EDUCATIONAL STATISTICS AND RESEARCH METHODS
Ph.D. in Educational Statistics and Research Methods

The doctoral program of Educational Statistics and Research Methods (ESRM) in the Department of Rehabilitation, Human Resources and Communication Disorders at the University of Arkansas prepares graduates for conducting theoretical and applied research in the fields of quantitative statistical methods, psychometrics, educational psychology, and education-related fields. Graduates are prepared for employment in higher education; local, state, and national educational agencies; research and policy organizations; and industries with internal data needs. The primary learning goals of the ESRM Ph.D. program are centered around the identification of statistical procedures, analyses of data, communicating findings, critiquing research studies, and collaborating effectively with others.

An assessment of the effectiveness of the program would include students' ability to:
1. Identify appropriate research designs for research questions,
2. Conducting statistical analyses for research hypotheses,
3. Understand the strengths, weaknesses, and appropriateness of different statistical procedures,
4. Critique statistical analyses completed by others,
5. Conduct simulation studies to evaluate statistical procedures under varying conditions,
6. Submit research proposals or manuscripts to professional conferences and journals,
7. Complete oral research presentations,
8. Use effective pedagogical processes to explain statistical design and processes to others.

In order to assess the effectiveness of our student training this year, we aggregated student data from research projects, candidacy exams, dissertation proposals, professional conference presentations, journal articles, grant submissions, internships, academic or professional awards, and job placements.

Assessment Information

Course-Based Data

The quality of course-based research projects and components of take-home exams provided data for the learning outcomes of identifying appropriate designs, conducting statistical analyses, and identifying strengths, weaknesses, and appropriateness of statistical procedures. Student projects and take-home examinations have been averaged (i.e., their final grades) for core coursework in the following three objects:

> *Objective 1 – Core Statistical Design & Research Method Courses*: educational statistics, experimental design, multiple regression, multivariate analysis, and qualitative research method.
>
> *Objective 2 – Measurement and Psychometrics*: measurement, item response theory (IRT)
>
> *Objective 3 – Advanced Statistical Design*: hierarchical linear modeling (HLM), structural equations modeling (SEM), advanced multivariate analysis, and seminar.

The course-based performances were graded a 4 if they earned a mastery level of 90% or higher on their project/assignment/exam, 3 for 80-89%, 2 for 70-79%, 1 for 60-69%, and a 0 for less than 60%. There were 17 students (included one new admitted student in fall 2020) in the ESRM Ph.D. program at varying stages of progress in 2020-2021. There were five ESRM doctoral students who took at least one learning objective course during the 2020-2021 academic year and the overall average score was ranged from 3.88 to 4.00 with 18 records (see Table 1).

Table 1.

Identifying Research Designs, Conducting Statistical Analyses, Evaluation Procedures

Learning Objectives 1, 2, and 3	Record	Average	Minimum	Maximum
Core Statistical Design Courses	8	3.26	3.00	4.00
Measurement and Psychometrics	5	3.26	3.00	4.00
Advanced Statistical Designs	5	4.00	-	4.00

- Three students took comprehensive exams in the 2020-2021 academic year. One who got a conditional pass in the written exam is working on her mini-proposal to meet the requirement. The other two successfully passed their comprehensive exam in spring 2021. Currently, both of them are actively working on their dissertation proposal topics.
- Two students will take their comprehensive exam in coming 2021-2022 academic year.
- One student successfully passed the dissertation proposal defense stage in spring 2021 and is planning to defend her dissertation in the 2021-2022 academic year.

Active Research, Internships, and Awards:

A summary of their research presentations, articles, grants, internships, and fellowships are provided in Table 2.

Publications: Many ESRM students work closely with faculty members. Nine manuscripts were published or are in-press in 2020-2021. Two manuscripts are currently under review.

Presentations: Doctoral students were active in research activities, with five students participating on 22 presentations at national and international conferences. Unfortunately, due to COVID-19, many conferences were either moved to virtual formats or cancelled. Therefore, many did not have the chance to physically attend conferences in 2020, however some participated in virtual conferences.

Internship: One student applied and was awarded the Educational Testing Service (ETS) internship (note: highly competitive) in summer 2021.

Award & Admission: ESRM admitted one new student in fall 2020.

Table 2.
Student Research Proposals, Manuscripts, Grants, and Internships

Learning Objectives 6 and 7	Number
Research Presentations	20
Journal Articles (published or in press)	9
Manuscript under review	2
Internships	1
Fellowships*	5

*One new recruited doctoral student awarded DAF & one second-year student awarded SREB in 2021

Training Others and Collaborating with Professionals in Other Fields:

Teaching: Doctoral students gain experience in using pedagogical methods to explain statistical processes to others through course instruction and tutoring in the statistics laboratory. Three of our graduate students teach undergraduate sections of ESRM 2403 Statistics in Nursing.

Tutoring: Four of our graduate students provided instructional support and tutoring to our undergraduate and graduate level courses in the computer/statistics lab. In addition, two of our doctoral students assisted ESRM faculty with their courses and Blackboard management.

Consulting Center: Two students who worked closely with an ESRM faculty member at the research consulting center in 2020. This center provides statistical consulting service to help COEHP faculty and graduate students who had questions related to their research, grants, and publications.

Others Assistantships & Grant Work: Three graduate students worked on an externally funded grant in 2020-2021. Our students have been active in collaborating on research projects with students and colleagues in other fields within our university. This is a valuable practice within our field.

Changes Planned Based on Assessment Findings

Student performance in classes and on skills-based evaluations have been appropriate. For meeting our program's goals, we emphasis a research-intensive environment with training in pedagogy and presentation skills.
- In the 2020-2021 academic year, we are continually modifying the program coursework realignment and the development of a more heavily research-intensive degree program.
- We are implementing new program requirements which were developed last year and encouraging more ESRM students to be involved in research, especially the first two-year students.
- We are attempting more purposeful pairings of senior and junior students in the research groups.
- We modified and finalized our comprehensive exam's format and procedure.
- All five faculty members are working on internal and external grants or grant proposals, with four of these grants supporting graduate assistant lines.
- For grant activities, our faculty members are collaborating not only within our college, but also across campus and on multi-institution projects.

Appendix

ESRM Student Publications (student name in bold)

1. **Myers, A.**, Ames Boykin, A., Cleveland, E., Schafer-Whitby, P., Holmes, R., Burnett, K., & **Ezike, N.** (In Press). Analysis of a state-wide Autism Waiver. *Journal of Autism and Developmental Disorders.* Impact Factor: 4.291, 5-year Impact Factor: 5.671
2. Ames Boykin, A., **Myers, A.**, & **Ezike, N.** (In Press). Bayesian model-data fit. In *International Encyclopedia of Education, 4th Edition.*
3. Ames Boykin, A., & **Myers, A.** (2021). Explaining variability in extreme response style traits: a covariate-adjusted IRTree. *Educational and Psychological Measurement,* 81(4), 756-780. DOI: 10.1177/0013164420969780. Impact Factor: 2.821, 5-year Impact Factor: 3.729
4. **Myers, A.**, Ames Boykin, A., Leventhal, B., & Holzman, M. (2020). An item response tree model for validating rubric scoring processes. *Applied Measurement in Education*, 33(4), 293-308. doi: 10.1080/08957347.2020.1789143. Impact Factor: 1.580, 5-year Impact Factor: 1.840
5. Liang, X., Kamata, A., & **Li, J.** (2020). Hierarchical Bayes Approach to Estimate the Treatment Effect for Randomized Control Trials. *Educational and Psychological Measurement.* 80(6), 1090-1114. Impact Factor: 2.821
6. **Ezike, N.**, & Ames Boykin, A. (2021). The diagnostic rating system: Rater behavior for an alternative performance assessment rating method. *Psychological Test and Assessment Modeling*, 63(3), 273-304.
7. **Myers, A**.[S], Ames Boykin, A., Cleveland, E., Schafer-Whitby, P., Holmes, R., Burnett, K., & **Ezike, N.**[S] (In Press). Analysis of a state-wide Autism Waiver. *Journal of Autism and Developmental Disorders.* Impact Factor: 4.291, 5-year Impact Factor: 5.671
8. Ames Boykin, A., **Myers, A.**, & **Ezike, N.** (In Press). Bayesian model-data fit. In *International Encyclopedia of Education, 4th Edition.*
9. Ames Boykin, A., Leventhal, B.C., & **Ezike, N.** (2020). Monte Carlo simulation in item response theory applications using SAS. *Measurement: Interdisciplinary Research and Perspectives.* 18:2, 55-74, DOI: [10.1080/15366367.2019.1689762](10.1080/15366367.2019.1689762). Impact Factor: 1.600

ESRM Student Manuscripts Under Review (student name in bold)

1. **Reimers, J.A.,** Turner, R.C. Crawford, B., L., Jozkowski, K. N., Lo, W.-J., & Keiffer, E. A. (submitted September 20, 2021). Demographic comparisons on data quality measures in web-based surveys. *Current Psychology*.
2. Cleveland, E., **Myers, A.**, Ames Boykin, A., Schafer-Whitby, P., Holmes, R., Burnett, K., & **Ezike, N**. (Under Review). Impact of the COVID-19 pandemic on Early Intensive Behavioral Intervention for children with Autism. *Research in Autism Spectrum Disorders.* Impact Factor: 2.881

ESRM Student Presentations (student name in bold)

1. **Asamoah, N.A.,** Turner, R. C., Lo, W., Crawford, B., Jozkowski, K., & McClelland, S. (2021, April). *Demographic Interactions of Differential Item Functioning in Attitudinal Scales*. Presented at the annual meeting of the American Educational Research Association, Virtual Meeting.

2. **Myers, A.**, Ames Boykin, A., Dobbs, P. D., & Primack, B. A. (2021). *Investigating topics and trends in hookah messaging on Twitter via probabilistic topic modeling*. Paper presented at the 148th American Public Health Association Annual Meeting, Denver, CO; November.

3. Dobbs, P.D., **Myers, A.**, Ames Boykin, A., Schisler, E., Colditz, J. B., & Primack, B. A. (2021). *A Mixed methods analysis of Tobacco 21 sentiment on Twitter*. Paper presented at the 148th American Public Health Association Annual Meeting, Denver, CO; November.

4. Ames Boykin, A., & **Myers, A.** (2021). *Validity evidence for item response trees*. Paper presented at the Annual Meeting of the National Council on Measurement in Education (NCME), Virtual paper presentation; June.

5. **Li, J.**, Lo, W., Liang, X., Cao, C., **Abbott, P.**, & **Ezike, N.** (2021, Aug). *Dealing with Missing Data in the Path Model with Mixed Continuous Variables and Categorical Outcome* [Poster Session]. Paper presented at the annual meeting of the American Psychological Association, Virtual.

6. **Li, J.**, & Liang, X. (2021, April). *The Model Size Effect in CFA with Ordinal Missing Data: A Comparison of Imputation Methods* [Paper Session]. American Educational Research Association Virtual Conference.

7. **Abbott, P.**, Liang, X., Cao, C., Lo, W., **Ezike, N.**, & **Li, J.** (2021, April). *Path Analysis with Mixed Categorical and Continuous Data: Maximum Likelihood, Least Squares and Bayesian Estimations* [Paper Session]. American Educational Research Association Virtual Conference.

8. **Ezike, N.**, Cao, C., Liang, X., Lo, W., **Abbott, P.**, & **Li, J.** (2021, April). *Path Analysis with Nonnormal Continuous Data: A Monte Carlo Simulation* [Paper Session]. American Educational Research Association Virtual Conference.

9. **Li, J.**, Lo, W., Liang, X., Cao, C., **Abbott, P.**, & **Ezike, N.** (2021, April). *Path Analysis with Categorical Outcome Data: A Closer Look of the Nonnormality Effects* [Roundtable Session]. American Educational Research Association Virtual Conference.

10. **Li, J.**, Liang, X., & Luo, Y. (2020, Jul). *Selecting Factorial Invariance Models with Variance Heterogeneity.* Poster presented at the International Meeting of the Psychometric Society, College Park, MD. (Virtual Conference)

11. **Myers, A.**, & Ames Boykin, A. (2020). *A noncompensatory and compensatory MIRT model for modeling response styles*. Virtual International Meeting of the Psychometric Society (IMPS), Paper presentation; July 17th – 20th, 2020.

12. **Ezike, N.,** Turner, R. C., Lo, W.-J., Crawford, B., & Jozkowski, K. N. (2021, July). *Comparing estimation procedures for omega reliability with non-normal ordinal data.* Poster presented at the International Meeting of the Psychometric Society, Virtual Meeting.

13. Ames Boykin, A., Leventhal, B. C., **Ezike, N.**, & Thompson, K. (2021, July 19-23). *Simulation studies in psychometrics: State of the practice* [Paper presentation]. International Meeting of the Psychometric Society (IMPS), Virtual, Originally: Baltimore, Maryland, USA.

14. **Ezike, N.**, Turner, R., Lo, W.-J., Crawford, B., Jozkowski, K, *Comparing estimation procedures for omega reliability with non-normal ordinal data*. Annual Conference of the International Meeting of the Psychometric Society. (July 2021). Poster presentation

15. **Ezike, N.**, Ames Boykin, A., & Leventhal, B. C. (2021). *Bayesian item response theory model selection: Conditional and marginal likelihoods*. Poster presented at the Annual Meeting of the National Council on Measurement in Education (NCME), Virtual poster presentation; June.

16. **Ezike, N.**, Cao, C., Liang, X., Lo, W.-J., Abbott, P.C., Li, J. Path Analysis with Nonnormal Continuous Data: A Monte Carlo Simulation. 2021 Annual Conference of the American Educational Research Association (AERA), Paper presentation.

17. **Ezike, N.**, Ames Boykin, A., & Leventhal, B. C. (2020). *Evaluation of the SAS IRT procedure: Parameter recovery and item fit*. Paper presented at the Annual Meeting of the National Council on Measurement in Education (NCME), Virtual poster presentation; September.

18. **Ezike, N.**, & Ames Boykin, A. (2020). *Evaluation of the SAS IRT and MCMC procedures for the Generalized Partial Credit Model: A Monte Carlo simulation study*. Virtual International Meeting of the Psychometric Society (IMPS), Poster presentation; July 17th – 20th, 2020.

19. Turner, R. C., Lo, W.J., **Reimers, J.,** Crawford, B.L., Jozkowski, K.N., & **Weese, J.** (2020, June 1 – September 1). *Impacts of Item Formatting on Self-Reported Support for Abortion Legality.* Poster presented at the Association of Psychological Science Virtual Poster Showcase *(APS international conference transitioned to virtual during 2020 coronavirus pandemic)*.

20. **Reimers, J.,** Turner, R. C., Jozkowski, K.N., Lo, W.J., Crawford, B.L., & **Weese, J.** (2020, June 1 – September 1). *Comparing Neutral Response Options and Location in Item Formatting for Social Surveys.* Poster presented at the Association of Psychological Science Virtual Poster Showcase *(APS international conference transitioned to virtual during 2020 coronavirus pandemic)*.

ESRM Student Fellowships:

Nnamdi Ezike	Doctoral Academy Fellowship (DAF),	2018-2022
Nana Amma Asamoah	Distinguished Doctoral Fellowship(DDF),	2020-2024
Merlin Kamgue	Southern Regional Education Board-State Doctoral Scholars Program (SREB)	2019-2024
Ejike Eden	Southern Regional Education Board-State Doctoral Scholars Program (SREB)	2021-2026
Ethen Harris	Doctoral Academy Fellowship (DAF),	2021-2024

ESRM Student Internship:

Nnamdi Ezike   The Educational Testing Service (ETS) Summer Internship 2021