Curriculum Vitae
Cheng Liu, Ph.D.

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Higher Education

University of Notre Dame	Ph.D. in Statistics	2023
University of Illinois Urbana-Champaign	Ph.D. in Physics	2011
University of Science and Technology of China	B.S. in Physics	2004

Academic Appointments

2021-Present: Research Assistant Professor, Lucy Family Institute, University of Notre Dame

2017- Present: Lead Data Scientist, Center for Social Science Research, University of Notre Dame

2015-2021:   Research Assistant Professor, Dept. of Psychology, University of Notre Dame

2015-2020:   Computational Scientist, Center for Research Computing, University of Notre Dame

2011-2015:   Research Programmer, Center for Research Computing, University of Notre Dame

2010:   Lab instructor, Dept. of Physics, University of Illinois Urbana-Champaign

2004-2009:   Research assistant, Dept. of Physics, University of Illinois Urbana-Champaign

Scholarships and Fellowships

2000 – 2003: Academic Merit Scholarship for four consecutive years, University of Science and Technology of China

Awards

2022: Runner up, 1st Source Bank Commercialization Award

2022: Infrastructure & Services Award by Lucy Family Institute, University of Notre Dame

2010: List of Teachers Ranked as Excellent by Their Students, University of Illinois

2008: Outstanding Presentation Award, The 21st CMB Research Symposium

2004: Outstanding College Graduate Award of Anhui Province, China

Publications

1. Ober, T. M., Cheng, Y., Carter, M. F., & **Liu, C**. (in press). Leveraging performance and feedback-seeking indicators from a digital learning platform for early prediction of students' learning outcomes. *Journal of Computer Assisted Learning.* doi: 10.1111/jcal.12870

2. Ober, T. M., Cheng, Y., Carter, M. F., & **Liu, C**. (2023). Disruptiveness of COVID-19: Differences in course engagement, self-appraisal, and learning. *Aera Open*, *9*, 23328584231177967.

3. Ober, T. M., Lu, Y., Blacklock, C. B., **Liu, C.,** & Cheng, Y. (2023). Development and Validation of a Cognitive Load Measure for General Educational Settings. *Journal of Psychoeducational Assessment.* doi: 10.1177/07342829231169171

4. Setzer, C., Cheng, Y., & **Liu, C.** (2023). Decision accuracy of compensatory composite test scores. *Journal of Educational Measurement, 60(3).* doi: 10.1111/jedm.12357

5. Ober, T., **Liu, C.,** & Cheng, Y. (2023) Development, validation, and evidence of measurement Invariance of a Shortened Measure of Trait Test Anxiety. *European Journal of Psychological Assessment.* doi: 10.1027/1015-5759/a000761

6. Lu, Y., Ober, T. M., **Liu, C.,** & Cheng, Y. (2022). Application of neighborhood components analysis to process and survey data to predict student learning of statistics. *2022 International Conference on Advanced Learning Technologies (ICALT).* 147-151. doi:10.1109/ICALT55010.2022.00051

7. Ober, T. M., Brodersen, A., Rebouças-Ju, D., Hong, M., **Liu, C.,** & Cheng, Y. (2022). Math attitudes and engagement-related behaviors: Direct and indirect effects on proficiency in high and low-stakes tests of statistics knowledge. *Journal for STEM Education Research.* doi: 10.1007/s41979-022-00076-4

8. Ober, T. M., Hong, M., Carter, M., Brodersen, S. A., Rebouças, D. A., **Liu, C.,** & Cheng, Y. (2022). Are high school students accurate in predicting their AP exam scores? *Assessment in Education: Principles, Policy & Practice.* doi: 10.1080/0969594X.2022.2037508

9. Ober, T. M., Hong, M., Rebouças, D. A., Carter, M., **Liu, C.,** & Cheng, Y. (2021). Linking Self-report and Process Data to Performance across Different Assessment Types. *Computers & Education, 167 (2021) 104188.* doi: 10.1016/j.compedu.2021.104188

10. **Liu, C.,** Han, K. T., & Li, J. (2019). Compromised item detection for computerized adaptive testing. *Frontiers in Psychology.* doi: 10.3389/fpsyg.2019.00829

11. **Liu, C.**, & Cheng Y. (2018). An application of the support vector machine for attribute-by-attribute classification in cognitive diagnosis. *Applied Psychological Measurement*, *42(1)*, 58-72. doi: 10.1177/0146621617712246

12. Cheng, Y., & **Liu, C** (2016). A note on the relationship between pass rate and multiple attempts. *Journal of Educational Measurement, 53*(4), 431-447. doi:10.1111/jedm.12124

13. McBurney, P. W., **Liu, C**., & McMillan, C. (2016). Automated feature discovery via sentence selection and source code summarization. *Journal of Software: Evolution and Process, 28*(2), 120-145. doi: 10.1002/smr.1768

14. Schiedler, N. H., **Liu, C.,** Hamby, K. A., Zalom, F. G., & Syed, Z. (2015). Volatile codes: evolution of olfactory signals and reception in drosophila-yeast chemical communication. *Nature Scientific Reports, 5,* 14059. doi: 10.1038/srep14059

15. Rodeghero, P., **Liu, C.,** McBurney, P. W., & McMillan, C. (2015). An eye-tracking study of Java programmers and application to source code summarization. *IEEE Transactions on Software Engineering, 41*(11), 1038-1054. doi: 10.1109/TSE.2015.2442238

16. Cheng, Y., **Liu, C.,** & Behrens, J. (2015). Standard error of ability estimates and the classification accuracy and consistency of binary decisions in linear and adaptive testing. *Psychometrika, 80*(3), 645-664. doi: 10.1007/s11336-014-9407-z

17. Cheng, Y., & **Liu, C.** (2015). The effect of upper and lower asymptotes of IRT models in computerized adaptive testing. *Applied Psychological Measurement. 39*(7), 551–565. doi: 10.1177/0146621615585850

18. Sullivan, G. A., **Liu, C.,** and Syed, Z. (2014). Oviposition signals and their neuroethological correlates in the Culex pipiens complex. *Infection, Genetics and Evolution, 28,* 735-743. doi: 10.1016/j.meegid.2014.10.007

19. Kijewski-Correa, T., Smith, N., Taflanidis, A., Kennedy, A., **Liu, C.,** Krusche, M. & Vardeman, C. (2014). CyberEye: Development of integrated cyber-infrastructure to support rapid hurricane risk assessment. *Journal of Wind Engineering & Industrial Aerodynamics, 133,* 211-224. doi:

10.1016/j.jweia.2014.06.003

20. Reidenbach, K. R., Cheng, C., Liu, F., **Liu, C.,** Besansky, N. J. & Syed, Z. (2014). Cuticular differences associated with aridity acclimation in African malaria vectors carrying alternative arrangements of inversion 2La. *Parasites & Vectors, 7*, 176. doi: 10.1186/1756-3305-7-176

21. Nabrzyski, J., **Liu, C.,** Vardeman, C., Gesing, S. & Budhatoki, M. (2014). Agriculture data for all: integrated tools for agriculture data integration, analytics and sharing. *BigData 2014, June 27-July 2, 2014, Anchorage, Alaska, US.* doi: 10.1109/BigData.Congress.2014.117

22. McBurney, P. W., **Liu, C.,** McMillan, C., & Weninger, T. (2014). Improving topic model source code summarization. *Proc. of 22nd International Conference on Program Comprehension, Early Research Achievements Track (ICPC'14 ERA), June 2-3 2014, Hyderabad, India.* doi: 0.1145/2597008.2597793

23. Shi, X., Jung, Y., Lin, C., **Liu, C**., Wu, C., Cann, I. K. O., & T. Ha. (2012). Quantitative fluorescent labeling of aldehyde-tagged proteins for single-molecule imaging. *Nature Methods*, *9*(5), 499-503. doi: 10.1038/nmeth.1954

24. Ragunathan, K., **Liu, C.,** & Ha, T. (2012). RecA filament sliding on DNA facilitates homology search. *eLife, 1,* e00067. *Pubmed ID: 23240082*. doi: 10.7554/eLife.00067

25. Cheng, Y., Yuan, K-H., & **Liu, C.** (2012). Comparison of reliability measures under factor analysis and item response theory. *Educational and Psychological Measurement, 72*(1), 52-67. doi: 10.1177/0013164411407315

26. **Liu, C.,** McKinney, M. C., Chen, Y. H., Earnest, T. M., Shi, X., Lin, L. J., Ishino, Y., Dahmen, K., Cann, I. K. O., & Ha, T. (2011). Reverse-chaperoning activity of an AAA+ protein, *Biophysical Journal, 100*(5), 1344-1352. doi: 10.1016/j.bpj.2011.01.057

27. Zhu, J., **Liu, C.,** & Wang, Z. (2006). Monte-Carlo simulation of a small gamma camera using fibers and YAP scintillation crystal. *ACTA PHOTONICA SINICA, 35*(10), 1497-1500.

Book Chapters

1. Brodersen, A., Carter, M. F., **Liu, C.,** & Cheng, Y. (2020). Collection of process data in web-based assessment systems and its applications to validating non-cognitive constructs. *In H. Jiao & R. Lissitz (Eds.), Enhancing Effective Instruction and Learning Using Assessment Data. Charlotte, NC: Information Age Publisher*

Technology Transfer

1. New Venture Development and Invention Program at Notre Dame invention. The invention is based on the education platform designed and developed through the AP-CAT and iDAP projects. I was heavily involved in its development. Tech ID #20-017 for Computerized adaptive testing with cognitive diagnostic feedback.

2. New Venture Development and Invention Program at Notre Dame invention. The invention is based on the FacultyDB project I developed with Dave Rimes, Office of Academic Mission Support. Tech ID #15-050 for Mission Hire. We already have a licensee (Mission Hire LLC) of the technology.

Invited Lectures and Addresses

1. **Liu, C.** (Jan, 2020). Compromised item detection for testing. *University of Florida*

2. **Liu, C.** (July, 2019). Compromised item detection for testing. *Invited talk at Goethe-Universität Frankfurt, Frankfurt, Germany.*

Conference Presentations

1. **Liu, C.,** Han, K. T., & Li, J. (July, 2023). Using response time for compromised item detection. International Society for Data Science and Analytics (ISDSA), Shanghai, China, July 4th-6th, 2023.
2. Ober, T. M., Denner, M., **Liu, C., &** Cheng., Y. (June, 2022). Comparing Subjective and Objective Estimates of Effort and Performance on Adaptive v. non-Adaptive Computerized Tests of Statistics Knowledge. Paper accepted at the Annual Meeting of International Society of the Learning Sciences, Hiroshima, Japan, June 6th-10th, 2022.
3. **Liu, C.,** Han, K. T., & Li, J. (April, 2022, accepted 2021). Compromised item detection for computer-based testing using response time. Presentation accepted at the Annual Meeting of the National Council on Measurement in Education, San Francisco, CA, San Diego, CA, April 21st–24th, 2022.
4. Ober, T. M., Ying, C., Carter, M. F., & **Liu, C.** (April, 2022, accepted 2021). Differences in course engagement and learning in AP Statistics: Examining the disruptiveness of COVID-19. Roundtable presentation accepted at the Annual Meeting of the American Educational Research Association, San Diego, CA, April 22nd–25th, 2022.
5. Ober, T. M., **Liu, C.,** Lu, Y., & Cheng., Y. (April, 2022, accepted 2021). Adaptive v. non-adaptive test mode effects on effort, test anxiety, and performance. Paper accepted at the Annual Meeting of the National Council on Measurement in Education, San Francisco, CA, San Diego, CA, April 21st–24th, 2022.
6. Ober, T. M., Cheng, Y., **Liu, C.,** & Carter, M. F. (May, 2021). Development of a self-report measure to capture learner's mental effort and perceived task difficulty. Flash Talk presented at the Association for Psychological Science Meeting, May 26th–September 1st, 2021.
7. Ober, T. M., Hong, M. R., Rebouças-Ju, D., Carter, M. F., **Liu, C.,** & Cheng, Y. (April, 2021). Self-report and process data indicators of engagement: Unique predictors of performance across assessment types. Paper presented at the Annual Meeting of the American Educational Research Association, April 8th–12th, 2021.
8. **Liu, C.,** & Cheng, Y. (September, 2020). AP-CAT: A Comprehensive, Adaptive Web-Based Assessment Platform with Diagnostic Features for AP Statistics. *Innovations in Testing 2020. San Diego, CA.*
9. **Liu, C.,** Han, K. T., & Li, J. (September, 2020). Compromised item detection for computerized adaptive testing. *Innovations in Testing 2020. San Diego, CA.*
10. **Liu, C.,** & Li, J. (April, 2017). Compromised item detection for computerized adaptive testing. *Annual Meeting of National Council for Measurement in Education. San Antonio, TX.*
11. Cheng, Y., & **Liu, C**. (April, 2016). The relationship between pass rate and multiple attempts on a test. *Annual Meeting of National Council for Measurement in Education, Washington DC.*
12. Cheng, Y., & **Liu, C** (Nov, 2015). Classification accuracy of a test battery under multiple decision rules. *Ideas in Testing Seminar, Chicago, IL.*
13. **Liu, C.,** & Cheng, Y. (July, 2015). Cognitive diagnostic assessments using support vector machine–a simulation study. *2015 International Meeting of Psychometric Society, Beijing, China.*

14. **Liu, C.,** & Cheng, Y. (April, 2015). The use of support vector machine in cognitive diagnostic assessments. *2015 NCME annual Meeting, Chicago, IL.*
15. Cheng, Y., & **Liu, C**. (April, 2013). *Detection of aberrant responses in survey data in the presence of calibration error*. Paper presented at the 75th annual meeting of the National Council of Measurement in Education, San Francisco, CA.
16. Cheng, Y., & **Liu, C**. (April, 2012). *Conceptual differences between two IRT-based decision making approaches in testing*. Paper presented at the 74th annual meeting of the National Council of Measurement in Education, Vancouver, Canada.
17. Cheng, Y., & **Liu, C**. (July, 2011). *Estimation of classification accuracy and consistency under item response theory models*. The 2011 International Meeting of Psychometric Society, Hong Kong.
18. **Liu, C**. (Oct, 2010). *Answering biological questions with computational and physics methods*. Presentation at *Wolfram Research*, Champaign, IL.
19. **Liu, C.,** Shi, X., Chen, Y. H., McKinney, M. C., Cann, I. K.O., & Ha, T. (2008). *Direct observation of sliding clamp dynamics during loading and polymerization*. Paper presented at the 21st Annual Cell & Molecular Biology/Molecular Biophysics Research Symposium, Champaign, IL.
20. McKinney, M. C., **Liu, C.,** Chen, Y. H., Cann, I. K. O., & Ha, T. (2007). *Active assembly of replication clamp by an archaeal clamp loader of novel stoichiometry*. Paper presented at the 51st annual meeting at the Biophysical Society, Baltimore, MD.

Other Research Products

1. Filonczuk, A., **Liu, C.,** & Cheng, Y. (2021). Develop the R package named "RobustIRT" (https://github.com/cliu7/RobustIRT) for robust IRT model fit.
2. **Liu, C.,** & Cheng, Y. (2021). iDAP v2.0 published on-line. The new platform provides support of multiple subject domains, new diagnostic features, a new assignment type with time limit, improved student testing interface with a clock, improved teacher report page with a better navigation design, new item bank with more items for both AP and non-AP statistics, new item calibrations and new learning materials.
3. **Liu, C.,** & Cheng, Y. (2020). AP-CAT OPEN published on-line to help the students better prepare the AP statistics exam post COVID-19. The new platform allows public registration and use and offers off-the-shelf, pre-calibrated practice tests.
4. **Liu, C.,** Ober, T. M., & Cheng, Y. (2020). Test mode research module developed and implemented to examine the effect of computer-based test on test anxiety and test performance. The module is supported by the internal grants we received from IEI and ISLA at University of Notre Dame.
5. **Liu, C.,** & Cheng, Y. (2020). iDAP assessment framework published on-line. The platform is the core development supported by the IES grant to facilitate the high school statistics education.
6. **Liu, C.,** & Cheng, Y. (2020). Item-banking framework with learning module published on-line. The platform allows teachers and other content experts to create, review, and edit statistics questions. This greatly facilitates item development and curation. The platform supports two item types: multiple choice and fill-in-the-blank.
7. **Liu, C.,** & Cheng, Y. (2019). Asynchronized survey collection module development and implementation to the AP-CAT framework. The new module enhanced the research capability of the

framework by allowing researchers to embed short pop-up surveys before or after assignment start/completion.

8. **Liu, C.,** & Cheng, Y. (2019). Asynchronized user interface development and implementation to the AP-CAT framework. The new asynchronized infrastructure design enables large user behavior data collection without interrupting the users' normal operations (so called stealth data collection).

9. **Liu, C.,** & Cheng, Y. (2018). Computer Adaptive Testing module development and implementation to the AP-CAT framework.

10. **Liu, C.,** & Cheng, Y. (2017). AP-CAT framework published for on-line assessment research. The on-line platform is for high-school education of AP statistics data collection.

Grants and Sponsored Programs

Senior Personnel. 2022-2023. "Trustworthy AI Lab for Education (TALE)." (PI: Dr. Ying Cheng). Flip the Script Grant Program award, university of Notre Dame $15,000

Senior Personnel. 2021-2026. "People with Hope to Bring: Instilling Authentic Excellence for a Campus Culture of Well-Being, Resilience, and Restoration." (PI: Erin Hoffmann Harding). *Lilly Endowment, Inc*. $2,500,000

Co-PI. 2020-2022. Testing Experiences of Students and Instructors during COVID-19: Issues of Equity, Validity, and Mode Effects of Online and Remote Testing. (PI: Dr. Teresa Ober) *Spencer Foundation.*
                                        $50,000

Co-PI. 2019-2022. "Statistical Quality Control of Low-Stakes Survey and Assessment Data" (PI: Dr. Ying Cheng). *National Science Foundation.* $331,480

Co-PI. 2018-2022. "Intelligent Diagnostic Assessment Platform (i-DAP) for High School Statistics Education" (PI: Dr. Ying Cheng). *Institute of Education Sciences.* $1,399,950

PI. 2021**.** "The Development of Software to Simulate the SBAC Computerized Adaptive Test." *Smart Balanced Assessment Consortium.* $153,018

Co-PI. 2020. "Effects of Test Mode and Test Anxiety among Underrepresented Students in STEM." (PI: Dr. Ying Cheng). *Institute for Educational Initiatives Seed Grant, University of Notre Dame*
                                        $3,500

Co-PI. 2020. "Effects of Test Mode on Underrepresented Students in STEM." (PI: Dr. Ying Cheng). *ISLA Large Social Science Grant, University of Notre Dame* $14,905

Professional Memberships

    American Statistical Association
    National Council of Measurement in Education

American Educational Research Association

Association of Test Publishers

Professional Services

1. Ad-hoc Reviewer for journals:
   a. Psychometrika
   b. Frontiers in Psychology
   c. Applied Psychological Measurement
   d. Journal of Educational and Behavioral Statistics
   e. British Journal of Math. and Stat. Psych

2. Selected Services at the Notre Dame

   Computational Scientist/Data Scientist (selected projects)

   As a computational scientist/data scientist, I help researcher on campus to reach their research goals, mainly through providing statistical consulting or data analysis:

   a. Work with Prof. Matthew Kloser and Catherine Wagner in the Center for STEM Education to develop python and R packages for E4 wristband data analytics (2022-2023).
   b. Work as senior personnel in a large mental health project for Notre Dame students (*Lilly Endowment 2021-2026, ~2.5M with Erin Hoffmann Harding*). My responsibility is to help the experimental design and the data analytics thereafter.
   c. Work with Prof. Paul Perrin's team in Keough School's Pulte Institute for Global Development to develop a web-based dashboard for the sustainable development goals (SDGs) for the state of Indiana (2021-2022). The project is to examine the relationship between the current levels and trends for the indicators, and their corresponding targets.
   d. Work with Prof. Ross Jacobucci in Department of Psychology to develop a mental health monitor system with an adaptive time model (2022). This project is supported by the Lucy Family Institute aiming to support the transformative research.
   e. Work with Prof. Tom Purkel's team in Keough School's Pulte Institute for Global Development to facilitate their ELM project (2022). The project aims to using item response theory (IRT) model to assess children's expressive language ability in Africa. I will serve on the team as an educational measurement expert for experimental design and data analytics.
   f. I am currently participating in the Mental Health Interventions project to help develop a resilience program for ND students. The work is a collaboration with Dr. Christine Caron Gebhardt, Division of Student Affairs.
   g. Design and develop the methodology for the ND-GAIN's Urban Adaptation Assessment (UAA) measures the risk and readiness of 278 U.S. cities. The project is a collaboration with Dr. Patrick Regan, Environmental Change Initiative (ECI).
   h. Work on building the automatic methodology workflow for the ND-GAIN Country Index project with Dr. Chen Chen, Environmental Change Initiative (ECI).
   i. Work on statistical data analysis of cuticular hydrocarbon of mosquitoes for Dr. Zainulabeuddin Syed, Dept. of Biological Sciences.
   j. Design AI-based model and implementing the model to a Django-based online platform for FacultyDB project with Dave Rimes, Office of Academic *Mission* Support.
   k. Rewrite and optimize R program for clustering analysis (RCOSA project with Dr. Gitta Lubke, Dept. of Psychology).

Software Development and Support (selected projects)

As a computational scientist, I have hands-on experience of many programming languages, including Python, C++, JAVA, Objective-C/iOS, etc., and research software, such as R, Matlab, Mathematica, Maple, etc. Participated in many research development and data analytics projects on campus:

a. Participate in the V-Dem project to develop an on-line platform to conceptualizing and measuring democracy. The project uses Django framework. Dr. Michael Coppedge, Dept. of Political Science.

b. Participate in the CyberEye project. Use C++, Python, Django and WEKA (a data-mining package) to develop web platform for hurricane prediction and damage evaluation. Dr. Tracy Kijewski-Correa, Dept. of Civil and Environmental Engineering and Earth Sciences

c. Participate in a Java package development using OpenGL to reconstruct 3D architecture image with 3D scanning data and photos.

d. Work as a Mobile developer for the Tempest app using Objective-C/iOS, a Shakespeare literature project. Responsible for interface programming, communication with backend database and html template, etc. The product is currently available in Apple store. Dr. Elliott Visconsi, Department of English.

e. Co-develop the software Molecular Hunter, a C++ & MFC-based software for traditional Total Internal Reflection Fluorescence (TIRF) microscopy setup, University of Illinois at Urbana-Champaign.