

In comparing equated scores: A graphical model

Christopher, W.T. Chiu

Law School Admission Council, 661 Penn Street, Newtown PA 18940, cchiu@lsac.org

Keywords: Hashing, Law School Admission Test (LSAT), SEER, Test equating, Visualization and graphical model

Abstract

This paper introduces a graphical method for visually comparing results of different test equating methods. Test equating is a process to adjust for score differences due to the random selection of similar test items in test forms. In practice, testing organizations compare different test equating methods before deciding on a method for operational purposes. Many psychometricians such as Kolen and Brennan (1995) use graphical displays for to examine standard errors in equating and differences among a variety of equating methods. The graphical displays can show which equating method(s) yield the least amount of equating errors or which method(s) exhibit the least amount of differences. In the event that a large discrepancy appears among the methods, researchers will need to further explore the potential root causes, which often require a closer examination of individuals test scores. While it is sufficient for traditional graphical tools to identify score points associated with large discrepancies; it is hard to depict individual test takers on traditional graphical displays, because the displays are designed to show aggregated data. To this end, the current paper applies a method — SEER (Chiu & Fecso 2002a) — to (a) visualize the effects of different equating methods on the scores of individual test takers and (b) display test score distributions on the same plot as is used to show individual level data. The SEER method is advantageous because it uses a set of matrix operations to model and represent the data. In addition, its underlying concepts are adapted from those of a widely used tool (Hashing) in computer science for indexing and organizing large databases (Knuth, 1968). With the aforementioned two advantages, one can easily create the SEER graphical displays by applying a one-step transformation process to test scores. A third advantage of the SEER method is that it creates binary matrices, which can be used to provide summary statistics for other non-graphical analyses. In this paper, data from the Law School Admission Test (LSAT) are used to illustrate the method. Simulated data are also used to illustrate the capacity of the graphical method in extreme cases that are rare, but can appear, in real data. In summary, the SEER method has been successfully applied to (a) categorical data in longitudinal surveys (Chiu & Fecso, 2002b) and (b) scores of repeat test takers (Chiu, 2002); and here we show its applications on test equating.

References

- Chiu, C.W.T. (2002). *Plotting multidimensional data onto a two dimensional display: A graphical method*. Paper presented to the 2002 Annual Meeting of the Psychometric Society, June 20. Chapel Hill, NC.
- Chiu, C.W.T., Fecso, R., & Reese, L. M. (2002a). *Visualizing and mining repeated measure data: Capturing career paths and test scores*. Paper presented to the 2002 Annual Meeting of the American Statistical Association, Aug 11-14. New York, NY.
- Chiu, C.W.T., & Fecso, R. (2002b). *In examining the relationship between education and career paths: The SEER graphical method*. Research Report. Newtown, PA: Law School Admission Council (LSAC).
- Knuth, D. E. (1968). *Fundamental algorithms*. Reading, MA: Addison-Wesley.
- Kolen, M. J., Brennan, R. L. (1995). *Test equating: Methods and practices*. New York: Springer.