# Modelling items in computerized tests, now and in the future

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Computerized tests have typically been analysed with either classical test theory or item response theory (IRT). The probability of answering an item correctly has typically been modelled with IRT. There are however at least two problems with using IRT to model test items in achievement tests. First, not all items have the properties required for using parametric modelling and does it might be problematic to obtain a good fit to an IRT model. Second, the probability of answering an item correctly in IRT is modelled over an infinite defined ability interval. This arbitrary defined ability might be difficult to explain to test takers which are unfamiliar with statistics and test theory. An advantage, with using the examined nonparametric estimation when modelling test items, is that test takers' ability is defined over the same distribution as the sum scores. The aim is to present the advantage of using nonparametric estimation of item characteristic curves by comparing this approach to an IRT approach of estimating item characteristic curves. Parameter cascading is used in the nonparametric estimation approach as it is relatively fast and can be used for large scale testing applications. Parametric cascading can be described as a generalized profiling where parameters are divided into structural parameters and nuisance parameters. Parameter cascading controls the impact of nuisance parameters on structural estimation by defining nuisance parameters as smooth functions of the structural parameters. To use profiling or parameter cascading is to reduce the optimization problem to a lower dimension problem and it typically speeds up the optimization. Nonparametric estimation with parametric cascading is compared with using IRT when estimating item characteristic curves with data from a college admission test. The results show that nonparametric estimations of item characteristic curves is a good alternative to IRT when modelling test items and it works for both large and small achievement tests. The result is useful as it shows that there are good alternatives to the standard use of IRT when modelling items in achievement tests.

**Keywords:** nonparametric estimation; parameter cascading, item characteristic curves