Day 4 Session 10:45 to 12.00 noon

RASCH UNIDIMENSIONAL MODELS FOR MEASUREMENT (RUMM)
Session objectives

In this session we will

• discuss the requirements of the Rasch model
• introduce the RUMM program
Requirements of the model

In his work in the 1920's Thurstone was meticulous in describing the theoretical conditions (requirements) for valid measurement. However Likert, in the 1930's incorrectly interpreted the requirements of Thurstone as assumptions. Most of the current literature in psychometrics, like Likert, fails to see the distinction between an assumption and a requirement. Therefore when talking about the limitations, it is appropriate to discuss the "requirements" of the model.

The basic requirement is that the group of persons to be measured and the set of items used to define the variable, can each be ordered in terms of their ability and difficulty respectively. This basic requirement has caused some concern on the grounds that the need to have items uniquely ordered, for all persons, in terms of their difficulty makes the SLM insensitive to instructional and curricular changes.

The simplification made by Rasch models is met adequately in practice. Where deviations occur they are taken to be indicators of the need for further investigation. The basic requirement leads onto other related requirements:
The basic requirement of the model leads onto other related requirements.

1. Local Independence
2. Unidimensionality
3. Equal Item Discrimination
4. No Guessing
5. Difficulty of Getting Fit to the Model
Requirement of local independence

1. The probability that a person responds correctly to a particular item should be independent of the responses that have been made to previous items. If this is not the case, then altering the sequence of items that constitute the test may alter the ordering of the items and persons on the continuum.

2. In responding to this criticism, or alleged weakness of the model, it would seem appropriate to agree that every testing situation is in fact contrived. However, test constructors have always sought, as part of good testing practice, to ensure independence between the items of the test.

3. Being aware of the requirement means that we can do something about it early in the test design. We can also monitor it during the analysis phase and make adjustments.

4. The requirement of local independence imposed by the model is not a limitation, but rather an explicit articulation of sound testing practice.
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4. The requirement of local independence imposed by the model is not a limitation, but rather an explicit articulation of sound testing practice.
1. If the performance of persons on a set of items depended upon their standing on more than one dimension, and the ordering on these dimensions is not identical, then it is impossible to represent the interaction of a person and an item with a single person parameter and place them on a single continuum.

2. The arguments against this requirement revolve around the belief that the complex patterns of behaviours that represent achievement cannot be adequately represented by any unidimensional model. It is also suggested that the practice of identifying and removing items which do not conform to the model can lead to a misrepresentation of the intended variable.

3. People who argue this have missed the point that unidimensionality is a relative, and not an absolute concept. The Rasch approach imposes the same requirements regarding unidimensionality that traditional test theorists have been implicitly making for decades. Whenever a single index is used to summarise performance on a set of items, the items are assumed to be unidimensional.
Requirement of unidimensionality

- Thread
- Number Pattern
- Few Threads
- Number
- Rope
- Mathematics
- Thick Rope
- TE Score
The Requirement of equal item discrimination
The Requirement of equal item discrimination

Figure 11: Item Characteristic Curves with Different Slopes
1. A further criticism of the model is that there is no guessing parameter in the model.
2. While this requirement is difficult to meet in practice with multiple choice items, it is not unique to test constructors using the SLM. All test constructors are aware of the deleterious effects that guessing can have on the validity of their results, and as a consequence they take extreme care, when constructing tests, to minimise the chances of guessing.
3. Like most other requirements imposed by the SLM, the requirements of no guessing makes explicit exemplary testing practice.
Requirement of getting fit to the model

1. Because of the requirements of the model it is very difficult to get overall fit to the model.
2. There is a bit of a trade-off between obtaining fit to the model and using a model with the distinctive features of the SLM. For example, the fewer the number of parameters used to capture the data, the less chance there will be good fit between the data and the model. This is one reason why the SLM has to be more than a statistical model. It in actual fact governs the entire test construction process.
3. The whole ethos underpinning the model is that if you wish to apply the model, then you have to construct tests that meet the requirements of the model. This not unlike developing a scale in the physical sciences - which is what Rasch was trying to emulate way back in 1951 and where we started today.