

Structural Equation Modeling Using Ability Parameters

Hiroto Murohashi
Graduate School of Literature
Waseda University
muhito@suou.waseda.jp

Hideki Toyoda
School of Letters, Arts and Sciences
Waseda University
toyoda@waseda.jp

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Abstract

The main purpose of this study is developing an analysis model of Structural Equation Modeling which uses ability parameters estimated by Item Response Theory. The chief characteristics of this method is to treat one's inverse number of Information Function as one's error of measurement and fix error term of measurement equation into inverse number of Information Function. Because estimated value of ability parameter has asymptotic normality and asymptotic efficacy when it's estimated by Maximum Likelihood method (Hambleton & Swaminathan, 1985). It means to appraise measurement error one by one.

The first merit of this method is that we can use test that is consisted of many items. When one analyze test data in SEM, they usually use Factor Analysis Model which treat one item as one observed variable. But SEM has nature that if the number of observed variables increases, model fit becomes bad and parameter estimation becomes unstable. But in this method, we use ability parameters as data to be analyzed. In most cases, one test has one ability parameter regardless of number of items. As a result, the number of items of tests doesn't be reflected to the model.

And the second merit of this method is that we can overcome one problem of estimation in SEM. SEM model is consisted of two equations, measurement equation and structural equation. And estimation of parameters of these two equations are normally done at once. This causes the problem that modification on one equation affects another equation. But in this method, we analyze a model that the all parameters in measurement equations are fixed. So, as a result, we estimate parameters in structural equation independently of measurement equation. It is thought to provide more stable and valid estimation result.

References

Hambleton, R.K., & Swaminathan, H. (1985). *Item response theory: Principles applications*. Boston, MA: Kluwer.