# Susu Zhang, Ph.D.

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## EDUCATION

*University of Illinois at Urbana-Champaign, Champaign, IL*      August 2018
Ph.D. in Quantitative Psychology

*University of Illinois at Urbana-Champaign, Champaign, IL*      December 2017
M.S. in Quantitative Psychology

*University of Illinois at Urbana-Champaign, Champaign, IL*      May 2017
M.S. in Applied Mathematics: Optimization and Algorithms

*Bryn Mawr College, Bryn Mawr, PA*      May 2014
B.A.: Psychology and Mathematics

## EMPLOYMENT HISTORY

**University of Illinois at Urbana-Champaign**
*Assistant Professor of Psychology and Statistics*      August 2020 - Present

**Columbia University**
*Postdoctoral Research Scientist in the Department of Statistics*      July 2018 - June 2020
**Supervisors:** Jingchen Liu, Zhiliang Ying
**Grant:** NSF: Latent and Graphical Models for Complex Dependent Data in Education
**Projects:**

- Analysis of log and timing data from PISA and PIAAC computer-based items;
- Efficient latent trait estimation and item bias correction with process data.

**ACT Inc.**
*Psychometric Intern*      June 2016 - August 2016
**Supervisors:** Haiyan Lin, Xiaohong Gao
**Projects:**

- Post-learning assessments with cognitive diagnostic computerized adaptive testing;
- Adaptive content recommendation based on diagnostic information for Workkeys Career Ready 101.

## RESEARCH INTERESTS

**Process Data Analysis**: Log data, interevent times, neural language modelling;

**Latent Variable Modeling**: Item response theory, cognitive diagnosis, missing data, longitudinal models, response time, estimation, model comparison, nonlinear models;

**Adaptive Design**: Computerized adaptive testing, online calibration, adaptive learning, interactive assessment design and evaluation;

**Assessment Development**: Automated test assembly, item pool development, differential item functioning, linking/equating/scaling, test security.

## TEACHING EXPERIENCE

**University of Illinois at Urbana-Champaign, Department of Psychology**
*Instructor*
**Courses:**

- Psyc 490: Measurement and Test Development Lab                                   Fall 2020

*Lab Instructor and Teaching Assistant*
**Courses:**

- Psyc 490: Measurement and Test Development Lab                                   Fall 2015
- Psyc 301: Statistical Methods for Psychology                    Spring 2016, Spring 2017

**Bryn Mawr College, Department of Psychology**
*Undergraduate Teaching Assistant*
**Courses:**

- Psyc 105: Introductory Psychology                                               Fall 2013
- Psyc 205: Experimental Methods and Statistics                   Spring 2013, Spring 2014

## MENTORING EXPERIENCE

**Columbia University, Department of Statistics**                    March 2019 - Present
*Graduate student mentoring*
**Supervised projects:**

- Modelling missing data in timed-tests using response time censoring.

- Multidimensional IRT modelling of passage-based questions in reading comprehension tests.

*Undergraduate summer exchange student mentoring*
**Supervised projects:**

- Neural language modelling of process data from PISA 2012 problem solving tasks.

**University of Illinois at Urbana-Champaign, Department of Statistics**   January 2018 - May 2018
*Undergraduate student mentoring*
**Supervised projects:**

- Software development for the `hmcdm` R package.

## CONSULTING EXPERIENCE

**Shanghai Municipal Educational Examinations Authority**        August 2019 - September 2019
**Project:**

- College entrance exam English reading item difficulty prediction based on experts' ratings.

**TAL Education Group, Silicon Valley R&D Center**              June 2018 - September 2019

- Development of classroom assessments, including assessment design, item pool construction, automated test assembly, and scoring.

- Providing expertise and knowledge of appropriate statistical and psychometric techniques.

## PUBLICATIONS

**Accepted:**

- Chang, H.-H., Wang, C., & **Zhang, S.** (2020) Statistical Applications in Educational Measurement. *Annual Review of Statistics and Its Application.*

- Rescorla, L., Jordan, P., **Zhang, S.**, Baelen-King, G., Althoff, R., Ivanova, M., & International ASEBA Consortium. (2020). Latent Class Analysis of the CBCL Dysregulation Profile for 6- to 16-Year-Olds in 29 Societies. *Journal of Clinical Child and Adolescent Psychology.*

- Wang, S., **Zhang, S.**, & Shen, Y. (2019). A Joint Modeling Framework of Responses and Response Times to Track Skill Acquisition and Fluency. *Multivariate Behavioral Research.*

- **Zhang, S.**, & Chang, H-H. (2019). A Multilevel Logistic Hidden Markov Model for Learning under Cognitive Diagnosis. *Behavior Research Methods.*

- **Zhang, S.**, & Wang, S. (2018). Modelling Learner Heterogeneity: A Mixture Learning Model with Responses and Response Times. *Frontiers in Psychology, section Quantitative Psychology and Measurement.*

- **Zhang, S.,** Douglas, J. A., Wang, S., & Culpepper, S. A. Reduced-Reparameterized Unified Model Applied to Learning Spatial Reasoning Skills. In von Davier, M., & Lee, Y.-S. (2018). *Handbook of Diagnostic Classification Models.*

- Wang, S., **Zhang, S.,** Douglas, J. A., & Culpepper, S. A. (2018). Using Response Times to Assess Learning Progress: A Joint Model for Responses and Response Times. *Measurement: Interdisciplinary Research and Perspectives.*

- **Zhang, S.,** Chang, H-H. (2017). From Smart Testing to Smart Learning: How Testing Technology Can Assist the New Generation of Education. *International Journal of Smart Technology and Learning.*

- Kang, H-A., **Zhang, S.**, & Chang, H-H. (2017). Dual-Objective Item Selection Criteria in Cognitive Diagnostic Computerized Adaptive Testing. *Journal of Educational Measurement.*

**Under Review/Revision:**

- **Zhang, S.**, Tang, X., He, Q., Liu, J., and Ying, Z. External Correlates of Adult Digital Problem-Solving Behavior: Log Data Analysis of a Large-Scale Assessment.

- Tang, X., **Zhang, S.**, Wang, Z., Liu, J., & Ying, Z. ProcData: An R Package for Process Data Analysis.

- **Zhang, S.**, Wang, Z., Qi, J., Liu, J., & Ying, Z. Accurate Assessment via Process Data.

- Guo, J., Xu, X., Ying, Z., & **Zhang, S.*** Modelling Not-Reached Items in Timed Tests: A Response Time Censoring Approach.

- Fu, Z., Su, Y.-H., **Zhang, S.***, & Tao, J. A Gibbs Sampler for the Four-Parameter Logistic Item Response Model via a Data Augmentation Scheme.

- **Zhang, S.**, Bergner, Y., DiTrapani, J., & Jeon, M. Modeling the Interaction between Resilience and Ability in Assessments with Allowances for Multiple Attempts.

- **Zhang, S.,** Culpepper, S. A. Bayesian Estimation of a General Identifiable Restricted Latent Class Model.

- Fang, G., Xin, X., Ying, Z., & **Zhang, S.*** Identifiability of the Bifactor Models.

**In Preperation:**

- Qi, J., **Zhang, S.**, Liu, J., & Ying, Z. Differential Item Functioning Detection and Correction with Process Features.

- **Zhang, S.**, Tang, X., Liu, J., Ying, Z., & He, Q. Exploring the Information in Interevent Times from Log Data.

- **Zhang, S.**, Liu, J., & Ying, Z. Uncovering Cross-Situational Consistency with Canonical Correlation Analysis of Process Data.
- Kern, J. L., **Zhang, S.**, Sun, T., Zhang, B., Amrhein, R., Deceanne, A., and Lee, A. An Ideal-Point Multidimensional Computerized Adaptive Test for the Big Five Personality Assessment.

*: Corresponding author

## PRESENTATIONS

**Invited Talks:**

- **Zhang, S.**, Tang, X., Liu, J., Ying, Z., & He, Q. (2020, July). Uncovering Cross-Situational Behavioral Consistency with Canonical Correlation Analysis of Log Data. *Spotlight Talk at the 85th International Meeting of the Psychometric Society*.
- **Zhang, S.**, Lin, H., Gao, X., Chang, H-H. (2017, June). Real-Time Assessment of Learning Progress Using Cognitive Diagnostic-Computerized Adaptive Testing. *ACTNext Invited Symposium Series*, Iowa City, IA.
- Chang, H-H., **Zhang, S.** (2016, December). Psychometrics in the Era of "Internet + Education". *2nd Annual Conference of the Collaborative Innovation Center of Assessment toward Basic Education Quality*, Beijing, China.
- Chang, H-H., **Zhang, S.** (2016, September). Cognitive Diagnosis and "Internet + Measurement and Evaluations". *Fourth Conference on the Statistical Methods in Psychometrics at Columbia University*, New York, NY.
- **Zhang, S.,** Chang, H-H. (2015, July). Using Computerized Adaptive Testing under the DINO Model for Psychological Testing: A Simulation Study. *Psychometrics in the Big Data Era Workshop at Beijing Normal University*, Beijing, China.
- **Zhang, S.,** Chang, H-H. (2015, July). From Smart Testing to Smart Learning: Theory, Research, and Potentials. *Psychometrics in the Big Data Era Workshop at Beijing Normal University*, Beijing, China.

**Training Sessions:**

- Liu, J., Tang, X., & **Zhang, S.** (2020, July). Workshop on Statistical Learning for Process Data. http://www.scientifichpc.com/processdata/workshop.html
- Douglas, J., Culpepper, S., Chen, Y., Balamuta, J., Chang, H-H., Wang, S., **Zhang, S.**, Fellouris, G., & Ye, S. (2018, April). Techniques and Software for Q-Matrix Estimation and Modeling Learning in Cognitive Diagnosis. *2018 National Council on Measurement in Education meeting*. New York, NY.
- **Zhang, S.,** Chang, H-H. (2017, December). Stationary and Real-Time Assessment of Learning Progress with Diagnostic Classification Models. *2017 Global Chinese Conference on Educational Information and Assessment*, Taichung, Taiwan.

**Leading Conference Presentations:**

- **Zhang, S.**, Tang, X., Wang, Z., Liu, J., Ying, Z., & He, Q. (2019, July). Understanding Respondent Characteristics through Log Data and Interevent Times. *Paper presented at the 83rd International Meeting of the Psychometric Society*. Santiago, Chile.
- **Zhang, S.**, Tang, X., Wang, Z., Liu, J., Ying, Z., & He, Q. (2019, June). Understanding Interactive Items' Characteristics by Deep Learning-based Process Data Analysis. *Paper presented at the 2019 International Association of Computerized Adaptive Testing Conference*. Minneapolis, Minnesota.

- **Zhang, S.**, & Wang, S. (2019, April). Understanding Learner Heterogeneity: A Mixture Learning Model with Responses and Response Times. *Electronic poster presented at the 2019 National Council on Measurement in Education meeting.* Toronto, Canada.

- **Zhang, S.**, & Wang, S. (2018, July). Modeling Heterogeneity in Online Learners: A Mixture Learning Model with Responses and Response Times. *Paper presented at the 83rd International Meeting of the Psychometric Society.* New York, NY.

- **Zhang, S.**, & Chang, H-H. (2018, April). A Multilevel Logistic Hidden Markov Model for Learning under Cognitive Diagnosis. *Paper presented at the 2018 National Council on Measurement in Education meeting.* New York, NY.

- **Zhang, S.**, & Chang, H-H. (2017, July). A Multilevel Logistic Hidden Markov Model for Learning under Cognitive Diagnosis. *Paper presented at the 82nd International Meeting of the Psychometric Society.* Zurich, Switzerland.

- **Zhang, S.**, Lin, H., Gao, X., & Chang, H-H. (2017, April). Measuring Adaptive Learning Progress Using Cognitive Diagnostic-Computerized Adaptive Testing. *Paper presented at the 2017 National Council on Measurement in Education meeting.* Austin, TX.

- **Zhang, S.**, & Culpepper, S. A. (2017, April). Bayesian Estimation of a General Class of Restricted Latent Class Models. *Paper presented at the 2017 National Council on Measurement in Education meeting.* Austin, TX.

- **Zhang, S.**, & Chang, H-H. (2017, April). Testlet Selection Method for Cognitive Diagnostic-Computerized Adaptive Testing. *Poster presented at the 2017 American Educational Research Association meeting.* Austin, TX.

- **Zhang, S.**, & Chang, H-H. (2016, April). The Relationship between Q-Matrix Specification and Item Exposure Rate in CD-CAT. *Paper presented at the 2016 National Council on Measurement in Education meeting,* Washington, D.C.

- **Zhang, S.**, & Chang, H-H. (2015, July). Using Computerized Adaptive Testing under the DINO Model for Psychological Testing: A Simulation Study. *Paper presented at the 80th International Meeting of the Psychometric Society,* Beijing, China.

**Contributed Conference Presentations:**

- Qi, J., **Zhang, S.**, Liu, J., & Ying, Z. (2020, July). Differential Item Functioning Detection and Removal by Process Features and Transfer Learning. *Paper presented at the 85th International Meeting of the Psychometric Society.*

- Guo, J., **Zhang, S.**, Xu, X., & Ying, Z. (2020, July). Modelling Not-Reached Items with Response Time Censoring Approach. *Paper presented at the 85th International Meeting of the Psychometric Society.*

- Xu, X., **Zhang, S.**, Guo, J., Fang, G., & Ying, Z. (2020, July). Latent Variable Selection for Testlet-Based Tests *Paper presented at the 85th International Meeting of the Psychometric Society.*

- Tang, X., **Zhang, S.**, Wang, Z., Liu, J., & Ying, Z. (2019, July). Cross-Item Response Process Prediction by Transformer. *Paper presented at the 84th International Meeting of the Psychometric Society.* Santiago, Chile.

- Wang, S., & **Zhang, S.** (2019, April). Measuring Learning Outcome Using Responses and Response Times: Mastery and Fluency. *Paper presented at the annual meeting of the National Council on Measurement in Education,* Toronto, Canada.

- Wang, S., **Zhang, S.**, Douglas, J., & Culpepper, S. (2018, July). A Joint Modeling Framework Using Responses and Response Times to Track Skill Acquisition: Model Estimation and Application. *Paper presented at the 2018 Joint Statistical Meeting,* Vancouver, Canada.

- Chang, H.-H., Wang, S., & **Zhang, S.** (2017, July). Some Promising Advancements Concerning CAT Foundation and Implementations. *Paper presented at the 81st International Meeting of the Psychometric Society,* Zurich, Switzerland.
- Chang, H.-H., Kang, H.-A., & **Zhang, S.** (2017, April). Using Cognitive Diagnostic Computerized Adaptive Testing to Help Classroom Learning. *Paper presented at the annual meeting of the National Council on Measurement in Education,* San Antonio, TX.
- Kern, J. L., **Zhang, S.**, Sun, T., Zhang, B., Amrhein, R., Deceanne, A., & Lee, A. (2016, October). Multidimensional Computerized Adaptive Test for the Big Five Personality Assessment. *Paper presented at the annual Ideas in Testing Research Seminar,* Chicago, IL.
- Kang, H.-A., **Zhang, S.**, & Chang, H-H. (2015, April). Jensen-Shannon Information as a Dual Objective Item Selection Criterion in CD-CAT. *Paper presented at the annual meeting of the American Educational Research Association*, Chicago, IL.

# SOFTWARE DEVELOPMENT

The **hmcdm** R package                                                     Creator/maintainer
- A package for fitting hidden Markov cognitive diagnosis models on longitudinal data for learning.
- `https://github.com/tmsalab/hmcdm`

The **ProcData** R package                                                            Co-author
- A package for exploratory process data analysis.
- `https://github.com/xytangtang/ProcData`

# PROFESSIONAL SERVICE AND AFFILIATIONS

**Managing Editor:**
- Applied Psychological Measurement (Jan 2017 - Jan 2019)

**Manuscript Reviewer:**
- Applied Psychological Measurement
- Educational Measurement: Issues and Practice
- Handbook of Diagnostic Classification Models
- Journal of Educational and Behavioral Statistics
- Behavioral Research Methods
- Journal of Classification
- International Journal of Testing
- Frontiers in Psychology
- Educational and Psychological Measurement
- Psychometrika
- British Journal of Mathematical and Statistical Psychology
- Multivariate Behavioral Research
- Large-Scale Assessments in Education

**Conference Proposal Reviewer:**
- American Educational Research Association Annual Conference
- American Educational Research Association SIG: Cognition and Assessment

**Grant Proposal Reviewer:**
- University of Illinois Campus Research Board
- National Science Foundation: Methodology, Measurement, and Statistics

**Committee Member:**

- Graduate Student Committee: Psychometric Society (2019 - 2020)

**Volunteer:**

- The 82nd International Meeting of the Psychometric Society, New York, NY

**Professional Affiliations:**

- American Educational Research Association, Division D
- National Council on Measurement in Education
- Psychometric Society
- International Association of Computerized Adaptive Testing
- American Psychological Association, Division 5

## HONORS AND AWARDS

**University of Illinois at Urbana-Champaign:**

- Jeffrey Tanaka Memorial Award, Department of Psychology, 2018.
- Student Travel Award, Department of Psychology, 2018.
- Converence Travel Award, Graduate College, 2017.
- List of Teachers Ranked as Excellent by Students, Center for Innovation in Teaching & Learning, 2016.
- Hobson Fellowship, Department of Psychology, 2014 - 2015 & 2015 - 2016.

**Miscellaneous:**

- Honorary mention (5th place), NAEP Data Mining Contest, 2020 (`https://sites.google.com/view/dataminingcompetition2019/home`)

## COMPUTING SKILLS

**Programming**: R, C++, Python, MATLAB/Octave, Mathematica, high performance computing

**Statistical and Specialized Software**: SPSS, SAS, Mplus, Winsteps, flexMIRT, MULTILOG.

**Developing:** Git