

**Lihua Yao
2015**

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Fields of Interest and Expertise:

Multidimensional item response theory; Equating and Linking; Parameter estimation technique; Differential item functioning; Bayesian inference network; longitudinal modeling of student achievement; value-added models for estimating teacher effects; Online computer adaptive testing(CAT); Norm development; Rater-effect model.

Work experience:

Mathematical Statistician at Department of defense, Dod data center, Feburay 2009---present.

- Developed software for automatically select test forms for the paper and pencil format.
- Linking the scale between the paper and pencil format and CAT format using the population distributions derived from the response data and the item parameters.
- Developed MCAT for item selection for fix-length test and varying-length test.
- MIRT classification accuracy and consistency, software and research study.
- MIRT for detecting DIF.
- ISCAT screen test based on MCAT for selecting items best for the overall (AFQT) score.
- Developed SimuMCAT using Symptson-Hetter exposure control method and Developed multidimensional priority Index method.
- Developed software for multidimensional Rater effect model.
- Developed procedures and software for optimal item pool generation.
- Worked on MCAT for noncompensatory model.

Consulting Services for ETS (Educational Testing Services) for Smart Balance Project, March 2013---March 2014

Consulting Services for AIR (American Institute of Research), March 2011---March 2012

Senior research scientist at CTB/McGraw-Hill, December 2005---Feburary, 2009.

Research scientist (I, II) at CTB/McGraw-Hill , March. 2001---November 2005.

Project Work

- Solely responsible for 2005 norm update: Design and produce new norms based on 2001 and 2005 customer data and 2000 norms data. The new updated norms will be used for Terranova shelf product form E and form F.
- Provide support and create norms for customer project and other CTB shelf product, including: LASlink English, LASLink spanish, TABE, Indinana, NYS.
- Solely responsible for the development and creation of norms for Terranova form G, a new shelf product at CTB.
- Lead research scientist for Terranova shelf product form F development. Job responsibility includes: Sample collection design for the test, student data analysis, item analysis, calibration, equating, and develop final scoring tables.

Research Work:

- Conduct basic psychometric research that is related to CTB's business. This involves development of new research methods and tools that will support future product.
- Developed and owned computer software BMIRT .
- Developed and owned LMFact, which is to estimate parameters for Bayesian Inference net work.
- Conduct research work and provide technical support and advice to customer projects. Duties include write project proposals, specs, and tech reports, and monitor the progress of projects.

Scientific Programmer/Analyst at CTB/McGraw-Hill , Jan. 1999---Feb.2001.

Provide scientific programming and Statistical analysis support to CTB/McGraw-Hill's customer projects. Conduct data processing and analysis on multiple platforms using SAS.

Instructor at The Ohio State University, Jan. 1998---Sep. 1998.

Teach College Mathematics .

Teaching Assistant at The Ohio State University, Sept.1991---Aug. 1997.

Teach College Mathematics.

Engineer at China Aerospace Standard Institute, Beijing, China, July 1987---Oct. 1990.

EDUCATION:

(1) The Ohio State University, Columbus, OH (Sept. 1991---Aug. 1997)

Ph.D. in Math(Probability), Aug, 1997

(2) Wuhan University, Wuhan, China (Sept. 1985---July 1988)

M.S. in Statistics, Oct, 1988

(3) Northeast Normal University, Changchun, China (Sept.1981---July 1985)

B.S. in Applied Mathematics, June, 1985

PUBLICATIONS:

Yao, L. Pommerich, M, & Segall, D. (2014). Using Multidimensional CAT Incorporating Item Response Time to Administer a Short, Yet Precise Screening Test. *Applied Psychological Measurement*. DOI: 10.1177/0146621614541514, 1-18.

Yao, L. (2014). Multidimensional Item Response Theory for Score Reporting. In Chang & Cheng (Ed), *Advances in Modern, International Testing: Transition from Summative to Formative Assessment*. Charlotte, NC: Information Age Publishing.

Yao, L. (2014). Multidimensional CAT item selection methods for domain scores and composite scores with item exposure control and content constraints. *Journal of Educational Measurement*. 51(1), 18-38.

Yao, L. (2014). Application of Testlet-Effect Models to Assessments With Multiple-Criteria Scoring Rubrics. *US-China Education Review A*, ISSN 2161-623X, 4, 1, 1-20.

Yao, L. (2013). Comparing the performance of five multidimensional CAT selection procedures with different stopping rules. *Applied Psychological Measurement*, 37, 3-12.

Wang, Z. Yao, L (2013). The Effects of Rater Distributions and Rater Severity on Students' Ability Estimation for Constructed-Response items. Research Report, ETS RR-13-23. <http://search.ets.org/researcher/>.

Yao, L. (2012). Multidimensional CAT item selection methods for domain scores and composite scores: Theory and Applications. *Psychometrika*, 2012, DOI: 10.1007/s11336-012-9265-5, 77(3), 495-523.

Yao, L. (2011). Multidimensional linking for domain scores and overall scores for nonequivalent groups. *Applied Psychological Measurement*, 35. 48-66.

Yao, L. (2010). Book Review: Introduction to applied bayesian statistics and estimation for social scientist. *Journal of Educational Measurement*. 47(2). 250-260

Yao, L. (2010). Book Review Multidimensional Item Response Theory. *Journal of Educational Measurement*. 47(4). 477-481

Yao, L. (2010). Reoprting valid and reliability overall score and domain scores. *Journal of Educational Measurement*. 47. 339-360

Yao, L., & Boughton, K. A.(2009). Multidimensional Linking for Tests with Mixed Item Types. *Journal of Educational Measurement*. 46, 2, 177-197,

Ito, K. Sykes, R.C., & Yao, L. (2008). Concurrent and Separate Grade-Group Linking procedures for vertical Scaling. *Applied Measurement in Education*. 21, 187-206.

Yao, L., & Boughton, K. A. (2007). A Multidimensional item response modeling approach for improving subscale proficiency estimation and classification, *Applied Psychological Measurement*. 31, 83-105.

Patz, R. J. & Yao, L. (2007). Methods and Models for vertical Scaling: Linking and Aliging Scores and Scales. In Dorans, N.J. & Holland, P.W.(Eds.), *Statistics for Social Science and Behavioral Sciences*, 253-273.

Yao, L., & Schwarz, R.D. (2006). A multidimensional partial credit model with associated item and test statistics: an application to mixed-format tests, *Applied Psychological Measurement*. 30, 469-492

Patz, R. J. & Yao, L. (2006). Vertical scaling: Statistical models for measuring growth and achievement. In Sinharay, S., and Rao, C. R. (Eds.), *Handbook of Statistics*. Volum 26, 955-975.

Li, L., Shiga, T., Yao, L. (1999). "The Reversibility Problem for Fleming-Viot Processes", *Electronic Communications in Probability*. 4, 65-76

Awards and Invited Talks:

- Recipient of the 2013 National Council on Measurement in Education (NCME) Bradley Hanson Award. The award honors significant contributions to the field of educational measurement or to the development.
- **Yao, L. (2013, July)**. Multidimensional Item Response Theory: Applications and BMIRT, LinkMIRT, and SimuMIRT Software. Invited workshop presented at CTB/Macgraw-Hill.
- **Yao, L. (2013, May)**. Multidimensional Item Response Theory: Applications and BMIRT, LinkMIRT, and SimuMIRT Software. Invited workshop presented at the Statistics Department of Columbia University.
- **Yao, L. (2015, January)**. Multidimensional Computer Adaptive Testing. Keynote Speaker presented at Third Lisbon Research Workshop on Economics, Statistics and Econometrics of Education, Lisbon.

Community Service

- Reviewer for "Applied Psychological Measurement", "Journal of Educational Measurement", "Educational and Psychological Measurement", "National Science Foundations", "Psychometrika", "BJP".
- Membership of "NCME".
- Supervisor for summer interns in the following years at CTB/McGraw-Hill: 2002, 2003, 2004, 2005, 2006, 2007, 2008.
- Graduate student PD.H. Dissertation committee member and supervisor for a few students.
- Committee member for NCME Brad Hanson Award Committee, 2005-2008.
- Committee member for NCME Jason Millman Award Committee, 2011-present.

- Advisory editorial board for JEM, 2011-2013.
- Constantly update free software BMIRT ToolKit at www.BMIRT.com
- Communicate and provide technical support every day for the software users.

PRESENTATIONS:

2014

Yao, L (2014, April). Optimized Item Pool Generation and the Performance of Multidimensional CAT. Invited Award Winner Presentation at the 2014 meeting of the National Council on Measurement in Education Philadelphia, Pennsylvania.

Yao, L (2014, April). The Magic of Bayesian Applications to Educational Measurement. Invited Presentation at the 2014 meeting of the National Council on Measurement in Education Philadelphia, Pennsylvania.

Yao, L, Reckase, M, Schwarz, R (2014, April). Multidimensional Item Response Theory: Theory and Applications and BMIRT, LinkMIRT, and SimuMIRT Software. Training presented at the 2014 meeting of the National Council on Measurement in Education Philadelphia, Pennsylvania.

Yao, L. & Schwarz, R (2014, April). Comparison of Methods in Detecting the Number of Dimensions and Item Clusters for Mixed Format and Mixed Structured Data Using MCMC Estimates. Paper Presented at the 2014 meeting of the National Council on Measurement in Education Philadelphia, Pennsylvania.

Sie, H. & Yao, L(2014, April). MULTIDIMENSIONAL COMPUTER ADAPTIVE TESTING WITH MIXED ITEM TYPES. Paper Presented at the 2014 meeting of the National Council on Measurement in Education Philadelphia, Pennsylvania.

2013

Yao, L (2013, April). Recipient of the 2013 National Council on Measurement in Education (NCME) Bradley Hanson Award. The award honors significant contributions to the field of educational measurement or to the development.

Yao, L(2013, July). Multidimensional Item Response Theory: Applications and BMIRT, LinkMIRT, and SimuMIRT Software. Invited workshop presented at CTB/Macgraw-Hill.

Yao,L(2013, May). Multidimensional Item Response Theory: Applications and BMIRT, LinkMIRT, and SimuMIRT Software. Invited workshop presented at the Statistics Department of Columbia University.

Yao,L. Reckase, M (2013, April). Multidimensional Item Response Theory: Theory and Applications and BMIRT, LinkMIRT, and SimuMIRT Software. Training presented at the 2013 meeting of the National Council on Measurement in Education, San Francisco, CA.

Yao, L, Pommarich, M & Segall, D (2013). Using Multidimensional CAT to Administer a Short, Yet Precise Screening Test. Paper presented at the 2013 meeting of the National Council on Measurement in Education, San Francisco, CA.

Wei, H & Yao, L (2013). A Comparison of IRT Linking and Trend Scoring in MixedFormat Test Equating. Paper presented at the 2013 meeting of the National Council on Measurement in Education, San Francisco, CA.

2012

Yao, L. (2012 April). Multidimensional CAT item selection methods for domain scores and composite scores with item exposure control and content constraints. Paper Presented at the 2012 meeting of the National Council on Measurement in Education, Vancouver, Canada.

Yao,L.(2012, April). **Discussant:** Linking and Equating: Mixed-Format Assessments. Discussion Presented at the 2012 meeting of the National Council on Measurement in Education, Vancouver, Canada.

Yao,L. Reckase, M, Yuan, H, & Cheng, Y (2012, April). Multidimensional Item Response Theory: Theory and Applications and BMIRT, LinkMIRT, and SimuMIRT Software. Training presented at the 2012 meeting of the National Council on Measurement in Education, Vancouver, Canada.

Wang, J. Yao, L (2012, April). The Effects of Rater Distributions and Rater Severity on Students' Ability Estimation for Constructed-Response Items. Paper Presented at the 2012 meeting of the National Council on Measurement in Education, Vancouver, Canada.

2011

Yao, L. (2011 April). Multidimensional CAT item selection methods

for domain scores and composite scores: Theory and Applications. Paper presented at the annual meetings of the National Council on Measurement in Education, New Orleans, Louisiana.

Yao, L., Yuan, H., & Cheng, Y. (2011, April). Multidimensional Item Response Theory: Theory and Applications and BMIRT, LinkMIRT, and SimuMIRT Software. Training presented at the 2012 meeting of the National Council on Measurement in Education, New Orleans, Louisiana.

Yao, L. (2011, April). **Discussant:** Vertical Equating and Academic Growth. Discussion Presented at the 2012 meeting of the National Council on Measurement in Education, New Orleans, Louisiana.

Grima, A. M., & Yao, L. (2011, April). Classification Consistency and Accuracy: Unidimensional Versus Multidimensional IRT Procedures. Paper presented at the annual meetings of the National Council on Measurement in Education, New Orleans, Louisiana.

Wang, J., Yao, L. (2011, April). The Effects of Scoring Designs and Rater Severity on Students' Ability Estimation for Constructed Response Items. Paper presented at the annual meetings of the National Council on Measurement in Education, New Orleans, Louisiana.

2010

Yao L., & Li F. (2010, May). "A DIF Detection Procedure in Multidimensional Framework and its Applications." Paper presented at the annual meetings of the National Council on Measurement in Education, Denver, CO.

Hong Y., Yao, L. & de la Torre (2010, May). A comparison among the major value-added models: A general model approach. Paper presented at the annual meetings of American educational research association, Denver, CO.

2009

Yao L. (2009, April). "Reporting Valid and Reliable Overall Scores and Domain Scores." Paper presented at the annual meetings of the National Council on Measurement in Education, San Diego, CA.

Yao L. (2009, July). "A DIF Detection Procedure in Multidimensional Framework and its Applications." Paper presented at the annual meetings of the Psychometric Society society, Cambridge, England.

2008

Yao L, Lewis D, Zhang L(2008, March). “An introduction to the application of BMIRT: Bayesian multivariate item response theory software.” Training session presented at the annual meetings of the National Council on Measurement in Education, NY.

Yao L, Rich C, (2008, March). “Application of Testlet-Effect Model to Performance Assessments with Multiple-Criteria Scoring Rubrics.” Paper presented at the annual meetings of the National Council on Measurement in Education, NY.

Hong Y, Yao L, Lewis D, Boughton K, (2008, March). “Value-Added Modeling: A comparison of several approaches using empirical data.” Paper presented at the annual meetings of the National Council on Measurement in Education, NY.

Lewis D, Yao L, (2008, March). “Validation and Application of Learning Maps for Cognitively Diagnostic Assessment.”
Paper presented at the annual meetings of the National Council on Measurement in Education, NY.

Yao L, (2008, March). Dimensionality: Assumptions, Errors, and Effect Sizes--paper session. Discussant of a paper session at the annual meetings of the National Council on Measurement in Education, NY.

Yao L, Hong Y (2008). “Value-Added Modeling: A comparison of several approaches using empirical data.” \$50,000.00. McGraw-Hill Assessment and Reporting Innovation Research and Development (R&D) 2008 Call for Proposals.

Yao L, Hong Y, Rich C (2008). “Using Multidimensional IRT Approach to Improve Diagnostic Subscore Reporting and Equating across Grades and Years in Chinese K-12 Assessment.” \$50,000.00. McGraw-Hill Assessment and Reporting Innovation Research and Development (R&D) 2008 Call for Proposals.

Hong, Y., & Yao, L. (2008, June). “ Comparison among major value-added models: A general model approach.” Poster presented at the International Meeting of Psychometric Society, Durham, NH.

Yao L, Rich C, (2008, June). “Application of Testlet-Effect Model to Performance Assessments with Multiple-Criteria Scoring Rubrics.” presented at the International Meeting of Psychometric Society, Durham, NH.

2007

Yao L.(2007). "Application of testLet-effect model to scaling performance assessments with multiple-criteria scoring rubrics". \$25,000.McGraw-Hill Assessment and Reporting Innovation Research and Development (R&D) 2007 Call for Proposals.

Lewis, D., Yao, L., Boughton, K., DiBello, L., Stout, B.(2007), “Advancing the CTB Core Curriculum Content Frameworks, Learning Maps, and LMFACT to Support Diagnostic Assessment”. \$149,725.00. McGraw-Hill Assessment and Reporting Innovation Research and Development (R&D) 2007 Call for Proposals.

2006

Yao L.(2006, April). "A non-compensatory multidimensional, multi-group IRT model for vertical scaling". Paper presented at the annual meetings of the National Council on Measurement in Education, San Francisco, CA.

Yao L, Bough K, (2006, April). “A multidimensional item response modeling approach for improving subscale proficiency estimation in cognitive diagnostic assessments.” Paper presented at the annual meetings of the National Council on Measurement in Education, San Francisco, CA.

Yao L, Bough K (2006, April). “Multidimensional linking for tests containing polytomous items.” Paper presented at the annual meetings of the National Council on Measurement in Education, San Francisco, CA.

Yao. L., Bough, K., Lewis, D. (2006, April). “Reporting Subscale Scores for Tests Composed of Complex Structure.” Paper presented at the annual meetings of the National Council on Measurement in Education, San Francisco, CA.

Yao, L., Gu, L. (2006, April). "A bayesian multidimensional item response theory approach to improve parameter estimation for short test with small sample size". Paper presented at the annual meetings of the National Council on Measurement in Education, San Francisco, CA.

Andrew, Boughton,K., Yao,L., Lewis,D.,& Steffen,M. (April, 2006). “Emperical study of subscore”. Paper presented at the annual meetings of the National Council on Measurement in Education, San Francisco, CA.

Finkelman, M., Hooker, G., Boughton, K., & Yao, L., (April, 2006). “A Multidimensional Adaptive Testing (MAT) Algorithm for Improving Subscale Proficiency Classification”. Paper presented at the annual meetings of the National Council on Measurement in Education, San Francisco, CA.

Finkelman, M., Hooker, G., Boughton, K., & Yao, L., (April, 2006). “Estimation irregularities in compensatory MIRT models”. Paper presented at the annual meetings of the National Council on Measurement in Education, San Francisco, CA.

2005

Yao, L., Schwarz, R.,(2005, April) “A Multidimensional Partial Credit Model with associate item and test statistics”. Paper presented at the annual meetings of the National Council on Measurement in Education, Montreal, Canada.

Patz, R., Yao, L., (2005, June). "Methods and models for vertical scaling". Paper presented at the ETS Conference, Linking and Aligning Scores and scales: A conference in Honor of Ledyard R Tucker's Approach to Theory and Practice, Princeton, NJ: Educational Testing Service.

Schwarz, R., Xie, H., & Yao, L., (2005, April). "Using Bayesian Inference Network for representing development Ordering in Diagnostic Assessments". Paper presented at the annual meetings of the National Council on Measurement in Education, Montreal, Canada.

Boughton, K., Yao, L., (2005, April). "The Effects of Multidimensionality on TCC Pre-Equating with Mixed-Format Tests: A Case for Multidimensional IRT". Paper presented at the annual meetings of the National Council on Measurement in Education, Montreal, Canada.

Boughton, K., Lorie, W., & Yao, L., (2005, April). "A multidimensional multi-group IRT model for vertical scales with complex test structure: An empirical evaluation of student growth using real data". Paper presented at the annual meetings of the National Council on Measurement in Education, Montreal, Canada.

Ito, K., Yao, L.,(2005, April) "Differences in Ability and Item Parameter Estimates by Applying Unidimensional Versus Multidimensional Models to Across-Grade Data". Paper presented at the annual meetings of the National Council on Measurement in Education, Montreal, Canada.

2004

Yao, L.,(2004) "Bayesian Multivariate Item Response Theory and BMIRT Software". 2005 Proceedings of the American Statistical Association, Statistical Computing Section [CD-ROM], Alexandria, VA: American Statistical Association: pp-pp.

Yao, L., & Mao, X.,(2004, April). "Unidimensional and Multidimensional Estimation of Vertical Scaled Tests with Complex Structure". Paper presented at the annual meetings of the National Council on Measurement in Education, San Diego, CA.

Yao, L., & Schwarz, R.,(2004, June). "Multidimensional Models for Tests Consisting of Mixed Item Types". Paper presented at the annual meetings of the Psychometric Society, Monterey, CA.

2003

Yao, L., Patz, R., Lewis, D., (2003, April). "Multidimensional IRT Models Applied to Vertical Scaling". Paper presented at the Annual Meeting of National Council on Measurement in Education, Chicago, IL.

Yao, L., Patz, R.,(2003, June). "Markov Chain Monte Carlo Methodology Application in Multidimensional IRT". Paper presented at International Workshop on Bayesian Data Analysis, Santa Cruz, CA.

Yao, L.,(2003). "BMIRT: Bayesian Multivariate Item Response Theory". Computer software. Monterey, CA: CTB/McGraw-Hill, December 2003.

Yao, L.,(2003) "LinkIRT: Bayesian Multivariate Item Response Theory Linking. Computer software. Monterey, CA: CTB/McGraw-Hill, December 2003.

Ito, K., Hanson B., Choi S., NylA, S.,Yao, L.,(2003, April). "An investigation of a conundrum in a large-scale assessment". Paper presented at the Annual Meeting of National Council on Measurement in Education, Chicago,IL

Thakur, K., Lewis, D., Hosken, M., Yao, L., (2003, April). "Separate Versus Concurrent Calibration Methods in Vertical Scaling". Paper presented at the Annual Meeting of National Council on Measurement in Education, Chicago,IL.

Patz, R., Yao, L.,(2003, April). "Psychometric models for use in vertical scaling". Paper presented at the Annual Meeting of National Council on Measurement in Education, Chicago,IL.

2002

Yao, L, Patz, R., Hanson B (2002, April). "More Efficient Markov Chain Monte Carlo Estimations in IRT using Marginal Posteriors". Paper presented at the Annual Meeting of National Council on Measurement in Education, New Orleans,LA.