



Measurement Properties Improve Assessment Validity

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Presentation outline

Question: Do measurement properties affect assessment validity? If, yes, then how?

- Introduce ordinal & linear scales.
- Review logical properties & examples.
- Present validity implications.
- Review empirical examples.
- Review 1 PL transformation function.
- Propose recommendations for practical use.

Ordinal and linear scale concepts

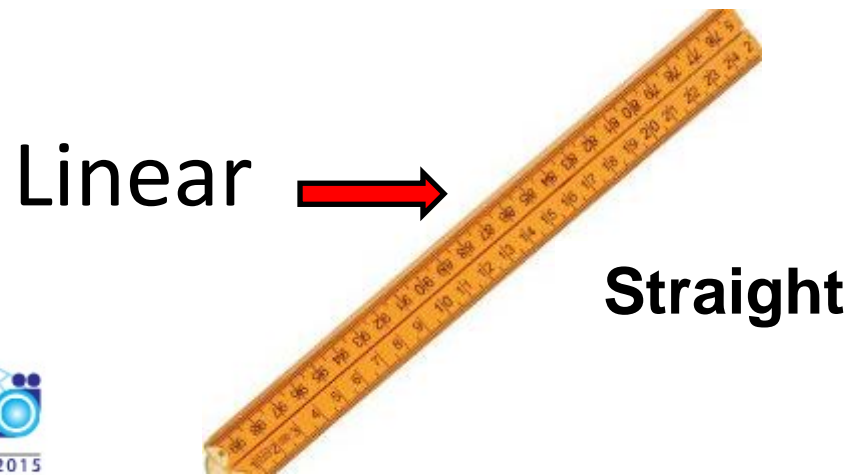
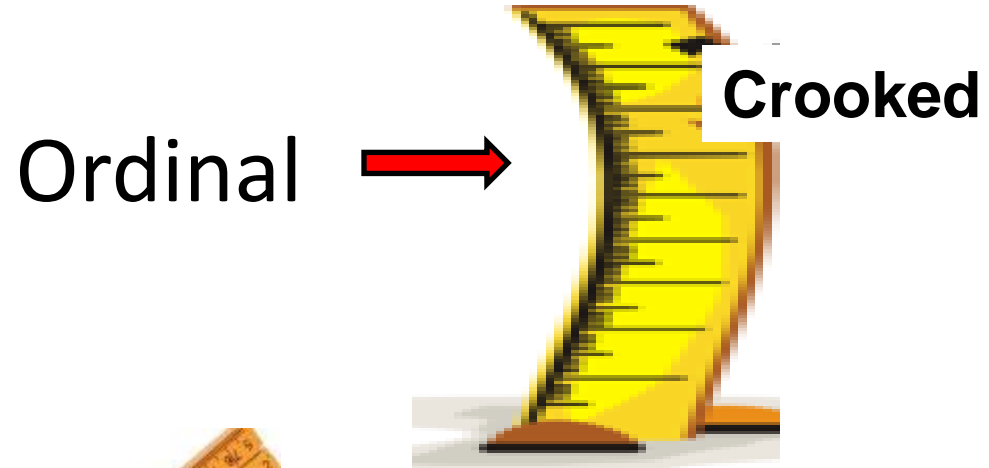
Ordinal: Unequal units

- Achievement tests – raw scores, standard scores, summated scores, & dichotomous scoring
- All rating scales, Likert scales of attitudes and opinions, & performance scoring rubrics

Linear: Uniform units

- Rasch model, Linear Logistic Test Model, General Additive Models

Fundamental ordinal and linear difference



How do ordinal and linear scale properties differ?

- Construction principles: Arbitrary raw score summation vs probabilistic concatenation
- Measuring units: Explicit vs assumed
- Number systems: Order vs magnitude
- Axiomatic logic: Meaningful scale operations
- Statistical invariance across empirical conditions

Practical implications for learning assessments

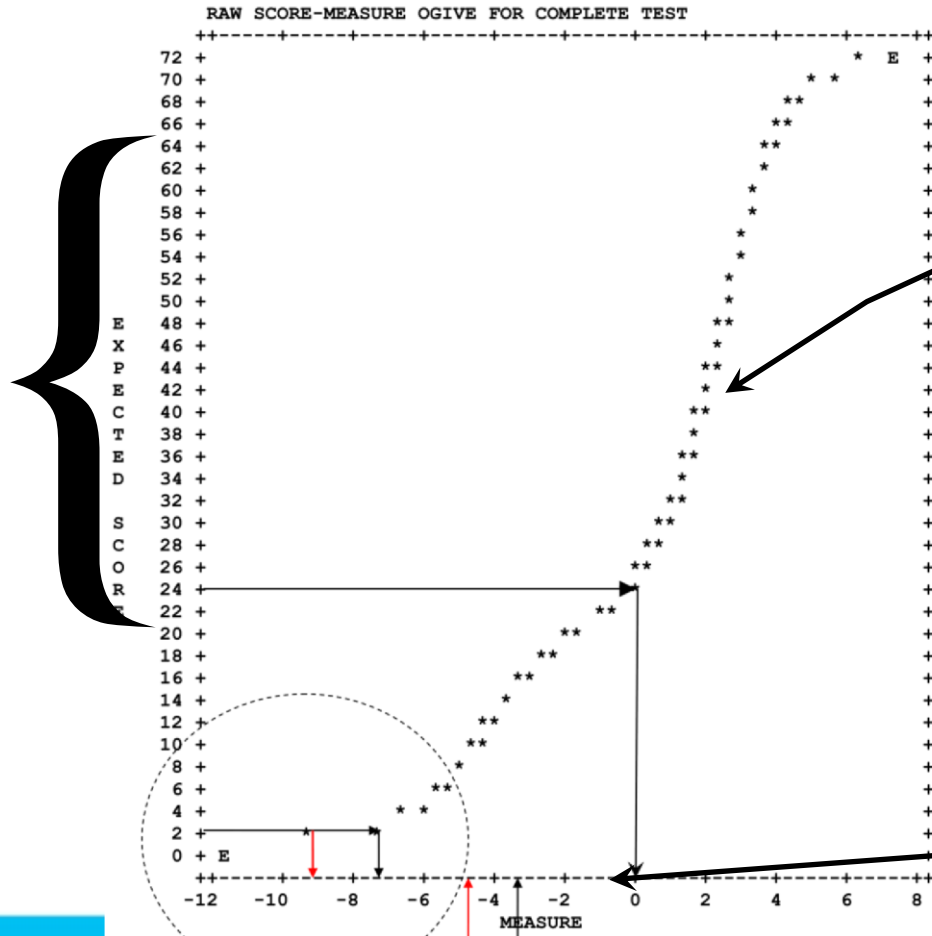
- Imprecise pre & post gain assessments
- Uncontrollable floor and ceiling effects
- Distorted treatment evaluation
- Distorted program evaluation
- Inaccurate estimation of institutional benefits
- Person measures conflated with group statistics
- Sample dependent results

How do Rasch models work?

- Measurement properties: Objectivity, sufficiency, separability, additivity
- Mathematical transformation of raw scores
- One parameter logistic link function
- Parametric fit analysis of items and persons

Ordinal to linear transformation fctn.

Raw scores



1 PL transform

Logit units

Are there alternatives to Rasch?

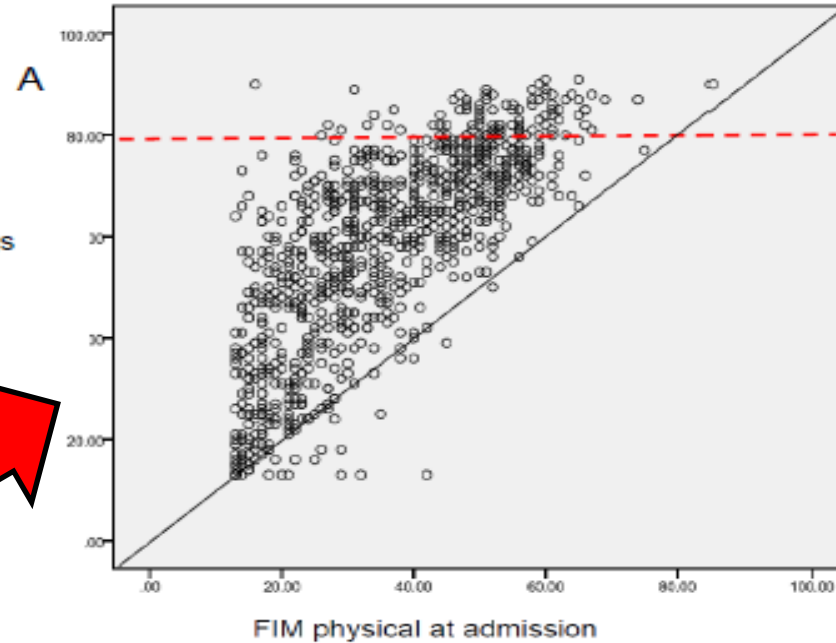
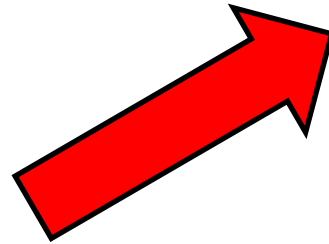
Yes, but they are more complicated.

- General Additive Models, which implement link functions (Poisson, gamma, Bernoulli, and binomial) transform ordinal to linear values.
- Longitudinal data points, multi-level models, residualized regression, structural equation, and latent variable models implement correlation methods to estimate gain.

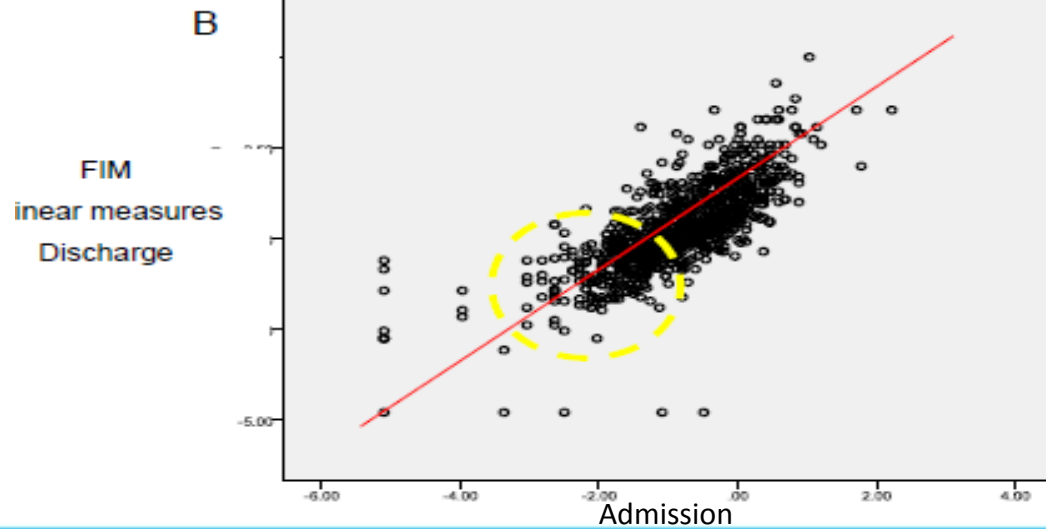
Empirical examples

Example 2: ratings

Unstable
units



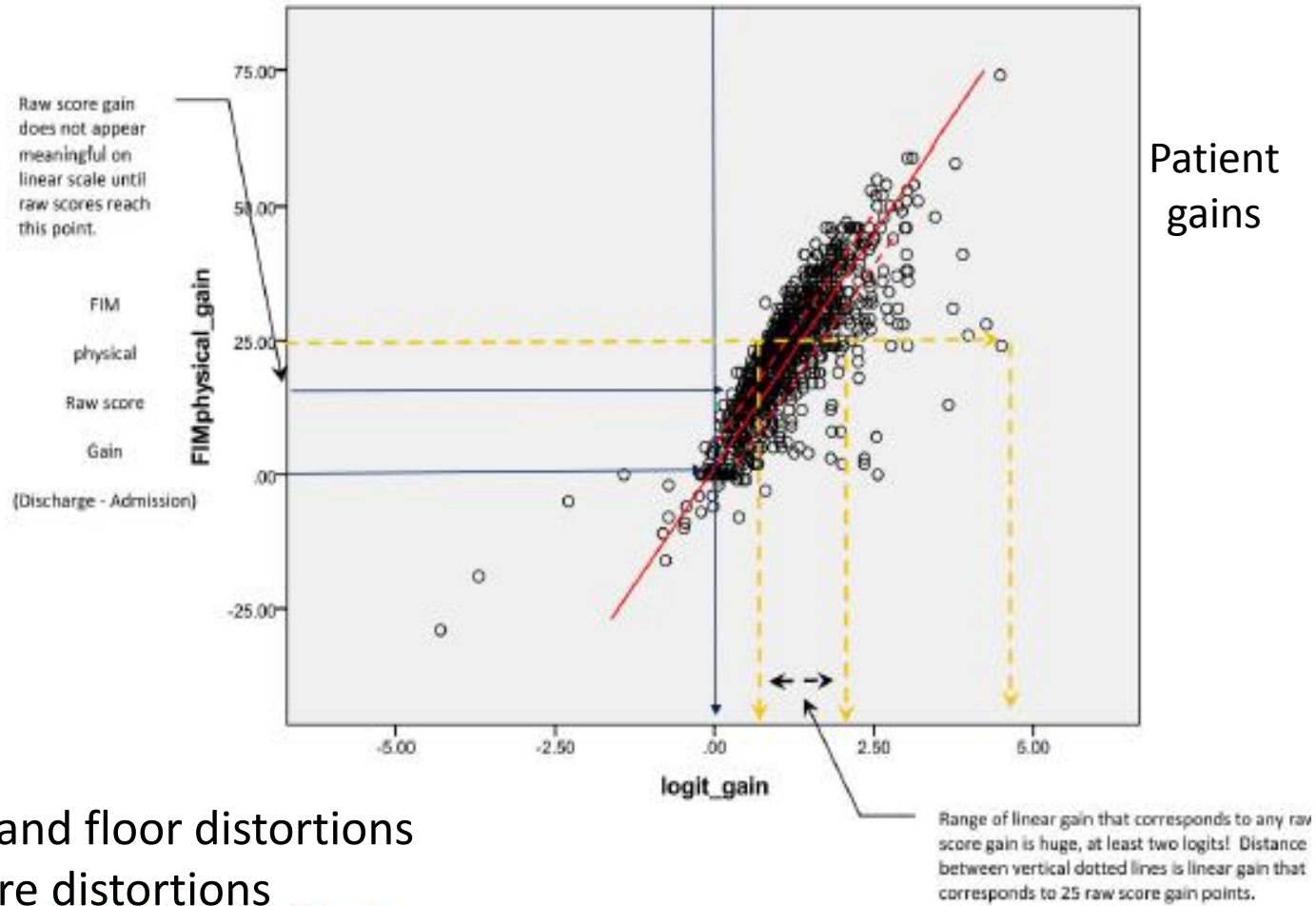
patients



patients

Ordinal gains vs linear gains

Gains: Ordinal ratings versus linear gains



Note: Ceiling and floor distortions
Person measure distortions

Recommendations

- Be cautious about “blind” assumptions.
- Establish numerical and scale properties. before conducting outcome assessments.
- Be aware of ceiling, floor & targeting issues.
- Verify scale unit properties periodically during evaluations.
- Measure “change” with linear units.

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