                    | Teaching, Seminar    |
| 22.3 | The professor engaged students in seminar by: building upon the contributions of students.                       | Teaching, Seminar    |
| 22.4 | The professor engaged students in seminar by: encouraging all students to participate.                           | Teaching, Seminar    |
| 23.1 | The professor added value to the Discussion Thread by: sharing relevant knowledge.                               | Teaching, Discussion |
| 23.2 | The professor added value to the Discussion Thread by: building upon the contribution of students.               | Teaching, Discussion |
| 23.3 | The professor added value to the Discussion Thread by: providing useful insights.                                | Teaching, Discussion |
| 23.4 | The professor added value to the Discussion Thread by: connecting student responses to course material.          | Teaching, Discussion |
| 23.5 | The professor added value to the Discussion Thread by: highlighting the practical relevance of course materials. | Teaching, Discussion |
| 24   | The professor encouraged me to do my best in this course.  | Teaching             |
| 25   | The professor's grading standards were appropriate.  | Teaching             |
| 26   | Overall, I rate the professor as: <sup>3</sup>   | Teaching             |

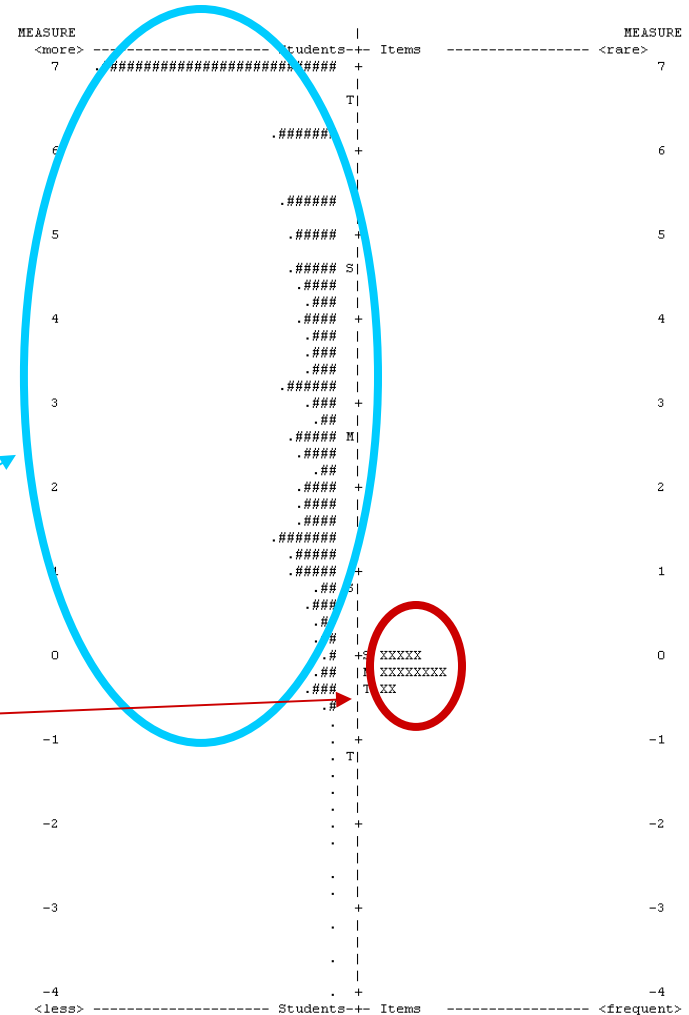
- Other subscales on the EOT Survey include Learner, Course, and there are some items that tap demographic information

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## Example | Item & Person $\times$ Logit

- The following examples are analyses of the 15-item teacher scale on the current undergraduate End of Term (EOT) Survey
- In a separate report, Cindy Hasemeier and I examined the dimensionality of the survey using exploratory factor analysis
- To the right, see the variable map from Facets for students and items
- Note that difficulty of **items** averaged at 0 logits, while **students** tended toward high (positive) ratings (aka highly skewed)
- Could suggest insufficient range for our teacher rating items

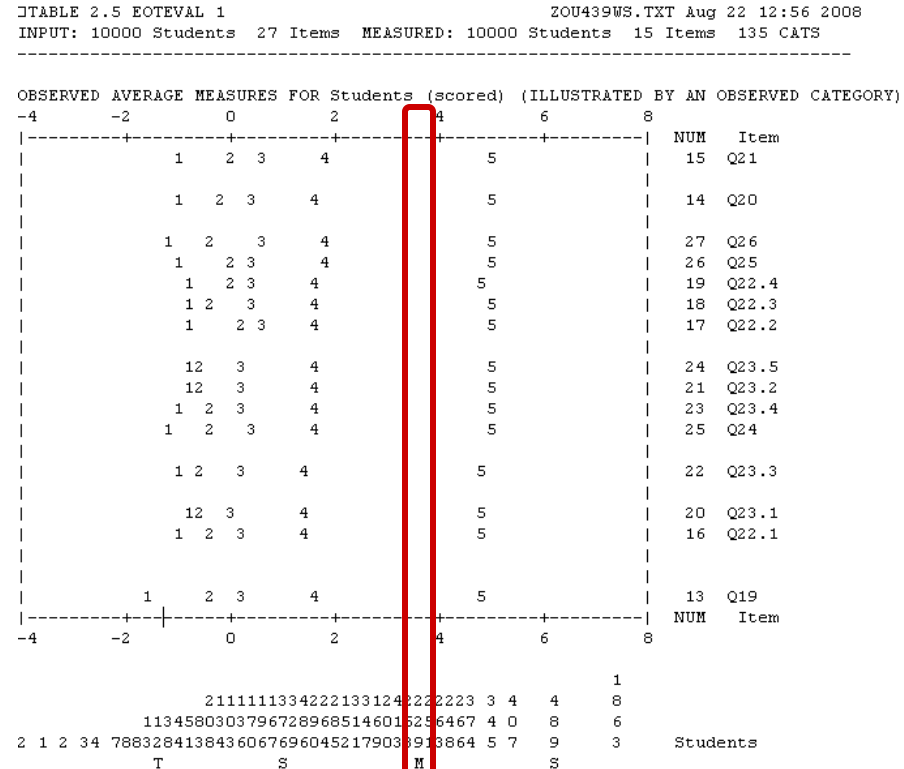


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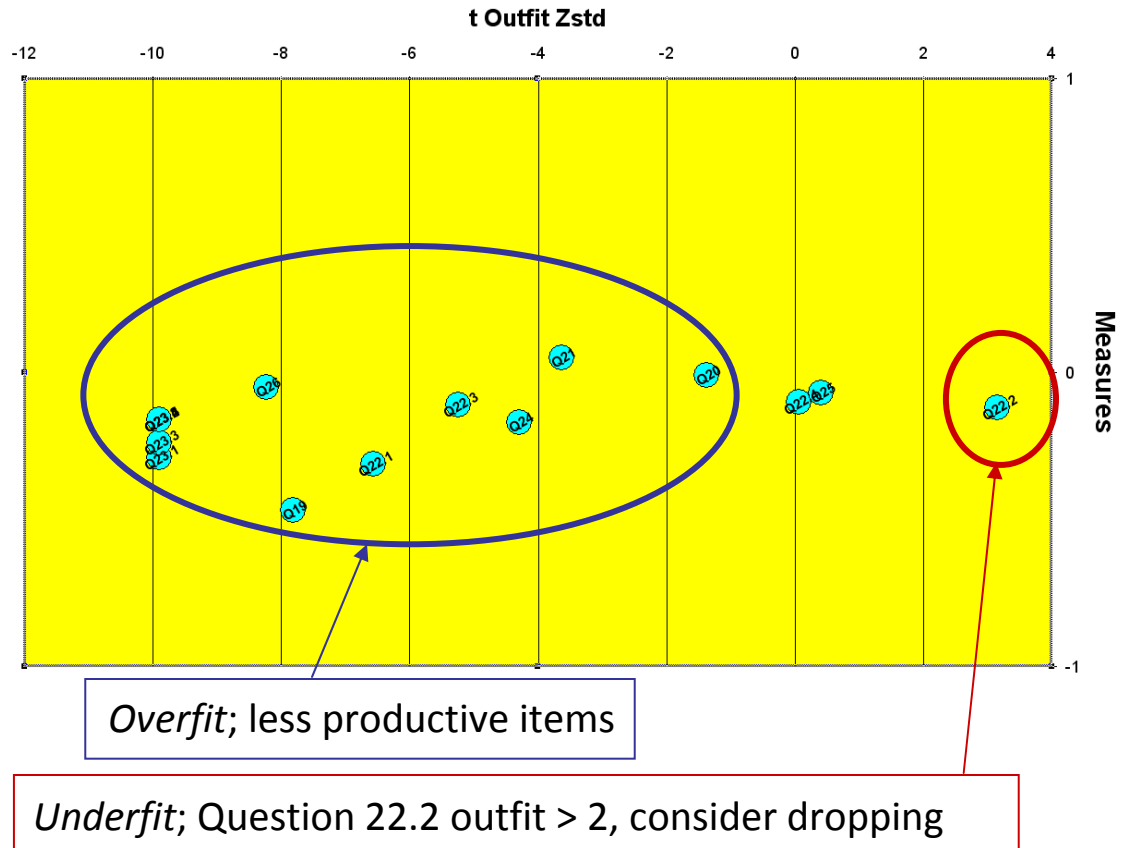
## Example | Empirical Item-Category Measures

- Main figure shows distribution of the item categories by logits from mean for measure. Note little variation in distance from mean by item; remember, *all items fall at same level of difficulty*
- See bottom of figure; that's the distribution of persons. Mean for persons shown by "M", which is nearly 3 logits above mean for measure.



## Example | Analysis of item misfit (here, outfit)

- Another indicator of possible problems with the Teacher subscale lies in examination of outfit statistics
- Outfit: Outlier sensitive fit statistic; high scores can suggest a distorted picture of the data
- Scores for *many* of the items are extreme
- *Perhaps time to rethink the scale*



## Future Directions | Features of a Better Measure

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- We are probably more concerned with dissatisfaction or poor quality – We need better item representation there
- We do not want all of our items to measure same point on satisfaction/quality dimension
  - This is true not only for stem, but also for any multiple choice options
- It may be easier to demonstrate desirable measurement properties if we use true-false items, or checklist items.



## **Future Directions** | Possible items (varying in difficulty)

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- The instructor was always well-prepared to teach.
- The instructor was usually very encouraging.
- The instructor succeeded in keeping our discussion on track.
- The instructor sometimes applied grading rules in an inconsistent manner.
- The instructor's train of thought wandered aimlessly during class.
- The instructor did not respond to my questions.

*Bottom line: Don't make the multiple choice options do all the work!*

## Professional Development | Course and Statistics.com

- Statistics.com is professional development resource for statistics and measurement
  - Rasch Core Topics is the first of 3 sequenced courses on Rasch measurement theory and methods; there are additional Rasch-related courses of interest beyond this sequence.
  - The \$385 core topics course had 4 units (one week each) and took one month to complete; it was equivalent to about 1 traditional university credit
  - The course was entirely asynchronous and had about 32 students
  - The instructor was Mike Linacre, a leader in Rasch measurement theory, and a developer of some of its leading specialized software tools
- Good resource: Bond, T. G., & Fox, Christine M. (2007). *Applying the Rasch model: Fundamental measurement in the human sciences* (2<sup>nd</sup> ed.). Mahwah, NJ: Lawrence Erlbaum.

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