

## Vertical Scales and Growth Models That Use Them Course Description

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### Summer School 'Applied Psychometrics in Education and Psychology'

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#### Course Description

The course “**Vertical Scales and Growth Models That Use Them**” by Dr. H. Gary Cook is designed to provide participants with basic concepts and approaches to establishing vertical scales on large scale educational assessments using Item Response Theory (IRT). It also presents methods for applying vertical scales to student growth models. A variety of growth models are presented along with discussions about the benefits and drawbacks of each model.

The course begins with a brief overview of measurement theory starting with Classical Test Theory (CTT) and moving to IRT. The session then discusses methods used to establish vertical scales. For ease of discussion, the one-parameter Rasch models are used, although differences between IRT scaling methodology are mentioned. Following this, an overview of different student growth models using vertical scales is addressed. In this section, theories of action behind each growth model along with methods and resources needed to calculate them are discussed. The course finishes with a discussion about the meaningful application of growth models in educational and research settings.

#### Prerequisites

The course requires a basic knowledge of measurement concepts such as reliability, validity, generalizability, fairness and equity. A basic understanding of classical test theory and IRT is important. Familiarity with statistics, especially regression models, is critical given that the growth model section of the course relies heavily on these types of statistical approaches. The course assumes participants have working knowledge of the R statistical software program. Targeted course participants are educational researchers, early career scholars, graduate students and those interested in how educational tests are scaled and used to evaluate student growth.

#### Course Format

The course will be part lecture and part hands on experience running different equating analyses and growth models. Anonymized data from a large-scale, language proficiency test is used in all examples. The goal in using these data is to give session participants experience with actual student data with all its idiosyncrasies. The dataset will be provided in R (<https://www.r->

[project.org](#)). Hands-on experience conducting analyses and examining results is part of this course. This course is intended to provide participants with experiences in establishing vertical scales and analyzing different growth models and comparing results.

### **Learning Objectives**

- Review basic concepts behind CTT and IRT
- Understand general approaches to establishing vertical scales using Rasch model horizontal and vertical equating methodologies
- Understand the benefits and challenges behind different IRT vertical scaling approaches
- Understand the background and theories of action associated with different educational growth models
- Understand the basic approaches and methodologies for calculating different educational growth models
- Have experience calculating different educational growth models using the R statistical software package

### **Helpful References**

Castellano, K. E., & Ho, A. D. (2013). [A Practitioner's Guide to Growth Models](#) . Council of Chief State School Officers.

Hambleton, R.K., Swaminathan, H., Rogers, H.J. (1991). Fundamentals of Item Response Theory, Volume 2. Newbury Park, CA: Sage Publications, Inc.

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (2014). Standards for educational and psychological testing. Washington, DC: American Educational Research Association.