# Missing data: a practical matter that confronts analysts, and has profound implications

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### Partnership

We work in partnership with our clients. This is more than a cliché for us: we care about the services we provide and the impact they have on learners. Experience has shown us that the best impact our work can have is when it is undertaken alongside our clients so we make partnership a key feature of our project approach and management method.

### Quality

We manage projects effectively and to the highest quality, freeing up experts to concentrate on their specialism, but ensuring that activities are manage to meet expectations. This means only making promises that we know we can keep, and remembering the promises we have made to make sure we deliver.

### Expertise

We ensure our teams consist of genuine sector experts with understanding in breadth and depth of both the theory and the practical complex everyday challenges faced by education providers.


### Development

We are committed to the improvement of our staff, both to promote the long-term development of our business and as an end in itself: we believe in the value of education for all.

### Educationalists

We are educationalists with a strong commitment to improving teaching, learning and assessment, based on intellectual integrity, sound evidence and innovative approaches.

# Missing data in diverse assessment contexts

| | 1 | 2 | 3 |
|---|---|---|---|
| **purpose** | Research project adult Eng and Ma learners | Primary school Eng or Ma tests | Professional post-grad assessment entrance exam (knowledge) |
| **Mode of delivery** | On screen | On paper | On paper |
| **Response mode** | Mostly select response | Mostly constructed response | Mostly select response |
| **Skew of test takers' scores** | Positive | Symmetrical or negative | Negative |
| **Relationship of missing data to difficulty** | Slight (test takers give no answer to questions slightly above their ability) | None (test takers just as likely to give no answer to easy or difficult items) | Not clear |
| **Position of missing data in test** | Throughout (slight bias to the end) | To the end | Throughout (no bias at all) |
| **Group effect** | No | • Whole classes tend to stop responding<br>• Pupils skip one subject (e.g. grammar) and answer a later one (spelling) | No |

# What we know about missing data (1)

- The extent of missing data is a useful initial indication of the quality of the data collection.
- Missingness could be attributed to diverse causes:
  - It might indicate that a test is speeded, or it may be associated with lack of motivation.
  - These are (very) different phenomena.  We should distinguish them if we can.
- One might treat missing data differently in different types of analyses
  - Estimating a reliability coefficient, treat missing responses as incorrect, and thus avoid listwise deletion of cases.
  - In estimating item difficulty, treat missing responses as truly missing.
  - In estimating person ability, score missing responses as incorrect.

# What we know about missing data (2)

- We can conceptualise different types of missing responses.
  - All missing responses (in bulk); omitted responses, and not reached
  - We have a method of distinguishing these responses based on their position in the response string but we are aware that others might define them differently.
  - These sub-divisions of missing data are different from the classical categories: missing completely at random, missing at random and missing not at random
    - If possible it is better to try to locate psychometrics within broad statistical traditions.
- In these examples we are assuming ‘unintended missing data’.
  - There are situations (equating, CAT) in which we design in sparse data matrices.
  - We may need to problematise this practice.

# Final thoughts about missing data and Rasch

- There are various discussions about how to derive Rasch parameters in the presence of missing data.
  - These seem to be at the ‘technocratic’ rather than principled level.
  - Most of the viable techniques for deriving parameters can be shown to give biased results.
- Rasch practitioners and theorists could perhaps ‘lift their eyes a little’.
  - It surprises me that Rasch practice can be so ‘blasé’ about missing data, when design balance is such a major issue in generalisability theory.
  - We could look the treatment of missing values in logistic regression to seek insight into how this issue could be better theorised under Rasch.