

**Michael Sze-hon Rugh**  
**PhD Curriculum and Instruction**

Postdoctoral Researcher in the LIVE Lab at Texas A&M University

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### **Research Interests**

Game-based Learning, Technology in Education, Project-Based Learning, Concept Mapping, K–16 Education, STEM Education, Mathematics Education, Interdisciplinary Communication

### **Educational Background**

Ph.D. Curriculum & Instruction, Texas A&M University, December 2021

M.S. Mathematics (Teaching Track), Texas A&M University, 2015

B.S. Mathematics, Texas A&M University, 2013

### **Employment History**

#### *Employment*

Postdoctoral Researcher, Texas A&M University, August 2022–Present

Adjunct Professor, Texas A&M University, January 2022–July 2022

GA—Teaching, Texas A&M University, August 2018–December 2021

GA—Research, Texas A&M University, August 2017–December 2021

Substitute Teacher, College Station ISD, College Station, TX, August 2016–May 2017

Research Assistant, Texas A&M University, January 2016–June 2016

SAT Instructor, C2 Education, College Station, TX, August 2015–July 2017

Grader, Department of Mathematics, Texas A&M University, July 2013–May 2014

#### *Consulting*

Summer Camp Instructor, Aggie STEM, Texas A&M University, June 2017–July 2022

### **Honors, Awards, and Listings**

College of Education and Human Development Distinguished Honor Graduate, Fall 2021

*Journal of Engineering Education* Mentored Reviewer honorarium recipient, Spring 2021

Special thank you from the Research Council on Mathematics Learning, Spring 2021

From the conference program: “A special thank you to Michael Rugh and Julia Calabrese for their dedication and willingness to help construct both a traditional and virtual conference program this year”

Graduate Merit Fellowship, Texas A&M University, August 2017–May 2020

Invited and gave a seminar at the University of Swansea, Wales, June 2019

## Publications

- Rugh, M. S.** & Capraro, R. M. (2022). *Breaking barriers for STEM learning: A meta-analysis of three years of findings on DIME maps*. Manuscript submitted for publication.
- Rugh, M. S.**, Beyette, D. J., Barroso, L. R., Capraro, M. M., Capraro, R. M. (2022). *Analysis of user interactions in automatically generated concept maps for education*. Manuscript submitted for publication.
- Rugh, M. S.**, Capraro, M. M., Capraro, R. M. (2022). *Improving self-efficacy with automatically generated interactive concept maps: DIME Maps*. Manuscript submitted for publication.
- Rugh, M. S.**, Chang, J. L., Capraro, R. M., & Capraro, M. M. (2021). Speaking STEMglish. In R. M. Capraro, M. M. Capraro, J. Young, & L. R. Barroso (Eds.), *STEM project-based learning: Integrated engineering for a new era* (pp. 253–270). Aggie STEM.
- Capraro, R. M., Capraro, M. M., Leonard, J., Lewis, C., Grant, M., James, M., Mosqueda, E., Young, J., Bicer, A., Hubert, T., Moldavan, A. M., Cannon, S. O., Kwon, H., **Rugh, M. S.**, & Chang, J. (2021). The end or beginning? Either way, the credits are not rolling yet! *Journal of Urban Mathematics Education*, 14(1), 1–11. <https://doi.org/10.21423/jume-v14i1a436>
- Rugh, M. S.**, Beyette, D. J., Capraro, M. M., & Capraro, R. M. (2021). Using DIME maps and STEM project-based learning to teach physics [Ahead-of-print]. *Interactive Technology and Smart Education*. <https://doi.org/10.1108/ITSE-07-2020-0109> (SJR = 0.451)
- Kwok, M., Vela, K. N., **Rugh, M. S.**, Lincoln, Y. S., Capraro, R. M., & Capraro, M. M. (2020). STEM words and their multiple meanings: The intricacies of asking a clarifying question. *Communication Education*, 69(2), 176–198. <https://doi.org/10.1080/03634523.2020.1723803> (SJR = 0.758)
- Rugh, M. S.**, Beyette, D. J., Capraro, M. M., & Capraro, R. M. (2020). Using computer-generated concept maps in the engineering design process to improve physics learning. *Proceedings of the 2020 American Society for Engineering Education Annual Conference and Exposition*. <https://doi.org/10.18260/1-2--35457>
- Bicer, A., Lee, Y., Capraro, R. M., Capraro, M. M., Barroso, L. R., **Rugh, M. S.** (2019). Examining the effects of STEM PBL on students' divergent thinking attitudes related to creative problem solving. *Proceedings of the 49th Annual IEEE Frontiers in Education (FIE) Conference*. <https://doi.org/10.1109/FIE43999.2019.9028431> (SJR = 0.322)
- Lee, Y., Bicer, A., Kwon, H., **Rugh, M. S.**, Capraro, R. M., Capraro, M. M., Barroso, L. (2019). Post-secondary ready: Does the STEM curriculum matter? *Proceedings of the 49th Annual IEEE Frontiers in Education (FIE) Conference*. <https://doi.org/10.1109/FIE43999.2019.9028434> (SJR = 0.322)
- Rugh, M. S.**, Williams, A. M., Lee, Y., Capraro, R. M. (2019). Comparing STEM Schools on Algebra Performance. *Proceedings of the 49th Annual IEEE Frontiers in Education (FIE) Conference*. <https://doi.org/10.1109/FIE43999.2019.9028395> (SJR = 0.322)
- Beyette, D., **Rugh, M. S.**, Lin, J., Wang, X., Wang, Z., Liu, J.-C., Capraro, R. M. (2019). DIME: A dynamic interactive mathematical expression tool for STEM education.

*Proceedings of the 2019 American Society for Engineering Education Annual Conference and Exposition.* <https://doi.org/10.18260/1-2--32664>

Lee, Y., Bicer, A., Capraro, R. M., Capraro, M. M., Barroso, L. R., Kwon, H., & **Rugh, M. S.** (2018). Comparing mathematics and science achievement of students from schools with PLTW versus schools without PLTW. *Proceedings of the 48th Annual IEEE Frontiers in Education (FIE) Conference.* (SJR = 0.322)

**Rugh, M. S.**, Calabrese, J. E., Madson, M. A., Capraro, R. M., Barroso, L. R., Capraro, M. M., & Bicer, A. (2018). STEM language can be the stem of the problem. *Proceedings of the 48th Annual IEEE Frontiers in Education (FIE) Conference.* <http://doi.org/10.1109/FIE.2018.8659231> (SJR = 0.322)

Wang, K., Wang, X. Q., Li, Y., & **Rugh, M. S.** (2018). A framework for integrating the history of mathematics into teaching in Shanghai. *Educational Studies in Mathematics*, 98, 135–155. <https://doi.org/10.1007/s10649-018-9811-x> (SJR = 1.574)

## Presentations

Zhou, F., Graves-Boswell, T., **Rugh, M. S.**, Clough, J. M., Hudock, M. M. (2023, April 13–16). *The impact of COVID-19 on graduate students' financial security* [Conference presentation]. Proposal submitted to the 2023 American Educational Research Association Annual Meeting, Chicago, IL, United States. (National/International)

**Rugh, M. S.**, Miller, D., & Thomas, A. (2023, March 2–4). *Game-based learning's effects on retention and success in calculus* [Conference presentation]. Proposal submitted to the 50th Annual Conference of the Research Council on Mathematics Learning (RCML), Las Vegas, NV. (National/International)

**Rugh, M. S.**, & Thomas, A. (2022, September 27–30). Using a calculus video game to visualize and learn foundational knowledge and skills [Conference presentation]. The 25th International Conference on Interactive Collaborative Learning (ICL), Vienna, Austria. (National/International)

**Rugh, M. S.**, & Beyette, D. J. (2022, September 26–28). *Introducing DIME maps: Automatically generated dynamic and interactive concept maps for STEM education* [Conference presentation]. The 9th International Concept Mapping Conference, Valletta, Malta. (National/International)

**Rugh, M. S.**, Thomas, A., Groves, S. (2022, September 26–28). *Using dual concept maps to compare two systems of knowledge* [Conference presentation]. The Ninth International Concept Mapping Conference, Valletta, Malta. (National/International)

**Rugh, M. S.** (2022, TBD). *The effect of project-based learning on mathematics achievement: A meta-analysis* [Paper presentation]. Paper submitted for presentation at the 2022 National Council of Teachers of Mathematics (NCTM) Research Conference, Virtual/Online. (National/International)

**Rugh, M. S.**, Beyette, D. J., Kwon, H., Barroso, L. R., Capraro, M. M., & Capraro, R. M. (2022, April 22–25). *Improving self-efficacy with computer-generated concept maps: Analysis of*

- user interactions* [Paper presentation]. The 2022 American Educational Research Association Annual Meeting, San Diego, CA. (National/International)
- Rugh, M. S.,** Young, J. R., Capraro, M. M., & Capraro, R. M. (2022, March 3–5). *Meta-analyses on few studies: Techniques, benefits, drawbacks, and examples* [Paper presentation]. The 49th Annual Conference of the Research Council on Mathematics Learning (RCML), Grapevine, TX. (National/International)
- Rugh, M. S.,** Beyette, D., J., & Capraro, R. M. (2022, February 23–25). *Cognitive impact of using dynamic, interactive, and automatically generated concept maps: A meta-analysis* [Paper presentation]. The 45th Annual Southwest Educational Research Association (SERA) Conference, New Orleans, LA. (Regional)
- Thomas, A., Young, J., **Rugh, M.,** & Ramadan, H. (2021, October 28–30). *Pushing the limits of game-based instruction in calculus: Assessing the effects of Variant Limits* [Conference presentation]. 2021 School Science and Mathematics Association (SSMA) Convention, Virtual/Online. (National/International)
- Rugh, M. S.** (2021, April 9–12). *How can advancing technology improve learning? Introducing DIME maps: Automatically generated concept maps* [Poster presentation]. The 2021 Virtual American Educational Research Association (AERA) Annual Meeting, Virtual/Online. (National/International)
- Rugh, M. S.** (2021, March 29–April 2). *Automatically generated concept maps for teaching physics* [Paper presentation]. TAMU Student Research Week 2021, Virtual/Online. (Local)
- Rugh, M. S.,** Capraro, M. M., & Capraro, R. M. (2021, March 23–26). *Teaching with STEM project-based learning in a virtual summer camp* [Conference presentation]. The American Society for Engineering Education Gulf-Southwest (ASEE-GSW) Annual Conference 2021, Virtual/Online. (Regional)
- Rugh, M. S.,** & Thomas, A. (2021, February 26–27). *Variant: Game-based learning for calculus* [Paper presentation]. 48th Annual Conference of the Research Council on Mathematics Learning (RCML), Virtual/Online. (National/International)
- Aubin, B., Raymond, C., **Rugh, M.,** & Greer, M. (2021, February 3–5). *Deep metric learning to evaluate student performance on standardized tests* [Paper presentation]. 44th Annual Southwest Educational Research Association (SERA) Conference, Virtual/Online. <http://hdl.handle.net/10950/2950> (Regional)
- Rugh, M.,** & Thomas, A. (2021, February 3–5). *Effects of a video game on failure rates in an engineering calculus class* [Paper presentation]. 44th Annual Southwest Educational Research Association (SERA) Conference, Virtual/Online. <http://hdl.handle.net/10950/2922> (Regional)
- Young, J., **Rugh, M.,** & Young, J. (2021, February 3–5). *The impact of STEM research in urban education: A citation analysis* [Paper presentation]. 44th Annual Southwest Educational Research Association (SERA) Conference, Virtual/Online. <http://hdl.handle.net/10950/2981> (Regional)

- Rugh, M. S.** (2020, November 5–7). *Automatically generated dynamic and interactive concept maps* [Conference presentation]. 2020 School Science and Mathematics Association (SSMA) Convention, Virtual/Online. (National/International)
- McIntush, K. E., & **Rugh, M. S.** (2020, October 2–3). *A little piece of Utopia* [Paper presentation]. Organization of Educational Historians Annual Meeting, Virtual/Online. (National/International)
- Rugh, M. S.**, Beyette, D. J., Capraro, M. M., & Capraro, R. M. (2020, June 22–26). *Using computer-generated concept maps in the engineering design process to improve physics learning* [Paper presentation]. 2020 American Society for Engineering Education Annual Conference and Exposition, Virtual/Online. <https://doi.org/10.18260/1-2--35457> (National/International)
- Williams, A. M., Bevan, D., Calabrese, J. E., **Rugh, M. S.**, & Capraro, R. M. (2020, April). *Geometry manipulatives can increase achievement for all types of learners* [Paper presentation]. Accepted for presentation at the 2020 American Educational Research Association (AERA) Annual Meeting, San Francisco, CA (Canceled due to COVID-19). (National/International)
- Rugh, M. S.**, Beyette, D. J., Young, J. R., Barroso, L. R., & Capraro, R. M. (2020, March 5–7). *Advances in machine learning make any textbook interactive* [Paper presentation]. The 47th Annual Conference of the Research Council on Mathematics Learning (RCML), Las Vegas, NV, USA. (National/International)
- Rugh, M. S.**, Fidai, A., & Jiang, L. (2020, February 12–14). *Effectiveness of T-STEM schools on standardized mathematics scores* [Paper presentation]. 43rd Annual Southwest Educational Research Association (SERA) Conference, Arlington, TX. (Regional)
- Rugh, M. S.**, Beyette, D. J. (2020, January 11–12). *Using advances in machine learning to make any textbook interactive* [Conference presentation]. 2020 STEM 4 Innovation Conference, College Station, TX.
- Bicer, A., Lee, Y., Capraro, R. M., Capraro, M. M., Barroso, L. R., **Rugh, M. S.** (2019, October 16–19). *Examining the effects of STEM PBL on students' divergent thinking attitudes related to creative problem solving* [Paper presentation]. 49th Annual Frontiers in Education (FIE) Conference, Cincinnati, OH. (National/International)
- Lee, Y., Bicer, A., Kwon, H., **Rugh, M. S.**, Capraro, R. M., Capraro, M. M., Barroso, L. (2019, October 16–19). *Post-secondary ready: Does the STEM curriculum matter?* [Paper presentation]. 49th Annual Frontiers in Education (FIE) Conference, Cincinnati, OH. (National/International)
- Rugh, M. S.**, Williams, A. M., Lee, Y., Capraro, R. M. (2019, October 16–19). *Comparing STEM Schools on Algebra Performance* [Paper presentation]. 49th Annual Frontiers in Education (FIE) Conference, Cincinnati, OH. (National/International)
- Beyette, D., **Rugh, M. S.**, Lin, J., Wang, X., Wang, Z., Liu, J.-C., Capraro, R. M. (2019, June 15–19). *DIME: A dynamic interactive mathematical expression tool for STEM education*

- [Paper presentation]. 2020 American Society for Engineering Education Annual Conference and Exposition, Tampa, FL. (National/International)
- Wang, K., Li, Y., & **Rugh, M.** (2019, April 5–9). *Analysis of mathematics textbooks from a curriculum coherent perspective: The case of equivalent fractions* [Paper presentation]. 2019 American Educational Research Association Annual Meeting, Toronto, Canada. (National/International)
- Rugh, M. S.**, Wang, X., Lin, J., Beyette, D., Barroso, L. R., Capraro, M. M., & Capraro, R. M. (2019, April 3–6). *Computer generated dynamic graphic organizer's effect on learning outcomes* [Paper presentation]. National Council of Teachers of Mathematics (NCTM) Research Conference, San Diego, CA. (National/International)
- Capraro, M. M., Capraro, R. M., Bevan, D., & **Rugh, M.** (2019, February 21). *STEM Leadership Mentorship and Coaching* [Conference presentation]. 2019 STEM 4 Innovation Conference, College Station, TX.
- Rugh, M. S.**, Capraro, R. M., & Capraro, M. M. (2019, February 6–8). *Factors that influence deductive reasoning* [Paper presentation]. 42nd Annual Southwest Educational Research Association (SERA) Conference, San Antonio, TX. (Regional)
- Lee, Y., Bicer, A., Capraro, R. M., Capraro, M. M., Barroso, L. R., Kwon, H., & **Rugh, M. S.** (2018, October 3–6). *Comparing mathematics and science achievement of students from schools with PLTW versus schools without PLTW* [Paper presentation]. 48th Annual Frontiers in Education (FIE) Conference, San Jose, CA. (National/International)
- Rugh, M. S.**, Calabrese, J. E., Madson, M. A., Capraro, R. M., Barroso, L. R., Capraro, M. M., & Bicer, A. (2018, October 3–6). *STEM language can be the stem of the problem* [Paper presentation]. 48th Annual Frontiers in Education (FIE) Conference, San Jose, CA. <http://doi.org/10.1109/FIE.2018.8659231> (National/International)
- Rugh, M. S.**, & Capraro, M. M. (2018, February 14–16). *The spin on fidget spinners: Using toys to teach physics* [Paper presentation]. 41st Annual Southwest Educational Research Association (SERA) Conference, New Orleans, LA. (Regional)

### Invited Seminars

- Rugh, M. S.** (2019, June 5). *The DIME map: A dynamic interactive mathematical expressions map* [Invited seminar]. University of Swansea, Swansea, Wales.

### University Courses Taught

- EDCI 620—STEM Teaching and Learning, Summer 2022 (Online)
- EDCI 726—History and Trends in STEM Education, TAMU, Spring 2022 (Online)
- MASC 351—Problem Solving in Mathematics, TAMU, Spring 2022
- MASC 450—Integrated Mathematics and Science, TAMU, Fall 2021
- MASC 351—Problem Solving in Mathematics, TAMU, Spring 2020 (F2F & Online)
- TEFB 412—Elementary Mathematics Methods, TAMU, Fall 2019
- MASC 450—Integrated Mathematics and Science, TAMU, Fall 2018

## Funding

Honorarium. Role: Recipient. *Journal of Engineering Education* Mentored Reviewer Program; 1/01/2021–5/01/2021; \$1000.

Grant Proposal Submitted: Mapping on a DIME. Role: Graduate Research Assistant; PI: Capraro, R. M.; Co-PIs: Liu, J.-C., Erukhimova, T., & Capraro, M. M. Submitted to the National Science Foundation; 6/1/2021–5/30/2023; \$300,000.

College Travel Grants. Role: Recipient. College of Education and Human Development at Texas A&M University; 2018–2021; \$850.

Department Travel Grants. Role: Recipient. Department of Teaching, Learning and Culture at Texas A&M University; 2018–2021; \$1,750.

Aggie STEM Travel Grants. Role: Recipient. Aggie STEM at Texas A&M University; 2018–2021.

Graduate Merit Fellowship. Role: Recipient. Texas A&M University / Association of Former Students; 8/1/2017–7/31/2020; \$87,000.

Supporting Mathematics in STEM Education (SMSE). Role: Graduate Research Assistant; PI: Nite, S. B.; Co-PIs: Allen, G. D., Capraro, R. M., Barroso, L. R., & Capraro, M. M. Texas Higher Education Coordinating Board; 2/01/2016–2/28/2018; \$780,095.

## Service

Taught weekly Spanish GED Math class for adults, Spring 2022

Hosted critical race theory student discussion with Dr. Gloria Ladson-Billings, Spring 2021

Instructor and coordinator for TEAMS competition, TAMU, 2018–Present

Led annual design/build challenges for Brownsville students, TAMU, 2018–Present

Helped organize and run Aggie STEM's STEM Family Nights

Franklin Elementary, Fall 2018 & 2019

Oakwood Intermediate School, October 2018 & 2019

Helped run professional development for teachers, University of Swansea, Summer 2019

Manned Aggie STEM booth at Black Kids Count 2019 Conference, Cypress, TX, Spring 2019

Assisted at Texas A&M University booth at the ASEE Conference, Tampa, FL, Summer 2019

Manned annual Aggie STEM booth at STEM 4 Innovation Conference, TAMU, 2019–Present

## Professional, Community, and Civic Activities

Associate Editor, *Journal of Urban Mathematics Education*, March 2022–Present

Awards and Endowment Committee Member, School Science and Mathematics Association, 2021–2024

Session Chair, American Educational Research Association, April 2021

Reviewer, *Journal of Engineering Education*, January 2021–Present

Assistant Editor, *Journal of Urban Mathematics Education*, June 2019–March 2022

Assistant Program Chair, RCML Conference, August 2020–February 2021

Member, School Science and Mathematics Association, 2020–Present

Revised 9/5/2022

Secretary, Graduate Student Advisory Council, 2020–Present  
Member, Graduate Student Advisory Council, 2019–Present  
Vice President, TLAC Graduate Student Association, May 2019–Present  
TAMU Graduate Representative, Southwest Educational Research Association, 2019–2020  
Manuscript Reviewer, American Society for Engineering Education, 2019–Present  
Member, American Educational Research Association, 2019–Present  
Member, National Council of Teachers of Mathematics, 2019–Present  
Social Coordinator, TLAC Graduate Student Association, May 2018–August 2019  
Member, Kappa Delta Pi, May 2018–Present  
Manuscript Reviewer, IEEE's Frontiers in Education, 2018–Present  
Created Literacy-Infused Science Using Technology Opportunities (LISTO) Video, 2017  
Proposal Reviewer, Southwest Educational Research Association, 2017–Present  
Various service callings, The Church of Jesus Christ of LDS, July 2016–Present