

## ELISE N. LOCKWOOD

Oregon State University, Department of Mathematics

Mailing address: Kidder Hall 292A, Corvallis, OR, 97331  
Email: Elise.Lockwood@oregonstate.edu

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### PROFESSIONAL POSITIONS:

**Professor**, Department of Mathematics, Oregon State University. Corvallis, OR. September 2023 – present.

**Rotating Program Officer**, Division of Undergraduate Education, National Science Foundation. Alexandria, VA. August 2021 – August 2024. Detail to Office of International Science and Engineering. April – August 2023.

**Associate Professor**, Department of Mathematics, Oregon State University. Corvallis, OR. September 2018 – August 2023.

**Affiliated Associate Professor**, Department of Physics, University of Oslo. Oslo, Norway. April 2020 – August 2021, August 2024 – present.

**Assistant Professor**, Department of Mathematics, Oregon State University. Corvallis, OR. September 2013 – August 2018.

### EDUCATION:

**Postdoctoral Fellow**, University of Wisconsin, Madison, WI. August 2011 – August 2013. Funded through the IES Postdoctoral Training Program in Mathematical Thinking, Learning, and Instruction. Advisers: Dr. Eric Knuth and Dr. Amy Ellis

**Ph.D. in Mathematics Education**, Portland State University, Portland, OR. July 2011. Dissertation: *Student Approaches to Combinatorial Enumeration: The Role of Set-Oriented Thinking*. Adviser: Dr. Sean Larsen

**M.S.T. in Mathematics**, Portland State University, Portland, OR. May 2006. Project: *The Combinatorics and Pedagogy of Rook Polynomials*. Adviser: Dr. John S. Caughman

**B.S. in Mathematics**, Wheaton College, Wheaton, IL. May 2004. Graduated Magna Cum Laude.

### RESEARCH:

My primary research interest concerns the teaching and learning of combinatorics at the undergraduate level. My research has focused on students' combinatorial thinking, particularly the extent to which students draw upon sets of outcomes as they solve counting problems. My additional research on combinatorics education has leveraged the notion of actor-oriented transfer to identify student-generated connections among counting problems, investigated student reasoning about the

multiplication principle, and examined the effects of listing on students' combinatorial activity. My work has been funded by the National Science Foundation and Google. My most current work involves examining ways in which having students engage in computational activity can help them solve counting problems more successfully.

## AWARDS & HONORS:

**Fulbright Specialist.** Awards travel to scholars to facilitate international collaboration. Travel granted to Maynooth, Ireland in for a project entitled *Enhancing the task design skills of mathematics education researchers and lecturers*. Summer 2025.

**Presidential Early Career Award for Scientists and Engineers (PECASE) Award.** Presidential award bestowed by the U.S. Government for outstanding scientists and engineers. Spring 2025.

**Promising Scholar Award.** Annual University-wide award at Oregon State University that recognizes a junior faculty member based on outstanding scholarly merit. Fall 2019.

**Fulbright U.S. Scholar Program Award Winner.** Awards travel to scholars to facilitate international collaboration. Travel granted to Oslo, Norway for a project entitled *Investigating the Role of Computing in Undergraduate Students' Learning of Mathematical Concepts*. Fall 2019.

**Dean's College of Science Early Career Impact Award Winner.** Recognizes exceptional achievement in research and education by an early-career tenure-stream faculty member in the College of Science at Oregon State University. Fall 2018.

**John and Annie Selden Prize Winner.** Mathematical Association of America's prize for Research in Undergraduate Mathematics Education, honoring a researcher who has established a significant record of published research in undergraduate mathematics education and who has been in the field at most ten years. Fall 2018.

**NSF CAREER Grant Award Winner.** CAREER: Developing Undergraduate Combinatorial Curriculum in Computational Settings. 2017 – 2022.

**Best Paper Award Winner.** Lockwood, E. & Reed, Z. Students' meanings of a (potentially) powerful tool for generalizing in combinatorics. 19<sup>th</sup> Annual Conference for the SIGMAA on Research in Undergraduate Mathematics Education. Fall 2016.

**Meritorious Citation Winner.** Lockwood, E. & Schaub, B. 19<sup>th</sup> Reinventing the Multiplication Principle. Annual Conference for the SIGMAA on Research in Undergraduate Mathematics Education. Fall 2016.

**Service, Teaching, and Research (STaR) Fellow.** National Science Foundation funded mentorship project for early career mathematics education faculty. Service, Teaching, and Research. 2015 – 2016.

**Best Paper Award Winner.** Lockwood, E. A model of students' combinatorial thinking: The role of sets of outcomes. 15<sup>th</sup> Annual Conference for the SIGMAA on Research in Undergraduate Mathematics Education. Fall 2012.

## SCHOLARSHIP & CREATIVE ACTIVITY

### Refereed journal articles

- J1. **Lockwood, E.** (2011). Student connections among counting problems: An exploration using actor-oriented transfer. *Educational Studies in Mathematics*, 78(3), 307-322. doi:10.1007/s10649-011-9320-7
- J2. **Lockwood, E.** (2013). A model of students' combinatorial thinking. *Journal of Mathematical Behavior*, 32, 251-265. doi:10.1016/j.jmathb.2013.02.008
- J3. **Lockwood, E.**, Johnson, E. M., & Larsen, S. (2013). Developing instructor support materials for an inquiry-oriented curriculum. *Journal of Mathematical Behavior*, 32(4), 776-790. doi:10.1016/j.jmathb.2013.02.007
- J4. Larsen, S. & **Lockwood, E.** (2013). A local instructional theory for the guided reinvention of the quotient group concept. *Journal of Mathematical Behavior*, 32(4), 726-742. doi:10.1016/j.jmathb.2013.02.010.
- J5. **Lockwood, E.** (2014a). A set-oriented perspective on solving counting problems. *For the Learning of Mathematics*, 34(2), 31-37.
- J6. **Lockwood, E.** (2014b). Both answers make sense! Using the set of outcomes to reconcile differing answers in counting problems. *Mathematics Teacher*, 108(4), 296-301.
- J7. Weber, E., & **Lockwood, E.** (2014). The duality between ways of thinking and ways of understanding: implications for learning trajectories in mathematics education. *Journal of Mathematical Behavior*, 35, 44-57. doi:10.1016/j.jmathb.2014.05.002.
- J8. **Lockwood, E.** & Knuth, E. (2014). A call for postdoctoral positions in mathematics education. *Journal for Research in Mathematics Education*, 45(5), 542-549.
- J9. **Lockwood, E.** & Weber, E. (2015). Connecting research to teaching: Ways of thinking and mathematical practices. *Mathematics Teacher*, 108(6), 461-465.
- J10. **Lockwood, E.**, Swinyard, C. A., & Caughman, J. S. (2015). Patterns, sets of outcomes, and combinatorial justification: Two students' reinvention of counting formulas. *International Journal of Research in Undergraduate Mathematics Education*, 1(1), 27-62. doi:10.1007/s40753-015-0001-2.
- J11. **Lockwood, E.** (2015). The strategy of solving smaller, simpler problems in the context of combinatorial enumeration. *International Journal of Research in Undergraduate Mathematics Education*, 1(3), 339-362. doi:10.1007/s40753-015-0016-8.
- J12. **Lockwood, E.** & Caughman, J. S. (2016). Set partitions and the multiplication principle. *Problems, Resources, and Issues in Mathematics Undergraduate Studies*, 26(2), 143-157. doi:10.1080/10511970.2015.1072118.
- J13. **Lockwood, E.**, & Gibson, B. (2016). Combinatorial tasks and outcome listing: Examining productive listing among undergraduate students. *Educational Studies in Mathematics*, 91(2), 247-270. doi:10.1007/s10649-015-9664-5.
- J14. **Lockwood, E.**, Ellis, A. B., & Lynch, A. G. (2016). Mathematicians' example-related activity when exploring and proving conjectures. *International Journal of Research in Undergraduate Mathematics Education*, 2(2), 165-196. doi:10.1007/s40753-016-0025-2.
- J15. **Lockwood, E.** & Swinyard, C. A. (2016). An introductory set of activities designed to facilitate successful combinatorial enumeration for undergraduate students. *Problems, Resources, and Issues in Mathematics Undergraduate Studies*, 26(10), 889-904. doi:10.1080/10511970.2016.1194934.
- J16. **Lockwood, E.**, Reed, Z., & Caughman, J. S. (2017). An analysis of statements of the multiplication principle in combinatorics, discrete, and finite mathematics textbooks.

*International Journal of Research in Undergraduate Mathematics Education*, 3(3), 381-416. doi:10.1007/s40753-016-0045-y.

J17. **Lockwood, E.** & Erickson, S. (2017). Undergraduate students' initial conceptions of factorials. *International Journal of Mathematical Education in Science and Technology*, 48(4), 499-519. doi:10.1080/0020739X.2016.1259517.

J18. Ellis, A. B., Ozgur, Z., Vinsonhaler, R., Dogan, M. F., Carolan, T., **Lockwood, E.**, Lynch, A. G., Sabouri, P., Knuth, E., & Zaslavsky, O. (2017). Student thinking with examples: The criteria-affordances-purposes-strategies framework. Online first, *Journal of Mathematical Behavior*. doi:10.1016/j.jmathb.2017.06.003.

J19. Lynch, A. G. & **Lockwood, E.** (2017). A comparison between mathematicians' and students' use of examples for conjecturing and proving. Online first, *Journal of Mathematical Behavior*. doi:10.1016/j.jmathb.2017.07.004.

J20. **Lockwood, E.**, Wasserman, N. H., & McGuffey, W. (2018). Classifying combinations: Do students distinguish between different categories of combination problems? *International Journal of Research in Undergraduate Mathematics Education*, 4(2), 305-322. DOI: 10.1007/s40753-018-0073-x.

J21. **Lockwood, E.** & Purdy, B. (2019). Two undergraduate students' reinvention of the multiplication principle. *Journal for Research in Mathematics Education* (50)3, 225-267.

J22. **Lockwood, E.**, DeJarnette, A. F., & Thomas, M. (2019). Computing as a mathematical disciplinary practice. *Journal of Mathematical Behavior*, 54. doi: 10.1016/j.jmathb.2019.01.004

J23. **Lockwood, E.** & Purdy, B. (2020). An unexpected outcome: Students' focus on order in the multiplication principle. *International Journal of Research in Undergraduate Mathematics Education*, 6(2), 213-244. doi:10.1007/s40753-019-00107-3

J24. **Lockwood, E.** & De Chenne, A. (2020). Using conditional statements in Python to reason about sets of outcomes in combinatorial problems. *International Journal of Research in Undergraduate Mathematics Education*, 6, 303-346. doi:10.1007/s40753-019-00108-2

J25. **Lockwood, E.**, Caughman, J. S., & Weber, K. (2020). An essay on proof, conviction, and explanation: multiple representation systems in combinatorics. *Educational Studies in Mathematics*, 103, 173-189.

J26. Odden, T. O. B., **Lockwood, E.**, & Caballero, M. D. (2020). Physics computational literacy: An exploratory case study using computational essays. *Physical Review Special Topics – Physics Education Research*, 15(2), 020152.

J27. **Lockwood, E.** & Reed, Z. (2020). Defining and demonstrating an equivalence way of thinking in enumerative combinatorics. *Journal of Mathematical Behavior*, 58. doi:10.1016/j.jmathb.2020.100780.

J28. **Lockwood, E.**, Wasserman, N. H., & Tillema, E. S. (2020). A case for combinatorics: A research commentary. *Journal of Mathematical Behavior*. Doi:10.1016/j.jmathb.2020.100783

J29. Erickson, S. & **Lockwood, E.** (2021a). Investigating undergraduate students' proof schemes and perspectives about combinatorial proof. *Journal of Mathematical Behavior*, 62. Doi: 10.1016/j.jmathb.2021.100868

J30. Erickson, S. A. & **Lockwood, E.** (2021b). Investigating combinatorial provers' reasoning about multiplication. *International Journal of Research in Undergraduate Mathematics Education*, 7, 77-106. doi: 10.1007/s50753-020-00123-8

J31. **Lockwood, E.**, Reed, Z, & Erickson, S. (2021). Undergraduate students' combinatorial proof of binomial identities. *Journal for Research in Mathematics Education*, 52(5), 539-580. Doi: <https://doi.org/10.5951/jresematheduc-2021-01>

J32. Reed, Z. & **Lockwood, E.** (2021). Leveraging a categorization activity to facilitate productive generalizing activity and combinatorial reasoning. Online first *Cognition and Instruction*. <https://doi.org/10.1080/07370008.2021.1887192>

J33. **Lockwood, E.** & Mørken, K. (2021). A call for research that explores relationships between computing and mathematical thinking and activity in RUME. *International Journal of Research in Undergraduate Mathematics Education*, 7(3), 404-416. doi: 10.1007/s40753-020-00129-2.

J34. **Lockwood, E.** & De Chenne, A. (2021). Reinforcing key combinatorial ideas in a computational setting: A case of encoding outcomes in Python programming. *Journal of Mathematical Behavior*, 62. doi: 10.1016/j.jmathb.2021.100857

J35. Ellis, A., **Lockwood, E.**, Tillema, E., & Moore, K. C. (2021). Generalization across multiple mathematical areas: Relating, forming, and extending. Online first *Cognition and Instruction*. doi: [10.1080/07370008.2021.2000989](https://doi.org/10.1080/07370008.2021.2000989)

J36. **Lockwood, E.** (2022). Leveraging prediction and reflection in a computational setting to enrich undergraduate students' combinatorial thinking. *Cognition and Instruction*, 40(3), 413-455. doi: <https://doi.org/10.1080/07370008.2021.2020793>

J37. Ellis, A., **Lockwood, E.**, & Celik, A. (2022). Empirical re-conceptualization: bridging from empirical generalizations to insight and understanding. Online first in *Journal of Mathematical Behavior*. doi: <https://doi.org/10.1016/j.jmathb.2021.100928>

J38. De Chenne, A. & **Lockwood, E.** (2022). A task to connect counting processes to lists of outcomes in combinatorics. *Journal of Mathematical Behavior*, 65. <https://doi.org/10.1016/j.jmathb.2021.100932>

J39. Cook, J. P., Reed, Z., & **Lockwood, E.** (2022). An initial framework for analyzing students' reasoning with equivalence across mathematical domains. Online first *Journal of Mathematical Behavior*. <https://doi.org/10.1016/j.jmathb.2022.100935>

J40. Sand, O. P., **Lockwood, E.**, Caballero, M. D., & Mørken, K. (2022). Students' development of a logarithm function in Python using Taylor expansions: a teaching design case study. *Digital Experiences in Mathematics Education*, 8, 213-255.

J41. **Lockwood, E.** & Ellis, A. B. (2022). Supporting students' mathematical thinking and activity across representational registers in a combinatorial setting. *ZDM – Mathematics Education*, 54, 829-845.

J42. Sand, O. P., **Lockwood, E.**, Caballero, M. D., & Mørken, K. (2022). Three cases that demonstrate how students connect the domains of mathematics and computing. Online first *Journal of Mathematical Behavior*. <https://doi.org/10.1016/j.jmathb.2022.100955>

J43. Sandefur, J., **Lockwood, E.**, Hart, E., & Greefrath, G. (2022). Teaching and learning discrete mathematics. *ZDM – Mathematics Education*, 54, 753-775.

J44. Lynch, A. G., **Lockwood, E.**, & Ellis, A. B. (2022). Comprehensive example generation: mathematicians' uses of examples when developing conjectures. *Research in Mathematics Education*, 26(3), 363–385. <https://doi.org/10.1080/14794802.2022.2156586>

J45. Cook, J. P., Richardson, A., Reed, Z., & **Lockwood, E.** (2023). Using conceptual analysis to resolve the tension between advanced and secondary mathematics: the cases of equivalence and inverse. *ZDM – Mathematics Education*, 55, 753-766.

J46. Erickson, S. & **Lockwood, E.** (2024). Experienced provers' use of contexts while engaging in combinatorial proof of binomial identities. *International Journal of Mathematical Education in Science and Technology*, 55(4), 946-975. <https://doi.org/10.1080/0020739X.2022.2119175>

J47. Cook, J. P., Richardson, A., Payne, H., Wilson, C., Reed, Z., & **Lockwood, E.** (2025). Analyzing students' productive use of equivalence transformations. *Journal of Mathematical Behavior*, 81. <https://doi.org/10.1016/j.jmathb.2025.101285>

### Non-Refereed (edited) journal articles

NJ1. **Lockwood, E.** (2012). Counting using sets of outcomes. *Mathematics Teaching in the Middle School*, 18(3), 132-135.

NJ2. Braun, B., Bremser, P., Duval, A., **Lockwood, E.**, & White, D. (2017). What does active learning mean for mathematicians? *Notices of the American Mathematical Society*, 64(2), 124-129.

NJ3. **Lockwood, E.** (2018). Students' combinatorial reasoning: Counting processes and sets of outcomes. *Notices of the American Mathematical Society*, 65(7), 821-823. doi: <http://dx.doi.org/10.1090/noti1705>.

NJ4. Gueudet, G., **Lockwood, E.**, & Nardi, E. (2021). Editorial. *International Journal of Research in Undergraduate Mathematics Education*, 7(1).

### Non-Refereed (edited) book and monograph chapters

B1. **Lockwood, E.** & Reed, Z. (2018). Reinforcing mathematical concepts and developing mathematical practices through combinatorial activity. In E. W. Hart, E & J. Sandefur (Eds.), *Teaching and learning of discrete mathematics worldwide: Curriculum and research* (93-110). Cham, Switzerland: Springer.

B2. Hauk, S., Infante, N., Rasmussen, C., **Lockwood, E.**, Zandieh, M., Brown, S., Lai, Y., & Hsu, P. (2018). Research in collegiate mathematics education. In A. Deines, D. Ferrero, E. Graham, M. S. Im, C. A. Manore, & C. Price (Eds.) *Advances in the mathematical sciences: AWM Research Symposium 2017. Association for Women in Mathematics Series Vol. 15* (245-268). Cham, Switzerland: Springer.

B3. Cummings, J., **Lockwood, E.**, & Weber, K. (2019). Building a coherent research program that links abstract algebra to secondary mathematics pedagogy via disciplinary practices. In N. Wasserman (Ed.) *Exploring advanced mathematics courses and content for secondary mathematics teachers* (pp. 319-331). Springer.

B4. **Lockwood, E.** & Reed, Z. (2021). Using an actor-oriented perspective to explore one undergraduate student's repeated reference to a particular problem in a combinatorial context. In C. Hohensee & J. Lobato (Eds.) *Transfer of learning: Progressive perspectives for mathematics education and related fields* (pp. 173-202). Springer.

B5. Ellis, A. B., Paoletti, T., & **Lockwood, E.** (2022). Empirical and Reflective Abstraction. To appear in P. Dawkins, A. Hackenberg, & A. Norton (Eds.) *Genetic Epistemology*. Springer.

B6. **Lockwood, E.** & Caughman, J. (2025). New Directions for Research on Domain-Specific Aspects of Proof: The Case of Combinatorics and Graph Theory. In M. Savic & K. Weber (Eds.) *New directions in proving: Honoring the legacy of John and Annie Selden*. Springer.

### Refereed conference papers (\* indicates submitted)

RC1. **Lockwood, E.** (2012). A model of students' combinatorial thinking: The role of sets of outcomes. In S. Brown, S. Larsen, K. Marrongelle, and M. Oehrtman (Eds.), *Proceedings of the 15<sup>th</sup> Annual Conference on Research in Undergraduate Mathematics Education* (pp. 1-15). Portland, OR: Portland State University. **Best Paper Award Winner**.

RC2. Ellis, A. E., **Lockwood, E.**, Williams, C. C. W., Dogan, M. F., & Knuth, E. (2012). Middle school students' example use in conjecture exploration and justification. In L. R. Van Zoest, J. J. Lo, & J. L. Kratky (Eds.), *Proceedings of the 34<sup>th</sup> Annual Meeting of the North*

*American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 135-142). Kalamazoo, MI: Western Michigan University.

RC3. **Lockwood, E.**, Ellis, A. E., Dogan, M. F., Williams, C. C. W., & Knuth, E. (2012). A framework for mathematicians' example-related activity when exploring and proving mathematical conjectures. In L. R. Van Zoest, J. J. Lo, & J. L. Kratky (Eds.), *Proceedings of the 34<sup>th</sup> Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 151-158). Kalamazoo, MI: Western Michigan University.

RC4. **Lockwood, E.**, Ellis, A., & Knuth, E. (2013). Mathematicians' example-related activity when proving conjectures. In S. Brown, G. Karakok, K. H. Roh, & M. Oehrtman (Eds.), *Proceedings of the 16<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education* (pp. 16-30). Denver, CO: Northern Colorado University. **Best Paper Honorable Mention.**

RC5. **Lockwood, E.** (2013). Developing facility with sets of outcomes by solving smaller, simpler counting problems. In S. Brown, G. Karakok, K. H. Roh, & M. Oehrtman (Eds.), *Proceedings of the 16<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education* (pp. 323-337). Denver, CO: Northern Colorado University.

RC6. Ellis, A. E., **Lockwood, E.**, Knuth, E., Dogan, M. F., & Williams, C. C. W. (2013). Choosing and using examples: How example activity can support proof insight. In A. Lindmeier & A. Heinze (Eds.), *Proceedings of the 37<sup>th</sup> Annual Meeting of the International Group for the Psychology of Mathematics Education* (Vol. 2, pp. 265-272). Kiel, Germany.

RC7. **Lockwood, E.**, Ellis, A. E., Knuth, E., Dogan, M. F., & Williams, C. C. W. (2013). Strategically chosen examples leading to proof insight: A case study of a mathematician's proving process. In M. Martinez & A. Castro Superfine (Eds.), *Proceedings of the 35<sup>th</sup> Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 245-252). Chicago, IL: University of Illinois, Chicago.

RC8. **Lockwood, E.** (2013). The Groups of Students problem: Insights about multiplication and implied order in combinatorial enumeration. In M. Martinez & A. Castro Superfine (Eds.), *Proceedings of the 35<sup>th</sup> Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 409-416). Chicago, IL: University of Illinois, Chicago.

RC9. **Lockwood, E.**, Swinyard, C., & Caughman, J. S. (2014). Examining students' combinatorial thinking through reinvention of basic counting formulas. In T. Fukawa-Connelly, G. Karakok, K. Keene, and M. Zandieh (Eds.), *Proceedings of the 17<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education* (pp. 169-184). Denver, CO: Northern Colorado University.

RC10. Weber, E. & **Lockwood, E.** (2014). The duality principle and learning trajectories in mathematics education. In T. Fukawa-Connelly, G. Karakok, K. Keene, and M. Zandieh (Eds.), *Proceedings of the 17<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education* (pp. 351-366). Denver, CO: Northern Colorado University.

RC11. **Lockwood, E.** & Gibson, B. (2014). Effects of systematic listing in correctly solving counting problems. In T. Fukawa-Connelly, G. Karakok, K. Keene, and M. Zandieh (Eds.), *Proceedings of the 17<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education* (pp. 153-168). Denver, CO: Northern Colorado University.

RC12. Ellis, A. B., Weber, E., & **Lockwood, E.** (2014). The case for learning trajectories research. In P. Liljedahl, C. Nicol, S. Oesterle, & D. Allan (Eds.), *Proceedings of the 38<sup>th</sup> Annual*

*Meeting of the International Group for the Psychology of Mathematics Education* (Volume 3, pp. 1-8). Vancouver, Canada.

RC13. **Lockwood, E.**, Lynch, A. G., Ellis, A. B., & Knuth, E. (2014). Mathematicians' example-related activity in formulating conjectures. In P. Liljedahl, C. Nicol, S. Oesterle, & D. Allan (Eds.), *Proceedings of the 38<sup>th</sup> Annual Meeting of the International Group for the Psychology of Mathematics Education* (Volume 4, pp. 129-136). Vancouver, Canada.

RC14. **Lockwood, E.**, Swinyard, C. A., & Caughman, J. S. (2015). Modeling outcomes in combinatorial problem solving: The case of combinations. In T. Fukawa-Connelly, N. Infante, K. Keene, and M. Zandieh (Eds.), *Proceedings of the 18<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education* (pp. 601-696). Pittsburgh, PA: West Virginia University.

RC15. **Lockwood, E.** & Weber, E. (2015). Mathematicians' views of mathematical practice. In T. Fukawa-Connelly, N. Infante, K. Keene, and M. Zandieh (Eds.), *Proceedings of the 18<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education* (pp. 697-703). Pittsburgh, PA: West Virginia University.

RC16. **Lockwood, E.**, Lynch, A. G., & Ellis, A. B. (2015). Exhaustive example generation: Mathematicians' uses of examples when developing conjectures. In T. Fukawa-Connelly, N. Infante, K. Keene, and M. Zandieh (Eds.), *Proceedings of the 18<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education* (pp. 216-230). Pittsburgh, PA: West Virginia University.

RC17. **Lockwood, E.**, Reed, Z., & Caughman, J. S. (2015). Categorizing statements of the multiplication principle. In Bartel, T. G., Bieda, K. N., Putnam, R. T., Bradfield, K., & Dominguez, H. (Eds.), *Proceedings of the 37<sup>th</sup> Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*, (pp. 80-87). East Lansing, MI: Michigan State University.

RC18. **Lockwood, E.** & Reed, Z. (2016). Students' meanings of a (potentially) powerful tool for generalizing in combinatorics. In T. Fukawa-Connelly, N. Infante, M. Wawro, & S. Brown (Eds.), *Proceedings of the 19<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education*, (pp. 1-16). Pittsburgh, PA: West Virginia University. **Best Paper Award Winner**.

RC19. **Lockwood, E.** & Schaub, B. (2016). Reinventing the multiplication principle. In T. Fukawa-Connelly, N. Infante, M. Wawro, & S. Brown (Eds.), *Proceedings of the 19<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education*, (pp. 31-45). Pittsburgh, PA: West Virginia University. **Meritorious Citation**.

RC20. **Lockwood, E.** & Erickson, S. A. (2016). Students' conceptions of factorials prior to and within combinatorial contexts. In T. Fukawa-Connelly, N. Infante, M. Wawro, & S. Brown (Eds.), *Proceedings of the 19<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education*, (pp. 1047-1054). Pittsburgh, PA: West Virginia University.

RC21. **Lockwood, E.**, Wasserman, N., & McGuffey, W. (2016). Classifying combinations: Do students distinguish between different types of combination problems? In T. Fukawa-Connelly, N. Infante, M. Wawro, & S. Brown (Eds.), *Proceedings of the 19<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education*, (pp. 296-309). Pittsburgh, PA: West Virginia University.

RC22. **Lockwood, E.**, Asay, A., DeJarnette, A. F., & Thomas, M. (2016). Algorithmic thinking: An initial characterization of computational thinking in mathematics. In M. B. Wood, E. E. Turner, M. Civil, & J. A. Eli (Eds.), *Proceedings of the 38<sup>th</sup> Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*, (pp. 1588-1895). Tucson, AZ: The University of Arizona.

RC23. Dorko, A. & **Lockwood, E.** (2016). What do students attend to when first graphing in R3? In M. B. Wood, E. E. Turner, M. Civil, & J. A. Eli (Eds.), *Proceedings of the 38<sup>th</sup> Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*, (pp. 565-572). Tucson, AZ: The University of Arizona.

RC24. **Lockwood, E.** & Schaub, B. (2017). An unexpected outcome: Students' focus on order in the multiplication principle. In (Eds.). A. Weinberg, C. Rasmussen, J. Rabin, M. Wawro, and S. Brown, *Proceedings of the 20<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education*, (pp. 715-722). San Diego, CA: San Diego State University.

RC25. **Lockwood, E.** (2017). A preliminary investigation of the reification of "choosing" in counting problems. In (Eds.). A. Weinberg, C. Rasmussen, J. Rabin, M. Wawro, and S. Brown, *Proceedings of the 20<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education*, (p. 1293-1298). San Diego, CA: San Diego State University.

RC26. Ellis, A. B., Tillema, E., **Lockwood, E.**, & Moore, K. C. (2017). Generalization across domains: The relating-forming-extending generalization framework. To appear in the *Proceedings of the 39<sup>th</sup> Annual Meeting of the North American Chapter of the Psychology of Mathematics Education*. Indianapolis, IN: Indiana University.

RC27. **Lockwood, E.**, Thomas, M. & DeJarnette, A. F. (2018). Computing as a mathematical disciplinary practice. In (Eds.). A. Weinberg, C. Rasmussen, J. Rabin, M. Wawro, and S. Brown, *Proceedings of the 21<sup>st</sup> Annual Conference on Research in Undergraduate Mathematics Education*, (pp. 458-465). San Diego, CA: San Diego State University.

RC28. **Lockwood, E.** & Reed, Z. (2018a). An initial exploration of students' reasoning about combinatorial proof. In (Eds.). A. Weinberg, C. Rasmussen, J. Rabin, M. Wawro, and S. Brown, *Proceedings of the 21<sup>st</sup> Annual Conference on Research in Undergraduate Mathematics Education*, (pp. 450-457). San Diego, CA: San Diego State University.

RC29. **Lockwood, E.** & Reed, Z. (2018b). Leveraging specific contexts and outcomes to generalize in combinatorial settings. In the *Proceedings of the Second Conference of the International Network for Didactic Research in University Mathematics*, (pp. 244-253). Agder, Norway: University of Agder.

RC30. Reed, Z. & **Lockwood, E.** (2018). Generalizing in combinatorics through categorization. In A. Weinberg, C. Rasmussen, J. Rabin, M. Wawro, and S. Brown (Eds.) *Proceedings of the 21<sup>st</sup> Annual Conference on Research in Undergraduate Mathematics Education*, (pp. 311-325). San Diego, CA: San Diego State University.

RC31. **Lockwood, E.**, Caughman, J., & Weber, K. (In press). Multiple semantic representation systems in binomial identities: An exploration of proofs that explain and proofs that only convince. In Weinberg, A., Moore-Russo, D., Soto, H., & Wawro, M. (Eds.) *Proceedings of the 22nd Annual Conference on Research in Undergraduate Mathematics Education* (pp. 774-782). Oklahoma City, Oklahoma.

RC32. **Lockwood, E.** (2019). Using a computational context to investigate student reasoning about whether "order matters" in counting problems. In Weinberg, A., Moore-Russo, D., Soto, H., & Wawro, M. (Eds.) *Proceedings of the 22nd Annual Conference on Research in Undergraduate Mathematics Education* (pp. 385-392). Oklahoma City, Oklahoma.

RC33. **Lockwood, E.**, De Chenne, A., & Valdes-Fernandez, S. (2019). Affordances of solving counting problems in a computational environment. In Graven, M., Venkat, H., Essien, A. & Vale, P. (Eds.). (2019). *Proceedings of the 43<sup>rd</sup> Conference of the International Group for the Psychology of Mathematics Education (Vol 3)* (pp. 41-48). Pretoria, South Africa: PME.

RC34. Ellis, A., **Lockwood, E.**, & Lynch, A. G. (2020). Empirical re-conceptualization: Bridging from empirical patterns to insight and understanding. In S. S. Karunakaran, Z. Reed, & A.

Higgins (Eds.). *Proceedings of the 23<sup>rd</sup> Annual Conference on Research in Undergraduate Mathematics Education* (pp. 159-167). Boston, MA.

RC35. De Chenne, A. & **Lockwood, E.** (2020). Student verification practices for combinatorics problems in a computational environment. In S. S. Karunakaran, Z. Reed, & A. Higgins (Eds.). *Proceedings of the 23<sup>rd</sup> Annual Conference on Research in Undergraduate Mathematics Education* (pp. 96-103). Boston, MA.

RC36. Erickson, S. & **Lockwood, E.** (2020). Investigating combinatorial provers' models of multiplication. In S. S. Karunakaran, Z. Reed, & A. Higgins (Eds.). *Proceedings of the 23<sup>rd</sup> Annual Conference on Research in Undergraduate Mathematics Education* (pp. 176-183). Boston, MA.

RC37. Purdy, B. & **Lockwood, E.** (2020). An example of computational thinking in mathematics. In S. S. Karunakaran, Z. Reed, & A. Higgins (Eds.). *Proceedings of the 23<sup>rd</sup> Annual Conference on Research in Undergraduate Mathematics Education* (pp. 1013-1018). Boston, MA.

RC38. Ellis, A., **Lockwood, E.**, & Lynch, A. (2020). Empirical Re-conceptualization as a Bridge to Insight. In Gresalfi, M. and Horn, I. S. (Eds.), *The Interdisciplinarity of the Learning Sciences, 14th International Conference of the Learning Sciences* (ICLS), Volume 3 (pp. 1593-1596). Nashville, Tennessee: International Society of the Learning Sciences.

RC39. **Lockwood, E.** & De Chenne, A. (2020). Investigating undergraduate students' generalizing activity in a computational setting. In Sacristán, A.I., Cortés-Zavala, J.C. & Ruiz-Arias, P.M. (Eds.) *Mathematics Education Across Cultures: Proceedings of the 42nd Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*, (pp. 2174-2182). Mexico. Cinvestav / AMIUTEM / PME-NA. <https://doi.org/10.51272/pmena.42.2020>

RC40. Ellis, A. B. & **Lockwood, E.** (2020). Beyond patterns: making sense of pattern-based generalizations through empirical re-conceptualization. In Sacristán, A.I., Cortés-Zavala, J.C. & Ruiz-Arias, P.M. (Eds.) *Mathematics Education Across Cultures: Proceedings of the 42nd Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*, (pp. 981-985). Mexico. Cinvestav / AMIUTEM / PME-NA. <https://doi.org/10.51272/pmena.42.2020>

RC41. Schaub, B. & **Lockwood, E.** (2021). Incorporating generalization into university classrooms: an emerging distinction from instructors. In Karunakaran, S. S. & Higgins, A. (Eds.). *Research in Undergraduate Mathematics Education Reports*, 229-238.

RC42. **Lockwood, E.** & De Chenne, A. (2021). Preservice teachers' development of mathematical knowledge for teaching via combinatorial tasks in a computational setting. Presented at the the 14<sup>th</sup> International Congress on Mathematics Education (postponed from 2020).

RC43. Reed, Z., Cook, J. P., **Lockwood, E.**, & Richardson, A. (2022). A framework for analyzing students' reasoning about equivalence across undergraduate mathematics. To appear in the proceedings of the 29<sup>th</sup> Annual Conference on Research in Undergraduate Mathematics Education. Boston, MA, February 2022.

RC44. **Lockwood, E.**, DeJarnette, A., Thomas, M., & Mørken, K. (2022). Exemplifying algorithmic thinking in mathematics education. To appear in the proceedings of the 12<sup>th</sup> Congress of the European Society of Research in Mathematics Education (CERME12). Virtual, February 2022.

RC45. **De Chenne, A.** & Lockwood, E. (2022). Listing algorithms for combinatorial problems with variable parameter values: a case study. To appear in the proceedings of the 12<sup>th</sup> Congress of the European Society of Research in Mathematics Education (CERME12). Virtual, February 2022.

RC46. Kalathas, P., Parham-Mocello, J., Elliott, R., & **Lockwood, E.** (2022). Exploring math + CS in a secondary education methods course. To appear in the proceedings of the SIGCSE conference. Providence, Rhode Island, March 2022.

RC47. De Chenne, A. & **Lockwood, E.** (2023). A Case of a Computational Setting Facilitating Empirical Re-Conceptualization. In Cook, S., Katz, B. & Moore-Russo D. (Eds.). *Proceedings of the 25th Annual Conference on Research in Undergraduate Mathematics Education*. Omaha, NE. 494-501.

RC48. Weber, K., Dawkins, P. C., & **Lockwood, E.** (2023). Proving as cooperative communication: Using Grice's maxims and implicature to understand proof comprehension in undergraduate mathematics education. In Cook, S., Katz, B. & Moore-Russo D. (Eds.). *Proceedings of the 25th Annual Conference on Research in Undergraduate Mathematics Education*. Omaha, NE. 815-823.

RC49. Cook, J. P., Reed, Z., Richardson, A., & **Lockwood, E.** (2023). How Do We Disentangle Equality from Equivalence? Well, It Depends. In Cook, S., Katz, B. & Moore-Russo D. (Eds.). *Proceedings of the 25th Annual Conference on Research in Undergraduate Mathematics Education*. Omaha, NE. 315-323.

RC50. Richardson, A. P., Cook, J. P., Reed, Z. K., Payne, O. H., Wilson, C., & **Lockwood, E.** (2024). In defense of transformational activity: analyzing students' productive reasoning about equivalence. In Cook, S., Katz, B. & Moore-Russo D. (Eds.). *Proceedings of the 26th Annual Conference on Research in Undergraduate Mathematics Education*. Omaha, NE. 250-258.

RC51. Reed, Z. K., **Lockwood, E.**, & Caughman, J. (2024). From an inclination to subtract to a need to divide: exploring student understanding and use of division in combinatorics. In Cook, S., Katz, B. & Moore-Russo D. (Eds.). *Proceedings of the 26th Annual Conference on Research in Undergraduate Mathematics Education*. Omaha, NE. 459-468.

RC52. De Chenne, A. & **Lockwood, E.** (In press). Computer programs as semiotic resources for counting problems. To appear in the proceedings of the Fifteenth International Congress on Mathematical Education. Sydney, Australia, July 2024.

RC53. Reed, Z. K., **Lockwood, E.**, & Cook, J. P. (In press). Elaborating an equivalence way of thinking in counting: a focus on partitioning outcome sets. To appear in the proceedings of the Fifteenth International Congress on Mathematical Education. Sydney, Australia, July 2024.

RC54. Olsen, J. F., **Lockwood, E.**, & Odden, T. O. B. (In press). Between the trivial and the impossible: CHAT as an analytic lens to study the role of programming in mathematical research. To appear in the proceedings of the 14<sup>th</sup> Congress of the European Society of Research in Mathematics Education. Bolzano, Italy, February 2025.

RC55. **Lockwood, E.** & Reed, Z. (In press). Generalizing in combinatorial problem solving: Process-based or numerical-based approaches. To appear in the proceedings of the 14<sup>th</sup> Congress of the European Society of Research in Mathematics Education. Bolzano, Italy, February 2025.

RC56. **Lockwood, E.**, Reed, Z. K., Caughman, J., & Cook, J. P. (In press). Examining ways in which students engage with sets of outcomes in combinatorics. To appear in the proceedings of the 31<sup>st</sup> Annual Conference on Research in Undergraduate Mathematics Education. Alexandria, VA, February 2025.

RC57. Olsen, J. F., Odden, T. O. B., & **Lockwood, E.** (In press). Exploring discrepancies in mathematicians' use of programming in teaching and research. To appear in the proceedings of the 31<sup>st</sup> Annual Conference on Research in Undergraduate Mathematics Education. Alexandria, VA, February 2025.

RC58. \*Reed, Z. & **Lockwood, E.** (Submitted) Using mathematical knowledge when learning to program: the case of Jack. Submitted to the 32<sup>nd</sup> Annual Conference on Research in Undergraduate Mathematics Education. Alexandria, VA, February 2026.

RC59. \*Kuss, R. & **Lockwood, E.** (Submitted). Examining novice and experienced programmers' use of Python in a combinatorial context. Submitted to the 32<sup>nd</sup> Annual Conference on Research in Undergraduate Mathematics Education. Alexandria, VA, February 2026.

RC60. \*Reed, Z., Paoletti, T., Cook, J. P., Stevens, I., Margolis, C., & **Lockwood, E.** (Submitted). Referential linking and clarifying descriptive equivalence. Submitted to the 32<sup>nd</sup> Annual Conference on Research in Undergraduate Mathematics Education. Alexandria, VA, February 2026.

RC61. \*Wilson, C., Paoletti, T., Cook, J. P., Reed, Z., & **Lockwood, E.** (Submitted). Descriptive interpretations of equivalence in measurement contexts: the case of Emily. Submitted to the 32<sup>nd</sup> Annual Conference on Research in Undergraduate Mathematics Education. Alexandria, VA, February 2026.

### Non-refereed conference proceedings

NRC1. Swinyard, C. A. & **Lockwood, E.** (2007). Research on students' reasoning about the formal definition of limit: An evolving conceptual analysis. *In the Electronic Proceedings for the 10<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education*. San Diego, CA: San Diego State University.

NRC2. Bartlo, J., Larsen, S., & **Lockwood, E.** (2008). Scaling up instructional activities: Lessons learned from a collaboration between a mathematician and mathematics education researcher. *In the Electronic Proceedings of the 11<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education*. San Diego, CA: San Diego State University.

NRC3. **Lockwood, E.** (2009). Investigating student approaches to counting problems: An exploration using the notion of actor-oriented transfer. *In the Electronic Proceedings for the 12<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education*. Raleigh, NC: North Carolina State University.

NRC4. **Lockwood, E.** (2010). An investigation of post-secondary students' understanding of two fundamental counting principles. *In the Electronic Proceedings for the 13<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education*. Raleigh, NC: North Carolina State University.

NRC5. **Lockwood, E.** & Strand, S. (2011). Student use of set-oriented thinking in combinatorial problem solving. In S. Brown, S. Larsen, K. Marrongelle, & M. Oehrtman (Eds.), *Proceedings of the 14<sup>th</sup> Annual Conference on Research in Undergraduate Mathematics Education* (pp. 132-135). Portland, OR: Portland State University.

NRC6. **Lockwood, E.**, Yeo, A., Crooks, N. M., Nathan, M. J. & Alibali, M. W. (2014). Teaching about confidence intervals: How instructors connect ideas using speech and gesture. In W. Penuel, S. A. Jurow, & K. O'Connor (Eds.), *Learning and Becoming in Practice: Proceedings of the Eleventh International Conference of the Learning Sciences* (pp. 1042-1046). Boulder, CO: University of Colorado.

### Other written products (edited American Mathematics Society blog posts)

O1. **Lockwood, E.** (2014). Striking the balance between examples and proof. American Mathematical Society Blog *On Teaching and Learning Mathematics*. Posted July 2014. Editorially reviewed.

02. **Lockwood, E.** (2014). Some thoughts on the teaching and learning of mathematical practices. American Mathematical Society Blog *On Teaching and Learning Mathematics*. Posted September 2014. Editorially reviewed.
03. **Lockwood, E.** (2014). Reading articles in mathematics education – it's not just for prospective teachers! American Mathematical Society Blog *On Teaching and Learning Mathematics*. Posted December 2014. Editorially reviewed.
04. **Lockwood, E.** (2015). Attending to precision: A need for characterizing and promoting careful mathematical work. American Mathematical Society Blog *On Teaching and Learning Mathematics*. Posted June 2015. Editorially reviewed.
05. **Lockwood, E.** (2015). Let your students do some grading? Using peer assessment to help students understand key concepts. American Mathematical Society Blog *On Teaching and Learning Mathematics*. Posted August 2015. Editorially reviewed.
06. Braun, B., Bremser, P., Duval, A., **Lockwood, E.**, & White, D. (2015). Active learning in mathematics, Part I: The challenge of defining active learning. American Mathematical Society Blog *On Teaching and Learning Mathematics*. Posted September 2015. Editorially reviewed.
07. Braun, B., Bremser, P., Duval, A., **Lockwood, E.**, & White, D. (2015). Active learning in mathematics, Part II: Levels of cognitive demand. American Mathematical Society Blog *On Teaching and Learning Mathematics*. Posted September 2015. Editorially reviewed.
08. Braun, B., Bremser, P., Duval, A., **Lockwood, E.**, & White, D. (2015). Active learning in mathematics, Part III: Teaching techniques and environments. American Mathematical Society Blog *On Teaching and Learning Mathematics*. Posted October 2015. Editorially reviewed.
09. Braun, B., Bremser, P., Duval, A., **Lockwood, E.**, & White, D. (2015). Active learning in mathematics, Part IV: Personal reflections. American Mathematical Society Blog *On Teaching and Learning Mathematics*. Posted October 2015. Editorially reviewed.
010. Braun, B., Bremser, P., Duval, A., **Lockwood, E.**, & White, D. (2015). Active learning in mathematics, Part V: The role of “telling” in active learning. American Mathematical Society Blog *On Teaching and Learning Mathematics*. Posted October 2015. Editorially reviewed.
011. Braun, B., Bremser, P., Duval, A., **Lockwood, E.**, & White, D. (2015). Active learning in mathematics, Part VI: Mathematicians’ training as teachers. American Mathematical Society Blog *On Teaching and Learning Mathematics*. Posted November 2015. Editorially reviewed.
012. **Lockwood, E.** (2015). Don’t count them out – Helping students successfully solve combinatorial tasks. American Mathematical Society Blog *On Teaching and Learning Mathematics*. Posted December 2015. Editorially reviewed.

**Additional conference presentations (not included among refereed or non-refereed conference papers, \* denotes presenter)**

- \***Lockwood, E.** “Here’s Rookin’ at You, Kid: Teaching Combinatorics Using Rooks on a Chessboard.” Annual spring meeting of the Pacific Northwest section of the Mathematical Association of America (MAA). Southern Oregon University. July 2006.
- \***Lockwood, E.** “Set-Oriented Thinking and the Evaluation of Alternative Solutions in Counting Problems.” Joint Mathematics Meetings. New Orleans, LA. January 2011.
- \***Lockwood, E.** “A Model of Students’ Combinatorial Thinking.” Joint Mathematics Meetings. Boston, MA. January 2012.
- \***Lockwood, E.** “A Model of Students’ Combinatorial Thinking: The Role of Sets of Outcomes.” Joint Mathematics Meetings (JMM). San Diego, CA. January 2013. **Invited talk.**

- \*Ellis, A. B., **Lockwood, E.**, Williams, C. C., Dogan, M. F., & Knuth, E. “How Students Use Examples When Developing Proofs.” Presented in the Paper Session, “*Choosing and Using Examples: A Promising Road to Proof?*” at the Annual Meeting of the American Education Research Association (AERA). San Francisco, CA. April 2013.
- \***Lockwood, E.**, Ellis, A. B., Dogan, M. F., Williams, C. C., & Knuth, E. “Mathematicians’ Example-Related Activity When Exploring and Proving Mathematical Conjectures.” Presented in the Paper Session, “*Choosing and Using Examples: A Promising Road to Proof?*” at the Annual Meeting of the American Education Research Association (AERA). San Francisco, CA. April 2013.
- Ellis, A. E., **Lockwood, E.**, Knuth, E., Williams, C. C., & \*Dogan, M. F. “How Does Example Use Influence Conjecturing and Proving?” Research Pre-Session of the 91<sup>st</sup> Annual Meeting of the National Council of Teachers of Mathematics (NCTM). Denver, CO. April 2013.
- \***Lockwood, E.** “Developing Instructor Support Materials in an Inquiry-Oriented Curriculum.” Invited Special Session of the Fall Southeastern Regional meeting of the American Mathematical Society (AMS). Louisville, KY. October 2013.
- \***Lockwood, E.** “Fostering the Development of Mathematical Practices.” Invited Panel at the Joint Mathematics Meetings (JMM). San Antonio, TX. January 2015. **Invited talk.**
- \*Reed, Z. & **Lockwood, E.** “Examining Student Generalizing Activity in an Accessible Combinatorial Task.” Joint Mathematics Meetings (JMM). Seattle, WA. January 2016.
- \***Lockwood, E.** & \*Schaub, B. “Student Interpretations of Textbook Statements of the Multiplication Principle.” Joint Mathematics Meetings (JMM). Seattle, WA. January 2016.
- \*Erickson, S. A. & **Lockwood, E.** “Listing as a Potential Connection between Sets of Outcomes and Counting Processes.” Joint Mathematics Meetings (JMM). Seattle, WA. January 2016.
- \*Caughman, J. C., **Lockwood, E.**, & Reed, Z. “Deconstructing and Reconstructing the Multiplication Principle.” Annual meeting of the Pacific Northwest section of the Mathematical Association of America (MAA). Oregon State University. April 2016.
- \*Ellis, A. E., \***Lockwood, E.**, \*Tillema, E., & \*Moore, K. C. “Generalization Across Multiple Mathematical Areas.” Research Symposium presented at the Research Pre-Session of the 94<sup>th</sup> Annual Meeting of the National Council of Teachers of Mathematics (NCTM). San Francisco, CA. April 2016.
- \***Lockwood, E.** “Eliciting Student Understanding of Mathematical Aspects of the Multiplication Principle.” Presentation at the research Pre-Session of the 94<sup>th</sup> Annual Meeting of the National Council of Teachers of Mathematics (NCTM). San Francisco, CA. April 2016.
- \***Lockwood, E.** “Generalization in students’ combinatorial thinking.” 13th Annual International Congress on Mathematics Education. Hamburg, Germany. July 2016.
- \***Lockwood, E.** “Exploring Undergraduate Students’ Generalizing Activity: Two Contrasting Cases from a Combinatorial Context.” Oklahoma Research on Undergraduate Mathematics Education (OKRUME) conference. Stillwater, OK. August 2016. **Invited plenary.**
- \***Lockwood, E.** & Reed, Z. “Students’ Meanings of a (Potentially) Powerful Generalized Representation in a Combinatorial Setting.” Joint Mathematics Meetings. Atlanta, GA. January 2017. **Invited talk.**
- \***Lockwood, E.** “How to Help Your Students Prove Combinatorial Identities.” Joint Mathematics Meetings. Atlanta, GA. January 2017.

- \***Lockwood, E.** "Examining Students' Combinatorial Reasoning: The Case of the Multiplication Principle." Association for Women in Mathematics Research Symposium. Los Angeles, CA. April 2017.
- \***Lockwood, E.** & \*Erickson, S. "Don't Count Them Out! Helping Your Students Successfully Solve Counting Problems." Northwest Mathematics Conference. Portland, OR. October 2017.
- \***Lockwood, E.** "Reinventing the Multiplication Principle." Joint Mathematics Meetings. San Diego, CA. January 2018.
- \***Lockwood, E.** "Leveraging Computing to Teach Mathematical Content: The Case of Programming and Productive Combinatorial Thinking." Annual American Mathematical Society (AMS) Spring Western Sectional Meeting. Portland State University. April 2018.
- \***Lockwood, E.** "Initial Conversations about Incorporating Computational Thinking and Activity into Mathematics Classrooms." Working Group. The Inquiry Based Learning and Teaching in Mathematics Conference. Austin, TX. May 2018.
- \***Lockwood, E.** "An Initial Exploration into Undergraduate Students' Computational Activity in a Combinatorial Setting." Mathfest. Denver, CO. August 2018.
- \*De Chenne, A. & **Lockwood, E.** "Student Verification Schemes for Combinatorial Problems in a Computational Setting." Annual meeting of the Pacific Northwest section of the Mathematical Association of America (MAA). University of Portland. April 2019.
- \***Lockwood, E.** & Reed, Z. "Using a Categorization Activity to Develop Students' Reasoning about Fundamental Counting Formulas." Joint Mathematics Meetings. Denver, CO. January 2020.
- \*De Chenne, A. & **Lockwood, E.** "Connecting Sets of Outcomes with Counting Processes: What is the nth Element?" Joint Mathematics Meetings. Denver, CO. January 2020.
- \*Caughman, J. & **Lockwood, E.** "The Power of Nested Loops." Joint Mathematics Meetings. Denver, CO. January 2020.
- \***Lockwood, E.** "Using a Computational Context to Investigate Student Reasoning About Whether "Order Matters" in Counting Problems." Joint Mathematics Meetings. Denver, CO. January 2020. **Invited talk.**
- \***Lockwood, E.** Making Room in RUME for Computational Activity: Using Programming to Support Students' Mathematical Reasoning. 23<sup>rd</sup> Annual Conference on Research in Undergraduate Mathematics Education. February 2020. **Invited plenary.**
- \*Casey, S., \*Kohler, B., \*Lai, Y., \*Lischka, A., \***Lockwood, E.**, \*Marzocchi, A., \*Noblitt, B., & \*Sullivan, P. Supporting MTEs to Develop Mathematical Knowledge for Teaching in Content Courses for Prospective Secondary Teachers. AMTE. Virtual presentation. February 2021.
- Elliott, R.\* & **Lockwood, E.**\* Conceptualizing Opportunities for Computational Thinking Practices to Solve Mathematics Tasks in Mathematics Methods Courses. AMTE. Virtual presentation. February 2021.
- \*Capaldi, M. & \***Lockwood, E.** "Funding Opportunities for the Mathfest Community." Annual Mathfest Conference. Philadelphia, PA. August 2022.
- \*Ellis, J., \*Hjalmarson, M., \*Knuth, E., & \***Lockwood, E.** "Funding Opportunities in the STEM Education Directorate." Annual Conference of the Psychology of Mathematics Education – North America. Nashville, Tennessee. October, 2022.
- \*Alvarez, J., \*Capaldi, M., \*Ferrara, M., \***Lockwood, E.** & \*Waller, E. "Funding Opportunities in the Division of Undergraduate Education." Annual Joint Mathematics Meetings. Boston, MA. January 2023.

- \***Lockwood, E.** “Counting Is Hard” but It’s Rewarding and Fun: Insights from a Research Program in Combinatorics Education.” NE RUME Conference. Presentation given virtually. November 2023. **Invited [lenary].**
- \*Alvarez, J., \*Ferrara, M., \***Lockwood, E.** & \*Waller, E. “Funding Opportunities in the Division of Undergraduate Education.” Annual Joint Mathematics Meetings. San Francisco, CA. January 2024.
- \*Alvarez, J., \*Ferrara, M., \***Lockwood, E.** “Funding Opportunities in the Division of Undergraduate Education: Tips for Writing Competitive EDU Proposals” 30<sup>th</sup> Annual Conference on Research in Undergraduate Mathematics Education. Omaha, NE, February 2024.
- \***Lockwood, E.** “Valuing the Concrete while Striving for the Abstract: The Importance of Examples in Discrete Mathematics.” International Workshop of Discrete Mathematics. Montpellier, France. June 2024. **Invited plenary.**
- \***Lockwood, E.**, Caughman, J., & Reed, Z. “Examining Nuances of Subtraction and Division in Counting Problems.” Annual Joint Mathematics Meetings. Seattle, WA. January 2025.
- \***Lockwood, E.** “Influential Research in Undergraduate Mathematics Education: The International Journal of Research in Undergraduate Mathematics Education.” Workshop on Building Capacity in the Scholarship of Mathematics Education: Supporting the Next Generation of Researchers. Fields Institute. Toronto, Canada. April 2025.
- \***Lockwood, E.** “Integrating Computing into Mathematics Education: A Case of Python Programming in Combinatorial Contexts.” Annual Meeting of the Irish Mathematical Society. August 2025. **Invited talk.**

**Posters (not included among refereed or non-refereed conference papers or additional conference presentations, ^ indicates refereed poster)**

- P1. **Lockwood, E.** “The Role of Sets of Outcomes in Students’ Combinatorial Thinking.” Poster presented at the University of Wisconsin – Madison’s Wisconsin Alumni Research Foundation (WARF) Discovery Challenge. Madison, WI. May 2012. **Best Poster Award.**
- P2. **Lockwood, E.** “The Role of Sets of Outcomes in Combinatorial Thinking.” Conference on Transforming Research in Undergraduate Stem Education (TRUSE). St. Paul, MN. June 2012.
- P3. ^**Lockwood, E.** “Students’ Uses of Smaller Problems when Counting.” 34<sup>th</sup> Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education. Kalamazoo, MI: Western Michigan University. November 2012.
- P4. **Lockwood, E.** “What Role Do Examples Plan in Exploring and Proving Conjectures? Making a Case for Sophisticated Example-Related Activity.” Wisconsin Center for Education Research (WCER) poster fair. Madison, WI. November 2012.
- P5. **Lockwood, E.** “Categorizing Student-Generated Connections from an Actor-Oriented Transfer Perspective.” Presented in the Poster Session, *The Transfer Showcase: Exciting Contemporary Advances About an Educationally Central Phenomenon* at the Annual Meeting of the American Education Research Association (AERA). San Francisco, CA. April 2013. **Invited Poster.**
- P6. ^Reed, Z. & **Lockwood, E.** “On the Variety of the Multiplication Principle’s Presentation in College Texts.” 19<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education (RUME). Pittsburgh, PA: West Virginia University. February 2016.

- P7. ^McGee, S., Erickson, S., & **Lockwood, E.** "Student Attitudes, Beliefs, and Experiences Related to Counting Problems." 20<sup>th</sup> Annual Conference on Research on Undergraduate Mathematics Education (RUME). San Diego, CA: San Diego State University. February 2017.
- P8. **Lockwood, E.** "Combinatorial Thinking in Computational Settings: An Initial Theoretical Discussion." Conference on Transforming Research in Undergraduate Stem Education (TRUSE). St. Paul, MN. July 2017.
- P9. **Lockwood, E.** "CAREER: Developing Undergraduate Combinatorial Curriculum in Computational Settings." Joint Mathematics Meetings (JMM). San Diego, CA. January 2018.

### Invited Colloquia and Presentations

- IC1. **Lockwood, E.** "Here's Rookin' at You, Kid: The Combinatorics and Pedagogy of Rook Polynomials." Digipen Institute of Technology, Department of Mathematics. November 2006.
- IC2. **Lockwood, E.** "Here's Rookin' at You, Kid: The Combinatorics and Pedagogy of Rook Polynomials." University of Portland, Department of Mathematics. October 2008.
- IC3. **Lockwood, E.** "Here's Rookin' at You, Kid: The Combinatorics and Pedagogy of Rook Polynomials." Pacific University, Department of Mathematics. October 2008.
- IC4. **Lockwood, E.** "Here's Rookin' at You, Kid: The Combinatorics and Pedagogy of Rook Polynomials." Linfield College, Department of Mathematics. February 2009.
- IC5. **Lockwood, E.** "Here's Rookin' at You, Kid: The Combinatorics and Pedagogy of Rook Polynomials." Clackamas Community College, Department of Mathematics. May 2010.
- IC6. **Lockwood, E.** "Students' Uses of a Set-Theoretic Perspective to Solve Counting Problems." University of Wisconsin – Madison, Department of Curriculum and Instruction. March 2011.
- IC7. **Lockwood, E.** "Students' Uses of a Set-Theoretic Perspective to Solve Counting Problems." Arizona State University, Department of Mathematics. February 2011.
- IC8. **Lockwood, E.** "Students' Uses of a Set-Theoretic Perspective to Solve Counting Problems." University of New Hampshire, Department of Mathematics. February 2011.
- IC9. **Lockwood, E.** "Students' Uses of a Set-Theoretic Perspective to Solve Counting Problems." University of Wisconsin – Eau Claire, Department of Mathematics. February 2011.
- IC10. **Lockwood, E.** "Students' Uses of a Set-Theoretic Perspective to Solve Counting Problems." Salisbury University, Department of Mathematics. February 2011.
- IC11. **Lockwood, E.** "Students' Uses of a Set-Theoretic Perspective to Solve Counting Problems." University of Oklahoma, Department of Mathematics. February 2011.
- IC12. **Lockwood, E.** "A Model of Students' Combinatorial Thinking: The Role of Sets of Outcomes." Oregon State University, Department of Mathematics. February 2012.
- IC13. **Lockwood, E.** "You're Close but You're Off by a Million: Helping Students Solve Counting Problems." University of Portland, Department of Mathematics. October 2013.
- IC14. **Lockwood, E.** "You're Close but You're Off by a Million: Helping Students Count Effectively." University of Kentucky, Department of Mathematics. October 2013.
- IC15. **Lockwood, E.** "Examining Students' Combinatorial Thinking through Reinvention of Basic Counting Formulas." San Diego State University, Center for Research on Science and Mathematics Education (CRMSE). March 2014.

- IC16. **Lockwood, E.** "Examining Students' Combinatorial Thinking through the Reinvention of Four Basic Counting Formulas." University of Portland, Department of Mathematics. March 2014.
- IC17. **Lockwood, E.** "Here's Rookin' at You, Kid: Rook Polynomials as a Unifying Combinatorial Concept." Pacific University, Department of Mathematics. September 2015.
- IC18. **Lockwood, E.** "You're Close, but You're Off by a Million: Helping Students Successfully Solve Counting Problems." Virginia Tech, Department of Mathematics. February 2016.
- IC19. **Lockwood, E.** "Isn't It Just Intuitive? Investigating Mathematical Subtleties of the Multiplication Principle." Oklahoma State University, Department of Mathematics. August 2016.
- IC20. **Lockwood, E.** "Investigating Students' Generalizing Activity: Two Contrasting Cases of Undergraduates in a Combinatorial Context." University of Georgia, Mathematics Education Student Association. September 2016.
- IC21. **Lockwood, E.** "Investigating Undergraduate Students' Generalizing Activity: Two Contrasting Cases from a Combinatorial Context." University of California – Berkeley, Graduate School of Education. April 2017.
- IC22. **Lockwood, E.** "Investigating Subtleties of the Multiplication Principle." Oregon State University, Mathematics Department. September 2017.
- IC23. **Lockwood, E.** "Computational Thinking in STEM Disciplines: Perspectives from a Mathematics Education Researcher." Christmas Seminar, University of Oslo, Center for Computing in Science Education. December 2017.
- IC24. **Lockwood, E.** "A Model of Students' Combinatorial Reasoning: A Case Study in Mathematics Education Research." University of Oslo, Mathematics Department. December 2017.
- IC25. **Lockwood, E.** "Investigating Subtleties of the Multiplication Principle." Michigan State University, Program in Mathematics Education. January 2018.
- IC26. **Lockwood, E.** "Leveraging Generalization in Instruction: Examples from Combinatorics and Real Analysis." University of Oslo, Mathematics Department. April 2018.
- IC27. **Lockwood, E.** "Investigating Students' Combinatorial Reasoning in a Computational Setting: Using Programming to Distinguish Four Fundamental Types of Counting Problems." Texas State University, Mathematics Department. October 2018.
- IC28. **Lockwood, E.** "Investigating Students' Combinatorial Reasoning in a Computational Setting: Using Programming to Distinguish Four Fundamental Types of Counting Problems. University of Bridgeport, Mathematics Department. December 2018.
- IC29. **Lockwood, E.** "Computational Thinking and Activity in STEM Education: What Happens When Math Students Engage with Python Code." Yale University, STEM Education Seminar Series. December 2018.
- IC30. **Lockwood, E.** "Investigating Students' Combinatorial Reasoning in a Computational Setting: Using Programming to Distinguish Fundamental Types of Counting Problems." University of Oslo, Mathematics Department. March 2019.
- IC31. **Lockwood, E.** "Investigating Students' Combinatorial Reasoning in a Computational Setting: Using Programming to Distinguish Fundamental Types of Counting Problems." Clackamas Community College, STEM Talk Seminar Series. April 2019.
- IC32. **Lockwood, E.** "Integrating Computing in Mathematics Education: Why Should We Do It, and How Can We Start?" Norwegian University of Science and Technology (NTNU), Department of Mathematical Sciences. Trondheim, Norway. November 2019.

- IC33. **Lockwood, E.** "Insights about Undergraduate Students' Generalizing Activity and Combinatorial Thinking." Seoul National University (SNU) Mathematics Education Webinar Series. Presentation given virtually. April 2021.
- IC34. **Lockwood, E.** "Insights about Undergraduate Students' Combinatorial Thinking in a Computational Setting." Seoul National University (SNU) Mathematics Education Webinar Series. Presentation given virtually. April 2021.
- IC35. **Lockwood, E.** "Integrating Programming in Mathematics Education: A Case of Undergraduate Students' Combinatorial Thinking in a Computational Setting." University College Dublin Seminar, "An Afternoon of Computation in Science Talks. Presentation given virtually. April 2021.
- IC36. **Lockwood, E.** "Supporting Undergraduate Students' Combinatorial Thinking in a Computational Environment." Indiana University – Bloomington, Graduate Professional Seminar. November 2021.
- IC37. **Lockwood, E.** "Integrating Computing into STEM Education: A Case of Python Programming in Combinatorial Contexts." Rochester Institute of Technology, Science and Mathematics Education Research Seminar. December 2021.
- IC38. **Lockwood, E.** "Integrating Computing into Mathematics Education: A Case of Python Programming in Combinatorial Tasks" Arizona State University. Mathematics Department Colloquium. January 2022.
- IC39. **Lockwood, E.** "Integrating Computing into STEM Education: A Case of Python Programming in Combinatorics." University of Kentucky, Mathematics Department Teaching and Learning Seminar. April 2022.
- IC40. **Lockwood, E.** "Integrating Computing into STEM Education: A Case of Python Programming in Combinatorics." Virginia Tech, Mathematics Department Colloquium. May 2022.
- IC41. **Lockwood, E.** "Integrating Computing into STEM Education: A Case of Python Programming in Combinatorial Contexts." Maxwell Institute, University of Edinburgh, Mathematics Education Seminar. Presentation given virtually. November 2022.
- IC42. **Lockwood, E.** "Integrating Computing into STEM Education: A Case of Python Programming in Combinatorial Contexts." Lund University, Mathematics Education Seminar. Presentation given virtually. March 2023.
- IC43. **Lockwood, E.** "Supporting Desirable Mathematical Practices via Computational Thinking and Activity: A Case of Generalizing in Combinatorics using Python." Seminar, University of Oslo, Center for Computing in Science Education. November 2023.
- IC44. **Lockwood, E.** "Integrating Computing into Mathematics Education: A Case of Python Programming in Combinatorial Contexts." James Madison University, Mathematics Department Colloquium. January 2024.
- IC45. **Lockwood, E.** "Integrating Computing into STEM Education: A Case of Python Programming in Combinatorial Contexts." George Mason University, Gateway2STEM Seminar. April 2024.
- IC46. **Lockwood, E.** "Integrating Computing into Mathematics Education: A Case of Python Programming in Combinatorics." University of Milan, Mathematics Department Colloquium. February 2025.
- IC47. **Lockwood, E.** "The role of the computer in balancing processes-based and numerical-based conjecturing and generalizing activity in mathematics." University of Oslo. Seminar, Center for Computing in Science Education. March 2025.
- IC48. **Lockwood, E.** "Developing computational tools to support students' mathematical thinking." Lund University, Mathematics Department Seminar. March 2025.

- IC49. **Lockwood, E.** “The NSF CAREER Award, Review Criteria, and the Importance of “Grantsmanship.” Oregon State University, College of Science Workshop. March 2025.
- IC50. **Lockwood, E.** “My Favorite Research: Investigating Subtleties of the Multiplication Principle.” Oregon State University. Math Education Seminar. April 2025.
- IC51. **Lockwood, E.** “‘Counting is Hard’ but It’s Rewarding and Fun: Insights from a Research Program in Combinatorics Education.” University of Galway, Mathematics Department Colloquium. September 2025.

### Other Presentations and Workshops

- OP1. **Lockwood, E.** “Matchings Polynomials are the Coolest Things Ever!” Invited lecture for the Graph Portland Area Lecture Series. November 2006.
- OP2. **Lockwood, E.** “The Role of Examples in Proving: Implications for Courses on Mathematical Proof and Proving.” Invited lecture and discussion session at a workshop for courses in Mathematical Proof and Proving. New York University. May 2013.
- OP3. **Lockwood, E.** “Reinventing Permutations and Combinations.” Mathematics Education Seminar. Oregon State University. February 2014.
- OP4. **Lockwood, E.** “Here’s Rookin’ at You, Kid: Rook Polynomials as a Unifying Combinatorial Concept.” Discrete mathematics seminar, Portland State University. February 2015.
- OP5. **Lockwood, E.** “Celebrating Individual Success.” Mentoring Partnerships for Women in RUME (MPWR). Invited presentation. Pittsburgh, PA. February 2015.
- OP6. **Lockwood, E.** “Actor-Oriented Transfer in Combinatorial Tasks.” Mathematics Education Seminar. Washington State University. March 2016.
- OP7. **Lockwood, E.** “Giving Students Opportunities to Explore Examples in the Classroom.” Challenge Workshop for Portland State University. Invited presentation. Portland, OR. March 2016.
- OP8. **Lockwood, E.** “Subtleties of the Multiplication Principle.” Discrete mathematics seminar, Portland State University. May 2016.
- OP9. **Lockwood, E.** “Investigating Mathematical Subtleties of the Multiplication Principle.” Research Experience in Undergraduate Colloquia Series. Oregon State University. July 2016.
- OP10. **Lockwood, E.** “Algorithmic Thinking: An Initial Characterization of Computational Thinking in Mathematics.” Mathematics Education Seminar. Oregon State University. November 2016.
- OP11. **Lockwood, E.** “Leveraging Computing to Teach Mathematical Content: The Case of Programming and Productive Combinatorial Thinking.” Research Experience in Undergraduate Colloquia Series. Oregon State University. July 2018.
- OP12. **Lockwood, E.** “Investigating Students’ Combinatorial Reasoning in a Computational Setting: Using Programming to Distinguish Four Fundamental Types of Counting Problems.” Mathematics Education Seminar. Oregon State University. October 2018.
- OP13. **Lockwood, E.** “Investigating undergraduate students’ generalizing activity: two contrasting cases from a combinatorial context.” Mathematics Education Seminar. Texas State University. October 2018.
- OP14. **Lockwood, E.** “Investigating Students’ Mathematical Reasoning in a Computational Setting: The Case of Python Programming and Counting Problems.” Research Experience in Undergraduate Colloquia Series. Oregon State University. July 2020.

- OP15. **Lockwood, E.** "Investigating Subtleties of the Multiplication Principle." Mathematics Education Seminar. Arizona State University. January 2022.
- OP16. **Lockwood, E.** "Supporting Algorithmic and Computational Thinking in Calculus and Statistics." Challenge Workshop for Portland State University. Invited presentation. Portland, OR. April 2022.
- OP17. **Lockwood, E.** "Exploring Connections between School and University Mathematics in Ireland: Conversations about Facilitating and Assessing Problem Solving." Two-day professional development workshop for the Fulbright Specialist Program. Maynooth University, Kildare Ireland. August 2025.
- OP18. **Lockwood, E.** "Task Design to Foster Rich Student Engagement in Mathematics Courses." Two-day professional development workshop for the Fulbright Specialist Program. Maynooth University, Kildare Ireland. September 2025.

## RESEARCH SUPPORT:

**Co-Principal Investigator**, *Undergraduate Students' Reasoning about Equivalence in Multiple Mathematical Domains: Exploration and Theory-Building* [in collaboration with John Paul Cook (Principal investigator), Oklahoma State University and Zackery Reed (Co-principal investigator) at Embry Riddle University]. National Science Foundation EDU Core – 2055590. 2021 – 2024. (Note, ended Co-PI status in 2021 to work at the NSF.)

**Co-Principal Investigator**, *Generalization Across Multiple Mathematical Areas – Classrooms and Teaching Areas* [in collaboration with Amy B. Ellis (Principal investigator), University of Georgia, Kevin Moore (Co-principal investigator), University of Georgia, and Erik Tillema (Co-principal investigator), IUPUI]. Oregon State University. \$1,499,857. Sub-award to OSU is \$293,992. National Science Foundation EDU Core – 1920538. 2019 – 2022. (Note, ended Co-PI status in 2021 to work at the NSF.)

**Co-Principal Investigator**, *Integrating CS Education into Teacher Education and K-12 Mathematics* [in collaboration with Jennifer Parham-Mocello (Principal investigator) and Rebekah Elliott (Co-principal investigator)], Oregon State University. \$141,800. Google. 2019 – 2020.

**Project Member**. *International Partnership for Computing in Science Education*. INTPART (funded in Norway). Morten Hjorth-Jensen, Principle Investigator. Travel partnership grant for travel between the University of Oslo, Michigan State University, and Oregon State University. 4.5 million Norwegian Kroner (~\$529,000 USD) over three years. 2019 – 2022.

**Principal Investigator**, *CAREER: Developing Undergraduate Combinatorial Curriculum In Computational Settings*. \$803,354. National Science Foundation Department of Undergraduate Education (DUE) – 1650943. 2017 – 2022. (Note, ended PI status in 2021 to work at the NSF.)

**Co-Principal Investigator**, *Generalization Among Multiple Mathematical Areas* [in collaboration with Amy B. Ellis (Principal investigator), UW-Madison, Kevin Moore (Co-principal investigator), University of Georgia, and Erik Tillema (Co-principal investigator), IUPUI]. \$1,499,908. Sub-award to OSU is \$336,377. National Science Foundation Research on Education and Learning (REAL) – 1419973. 2014 – 2017.

**Co-Principal Investigator, Improving Understanding of Student Combinatorial and Statistical Concept Learning Using Machine Learning** [in collaboration with Bryan R. Gibson, UW-Madison]. \$5,000. Sub-award is \$2,500. Wisconsin Alumni Research Foundation. 2012 – 2013.

**Undergraduate Research, Scholarship and the Arts (URSA) Engage Award.** \$250 for research funds to work with an undergraduate student. The student, Caitlin Pellerin, receives a \$1,000 scholarship for her contributions to the work.

**L.L. Stewart Faculty Development Award.** \$1700 awarded for faculty development. Oregon State University. Winter 2014.

## OTHER AWARDS AND HONORS:

**Faculty Release Time Award.** University-wide award at Oregon State University for release from teaching a course. Spring 2015.

**President's Commission on the Status of Women Travel Award.** \$500 University-wide travel award. Oregon State University. Fall 2013.

**Association for Women in Mathematics Travel Award Winner.** National prize given to women with PhDs in mathematics education for travel to mathematics conferences. Fall 2011, Fall 2014.

**Discovery Challenge Outstanding Poster Winner.** Awarded best poster by the Wisconsin Alumni Research Found WARF during a poster section that facilitated interdisciplinary collaboration. Spring 2012.

**Brose Memorial Scholarship.** Awarded to select graduate students based on academic achievements and potential. Mathematics Department, Portland State University. 2010 – 2011.

**Academically Controlled Auxiliary Activities Travel Award.** Awarded to select PSU graduate students. Portland State University. Spring 2010.

**Marie Brown Travel Award.** Awarded to select PSU graduate students. Portland State University. Spring 2009.

**Award for Excellence in Teaching.** ITT Technical Institute, Portland, OR. Spring 2008.

## TEACHING EXPERIENCE:

### COURSES TAUGHT AT OREGON STATE UNIVERSITY:

- **Elements of Discrete Mathematics** (Math 231, 231H). Fall 2017. Fall 2024. Spring 2025.
- **Calculus II – Integral Calculus** (Math 252). Winter 2017.
- **Discrete Mathematics** (Math 355). Winter 2014. Fall, 2015.
- **Linear Algebra** (Math 341). Fall 2014.
- **Algebra and Geometric Transformations I, II, III** (Math 4/591, 4/592, 4/593). Fall 2014, Winter 2015. Fall 2016, Winter 2017. Fall 2018, Winter 2019, Spring 2019. Winter 2021. Fall 2024. Spring 2025. Fall 2025.

- **Introduction to Combinatorial Mathematics** (Math 4/599). Spring 2019. Spring 2021.
- **Teaching Middle School Mathematics – e-campus** (Math 4/599). Summer 2021.
- **Teaching and Learning Probability and Statistics** (Math 682). Winter 2014.
- **Computers and Mathematics** (Math 684). Winter 2018.
- **Advanced Problem Solving** (Math 685). Fall 2013. Fall 2015.
- **Topics in Mathematics Education – Advanced Combinatorics** (Math 689). Spring 2014.
- **Topics in Mathematics Education – Introduction to Research on Undergraduate Mathematics Education** (Math 689). Winter 2016.
- **Topics in Mathematics Education – Introduction to Research in Mathematics Education** (Math 689). Fall 2017.
- **Topics in Mathematics Education – Technology and Computational Thinking** (Math 689). Winter 2021.

#### **COURSES TAUGHT AT PORTLAND STATE UNIVERSITY:**

- **Elementary College Mathematics** (Math 070). Fall 2007.
- **Excursions in Mathematics** (Math 105). Winter 2008, Winter 2010.
- **Introductory College Mathematics I and II** (Math 111, 112). Fall 2005 (I), Fall 2006 (I), Winter 2006 (II), Fall 2006 (I), Winter 2007 (II), Spring 2007 (I).
- **Foundations of Elementary Mathematics I and II** (Math 211, 212). Summer 2006 (I), Summer 2007 (I), Spring 2008 (II), Summer 2008 (I), Fall 2008 (I), Summer 2008 (I), Fall 2010 (I).
- **Calculus I, II, and III** (Math 251, 252, 253). Spring 2006 (I), Spring 2009 (I), Fall 2009 (II), Spring 2011 (I), Winter 2010 (III), Spring 2010 (III).
- **Discrete Mathematics** (Math 356). Winter 2009, Summer 2010.
- **Introduction to Combinatorial Analysis** (Math 487/587). Summer 2008.

#### **COURSES TAUGHT AT MULTNOMAH UNIVERSITY:**

- **Contemporary Mathematics** (Math 110). Spring 2009.

#### **COURSES TAUGHT AT ITT TECHNICAL INSTITUTE:**

- **Problem Solving** (Math GE-184). Spring 2008.

#### **STUDENTS SUPERVISED:**

##### **Major advisor (PhD)**

Rebekah Kuss (PhD, Mathematics Department, expected Spring 2027).

Adaline De Chenne (PhD, Mathematics Department, Summer 2023). Dissertation:

*Characterizing and Understanding Semiotic Representations in Combinatorics Problems.*

Branwen Purdy (PhD, Mathematics Department, Summer 2021). Dissertation: *Creating Community: A Case Study of Students' Experiences in Inquiry-Based Learning.*

Sarah Erickson (PhD, Mathematics Department, Summer 2020). Dissertation: *Investigating Provers' Understanding of Combinatorial Proof.*

Zackery Reed (PhD, Mathematics Department, Summer 2018). Dissertation:

*Undergraduate Students' Generalizing Activity in Real Analysis: Constructing a General Metric.*

Allison Dorko (PhD, College of Education, Spring 2017). Dissertation: *Students' Generalization of Function from Single to Multivariable Settings.*

**Committee Member (PhD)**

Camden Collins (PhD, Mathematics Department, Expected Spring 2027)  
 Noah Prentice (PhD, Mathematics Department, Expected Spring 2027)  
 Luke Nearhood (PhD, Physics Department, Expected Spring 2027)  
 Brandi Whiteman (PhD, Mathematics Department, Expected Spring 2026)  
 Michael Steube (PhD, College of Education, Expected Spring 2026) – GCR  
 Brett Muskavage (PhD, College of Education, Expected Spring 2026) – GCR  
 Katie Hecht-Weber (PhD, College of Education, Winter 2025) – GCR  
 Leah Sturman (PhD, Mathematics Department, Spring 2023)  
 Christian Solorio (PhD, Physics Department, Spring 2023)  
 Gayathri Garimella (PhD, College of Electrical Engineering and Computer Science, Spring 2023)  
 Jonathan Alfson (PhD, Physics Department, Spring 2023)  
 Elyssa Stoddard (PhD, College of Education, Summer 2022)  
 Sylvia Valdes-Fernandez (PhD, College of Education, 2019-present)  
 Erin Glover (PhD, College of Education, Fall 2019)  
 Claire Gibbons (PhD, Mathematics Department, Spring 2019)  
 Michael Renne (PhD, Mathematics Department, Spring 2019)  
 Cecilia Tomcal (PhD, College of Education, 2018-2019)  
 Ally Stacy (PhD, Mathematics Department, 2018-2019)

**External Dissertation Committee Member**

Jan-Fredrik Olsen, (PhD, Department of Physics, University of Oslo, Expected Spring 2027)  
 Andreas Haraldsrud (PhD Department of Physics, University of Oslo, Fall 2024)  
 Michael Hicks (PhD, Department of Mathematics, Texas State University, Spring 2021)  
 Odd Petter Sand (PhD, Department of Physics, University of Oslo, Summer 2021)  
 Christian Woods (PhD, Department of Education, Rutgers University, 2020-2024)  
 Elisha VanMeenen (PhD, Department of Education, Illinois State University, 2020-2024)

**External Dissertation Reader**

Katherine Pauletti, (PhD, Department of Education, New York University, Fall 2024)  
 Michael Tallman (PhD, Mathematics Department, Arizona State University, July 2015)

**Major adviser (Master's)**

Rebekah Kuss (MS, Mathematics Department, Spring 2025). Expository paper: *Grouping Commutativity and Associativity: A Lesson for Preservice Teachers*.  
 Adaline De Chenne (MS, Mathematics Department, Summer 2020). Passed by examination.  
 Samantha McGee (MS, Mathematics Department, Summer 2017). Thesis: *Student Affect Towards Mistakes in the Context of Counting*.  
 Kevin Cramer (MS, Mathematics Department, Spring 2017). Expository paper: *Amazing Graze: Milking the Cow Problem for Insights about Parametric Integration*.  
 Sarah Erickson (MS, Mathematics Department, Fall 2015). Thesis: *Listing as a Potential Connection Between Sets of Outcomes and Counting Processes*.  
 Kathryn Williams (MS, Mathematics Department, Spring 2014). Expository paper: *Function Transformation: A Triple Threat Approach*.

**Committee Member (Master's)**

Tingyan Wu (MAIS, Interdisciplinary, Fall 2025) – GCR  
 Cecilia Holguin Lopez (MFA, School of Writing, Summer 2025) – GCR

Kristina Reitan (MS. Psychology, Spring 2025) – GCR  
 Yvette Rosales (MS, Rhetoric, Writing, and Composition, Spring 2024) – GCR  
 Katie Spiker (MS, Mathematics Department, Summer 2024)  
 Yvette Rosales (MA, School of Writing, Spring 2024)  
 Lynne Gumpinger (MS, College of Education, Summer 2023)  
 Diane McMillan (MS, Mathematics Department, Summer 2021)  
 Paula Salazar Vasconez (MS, Mathematics Department, Summer 2020)  
 Amanda Petty (MS, Mathematics Department, Spring 2019)  
 Mesa Walker (MS, Mathematics Department, Spring 2019)  
 Leah Sturman (MS, Mathematics Department, Spring 2019)  
 Jonathan Alfson (MS, Physics Department, Spring 2015)  
 Nick Ingalls (MS, College of Education, Spring 2018)  
 Bryant Rominger (MS, College of Education, Spring 2018)  
 Kate Stevens (MS, College of Education, Spring 2018)  
 Bin Zhang (MS, Mathematics Department, Summer 2017)  
 Chris Watkins (MS, Mathematics Department, Winter 2017)  
 Sharon Green (MS, Mathematics Department, Summer 2016)  
 Raven Dean (MS, Mathematics Department, Winter 2016)  
 Zackery Reed (MS, Mathematics Department, Fall 2015)  
 Evan Hedlund (MS, Mathematics Department, Fall 2015)  
 Eric Fleming (MS, Mathematics Department, Fall 2015)  
 Matthew Keeling (MS, Mathematics Department, Fall 2015)  
 Candice Ruscher (MS, College of Education, Spring 2015)  
 Kaylee Roderick (MS, College of Education, Spring 2015)  
 Brandon Johnson (MS, College of Education, Spring 2015)  
 Zac Hervey (MS, College of Education, Spring 2014)  
 Kyle May (MS, College of Education, Spring 2014)  
 Krista Foltz (MS, Mathematics Department, Spring 2014)  
 Allan Boone (MS, Mathematics Department, Spring 2014)

**External Master's Thesis Co-adviser**

Konrad Thoresen (MS, Mathematics Department, University of Oslo, June 2019)  
 Anna Katrine Bækkelie (MS, Mathematics Department, University of Oslo, June 2019)

**External Master's Thesis Committee Member**

Jalini Srisgantharajah (MS, Mathematics Department, University of Oslo, June 2018)

**Major adviser (Undergraduate)**

Michael Aimonetto (Honor's Thesis, Mathematics Department, Spring 2019)  
 Cheyenne Gordon (Honors Thesis, Mathematics Department, Spring 2019)  
 Caitlin Pellerin (Honor's Thesis, College of Engineering, 2015-2016)

**Committee Member (Undergraduate)**

Abbie Glickman (Honor's Thesis, College of Education, Spring 2021)  
 Josey Sechrist (Honor's Thesis, Mathematics Department, Spring 2016)  
 Sarah Kerrigan (Honor's Thesis, Mathematics Department, Spring 2015)

**OTHER EXPERIENCE:**

**UNIVERSITY SERVICE**

**College of Science Promotion and Tenure Committee.** Responsibilities included reviewing promotion and tenure cases at the college level. Three-year term beginning Fall 2024.

**College of Science Faculty Research Awards Selection Committee.** Responsibilities included reviewing research award nominations and contributing to discussions about nominees and nominations. December 2022, January 2025.

**College of Science Research Council Member.** Responsibilities include regular meetings about research issues and needs for the College of Science. 2020 – 2021.

**Search Committee Member.** Responsibilities include regular meetings and review of candidates for Associate Dean for Research in the College of Science. 2020 – 2021.

**SciRIS II Proposal Reviewer.** Responsibilities include reviewing proposals for the College of Science's SciRIS program. Winter 2019.

**Learning Innovation Grant Reviewer.** Responsibilities include reviewing proposals for the University's Learning Innovation Grant program. 2018 – 2019.

**Search Committee Member.** Responsibilities include regular meetings and review of candidates for a Mathematics Education Hire in the College of Education. 2018 – 2019.

**SURE Science Proposal Reviewer.** Responsibilities include reviewing proposals for the College of Science's SURE Science Program. Spring 2016.

## **DEPARTMENTAL SERVICE**

**Department Advisory Committee Member.** Elected position on an advisory committee, which serves as a means of communication between the department and the department head. 2018 – 2021, 2024 – present.

**Teaching Committee Chair.** Responsibilities include coordinating teaching observations for faculty and graduate teaching assistants. 2024 – present.

**Graduate Committee Member.** Responsibilities include reviewing applications and selecting incoming graduate students, addressing graduate student matters that arise, making decisions about petitions or special circumstances related to graduate students, and discussing graduate curriculum issues. The committee meets regularly (weekly or bi-weekly) throughout the academic year. 2013 – 2021.

**Math Club Faculty Adviser.** Responsibilities include regular (approximately monthly) meetings with members of the Math Club, attending and supporting social events put on by the club, helping with elections, and generally providing support to the officers and to the Club. 2013 – 2018.

**Student Competition Coordinator.** Responsibilities include recruiting, planning for, and proctoring two national mathematics competitions (the Putnam Exam and the Virginia Tech

Regional Mathematics Competition). In 2014 – 2015 organized and ran a one-hour Student Competition study session was held in the fall term. 2013 – 2016.

**Student Organizations and Clubs Committee Chair.** Responsibilities include delegating and overseeing faculty advising of Math Club, SIAM, Pi Mu Epsilon, Student Competitions, and the Association for Women in Mathematics. 2015 – 2016.

**Association for Women in Mathematics Faculty Advisor.** Responsibilities include working with student representatives of the Association for Women in Mathematics. 2015 – 2018.

**Local Organizing Committee Member** for the 2016 Meeting of the Pacific Northwest Chapter of the Mathematical Association of America (PNWMAA). Responsibilities include working with other local organizers to manage details of the conference planning. Specifically, this has involved coordinating student volunteers, planning student activities, and managing catering details. 2015 – 2016.

**Graduate Teaching Assistant (GTA) Workshop and Orientation Committee Member.** Responsibilities include planning and running the 3-day orientation workshop before the start of the fall term. This involves facilitating teaching demonstrations, making presentations, evaluating teaching episodes, and generally providing support and input. GTA 2013 – 2019.

**Undergraduate Advising Committee Member.** Responsibilities include biannual meetings with approximately 15 secondary education mathematics majors and helping to schedule their upper-division coursework. 2014 – 2015. 2024 – 2025.

**Teaching Committee Contributor.** Responsibilities include observing instructors, filling out an observation report, and meeting with the observed instructor. This occurs approximately 1-2 times per year. 2014 – 2019.

## PROFESSIONAL SERVICE

**External letter writer** for promotion and tenure cases. I have written nine external letters for promotion and tenure at national and international institutions (2018 – present).

**Co-Editor in Chief** for the *International Journal on Research in Undergraduate Mathematics Education* (IJRUUME). Responsibilities include selecting reviewers and soliciting reviews, synthesizing reviews, making publication decisions, and attending regular meetings with the two other co-editors in chief. Five-year term beginning January 2021.

**Chair of Topic Study Group** on Discrete Mathematics at the quadrennial International Congress on Mathematics Education (ICME) to be held in Shanghai, China in 2020 (pushed to a 2021 virtual conference due to the Covid-19 Pandemic). Responsibilities include providing a written description of the TSG, inviting speakers, reviewing abstracts, and running the session in Shanghai. 2018 – 2021.

**Editorial Board Member** for mathematics education research journals. Responsibilities include reviewing several manuscripts per year and engaging in strategic discussions about directions for the journal.

- *Educational Studies in Mathematics* (ESM). 2026 – 2029.
- *Journal of Mathematical Behavior* (JMB). 2019 – 2021.
- *International Journal on Research in Undergraduate Mathematics Education* (IJRUME). 2016 – 2020.

**Founding Contributing Editor** for the American Mathematical Society (AMS) blog “On Teaching and Learning Mathematics.” Responsibilities include writing and recruiting 6 posts a year and overseeing organizational matters. 2014 – 2016.

**Treasurer** for the Special Interest Group of the Mathematical Association of America on Research on Mathematics Education (SIGMAA on RUME). Elected as treasurer for the Special Interest Group of the MAA on Research on Undergraduate Mathematics Education. February 2015 – February 2019.

**Program Committee Member** for the Conference on Research on Mathematics Education (RUME). Responsibilities include participation in in-person and virtual planning meetings and reviewing conference proposals. 2012 – 2019.

**Working Group Co-Organizer (National Conference)**. Co-organized (with Sarah Castle and Addie De Chenne) a working group for the Conference on Research in Undergraduate Mathematics Education. *Working group entitled Computation and Coding in Post-Secondary Mathematics Working Group*. Responsibilities include proposing and organizing the session, as well as running the session at the RUME conference. Alexandria, VA. 2025.

**Special Session Organizer (National Conference)**. Co-organizing (with John Caughman, Art Duval, Oscar Levin) a special session for the Mathematical Association of America at the 2017, 2018, 2019, and 2020 Joint Mathematics Meetings. Session entitled *Discrete Mathematics in the Undergraduate Curriculum – Ideas and Innovations for Teaching*. Responsibilities include proposing and organizing the session, reviewing and accepting abstracts, and running the session at the JMM. 2016 – 2020.

**Special Session Organizer (Regional Conference)**. Organized a special session for the 2016 Annual Meeting of the Pacific Northwest Chapter of the Mathematical Association of America (PNWMAA) in Corvallis, OR. Session entitled *Research on Undergraduate Mathematics Education*. Responsibilities include proposing, organizing, and running the session and reviewing and accepting abstracts. Spring 2016.

**Special Session Organizer (Regional Conference)**. Co-organizing (with Natalie Hobson) a special session for the 2018 Annual Regional Meeting of the American Mathematics Society held in Portland, OR. Session entitled *Teaching and Learning Undergraduate Mathematics*. Responsibilities include proposing and organizing the session, inviting speakers, and reviewing and accepting abstracts. Spring 2018.

**Special Session Organizer (Regional Conference)**. Organized a special session for the 2019 Annual Meeting of the Pacific Northwest Chapter of the Mathematical Association of America (PNWMAA) in Portland, OR. Session entitled *Topics in Undergraduate Mathematics Education*. Responsibilities include proposing, organizing, and running the session and reviewing and accepting abstracts. Spring 2019.

**Advisory Board Member** for Institute of Education Sciences (IES) grant *How Dynamic Gestures and Directed Actions Contribute to Mathematical Proof Practices*. Mitchell Nathan (Principal investigator), Peter Steiner (Co-Principal investigator), Candace Walkington (Co-Principal investigator). 2016 – 2019.

**Advisory Board Member** for National Science Foundation (NSF) grant *Comprehending Conditional Claims' Proofs Organically (C3PO)*. Paul Dawkins (Principal investigator) & Kyeong Hah Roh (Co-Principal investigator). 2020 – 2021.

**Member of the Mathematical Association of America Committee on Invited Addresses.** Responsibilities include virtually meeting during 2017 to select invited addresses for the 2019 Joint Mathematics Meetings. 2017.

**Member of the SIGMAA on RUME Nominating Committee.** Responsibilities include virtually meeting during 2020 to solicit and select nominees for positions on the executive committee on the SIGMAA on RUME. 2020.

**Probability and Statistics Strand Leader** for the 2017 Conference of the North American chapter of the International Group of the Psychology of Mathematics Education (PME-NA). Responsibilities included assigning reviewers and making recommendations for conference proposals related to probability and statistics. 2016 – 2017.

**National Science Foundation Panelist.** Reviewed proposals for the National Science Foundation in Alexandria, VA.

#### **Referee**

##### **Reviewed articles for the following journals:**

*Cognition and Instruction*

*Journal for Research in Mathematics Education*

*Educational Studies in Mathematics*

*Mathematical Thinking and Learning*

*Journal of Mathematical Behavior*

*International Journal of Research in Undergraduate Mathematics Education*

*International Journal of Mathematical Education in Science and Technology*

*Zentralblatt für Didaktik der Mathematik (now The International Journal on Mathematics Education)*

*Problems, Resources, and Issues in Mathematics Undergraduate Studies*

*Elementary School Journal*

*Mathematics Teacher*

*Mathematics Teaching in the Middle School*

*Association for Women in Mathematics Springer Mathematics Education Volume*

##### **Reviewed conference proposals for the following conferences:**

*Conference on Research on Undergraduate Mathematics Education (RUME)*

*Annual Meeting of the Psychology of Mathematics Education –*

*North America (PME-NA)*

*American Education Research Association (AREA)*

*International Congress for Mathematics Education (ICME)  
Congress of the European Society for Research in Mathematics Education  
(CERME)*

### **OTHER PROFESSIONAL DEVELOPMENT**

Participated in a **Teaching and Artificial Intelligence Faculty Learning Community** through OSU's Center for Teaching and Learning. Participation included attending five online seminars, completing readings and activities, and presenting in a final AI showcase. Winter 2025.

Participated in a professional development workshop through Equity in the Center entitled "More than Fragility: A Deep Dive into Understanding and Dismantling Whiteness, Spring and Summer 2022.

### **OTHER RESEARCH WORK**

**Research assistant on NSF Grant 0814829 – Justification in Algebra: Growing Understanding of Algebraic Reasoning (JAGUAR).** Sean Larsen, PI. Duties included collecting videotape data in middle school classrooms. Fall 2009 and Winter 2010.

**Research assistant on NSF Grant 0412553 – Oregon Math Leadership Institute Partnership (OMLI).** Tom Dick, PI. Duties included collecting and organizing videotape data, and other miscellaneous duties. Summer 2006 and Summer 2007. Additional work included conducting numerous classroom observations in K-12 classrooms. Fall 2006 – Spring 2009.

### **FURTHER INFORMATION:**

**Professional Affiliations:** Member of the Mathematical Association of America (MAA) and the National Council of Teachers of Mathematics (NCTM).

**Technological Experience:** Knowledge of LaTeX, TI graphing technology, Geometer's Sketchpad, Python, Excel, PowerPoint, Word, and video editing/transcribing software.

**Languages:** English.

**Hobbies and Interests:** Running, cooking, traveling, reading, writing, enjoying my Ragdoll cats, and cheering for the Portland Trail Blazers.

**Citizenship:** United States.

### **REFERENCES:**

Dr. John S. Caughman  
Professor of Mathematics, Portland State University  
caughman@pdx.edu  
(503) 725-3634

Dr. Amy B. Ellis

Professor of Mathematics Education, University of Georgia  
[amyellis@uga.edu](mailto:amyellis@uga.edu)

Dr. Knut Mørken  
Professor of Mathematics, University of Oslo  
[knutm@math.uio.no](mailto:knutm@math.uio.no)  
+47-22855025