

JOHN R. THOMPSON

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Physics Education Research – research on the learning and teaching of physics as well as the associated mathematics – including research-based curriculum development.

Supervised/co-supervised 7 Ph.D., 2 M.S. in Physics, 11 M.S. in Teaching, 2 Honors Thesis, and 2 Senior Project students to completion; mentored/co-mentored 5 postdoctoral research associates.

PROFESSIONAL EXPERIENCE

Professor of Physics September 2016 to present
Member, Maine Center for Research in STEM Education
Cooperating Professor of STEM Education

Chair, Department of Physics and Astronomy July 2017 to June 2022
Associate Professor of Physics September 2008 to August 2016
Member, Maine Center for Research in STEM Education
Cooperating Associate Professor of STEM Education
University of Maine, Orono, ME

Visiting Professor, Fulbright Scholar September 2008 to July 2009
Physics Education Research Group, School of Physics
*Dublin Institute of Technology (now Technological University Dublin),
Dublin, Ireland*

Assistant Professor of Physics September 2002 to August 2008
Member, Center for Science and Mathematics Education Research
Cooperating Assistant Professor of Education
University of Maine, Orono, ME

Assistant Professor of Physics, August 2000 to August 2002
Grand Valley State University, Allendale, MI

Research Associate, Physics Education Group September 1997 to July 2000
Department of Physics, *University of Washington, Seattle, WA*

EDUCATION

Brown University, Providence, RI Ph.D., Physics, May 1998

Sc.M., Physics, May 1992

Rensselaer Polytechnic Institute, Troy, NY B.S., Physics, May 1990

SELECT RECENT PUBLICATIONS

Peer-reviewed journal articles

R. R. Bajracharya, V. L. Sealey, and J. R. Thompson, “Student understanding of the sign of negative definite integrals in mathematics and physics,” accepted for publication in *International Journal of Research in Undergraduate Mathematics Education*, Special Issue on The Teaching and Learning of Definite Integrals, R. Ely & S. R. Jones, Eds. (2023).

S. Van den Eynde, B. P. Schermerhorn, J. Deprez, M. Goedhart, J. R. Thompson, and M. De Cock, “Dynamic conceptual blending analysis to model student reasoning processes while integrating mathematics and physics: a case study in the context of the heat equation,” *Phys. Rev. Phys. Educ. Res.* **16**, 010114 (2020).

R.P. Springuel, M.C. Wittmann, and J.R. Thompson, “Reconsidering the encoding of data in physics education research,” *Physical Review Physics Education Research* **15**, 020103 (2019). Part of the Focused Collection *Quantitative Methods in PER: A Critical Examination*.

- B. P. Schermerhorn and J. R. Thompson, "Physics students' construction of differential length vectors in an unconventional spherical coordinate system," *Physical Review Physics Education Research* **15**, 010111 (2019).
- B. P. Schermerhorn and J. R. Thompson, "Physics students' construction and checking of differential volume elements in an unconventional spherical coordinate system," *Physical Review Physics Education Research* **15**, 010112 (2019).
- R.R. Bajracharya and J.R. Thompson, "Analytical derivation: An epistemic game for solving mathematically based physics problems," *Physical Review Physics Education Research* **12**, 010124 (2016).

Peer-reviewed conference proceedings

- W. Riihiluoma, Z. Topdemir, J. R. Thompson, "Applying a symbolic forms lens to probability expressions in upper-division quantum mechanics," *2022 PERC Proceedings* [Grand Rapids, MI, July 13-14, 2022], edited by B. W. Frank, D. Jones, and Q. Ryan (2022), doi:[10.1119/perc.2022.pr.Riihiluoma](https://doi.org/10.1119/perc.2022.pr.Riihiluoma).
- B. P. Schermerhorn and J. R. Thompson, "Connecting Physics Students' Conceptual Understanding to Symbolic Forms Using a Conceptual Blending Framework," in *Proceedings of the 21st Annual Conference on Research in Undergraduate Mathematics Education*, San Diego, California, 1607-1608 (2018).
<http://sigmaa.maa.org/rume/RUME21.pdf>
- B. P. Schermerhorn and J. R. Thompson, "Student determination of differential area elements in upper-division physics," 2017 PERC Proceedings [Cincinnati, OH, July 26-27, 2017] (2017), doi: [10.1119/perc.2017.pr.084](https://doi.org/10.1119/perc.2017.pr.084).
- V. L. Sealey and J. R. Thompson, "Students' interpretation and justification of 'backward' definite integrals," in *Proceedings of the 19th Annual Conference on Research in Undergraduate Mathematics Education* (Mathematical Association of America, 2016).
- R. R. Bajracharya and J. R. Thompson, "Student application and understanding of the Fundamental Theorem of Calculus at the mathematics-physics interface," *Proceedings of the 17th Annual Conference on Research in Undergraduate Mathematics Education* (Mathematical Association of America, 2014).

SELECTED RECENT PRESENTATIONS

Invited presentations

- Colloquium, Department of Mathematics, Virginia Polytechnic Institute and State University, Blacksburg, VA, 2 December 2022, "Student understanding at the physics-mathematics interface: mathematization and evaluation."
- Colloquium, Department of Physics & Astronomy, Texas Tech University, Lubbock, TX, 6 December 2022, "Student understanding at the physics-mathematics interface: mathematization and evaluation."

Contributed presentations

2022 Physics Education Research Conference (PERC), Grand Rapids, MI, July 2022

"Interdisciplinary Perspectives on Evaluation Strategies," A. Akinyemi, M. E. Loverude, J. R. Thompson.

"Student-Constructed Eigenvalue Equations in Quantum Mechanics: Symbolic Forms and Mathematical Sensemaking Analysis," A. Pina, Z. Topdemir, J. R. Thompson.

"Applying a symbolic forms lens to probability expressions in upper-division quantum mechanics," W. Riihiluoma, Z. Topdemir, J. R. Thompson.

"Student reasoning about partial derivatives in divergence and curl in vector field graphical representations," Z. Topdemir, J. R. Thompson, M. E. Loverude.

2022 Summer AAPT Meeting, Grand Rapids, MI, July 2022

"Perspectives on Evaluation Strategies," A. Akinyemi, M. E. Loverude, J. R. Thompson.

"Student-Constructed Eigenvalue Equations in Quantum Mechanics: A Symbolic Forms Analysis," A. Pina, Z. Topdemir, J. R. Thompson.

"Network Analysis of Student Interpretations of Dirac Expressions Across Curricula," W. Riihiluoma, Z. Topdemir, J. R. Thompson.

“Student Understanding of the Partial Derivatives in Curl and Divergence,” Z. Topdemir, M. E. Loverude, J. R. Thompson.

24th Conference on Research in Undergraduate Mathematics Education (RUME), hybrid, Boston, MA, 24-26 February 2022, “Using Network Analysis Techniques to Probe Student Understanding of Expressions Across Notations in Quantum Mechanics,” W. Riihiluoma, Z. Topdemir, J. R. Thompson.

2020 PERC, virtual, July 2020

“Modeling the construction and interpretation of equations: Incorporating symbolic forms into a conceptual blend,” B. P. Schermerhorn and J. R. Thompson, in Talk Symposium “Using the theory of conceptual blending at the mathematics-physics interface”.

“Dynamic conceptual blending analysis to model student reasoning processes while integrating mathematics and physics,” S. Van den Eynde, B. P. Schermerhorn, J. Deprez, M. Goedhart, J. R. Thompson, M. De Cock, in Talk Symposium “Using the theory of conceptual blending at the mathematics-physics interface”.

ACTIVE GRANTS AND AWARDS

“Beyond procedures: a research-based approach to teaching mathematical methods in physics,” NSF Education and Interdisciplinary Research (EIR), PHY-1912087; Collaborating PI, with M.E. Loverude (Lead PI), Calif. St. U. Fullerton, W.M. Christensen (co-PI), N. Dakota St. U.; \$454,055 at UMaine, 9/1/2019-8/31/2023.

TEACHING EXPERIENCE ^(^MUMaine; ^DDIT/TUD; ^GGVSU; ^WUW)

Physics courses

Introductory algebra-based mechanics.^W

Introductory calculus-based physics.^G

Introductory physics: Problem-Based Learning.^D

Experimental Methods in Physics.^G

Mathematical Methods for Physics.^M

Intermediate Modern Physics^G/*Quantum*

Mechanics^G/*Quantum and Atomic Physics.*^M

Introduction to Physics and Engineering Physics.^M

Physics Seminar II.^M (career preparation seminar.)

Courses related to K-12 teacher preparation, physics education, and physics education research

Physics by Inquiry.^{M,G,W} (courses for preservice and in-service K-12 teachers)

Postgraduate Certificate courses in *Third-Level Teaching and Learning.*^D

Integrated Approaches to Physics Education I and II.^M (graduate courses in M.S. in Teaching)

Graduate Seminar in Physics Education Research.^M

Graduate Seminar: Group Teaching and Learning.^M

Research-related Curriculum Development in Science and Mathematics.^M

Independent Study in Physics Education Research.^M

Senior Project in Physics / Honors Thesis in Physics.^M

Seminar in Teaching Physics.^W

SERVICE HIGHLIGHTS

Chair line (and co-founder), American Physical Society Topical Group on Physics Education Research Executive Committee (nationally elected office): Vice Chair, 2016; Chair-Elect, 2017; Chair, 2018; Past Chair, 2019.

Member, Editorial Board, *Physical Review Physics Education Research*, 1 January 2014 – 31 December 2016.

Participant, Congressional Visits Day, American Physical Society, Washington, DC: Jan 2017; Feb 2018; Jun 2018; Jun 2021 (virtual).

Physics Education Research Leadership and Organizing Council (AAPT), April 2009 – February 2012

Chair, January 2011 – February 2012.

American Physical Society Forum on Education Executive Committee, Member-at Large, April 2008 – April 2011; Programs Committee for 2009, 2010, and 2011 March and April meetings.

Conference and conference session organization

Co-organizer, 2017 Physics Education Research Conference, “Mathematization in Physics Education Research,” Covington, KY, 26-27 July 2017.

Co-organizer, *2017 Transforming Research on Undergraduate STEM Education*, The University of St. Thomas, St. Paul, MN, 5-9 July 2017, as co-PI of NSF grant DUE-1551038; *2012 Transforming Research on*

Undergraduate STEM Education (TRUSE), The University of St. Thomas, St. Paul, MN, June 3-7, 2012, and *Transforming Research on Undergraduate STEM Education (TRUSE)*, The University of Maine, Orono, ME, June 14-18, 2010, as co-PI of NSF grant DUE-0941191.

Co-organizer, “Integration in Multivariable and Vector Calculus,” Working Group on Education Research at the Interface of Mathematics and Physics, 19th Annual Conference on Research in Undergraduate Mathematics Education, Pittsburgh, PA, 25 February 2016.

Consulting and Advisory Committees

Advisory board member, “Research Initiation: Facilitating Knowledge Transfer within Engineering Curricula,” NSF EEC-2205022, PFE: Research Initiation in Engineering Formation program, A. J. DeRosa (Stevens Institute of Technology, NJ) PI, T. Reed, co-PI; 9/1/2022-8/31/2025.

PER Online Journal Club Planning Committee Member, APS GPER & *Physical Review Physics Education Research*, 2022-2023 year.

Reviewer, “Upper-level physics curriculum section” in “A Guide to Effective Practices for Physics STEM Programs (EP3)”, S. McKagan, D. A. Craig, M. Jackson, and T. Hodapp, Eds., (American Physical Education Society, College Park, MD, Version 2021.1), 2021.

Member of Advisory Board, “Research as a base to develop adaptable curricula bridging instructional paradigms in Quantum Mechanics,” NSF DUE-1626594, Steven Pollock (CU-Boulder), Gina Passante (Cal State Fullerton), and Homeyra Sadaghiani (Cal Poly Pomona), PIs, 10/1/16–9/31/20.

Participating instructor, “An Interdisciplinary Investigation of Learning: Student Understanding of Linear Algebra in Physics,” NSF CAREER grant, Megan Wawro (Virginia Tech) PI, 9/1/2015-8/30/2022.

Grant proposal reviewer: National Science Foundation; Research Foundation Flanders (Fonds Wetenschappelijk Onderzoek); Fulbright Ireland Student Awards

Referee

American Journal of Physics

Physics Education Research, A Supplement to the American Journal of Physics

International Journal of Research in Undergraduate Mathematics Education

Journal of Chemical Education

Journal of Engineering Education

Physical Review Physics Education Research

The Physics Teacher

Physics Education Research Conference Proceedings

Conference on Research in Undergraduate

Mathematics Education Research, Proceedings

AWARDS/HONORS

ΦΚΦ, inducted 2021

Fulbright Scholar, 2008-2009, School of Physics, Dublin Institute of Technology (now Technical University Dublin), Dublin, Ireland

Outstanding Referee, *Physical Review Journals*, American Physical Society, 2020 group

Finalist, 2011 Physics Education Research Conference (PERC) Proceedings Paper Award

Finalist, 2010 PERC Proceedings Paper Award

Dean’s Award of Excellence in Engineering Physics program, College of Engineering, 2007–2008

Honorary Engineer, Francis Crowe Society, College of Engineering, U. Maine

ΣΠΣ (Physics Honor Society; inducted 1989)

PROFESSIONAL MEMBERSHIPS

American Association of Physics Teachers: Physics Education Research Topical Group; New Engl. Sec.

American Physical Society: Topical Group on Physics Education Research; Forum on Education; Forum on History of Physics; New Engl. Sec.