

**Public Abstract****Yanyan Sheng****Ph.D.****Educational Psychology****Bayesian Analysis of Hierarchical IRT Models****Advisor: Dr. Steven Osterlind****Graduation Term: Summer 2005**

Item response theory (IRT) models are stochastic models for responses to individual test items by individual examinee. In the testing setting, more often a test consists of several subtests with each focusing on one specific ability so that the items in a particular subtest are designed to measure one ability in common. One can fit a unidimensional model or a multidimensional model based on different assumptions. However, it is natural to consider a model with both general and specific abilities and hypothesize that this model would be more efficient and describe the test data more adequately. The purpose of the study is to propose such an IRT-based model under the Bayesian framework so that both general and specific abilities can be estimated with one implementation. The proposed model is further compared with the conventional IRT models using Bayesian model choice techniques. The results from simulation studies as well as actual data suggest: 1) models with general and specific abilities can be developed, 2) fully Bayesian method is proved to be more accurate and efficient in parameter estimation compared with the usual marginal maximum likelihood method, 3) compared with the conventional IRT models, the proposed model describes the actual data conceivably better. Therefore, the proposed model offers a better way to represent the test situations not realized in existing models. It also tells the test developer to design tests based on certain beliefs on their underlying structure. In addition, the proposed IRT model can be applied in other areas, such as intelligence or psychology, among others.