Sarah Maestrales, Ph.D.

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About Me

AI Implementation Strategist & Psychometrician with a Ph.D. in Measurement & Quantitative Methods. I design, deploy, and rigorously evaluate AI systems to ensure they deliver measurable impact in real-world educational settings. My work focuses on building and refining RAG-based and automated workflows, using statistical modeling and data pipelines to improve GenAI output quality, optimize assessments, and reduce operational costs.

Experience

Research and AI Consultant, NWD Consulting – Santiago de Compostela, Spain Dec 2023 – Present

- Developed lessons and learning materials as part of a proposal for a Master's course in critical analysis and effective methodology in GenAI.
- Developing learning materials and data collection instruments for RAG models which optimize and personalize in-game user experiences using GenAI for an upcoming MMORPG.
- Reduced AI operational costs by optimizing model usage and implementing lightweight automation pipelines through the creative use of statistical models and basic automation procedures.
- Advised on the dissemination of academic research and product development: statistical modeling, survey development, psychometric evaluation methods, academic writing, and presentations for a variety of unique studies, datasets, and purposes.
- Designed and deployed RAG-based AI systems to automate generation of curriculum and assessment materials across 11 Advanced Placement subjects in history, science, and social science.
- Built evaluation frameworks to assess LLM-generated content quality, combining quantitative metrics and expert review to measure scientific or historical accuracy, depth of knowledge, and appropriateness for inclusion in learning materials, measuring success through a combination of qualitative and quantitative measures.
- Iteratively improved system performance using both human-in-the-loop evaluation and LLM-to-LLM agreement.
- Used feedback and metrics to refine prompts, retrieval strategies, and outputs
- Led a cross-functional team to develop 11 AP-aligned courses, contributing to 93% of students achieving scores of 4 or 5 on the AP Exam.
- Supported educators in integrating AI-generated learning materials into their instructional workflows.
- Translated educator requirements into AI-driven workflows by designing and implementing automation solutions while acting as subject matter expert.

Graduate Teaching Assistant, Michigan State University – East Lansing, MI Aug 2022 – Apr 2024

- Facilitated lectures in quantitative analyses using multivariate statistics and multi-level modeling.
- Guided students in survey development, statistical modeling and hypothesis testing for multivariate statistical analysis in Stata, R, and SPSS; and facilitated their interpretations of the results for technical writing.

Graduate Research Assistant, Michigan State University – East Lansing, MI Mar 2019 – July 2022

- Served as an analyst for a large scale education research intervention where I used multi-variate regressions and hierarchical linear modeling techniques to predict student learning outcomes.
- Lead an international team to develop surveys and investigate student engagement and interest in their online courses during the COVID-19 Pandemic using multivariate logistic regression.
- Designed and published an investigation discussing methodology in training and measuring automated classification of students' constructed responses.
- Applied statistical modeling techniques to study an algorithm's "certainty" in its classification based on various demographic and performance-based predictors for presentation at WERA.
- Designed various survey and assessment instruments to measure intervention outcomes, and optimized those instruments with IRT-based analyses (2PL, 3PL, PCM) to assess item and test-level functioning, measurement precision (TIF), item discrimination (IIC), bias (DIF), internal and external reliability, validity, and data reduction methods (EFA and CFA).

Education

Michigan State University, Ph.D. Measurement & Quantitative Methods — Aug 2019 – Apr 2024

- **Coursework:** Quantitative Methods in Education Research, Psychometric Theory, Survey Research & Instrument Development, Multivariate Data Analyses, Hierarchical Linear Modeling, Latent Variable Modeling, Item Response Theory, Econometrics, Probability & Statistics.

Michigan State University, B.S. Physics — Aug 2015 – Dec 2018

- **Coursework:** Higher Geometry, Classical Mechanics, Matrix Algebra, Calculus, Differential Equations, Quantitative Chemistry, Classical Mechanics, Quantum Physics, Thermal and Statistical Physics, Nuclear Physics, Advanced Laboratory & Procedures, Electricity and Magnetism, Condensed Matter Physics.

Lansing Community College, A.A. Psychology — Aug 2002 – May 2006

- **Coursework:** Human Growth and Development, Adolescent Psychology, Introduction to Education, Integrated Science for Education, Cognitive Psychology, Psychology of Personality, Design & Communication.

Skills

Programming Languages: Python, R, Stata, SPSS

Document & Web Formatting: LaTeX, HTML, Markdown, QTI, XML

AI & LLM Systems: RAG pipelines, prompt optimization, LLM evaluation frameworks, human-in-the-loop evaluation, automated content generation, multi-LLM evaluation tools; OpenAI (ChatGPT, API, Assistants), Anthropic Claude (API, Bedrock), Google Gemini (API)

Tools & Platforms: Qualtrics, LMS(Edmentum, Khan Academy, D2L, Edulastic), Slack, JIRA

Data & Modeling: Regression Modeling (uni-variate, multi-variate, linear, non-linear); Hierarchical Linear Modeling, Hypothesis Testing; Item Response Theory (1PL, 2PL, 3PL,PCM), DIF, TIF, IIF, IIC, TIC, Exploratory & Confirmatory Factor Analysis (EFA & CFA).

Soft Skills: Pattern recognition, solution-oriented thinking, creative problem solving, teamwork & collaboration, multi-tasking, adaptability

Publications

Using machine learning to score multi-dimensional assessments of chemistry and physics — Apr 2021

Sarah Maestrales, Xiaoming Zhai, Israel Touitou, Quinton Baker, Barbara Schneider, Joseph Krajcik

Improving Science Achievement—Is It Possible? Evaluating the Efficacy of a High School Chemistry and Physics Project-Based Learning Intervention — Apr 2022

Barbara Schneider, Joseph Krajcik, Jari Lavonen, Katariina Salmela-Aro, Christoper Klager, Lydia Bradford, I-Chien Chen, Quinton Baker, Israel Touitou, Deborah Peek-Brown, Rachel Marias Dezendorf, ***Sarah Maestrales***, Kayla Bartz

U.S. and Finnish high school science engagement during the COVID-19 pandemic — Apr 2022

Sarah Maestrales, Rachel Marias Dezendorf, Xin Tang, Katariina Salmela-Aro, Kayla Bartz, Kalle Juuti, Jari Lavonen, Joseph Krajcik, Barbara Schneider

Improving Oster's δ^*: *Exact Calculation for the Coefficient of Proportionality Without Subjective Specification of a Baseline Model* — Dec 2022

Kenneth Frank, Qinyun Lin, Spiro Maroulis, Shimeng Dai,Nicole Jess, Hung-chang Lin, Yuqing Liu, ***Sarah Maestrales***, Ellen Searle, Jordan Tait