

# Department of Mathematical Sciences

MATHEMATICS • ACTUARIAL SCIENCE • MATH ED • STATISTICS

2022 • Fall Semester • October

**\$1,891,360**

New Grant Funding  
in 2022!

- › **Bleiler-Baxter**
- › **Ding**
- › **Lischka**
- › **Martin**
- › **Xiong**

See page 2 for details

**\$1,886,018**

Continuing Funding

- › **Bleiler-Baxter**
- › **Ding**
- › **Hong**
- › **Leander**
- › **Lischka**
- › **Lovett**
- › **Manathunga**
- › **Lovett**
- › **Wu**
- › **Xiong**

See page 2 for details

**\$8,992,730**

Proposed in 2022

See page 3 for details



**PHDs  
SINCE 2021**

- › **Olumoyin**
- › **Ambahera**
- › **Tessema**
- › **Harris**
- › **Wanner**
- › **Reed**
- › **Quinn**
- › **Haupt**
- › **Biala**

See page 4 for details



**PAPERS  
IN 2022**

- › featuring over **20** MTSU Math faculty
- › **51** Presentations in 2022

See pages 5-8

## RECENT SEMINARS

- › "Alternating products of binomial coefficients," **Will Cox**, 10/21/22
- › "Mod 3 orientation and signed circuit cover," **Dong Ye**, 10/7/22
- › "Sieve methods in random graph theory," **J.C. Saunders**, 9/23/22

## UPCOMING EVENTS

Oct 31, 2022 Pizza and Treats for students in the math office

Nov 17-20, 2022 MTSU is hosting the **44th Psychology of Mathematics Education, North America chapter (PME-NA) Conference** in Nashville, TN. The theme is "Critical Dissonance and Resonant Harmony." Organizers are **Alyson Lischka**, **Jeremy Strayer**, and **Jennifer Lovett** from the MTSU math department.

May 13-14, 2023 MTSU is hosting the **32nd Cumberland Conference on Combinatorics, Graph Theory, and Computing**. The event will be held on MTSU campus and will feature an array of research talks, plus a talk geared toward a general audience. High School students interested in math are encouraged to attend! Organizers: **Dong Ye**, **Chris Stephens**, **J.C. Saunders** from the MTSU math department.

## NEW FUNDING IN 2022 (\$1,891,360)



- ▶ "MTSU – Upward Bound Proposal – Rutherford and Bedford Counties" (**Mary Martin**) for **\$1,437,340** U.S. Department of Education, 2022-2027
- ▶ "The Alliance of Students with Disabilities for Inclusion, Networking, and Transition Opportunities in STEM (TAPDINTO-STEM)" (**Sarak K. Bleiler-Baxter**, PI) for **\$109,000** Subaward funded through NSF INCLUDES.
- ▶ "Collaborative Research: Using Networked Improvement Communities to Scale Up Program Transformation for Secondary Mathematics Teacher Preparation (NIC-Transform Scale Up)" (**Alyson Lischka**, PI) for **\$275,000** Sub-award funded by NSF IUSE program; primary institutions: Auburn University and University of Nebraska-Lincoln.
- ▶ "NSF Conference grant: the 2023 Shanks Workshop on Advances in Mathematical and Theoretical Biology" (**Wandi Ding**, co-PI) for **\$27,000** Funded by National Science Foundation
- ▶ "Increasing Success and Retention of Female Students in Computer Science by Enhancing Two Key factors: Math Proficiency and Programming Skills" (**Lu Xiong**, PI) for **\$33,020** Submitted to Tennessee Board of Regents
- ▶ "State of TN Algebra I training and certification–summer 2022" (**Mary B. Martin**, PI) for **\$10,000** Tennessee Department of Education, 2022

## CONTINUING FUNDING IN 2022 (\$1,886,018)



- ▶ "The Alliance of Students with Disabilities for Inclusion, Networking, and Transition Opportunities in STEM (TAPDINTO-STEM)" (**Sarah K. Bleiler-Baxter**, PI) for **\$109,000** NSF, 2021-26
- ▶ "REU site: computational modeling and simulation in applied sciences" (**Wandi Ding**, PI; **Rachel N. Leander**, co-PI) for **\$241,470** National Science Foundation, 2018-2022
- ▶ "NLP and other AI Techniques for Applications in Actuarial Science" (**Lu Xiong**, PI; **Don Hong**, PI; **Vajira Asanka Manathunga**, PI; **Qiang Wu**, PI) for **\$15,000** Sponsored by Casualty Actuarial Society, 2021-22
- ▶ "MODULE(S2): collaborative research: mathematics of doing, understanding, learning, and educating for secondary schools" (**Jeremy Strayer**, PI; **Alyson Lischka**, co-PI) for **\$727,437** Sponsored by National Science Foundation, 2017-2023
- ▶ "Collaborative Research: Preparing to Teach Mathematics with Technology - Examining Student Practice (PTMT-ESP)" (**Jennifer Nickell Lovett**, PI) for **\$594,112** National Science Foundation, 2018-2023
- ▶ "Robust machine learning for non-gaussian data" (**Qiang Wu**, PI) for **\$42,000** Sponsored by Simons Foundation, 2020-25
- ▶ "Collaborative Research: Mathematical Foundation of Learning with Information-Theoretic Criteria from Non-Gaussian Data" (**Qiang Wu**, PI) for **\$114,999** National Science Foundation, 2021-24
- ▶ "Healthcare data integration based on HL7 technology" (**Lu Xiong**, PI) for **\$42,000** Sponsored by MITEM, 2021-23

GRANTS SUBMITTED IN 2022 **(\$8,992,730)**

- ▶ "MTSU - Upward Bound Proposal - Cannon, Dekalb & Warren" (**Mary B. Martin**) for **\$1,437,340** U.S. Department of Education, pending
- ▶ "MTSU - Upward Bound Proposal - Coffee, Grundy, & Van Buren" (**Mary B. Martin**) for **\$1,437,340** U.S. Department of Education, pending
- ▶ "Stimulating progress through Autonomy, Relatedness, and Competence (SPARC) in Undergraduate Mathematics Leaders" (**Sarah K. Bleiler-Baxter**, PI) for **\$150,000** Submitted to National Science Foundation IUSE Program.
- ▶ "Collaborative research: framework for integrating technology for equity" (**Rongjin Huang**, PI) for **\$500,000** Submitted to National Science Foundation DR12.
- ▶ "Collaborative research: Assessing Mathematical Sensemaking in STEM (AMaSS)" (**Jennifer Kaplan**, PI) for **\$231,670** Submitted to National Science Foundation, DUE.
- ▶ "Career: Statistical methods for modeling network data" (**Ramchandra Rimal**, PI) for **\$897,612** submitted to National Science Foundation
- ▶ "AutoReserve: a web-based tool for personal auto insurance loss reserving with classical and machine learning methods" (**Lu Xiong**, PI) for **\$15,000** Submitted to Casualty Actuarial Society
- ▶ "Collaborative research: Embedding, cycle covers and traversability" (**Dong Ye**, PI) for **\$159,602** Submitted to National Science Foundation
- ▶ "The 32nd Cumberland Conference on Combinatorics, Graph Theory and Computing" (**Dong Ye**, PI; **Chris Stephens**, co-PI; **J.C. Saunders**, co-PI) for **\$19,906** Submitted to National Science Foundation
- ▶ "Flows, circuit covers, and embeddings" (**Dong Ye**, PI) for **\$42,000** Submitted to National Science Foundation
- ▶ "Collaborative Research: Expanding a National Network for Automated Analysis of Constructed Response Assessments to Reveal Student Thinking in STEM" (**Jennifer Kaplan**, PI) for **\$1,700,000** Submitted to NSF
- ▶ "Managing post-acute care utilizing the most efficient approach" (**Yeqian Liu**, PI) for **\$70,000** Submitted to naviHealth, Inc.
- ▶ "Partners for Advancing the Learning of Statistics" (**Ginger Holmes Rowell**, co-PI; **Lisa Bloomer Green**, co-PI; **Sarah K. Bleiler-Baxter**, supporting; **Jeremy F. Strayer**, supporting; **Jennifer Nickell Lovett**, supporting) for **\$293,493** Submitted to NSF
- ▶ "Research in Interdisciplinary Science Education (RISE) for Inclusion" (**Jennifer Kaplan**, co-PI; **Sarah K. Bleiler-Baxter**, co-PI) for **\$1,239,324** Submitted to National Science Foundation
- ▶ "Agri-analytics Fellowship: an interdisciplinary approach to expanding career pathways for undergraduate students" (**Qiang Wu**, co-PI) for **\$749,443** Submitted to USDA
- ▶ "Faculty-led "UR-STEM Student Success Program" (**Wandi Ding**, co-PI) for **\$50,000** Submitted to NSF

## PHDs: ACADEMIC YEAR 2021-22

**Sujani Ambahera (2022)**

*Mathematical Analysis of ordinary differential equations (ODE) and fractional order differential equation (FODE) models of CD70 CAR T-cell therapy for gliomas*

**Zach Sinkala**, dissertation chair.

**Kayode Daniel Olumoyin (2022)**

*Data-driven deep neural networks for epidemiological and biochemical models*

**Abdul Khaliq**, dissertation chair.

**Amdeberhan Ayeligne Tessema (2022)**

*Students' Smooth Continuous Covariational Reasoning: A Comparative Case Study*

**Jeremy Strayer**, dissertation chair.

**Ashlin Powell Harris (2021)**

*Fractional calculus in population dynamics*

**Abdul Khaliq**, dissertation chair.

## PHDs: SPRING-SUMMER 2021

**Sister Cecilia Anne Wanner, O.P. (2021)**

*Narrowing the gap: the mediated field experience as a pedagogy to identify and build coherence between mathematics methods coursework and field experience*

**Alyson Lischka**, dissertation chair.

**Samuel D. Reed (2021)**

*Connecting logic and proof techniques: identifying learning in an introduction to proofs course*

**Sarah K. Bleiler-Baxter**, dissertation chair.

**Candice M. Quinn (2021)**

*Group testing and sense of belonging in reform-based calculus: equitable for all women?*

**Jennifer J. Kaplan**, dissertation chair.

**Melanie E. Haupt (2021)**

*Lesson study as a component of an induction program for novice teachers*

**Rongjin Huang**, dissertation chair.

**Toheeb Ayinde Biala (2021)**

*Numerical algorithms for fractional partial differential equations with time-dependent boundary conditions*

**Abdul Khaliq**, dissertation chair.



1. F. Agosto, D. Bond, A. Cohen, **W. Ding**, **R. Leander** and A. Royer, *Optimal Impulse Control of West-Nile Virus*, AIMS Mathematics 7 (2022) pp. 19597–19628.
2. Barak-Pelleg, Dina, Daniel Berend, and **J.C. Saunders**, *A model of random industrial SAT*, Theoretical Computer Science 910 (2022) pp. 91-11.
3. Barlow, A. T., Willingham, J. C., **Lischka, A. E.**, **Stephens, D. C.**, & Hartland, K. S., *Implementing lesson study: Challenges identified by emerging teacher leaders*, NCSM Journal of Mathematics Education Leadership 22 (2022) pp. 3-17.
4. Bhandari, Hum Nath, Binod Rimal, Nawa Raj Pokhrel, **Ramchandra Rimal**, and Keshab R. Dahal, *LSTM-SDM: An integrated framework of LSTM implementation for sequential data modeling*, Software Impacts (2022).
5. Bhandari, Hum Nath, Binod Rimal, Nawa Raj Pokhrel, **Ramchandra Rimal**, Keshab R. Dahal, and Rajendra KC Khatri, *Predicting stock market index using LSTM*, Machine Learning with Applications (2022).
6. T. A. Biala, Y.O. Afolabi, **A.Q.M. Khaliq**, *How efficient is contact tracing in mitigating the spread of COVID-19? A mathematical modeling approach*, Applied Mathematical Modelling 103 (2022) pp. 714-730.
7. L. Cai, L. Bao, L. Rose, J. Summers and **W. Ding**, *Malaria Modeling and Optimal Control Using Sterile Insect Technique and Insecticide-Treated Net*, Applicable Analysis 101 (2022) pp. 1715-1734.
8. Shanshan Chen, Junping Shi, Zhisheng Shuai, **Yixiang Wu**, *Two Novel proofs of Spectral Monotonicity of Perturbed Essentially Nonnegative Matrices with Applications in Population Dynamics*, SIAM Journal on Applied Mathematics 82 (2022) pp. 654-676.
9. Shanshan Chen, Junping Shi, Zhisheng Shuai, **Yixiang Wu**, *Global dynamics of a Lotka–Volterra competition patch model*, Nonlinearity 35 (2022) p. 817.
10. Shanshan Chen, Jie Liu, and **Yixiang Wu**, *Invasion analysis of a two-species Lotka–Volterra competition model in an advective patchy environment*, Studies in Applied Mathematics (2022).
11. Ziren Chen, Lin Feng, Harold A. Lay Jr., Khaled Furati, **Abdul Khaliq**, *SEIR model with unreported infected population and dynamic parameters for the spread of COVID-19*, Mathematics and Computers in Simulation 198 (2022) pp. 31-46.
12. **Wandi Ding**, *Malaria Modeling: an optimal control problem*, Research Outreach (2022).
13. M. Ellingham, W. Liu, and **X. Zha**, *Minimal quadrangulations of surfaces*, J. Combin. Theory Ser. B 157 (2022) pp. 235–262.
14. Fang, Y., Paine, L., & **Huang, R.**, *Continuity and change: Chinese lesson study redefined in the context of key competencies-based reform.*, International Journal for Lesson and Learning Studies 11 (2022) pp. 49-59. <http://IJLLS.org>.
15. Lin Feng, Ziren Chen, Harold A. Lay, Jr., Khaled Furati, and **Abdul Khaliq**, *Data driven time-varying SEIR-LSTM/GRU algorithms to track the spread of COVID-19*, Mathematical Bio Sciences and Engineering 19 (2022) pp. 8935–8962.
16. Florez, Rigoberto, and **J.C. Saunders**, *Irreducibility of generalized Fibonacci polynomials*, Integers 22 (2022) pp.1-16.



17. S. Hansun, F.P. Putri, **A.Q.M. Khaliq**, H. Hugeng, *On searching the best mode for forex forecasting: bidirectional long short-term memory default mode is not enough*, IAES International Journal of Artificial Intelligence 11 (2022) pp. 1596-1606.
18. Seng Hansun, Arya Wickson, and **Abdul Q.M. Khaliq**, *Multivariate cryptocurrency prediction: comparative analysis of three recurrent neural networks approaches*, Journal of Big Data 9 (2022) <http://big.data>.
19. Hare, Kevin, and **J.C. Saunders**, *Generalised Fibonacci sequences constructed from balanced words*, Journal of Number Theory 231 (2022) pp. 349-377.
20. Fangchao He, Yu Zeng, Lie Zheng, and **Qiang Wu**, *Optimality of Regularized Least Squares Ranking with Imperfect Kernels*, Information Sciences 589 (2022) pp. 564-579.
21. **Heath, A.L., Kirby, J.E., & Bleiler-Baxter, S.K.**, *Group reflection on mathematical creativity in proving*, Proceedings of the 24th annual meeting of Research in Undergraduate Mathematics Education (2022) 1054-1060.
22. Shouyou Huang, Yunlong Feng and **Qiang Wu**, *Fast Rates of Gaussian Empirical Gain Maximization with Heavy-Tailed Noise*, IEEE transactions on neural networks and learning systems (2022) , accepted.
23. Huang, X., Lee, M. Y., & **Huang, R.**, *Teachers' learning through addressing online mathematics teaching challenges: A case study in Shanghai during the COVID-19*, ZDM Mathematics Education 11 (2022) pp. 121-132. <http://zdm.mathed>.
24. Huang, X., **Huang, R.**, & Trouche, L., *Teachers' learning from addressing the challenges of online teaching in a time of pandemic: a case in Shanghai*, Educational Studies in Mathematics (2022) <http://educational.studies>.
25. Huang, X., **Huang, R.**, & Lai, M.Y., *Exploring teacher learning process in Chinese lesson study: a case of representing fractions on a number line*, International Journal for Lesson and Learning Studies 11 (2022) pp. 121-132 <http://IJLLS.org>.
26. **Kaplan, J.J.** & Roland, K.E., *Content and pedagogical knowledge for teaching confidence intervals in a post  $p < 0.05$  world*, In Short, P., Henson, H., & McConnell, J.R. (Eds.), *Age of inference: Cultivating a scientific mindset* (2022) Information Age Publishing, pp 317-346..
27. **Kaplan, J.J.** & Roland, K.E., *Confidence means what?!?!? Lexical ambiguity in the interpretation of confidence intervals*, Proceedings of the 11th International Conference on Teaching Statistics (ICOTS-11). International Association for Statistics Education (IASE) (2022) .
28. Kastberg, S. E., **Lischka, A. E.**, & Hillman, S. E., *Supporting discussion practice in mathematics methods: applications of whole-class scaffolding*, In A. E. Lischka, E. Dyer, R. S. Jones, J. Lovett, J. F. Strayer, & S. Drown (Eds.) *Proceedings of the forty-fourth annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (2022) .
29. Koklu, O. & **Kaplan, J.J.**, *Undergraduate students' use of primitive notions when reasoning about variability*, International Journal of Science and Mathematics Education (2022) <http://IJSME>.
30. **Lischka, A. E.**, Burns, B., Huang, W. Y., Lim, D., Parrish, C. W., & Smucker, K., *Using rehearsals to support prospective teachers in teaching with technology*, In A. E. Lischka, E. Dyer, R. S. Jones, J. Lovett, J. F. Strayer, & S. Drown (Eds.) *Proceedings of the forty-fourth annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (2022) .



31. **Lischka, A. E.**, Dyer, E., Jones, R. S., **Lovett, J.**, **Strayer, J. F.**, & Drown, S., *Proceedings of the Forty-Fourth Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*, Middle Tennessee State University (2022) .
32. **Liu, Y.**, Chen, J., *Sieve Semiparametric Estimation of Multiple Interval-censored Data with Application to a Phase III Metastatic Colorectal Cancer Clinical Trial*, *Annals of Biostatistics and Biometrics Applications* (2022) <http://annals.biostat>.
33. McCulloch, A. W., **Lovett, J. N.**, Dick, L. K., Sherman, M. F., Edgington, C., & Meagher, M., *Eliciting the coordination of preservice secondary mathematics teachers' definitions and concept images of function*, *International Journal of Mathematical Education in Science and Technology* 53 (2022) pp. 1387-1412 <http://IJMEST.org>.
34. McCulloch, A. W., **Lovett, J. N.**, Meagher, M., & Sherman, M. F., *Challenging preservice secondary mathematics teachers' conceptions of function*, *Mathematics Education Research Journal* 34 (2022) 343-368 <http://MERJ.org>.
35. Pokhrel, Nawa Raj, Keshab Raj Dahal, **Ramchandra Rimal**, Hum Nath Bhandari, Rajendra KC Khatri, Binod Rimal, and William Edward Hahn, *Predicting nepse index price using deep learning models*, *Machine Learning with Applications* 9 (2022) .
36. Roland, K.E. & **Kaplan, J. J.**, *Brody and Jamie's colleague: The difference in confidence interval estimators and estimates*, *Proceedings of the 11th International Conference on Teaching Statistics (ICOTS-11)*. International Association for Statistics Education (IASE) (2022) .
37. Roland, K.E. & **Kaplan, J. J.**, *Using Concept Images as a Framework for the Concept of Confidence Intervals*, *Proceedings of the 24th Annual Conference on Research on Undergraduate Mathematics Education* (2022) .
38. Roland, K.E. & **Kaplan, J. J.**, *The Implications of the Difference Between Estimators and Estimates in the Meaning of Confidence Intervals: Brody and the Jamie's Colleague Task*, *Proceedings of the 24th Annual Conference on Research on Undergraduate Mathematics Education* (2022) .
39. Ibrahim O. Sarumi, Khaled M. Furati, Kassem Mustapha, **Abdul Q. M. Khaliq**, *Efficient high-order exponential time differencing methods for nonlinear fractional differential models*, *Numerical Algorithms* (2022) <http://numerical>.
40. **Saunders, J.C.**, *The Euler totient function on Lucas sequences*, *International Journal of Number Theory* (2022) <http://IJNT>.
41. **Donglin Wang**, **Don Hong**, and **Qiang Wu**, *Prediction of Loan Rate for Mortgage Data: Deep Learning Versus Robust Regression*, *Computational Economics* (2022) <http://springer.com>.
42. **Donglin Wang**, **Don Hong**, and **Qiang Wu**, *Attention Deficit Hyperactivity Disorder Classification Based on Deep Learning*, *IEEE/ACM Transactions on Computational Biology and Bioinformatics* (2022) <http://IEEE.ACM>.
43. **Donglin Wang**, **Qiang Wu** and **Don Hong**, *Extracting Default Mode Network Based on Graph Neural Network for Resting State fMRI Study*, *Frontiers in Neuroimaging* (2022) .
44. **Donglin Wang**, Rencheng Sun, **Lisa Green**, *Prediction intervals of loan rate for mortgage data based on bootstrapping technique: A comparative study*, *Mathematical Foundations of Computing* (2022) <http://AIMS.org>.

## PAPERS PUBLISHED IN 2022



45. **Donglin Wang** and **Qiang Wu**, *On the Selection of Hyperparameters in Convolutional Neural Networks*, 2021 International Conference on Computational Science and Computational Intelligence (CSCI) 2021 (2022) pp. 1728-1731, Published by IEEE Xplore: 22 June 2022 <http://IEEE.Xplore>.
46. Wei, G., & **Huang, R.**, *Research-practice partnerships in lesson and learning studies: A review from Asian experiences*, Asia Pacific Journal of Education (2022) <http://asia.pacific>.
47. **Xiong, L.** & Duncan-Williams, S., *Generalized Linear Model for Predicting the Credit Card Default Payment Risk*, Advances in Science, Technology and Engineering Systems Journal 7 (2022) pp., 51-61.
48. Xu, Y., **Liu, Y.**, *Bias Adjustment Methods for Analysis of a Non-randomized Controlled Trials of Right Heart Catheterization for Patients in ICU*, Biomedical Statistics and Informatics 6 (2022) pp. 32-41.
49. Y. Yang and **X. Zha**, *Partial-dual Euler genus distributions for bouquets with small Euler genus*, Ars Math Comtemp. 22 (2022) <http://ars.math.contemp>.
50. Zhao, W., **Huang, R.**, Cao, Y., Ning, R., & Zhang, X., *A teacher's learning of transforming curriculum reform ideas into classroom practices in lesson study in China*, International Journal for Lesson and Learning Studies 11 (2022) 133-146 <http://IJLLS.org>.